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Workplace Health and Wellbeing during and beyond COVID-19

Edited by
Holly Blake

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Editor

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About the Editor

Holly Blake

Professor Holly Blake is a Chartered Health Psychologist (CPsychol) and Principal Fellow of AdvanceHE. She has significant research expertise in workplace health and wellbeing in the public and private sector. She leads on national workforce evaluations and has expertise in the design, delivery and evaluation of workplace health promotion interventions to promote the physical and mental health of employees. She has delivered workplace health interventions in organisations across the UK, as well as internationally. Throughout the COVID-19 pandemic, she led numerous COVID-19 response studies exploring the impact of the pandemic on the mental health of vocationally active adults, and implementing innovations to support workforce wellbeing and mitigate the impacts of the pandemic on mental health. She has a particular interest in digital interventions for education and training, health promotion and behaviour change. Throughout the COVID-19 pandemic, her impactful workforce interventions had a global reach.

Preface to "Workplace Health and Wellbeing during and beyond COVID-19"

Coronavirus is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. After the first cases of novel coronavirus were detected in China in 2019, cases rapidly spread to countries across the world. This global outbreak was declared a pandemic by the World Health Organization on 11 March 2020. Over three years later, as of 12 July 2023, the number of cases exceeds 691 million, and almost 6.9 million deaths due to COVID-19 have been recorded. This led to an unprecedented mobilisation of the scientific community, responding at pace with research efforts to understand, cure or mitigate the virus.

The impact of the pandemic on work, health and wellbeing has been profound. Rapidly rising infection rates, led to national lockdown policies and changes to work activities. Mental and physical health has been impacted, with disproportionate effects in vulnerable groups. Unemployment has soared, and inequalities in the labour market have widened. For most people in work, the nature of work and their work environments have dramatically changed, with impacts on travel. Remote, home and hybrid working have become commonplace.

In this book, we begin by exploring the impacts of the pandemic on diverse occupational groups, including consideration of the broader mental health impacts of the pandemic, reactions to national lockdowns and behavioural strategies to control the spread of the virus, such as social distancing and self-isolation, attitudes towards infection control and work presenteeism. Based on longitudinal or cross-sectional data, papers focus on working-age adults, office, church and factory workers, hospitality staff, frontline healthcare workers (doctors, intensivists, paramedics, trainees), childcare staff and teachers, and university staff and students.

Next, we explore the relationship between job factors, working conditions and psychological wellbeing of employees. The papers that follow examine changes in work patterns and locations, such as remote, hybrid, and on-site working, the impact of organizational climate on mental wellbeing, and organizational approaches to return-to-work after lockdown.

The rapidity with which mitigation strategies were put into action is evident in this collection of papers. We delve into interventions that are aimed at improving mental wellbeing in the current and future generation of workers, including off-job crafting approaches, and digital support for mental health which was developed within three weeks of pandemic outbreak in the UK, with global reach among health and care workers, and trainees. Authors present in-depth evaluations of strategies to control the spread of the virus. This collection includes the first mixed-methods evaluation of the implementation of a highly innovative SARS-CoV-2 testing programme in a higher education setting and explored the barriers and enablers of testing access. While there were marked, negative impacts on diverse occupational groups through the pandemic, there were silver linings. Here, we present the first paper on workforce experiences of the rapid implementation of a COVID-19 mitigation strategy, revealing the career development opportunities afforded for employees. Other papers report on healthy environment initiatives, strategies for surveillance response and novel intervention involving the use of fluorescent markers for infection control and reduction of cross-contamination in clinical settings.

As the pandemic progressed, special attention was paid to the development of safe and effective vaccines that would be essential to control virus outbreaks, now, and in the future. To reduce inequalities in education and reduce vaccine hesitancy, we present COVID-19 Vaccine Education (CoVE) which was the first digital training package to promote the individual and societal benefits of the COVID-19 vaccine, accessed by healthcare workers worldwide.

This book demonstrates the breadth of research on work, health and wellbeing, during and beyond the COVID-19 pandemic, covering workforce impacts and workforce interventions in various countries and settings. Learning from this research will help to build global preparedness for future pandemics and foster resilience for responding in times of crisis and uncertainty.

Holly Blake
Editor

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Brief Report

Occupational Characteristics in the Outbreak of the COVID-19 Delta Variant in Nanjing, China: Rethinking the Occupational Health and Safety Vulnerability of Essential Workers

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Abstract: The risk of contracting COVID-19 varies by occupation. Clarifying the occupational disparity in the infection risk is crucial to the prevention and control of the epidemic in the workplace. In late July, some new cases of COVID-19 were confirmed among cleaners working in Lukou International Airport in Nanjing, China. The infected cases rapidly increased and spread to many domestic cities in the following days. The present study traces the brief reports of epidemiological investigations among the confirmed cases released by the Nanjing government from 20 July to 2 August, and offers a descriptive analysis on the occupational distribution of these cases. Cleaners and other staff working in the airport were found to make up more than 40% of all cases. The overwhelming majority of the cleaner cases were confirmed in the first 7 days. The present study statistically ascertains that the airport cleaners were the initial sufferers and transmitters in this outbreak. They experienced occupational health and safety vulnerability on both individual and contextual levels, including workplace hazards, workplace safety policies, and lack of awareness and empowerment. Effective protection for essential workers and the strict surveillance of occupational health in the workplace is urgently needed.

Keywords: COVID-19 disease; Delta variant strain; Nanjing Lukou International Airport; airport cleaner; essential worker; infection risk; occupational characteristics; occupational health and safety vulnerability; epidemic prevention and control

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1. Introduction

1.1. COVID-19 Outbreak in Nanjing

Nanjing Fa Bu, the new media platform of the Municipal Party Committee and the Municipal government of Nanjing, which is the provincial capital of Jiangsu, China, and has a population of more than 9.3 million, notified that nine samples of the regular nucleic acid testing among the staff working in Lukou International Airport tested positive for SARS-CoV-2 on 20 July. On the 21st, the Nanjing government announced that there were seven new local confirmed cases and two asymptomatic cases [1]. These cases were all female cleaners working in Lukou International Airport, aged from 38 to 51. On the same day, the government delimited four medium-risk areas and one control area and decided to carry out the first nucleic acid testing among all permanent-resident populations and visitors in Nanjing. The number of new local confirmed cases increased rapidly in the following days and peaked on the 27th (47 cases). As of 24:00 on 2 August, the total number of local confirmed cases in Nanjing was 220, including 82 light cases, 132 regular cases and 6 severe cases. More seriously, confirmed cases related to this outbreak were identified in many cities such as Yangzhou, Huaian and Zhangjiajie (in Hunan Province).

On 30 July, the Nanjing government held the tenth press conference on this COVID-19 outbreak. In the conference, an official of Nanjing Municipal Center for Disease Control and Prevention reported the finding of virus genes in 52 related cases in this outbreak [2]. The virus genome sequences were highly homologous, indicating the same transmission chain. The early cases (airport cleaners) have been found to share the same RNA sequence as the Delta variant strain, which was consistent with the genetic sequence of an imported case on Flight CA910 from Russia on 10 July. The official suggested that several airport cleaners may have been infected due to the nonstandard washing and removing of protective equipment after the cabin cleaning on Flight CA910. Then, the virus was transmitted among the employees in the cleaning company to which the airport cleaners belonged. Furthermore, because those cleaners were responsible for the garbage clearance of international and domestic flights simultaneously, other staff working in the airport might have been infected, by contact with those cleaners or the contaminated environment.

An anonymous cleaner working in Lukou International Airport, who was a confirmed case, provided more details in an interview [3]. The cleaners usually sprayed the disinfector and cleaned the cabin immediately after the passengers left, without closing the door to allow the disinfector to react in the confined space for a sufficient amount of time. The cleaners took part in the cleaning of international and domestic flights concurrently, and shared the cleaning tools such as brooms, duster cloths, dust collectors, and the rest room. Furthermore, they were required to carry the cabin garbage under the airbridge, which may have led to the secondary pollution of the garbage.

Information from multiple sources revealed that the nonstandard methods of disinfection and the mismanagement of Lukou International Airport were the key factors leading to this COVID-19 outbreak in Nanjing. Some news agencies pointed out that the airport outsourced its cleaning business to external cleaning companies in 2019 [4,5]. Although outsourcing is a common practice in airport management, the work of the contractor needs to be surveilled by the airport. The prevention of the epidemic in cleaning work is the most important component of the whole epidemic-prevention system in the airport. Given that the early cases in this outbreak were among the cleaners and other staff working in the airport, and the Delta variant is highly transmissible, the occupational risk in the transmission of SARS-CoV-2 virus is alarming.

1.2. Occupational Risk in Contracting COVID-19

For some people, the workplace is not only a place to earn payment and achieve personal value, but also a place which is inundated with risks that threaten their physical and mental health. Previous empirical studies have revealed that the work organization and job characteristics, such as work schedules, psychosocial job stressors and the organizational climate, are significantly related to the workers' health conditions [6,7]. However, the distribution of occupational health risks is uneven. Workers in some occupations encounter more health hazards than those in other occupations, and confront specific risks in special periods or contexts. For instance, a Belgian census-linked mortality study reported that respiratory and cardiovascular mortality is considerably higher for male and female cleaners than for non-manual workers [8].

Existing studies found that an individuals' exposure to infectious diseases is closely associated with their occupation [9–11]. The occupational risk in COVID-19 infection has been demonstrated in several studies. At the very beginning of the outbreak, people who worked in the Huanan Seafood Wholesale Market in Wuhan were a high-risk group [12]. Then, the healthcare workers (HCWs) such as the doctors, nurses and paramedical staff that were working at the front line of the global pandemic and confronting substantial risk in workplace, obtained the most academic attention. A systematic review showed that a total of 152,888 infections and 1413 deaths were reported among HCWs worldwide in 2020 [13]. A study conducted in Wuhan reported that the case infection rate of HCWs (2.10%) was dramatically higher than that of non-HCWs (0.43%) [14].

The risk of COVID-19 infection in other occupations seemed to receive less attention. A handful of studies summarized the infection status across different occupations. For instance, Lan and colleagues observed work-related COVID-19 transmission in six Asian countries/areas for 40 days after its first locally transmitted case [15]. They identified five occupation groups with the most cases: healthcare workers, drivers and transport workers, services and sales workers, cleaning and domestic workers and public safety workers in proper order. Feng and colleagues described the occupational characteristics of the confirmed cases (such as occupations related to the cold-chain) in sporadic COVID-19 outbreaks from June to December 2020 in China [16]. They suggested that the occupation and work information were crucial in tracking down "patient zero" and reducing the transmission rate.

COVID-19 is the first new occupational disease to be described this decade [17]. The outbreak in Nanjing, the source of which was the infected cleaner who cleaned the cabin of Flight CA910 that subsequently reported an imported case, brings our attention back to the occupational risk and vulnerability during viral transmission. As an important pivot of the world-class airport group in the Yangtze River Delta, Nanjing Lukou International Airport has air routes to 78 domestic cities and 35 international destinations, and the passenger throughput for the year was 25.8 million in 2017 [18]. In a place with such a huge flow of people, why did the COVID-19 Delta variant transmit first among airport cleaners, rather than the passengers or flight attendants? Do the individual characteristics or the surveillance system in the airport make cleaners more vulnerable to COVID-19 infection? How many cleaners were infected and what was the proportion? These questions need to be clarified to implement effective protection in the workplace, prevent the epidemic, and control rapid transmission of the Delta variant.

In the present study, a conceptual model developed by Smith and colleagues was employed to address the occupational disparity in the risk of being infected in the Nanjing outbreak [19]. This model defined four dimensions of occupational health and safety (OHS) vulnerability, including: (1) exposure to workplace hazards; (2) workplace safety policies and procedures; (3) worker awareness of health and safety-related rights and responsibilities; and (4) worker empowerment to act to protect themselves and colleagues. The core idea of this model was that vulnerability resulted from exposure to on-the-job hazards, along with inadequate access to resources (policies and procedures, awareness or empowerment) to mitigate the effects of these risks. In other words, workers' vulnerability was not only determined by their personal traits but was also related to their working environment. The OHS vulnerability model was utilized in research on multiple working populations, such as recent immigrants and refugees, brick-factory workers and nonstandard workers [20–22]. Considering the similarities of the working conditions between these workers and the airport cleaners, we adopted this model in our present study.

Taken together, the objective of this study was to describe the occupational characteristics among confirmed cases of the COVID-19 outbreak in Nanjing and investigate the potential factors leading to OHS vulnerability on both an individual and contextual level. Policies and the practical implications of maintaining and promoting the occupational health and safety of essential workers in the midst of the pandemic are also discussed.

2. Methods

Since the first batch of new local cases in Nanjing was identified on 20 July, *Nanjing Fa Bu*, the official media platform, has released the information of epidemiological investigations into new confirmed cases on a daily basis, to help citizens check the history of contact. We followed the information on this platform from 21 July to 3 August (confirmed cases from 20 July to 2 August), because 14 days is widely believed as the incubation period suggested by health authorities for active monitoring [23]. The data we recorded and summarized included: each confirmed case's gender, age, occupation, the date, and the type of symptom when diagnosed. It should be noted that we did not collect the individuals' characteristics directly from the confirmed cases; the anonymous information was extracted

from the epidemiological investigation reports issued by the Nanjing government. The number of cases that we included in our final analysis was 220.

Confirmed cases in the present study fell into 5 occupational groups, including: airport cleaners, other staff working in the airport (such as airline ground staff, auxiliary police officers, drivers and restaurant staff), peasants/retirees/the unemployed, other occupations, and children/adolescents. Given that the occupations of those cases who did not work in the airport were extremely varied, we categorized them in the "other occupation" group. Preschool children and students (aged from 8 months to 18 years) were classified as "children and adolescents" in our analysis.

Descriptive analyses were performed by R (a free language and environment for statistical computing and graphics). We used the variance analysis to compare the mean ages of five occupational groups. As the cases in one category were less than five, the Fisher's precision probability test was adopted to compare the gender proportion across five occupations. Chi-squared tests were included to examine the differences of notification dates and symptoms among occupational groups. Multiple comparisons using the Bonferroni approach were utilized to uncover if there were significant differences on these characteristics between any two occupational groups. The figure was plotted by Excel (Microsoft, Redmond, WA, USA).

3. Results

The basic characteristics of the cases are summarized in Table 1. The mean age was 43.25 (SD = 16.96) and females made up nearly 60% of all cases. The 69 airport cleaners accounted for more than 30% of all cases. The proportion of other staff working in the airport was 13.18%. Almost 11% of cases were children and adolescents. As a result of the Nanjing government implementing the second and the third nucleic acid tests on 25 July and 28, respectively, confirmed cases reported in the second 7 days (27 July–2 August) were slightly higher than those reported in the first 7 days (20 July–26 July). More than 60% of the cases had light symptoms when they were diagnosed.

Table 1. Basic Characteristics of Confirmed Cases of COVID-19 in Nanjing from July 20 to August 2 in 2021 (N = 220).

Variable	Mean (SD) or N (%)
Age	43.25 (16.96)
Gender	
Female	131 (59.82)
Male	88 (40.18)
Occupation	
Airport cleaner	69 (31.36)
Other staff working in the airport	29 (13.18)
Peasant, retiree and unemployed person	48 (21.82)
Other occupations	50 (22.73)
Children and adolescents	24 (10.91)
Date of notification	
The first 7 days	106 (48.18)
The second 7 days	114 (51.82)
Symptoms	
Light	137 (62.27)
Regular	83 (37.73)

Table 2 displays the basic characteristics of confirmed cases grouped by five occupations. There were statistically significant differences in age, gender and date of notification across the different occupational groups, indicating a necessity to further conduct the comparisons between any two occupational groups. However, symptoms when being diagnosed were not significantly related to occupation.

Table 2. Basic Characteristics of Confirmed Cases Categorized by Occupation in Nanjing.

	Airport Cleaner	Other Staff Working in the Airport	Peasant, Retiree and Unemployed Person	Other Occupations	Children and Adolescents	*p* Value
Age	44.68 (5.35) $_{a}$	40.62 (9.54) $_{a}$	59.19 (15.20) $_{b}$	43.74 (11.79) $_{a}$	9.45 (6.01) $_{c}$	0.0000
Gender						
Female	63 (91.30) $_{a}$	4 (14.29) $_{b}$	31 (64.58) $_{c}$	22 (44.00) $_{b,c}$	11 (45.83) $_{b,c}$	0.0005
Male	6 (8.70) $_{a}$	24 (85.71) $_{b}$	17 (35.42) $_{c}$	28 (56.00) $_{b,c}$	13 (54.17) $_{b,c}$	
Date of notification						
The first 7 days	53 (76.81) $_{a}$	12 (41.38) $_{b}$	16 (33.33) $_{b}$	19 (38.00) $_{b}$	6 (25.00) $_{b}$	0.0000
The second 7 days	16 (23.19) $_{a}$	17 (58.62) $_{b}$	32 (66.67) $_{b}$	31 (62.00) $_{b}$	18 (75.00) $_{b}$	
Symptoms						
Light	45 (65.22) $_{a}$	18 (62.07) $_{a}$	27 (56.25) $_{a}$	29 (58.00) $_{a}$	18 (75.00) $_{a}$	0.5512
Regular	24 (34.78) $_{a}$	11 (37.93) $_{a}$	21 (43.75) $_{a}$	21 (42.00) $_{a}$	6 (25.00) $_{a}$	

Note: Subscripted lowercase letters (a, b, c) represent the subset of categories among occupations. The same letters in different categories suggest that there are not statistically significant differences, and different letters in different categories indicate that there are significant differences ($p < 0.05$).

Multiple comparisons were performed using the Bonferroni approach. We paid particular attention to the airport cleaners and other staff working in the airport. The same subscripted letter "a" in the first row in Table 2 meant that the difference between the mean age of the airport cleaners (44.68) and of other staff working in the airport (40.62) or other occupations (43.74) was not statistically significant. The proportion of female airport cleaners was 91.3%, which was significantly higher than that of other staff working in the airport (14.29%) or in other occupations (44%). Accordingly, the overwhelming majority of other staff working in the airport were male. Moreover, compared to the other four occupational groups, the vast majority of the airport cleaner cases were confirmed or notified in the first 7 days of transmission (76.81%). There were not significant differences in the date of notification among the other four occupations.

The trends in new local cases confirmed daily from 20 July to 2 August are displayed in Figure 1. The new cases peaked on 27 July and declined over the next few days. The number of airport cleaner cases, other staff working in the airport and other confirmed cases are marked in Figure 1. In the first 7 days of transmission, airport cleaner cases accounted for a large proportion of daily new confirmed cases. Although this proportion fluctuated, the overall trend declined after 14 days. The proportion of other airport staff in daily new confirmed cases peaked on 24 July, then declined with small fluctuations.

Figure 1. The trends of new local cases confirmed daily from 20 July to 2 August.

4. Discussion

In the present study, we collected the personal information of the confirmed daily cases from 20 July to 2 August in Nanjing, including gender, age, occupation, date and symptoms when diagnosed. We first provided a description of the confirmed cases' occupational characteristics, and then preliminarily examined the differences among these occupational groups. We found that nearly one-third of confirmed cases were airport cleaners, and that the overwhelming majority of cleaner cases were confirmed in the first 7 days of this outbreak. Other staff working in the airport accounted for around 13% of all cases. Later transmission occurred mainly in cleaners' households and communities near the airport, without a significant correlation with occupation. We statistically ascertained that the airport cleaners were the initial sufferers and early transmitters in this outbreak.

We argue that the disproportionate infection among airport cleaners in this outbreak reflects the occupational health and safety vulnerability of this occupation. As mentioned in previous paragraphs, the cleaners were responsible for the cleaning and disinfection of domestic and international flights concurrently, and were required to carry the cabin garbage to the lounge bridge by themselves. Considering that the daily new confirmed cases in foreign countries were far more than that in mainland China, the duties related to the international flights placed the cleaners at a high risk of infection. Furthermore, although an anonymous airport cleaner disclosed that they were asked to wear protective suits when cleaning the international flights and were trained to wear the personal protective equipment in the correct order [3], this outbreak exposed the defects of management and surveillance for the cleaning and daily functioning of the airport. Some media have revealed that the cleaning business in Lukou Airport was outsourced to an external cleaning company. In general, the cleaning company should be responsible for the employment and training of their cleaners, whereas the airport is not involved in the company's management system. It is reported that the airport cleaners were asked to simultaneously clean the domestic and international flights because the cleaning company wanted to save costs, and the airport failed to perform its surveillance duty [5].

This outbreak reflects the drawbacks of labor outsourcing, which emerged at the end of the 20th century in China. Limited by the gross payroll system, many large state-owned enterprises, such as Lukou Airport, outsource their ancillary services, such as the cleaning service, to external specialized agencies. In this employment mode, the airport is the contractee, and the cleaning company is the contractor; there is not a legal labor relation between the airport and the cleaners. Labor outsourcing is considered as a form of flexible employment and is expected to save operating costs; however, it could also harm the employees' rights, and put them at risk. In the case of Lukou Airport, the cleaners were the main victims of mismanagement.

In addition to the vulnerabilities of workplace hazards and workplace safety policies, the airport cleaners in the Nanjing outbreak experienced another vulnerability: lack of awareness towards health and safety in the workplace. The anonymous airport cleaner mentioned above recalled that a co-worker coughed on July 13 and infected several colleagues. Nevertheless, this phenomenon did not attract the attention of the cleaners and administrative staff in the cleaning company, which may foreshadow the later transmission. We contend that inadequate awareness arises from individual characteristics in conjunction with contextual factors. On one hand, the cleaning service is a labor-intensive industry, and does not require a good educational background. The epidemiological investigation also showed that most of the cleaners were middle-aged female villagers living near the airport, whose health literacy may have limited their awareness to the infection risk. On the other hand, to some extent this can be regarded as the negative result of chronically neglecting the occupational health and safety among essential workers.

Essential workers are those who work in health care, cleaning services, delivery services, retail establishments, agriculture and other essential industries. Telework, widely adopted by teachers and programmers in the pandemic, is not applicable among essential workers. In other words, society is not able to function normally without essential

workers. The indispensable nature of essential work means that workers are subjected to elevated health hazards, as well as concerns about transmitting the virus to their family and community members [24]. As a matter of fact, there appeared a cluster of cases in the Sixth People's Hospital in Zhengzhou, the capital city of Henan Province since 31 July, of which the earliest cases included two cleaners in this hospital. On 2 and 5 August, Shanghai Pudong Airport and Haikou Meilan Airport separately reported one service staff and one stevedore who tested positive for nucleic acid. On 4 September, a female cleaning staff member working in a quarantine hotel in Guangzhou, the capital city of Guangdong Province, tested positive for nucleic acid. The essential workers in airports, hospitals and hotels, who confront an impaired health risk in the workplace in ordinary times, have become the high-risk group in the COVID-19 epidemic.

Although the Labor Law of the People's Republic of China has a section on labor health and safety, essential workers, especially those who migrate from rural areas to cities and work in 3D (dirty, difficult and dangerous) industries, suffer from huge health hazards [25]. These essential workers usually work in a detrimental environment without effective protective equipment or work overtime frequently. Additionally, most of them do not have social and medical security. Moreover, this population experiences power-related vulnerability; they do not have a large voice, leading to their health conditions becoming marginalized and invisible. For instance, the cleaners and care workers in hospitals are exposed to higher infection risks because they are in direct contact with patients and medical waste, and their awareness and knowledge is not as sufficient as medical professionals. They do not receive the attention they deserve.

After a series of strict prevention and control measures, there have been no new cases in Nanjing since 13 August, and the whole city has been designated as a low-risk area since 19 August. Lukou Airport also resumed domestic flights on 26 August after the completion of terminal disinfection in all areas. This Delta-variant COVID-19 outbreak raises new challenges to epidemic prevention and control in China and the global community. In the meantime, it urges the authorities and employers to seriously rethink the occupational health and safety vulnerability of essential workers. As Baker suggested, surveillance of occupational health might be a powerful tool for COVID-19 prevention [26]. On one hand, in workplaces such as airports and hospitals, in which the environment is complicated and the number of people is huge, the health and safety of essential workers should receive equal, if not more attention, than other workers. Periodic screening programs, sufficient personal protective equipment and occupational health education to raise awareness of the risks should be provided [27]. On the other hand, although the essential workers in these workplaces may be directly managed by outsourcing companies, the contractee (the airport or hospital) should routinely perform surveillance to ensure the well-being of their workers.

Although the present study illustrates the occupational health and safety vulnerabilities in the COVID-19 outbreak in Nanjing for the first time, it has certain limitations. Most of all, as mentioned in the methods section, we collected the individual characteristics of confirmed cases in this outbreak from the official reports of epidemiological investigations carried out by the government, instead of interviewing them face-to-face. Therefore, the information only contained their age, gender, occupation, date of notification and symptoms when diagnosed. More detailed socio-demographic characteristics and clinical features (such as a change in symptoms, the course of illness and follow-up rehabilitation) are unknown to us. Furthermore, the sample in the present study only covered the sectional confirmed cases in the Nanjing outbreak. We are unable to include further classification of occupations and cannot compare the morbidity and mortality rates across more occupational groups in the analysis. In other words, the small-sized, information-limited and cross-sectional data prevented us from performing causal inference to inquire the potential causal relations between occupation and the infection risk of COVID-19. More scientific and longitudinal research designs are needed to address this gap in the future.

5. Conclusions

In conclusion, the present study describes the occupational characteristics among confirmed cases of the Delta-variant COVID-19 outbreak in late July in Nanjing. Using the data extracted from the brief reports of epidemiological investigation released by the Nanjing government, we statistically confirmed that the airport cleaners were the initial victims and early transmitters of this outbreak. We analyzed the individual and contextual factors that led to the vulnerability of airport cleaners in terms of occupational health and safety, and demonstrated that labor outsourcing and the consistently unheeded occupational health and safety among essential workers were the source of this transmission. We urge the government and employers to rethink this issue, not only to prevent and control the COVID-19 epidemic, but also to establish a healthy workplace and improve the workers' well-being.

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Assessing Differences in Attitudes toward Occupational Safety and Health Measures for Infection Control between Office and Assembly Line Employees during the COVID-19 Pandemic in Germany: A Cross-Sectional Analysis of Baseline Data from a Repeated Employee Survey

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Abstract: In our study, we investigated possible differences across occupational groups regarding employees' perceived work-related risk of infection with SARS-CoV-2, attitudes toward technical, organisational, and personal occupational safety and health (OSH) measures for infection control, and factors associated with this attitude. We analysed baseline data (10 August to 25 October 2020) from a repeated standardised online survey distributed at a worldwide leading global supplier of technology and services in Germany. 2144 employees (32.4% women; age (mean ± SD): 44 ± 11 years) who worked predominantly remotely (n = 358), at an on-site office (n = 1451), and assembly line/manufacturing (n = 335) were included. The work-related SARS-CoV-2 risk of infection differed between office employees working remotely and on-site (mean ± SD = 2.9 ± 1.5 vs. 3.2 ± 1.5; Mann-Whitney-U-Test: W = 283,346; $p < 0.002$; $\varepsilon^2 = 0.01$) and between on-site office and assembly line/manufacturing employees (3.8 ± 1.7; W = 289,174; $p < 0.001$; $\varepsilon^2 = 0.02$). Attitude scores toward technical OSH-measures differed between remote and on-site office (4.3 ± 0.5 vs. 4.1 ± 0.6; W = 216,787; $p < 0.001$; $\varepsilon^2 = 0.01$), and between on-site office and assembly line/manufacturing employees (3.6 ± 0.9; W = 149,881; $p < 0.001$; $\varepsilon^2 = 0.07$). Findings were similar for organisational and personal measures. Affective risk perception, COVID-19-specific resilience, and information about COVID-19-related risks were associated with the employees' attitudes. To promote positive attitudes, it seems to be important to consider occupational-group-specific context factors when implementing OSH-measures for infection control.

Keywords: COVID-19 pandemic; workforce; occupational safety and health; workplace health; infection control measures; occupational SARS-CoV-2 risk of infection; baseline data; working conditions

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1. Introduction

The severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) has evolved rapidly since the end of 2019. On 30 January 2020, the World Health Organisation (WHO) declared the communicable coronavirus disease (COVID-19) a Public Health Emergency of International Concern [1], and then, on 11 March 2020, a pandemic [2]. Due to a lack of effective treatment and vaccines at that time, governments worldwide introduced temporary preventive behavioural measures to slow down the spread of the virus, prevent

overload on local health systems, and enable the identification of common sources of exposure to trace infection chains [3,4].

Prior research has shown that the workplace is a setting with the potential to reinforce or mitigate the spread of SARS-CoV-2 depending on workplace characteristics [5–7]. Even during previous influenza pandemics, occupational groups working in crowded workplaces faced a high risk of exposure [8]. The reduction of direct contact at work was identified as an effective measure to limit the transmission of various influenza virus strains [8]. Concerning the risk assessment of work-related exposure to SARS-CoV-2, the WHO has established definitions for three occupational groups: (1) "low exposure risk": employees without constant or close contact with clients or colleagues; (2) "medium exposure risk": employees fulfilling job tasks requiring close and constant contact with the clients or colleagues; (3) "high exposure risk": employees caring for SARS-CoV-2-infected patients or with close contact with individuals suspected of being infected [9]. Accordingly, in the nonhealthcare sector, the risks of work-related exposure to SARS-CoV-2 differ greatly, for example, between office workers (low) and skilled workers on the assembly line or in production (medium). Besides preventive behavioural measures, the COVID-19 pandemic required the implementation of structural measures to combat infection in the workplace and protect the occupational safety and health (OSH) of professionals across all occupational settings according to their exposure risk [7,10,11].

In Germany, the German Federal Ministry of Labour and Social Affairs (BMAS) provided a SARS-CoV-2 Occupational Safety and Health Standard in April 2020 to reduce the work-related risk of infection of the employees [12]. All companies in Germany were required to implement infection control measures regarding workplace setting, ventilation, remote work, working equipment, and hygiene rules on technical, organisational, and personal levels (TOP) [13,14]. The more extensive SARS-CoV-2 Occupational Health and Safety Regulation was introduced on 20 August 2020 [14] and complements the German national government's pandemic roadmap in the private and public sectors. This roadmap provided recommendations on the targeting and effectiveness of public containment measures to serve as a toolbox for implementation by the single federal state governments according to the respective epidemiological situation [15]. Preventive behaviours to reduce virus transmission in private and public settings were also further promoted, e.g., maintaining distance, observing hygiene rules such as regular hand washing, mouth and nose protection, using the Corona-Warn-App, and room ventilation (DHM-AA or AHA+A+L formula) [16,17].

Attitudes affect behaviour: a high positive attitude toward a certain behaviour increases the probability of transferring plans into action [18], e.g., realising compliant preventive behaviour during the COVID-19 pandemic [19,20]. An attitude can be defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" [21]. The attitude's formation is described as an ongoing process which occurs whenever new information is received related to the attitude object [18]. Therefore, attitude and attitude strength can change [18,22]. Previous research has shown that the attitude toward measures for infection control in public life (e.g., in the general Spanish population [23]) and in the workplace (e.g., in dentists [24]) influences the implementation and realisation of preventive behaviours. The German serial cross-sectional COVID-19 Snapshot Monitoring study (COSMO) has monitored different COVID-19-related topics, e.g., protective or preparedness behaviours and public risk perceptions, and used a representative quota sample for the German general population [25,26]. Overall, little is known about how employees of different occupational groups, such as office or assembly line/manufacturing workers, perceive their work-related risk of infection. Furthermore, preventive OSH-measures introduced for infection control elicited compulsive changes regarding working conditions, e.g., workplace environment and organisation [27]. There is a lack of research on the employees' reactance towards these changes. A better understanding of how those employees experience their 'new normal', could therefore help to adapt these measures according to target group-specific characteristics and

promote acceptance [10,28,29]. The personal relevance of measures influences attitude [30], e.g., previous research has shown that concern about the virus increases when personal contact with positive COVID-19 cases increases [19,31]. We therefore assume that a person who is personally affected by the OSH-measures, e.g., working on-site, might evaluate the consequences of the measures differently than a person who is not directly affected, e.g., working remotely.

Our objective is to compare the different work-related risks of exposure to SARS-CoV-2, based on the classification of the WHO [9], for employees who do office work predominantly remotely (at least 80% of the working time remote) with employees who do office work on-site with assembly line/manufacturing employees on the topics of:

a) How did employees rate their risk of infection with SARS-CoV-2 in the summer and fall of 2020?
b) What are the employees' attitudes and reactances toward SARS-CoV-2 infection control measures in the workplace?
c) What factors are associated with their attitudes toward OSH-measures for infection control?

2. Materials and Methods

2.1. Study Design

This cross-sectional study was conducted using baseline data from an employee survey that was administered three times. It is part of an explorative modular mixed-methods study project investigating how companies and employees in Germany dealt with adjusted working conditions due to infection control measures introduced during the COVID-19 pandemic [32,33]. This study was approved by the ethics committee of the Medical Faculty, University of Tübingen, and University Hospital of Tübingen in June 2020 (No.: 423/2020BO). The manuscript was reported following the STROBE checklist [34], see Supplementary Material File S1.

2.2. Study Setting and Recruitment

The study was conducted at six German company sites of a worldwide leading global supplier of technology and services located in the federal states of Bavaria, Baden-Wurttemberg, and Lower Saxony. Baseline data were collected via a partly standardised online survey between 10 August and 25 October 2020. We distributed the invitations for all employees in close cooperation with the company's corporate communications department by e-mail, newsletter, intranet, postcards, and posters including a link and QR code to the survey. The completion of the survey was voluntary, took about 25 min, and could be completed during working hours.

Regarding the epidemiological context at the time of data collection, the German national government and federal states faced the challenge of balancing constraints in private and public life such as contact restrictions, quarantine regulations for people with suspected or confirmed SARS-CoV-2-infection, and closure of educational or non-systematically relevant public and commercial institutions [15]. The 7-day incidence at the state level was used as a key indicator for the introduction or repeal of measures. During summer and until the end of September 2020, the 7-day incidence in Germany was below 20 cases per 100,000 inhabitants [35]. Until 31 October 2020, the 7-day incidence increased to 110 cases per 100,000 inhabitants [35]. Again, temporary restrictions (e.g., contact restrictions or restaurant closures) were discussed [3,15].

2.3. Study Population

The study population consists of professionals employed in the company. The following inclusion criteria were applied: minimum age of 18 years and the ability to access and complete the online survey in German. All included study participants provided informed consent. In this study, we focus on the two largest areas of work in this company. Employees working in the 'office' mainly carry out business activities at visual display units in separated office spaces of various sizes, including individual to open-plan offices

or conference rooms. 'Assembly line and manufacturing' characterises hands-on factory or quality-control tasks on production parts performed on site at assembly lines, machines, laboratories, and cleanrooms.

2.4. Measures (Questionnaire)

The survey was developed in close interdisciplinary cooperation with professionals providing expert knowledge on health science research, occupational medicine, and corporate communication. Our target group was involved in the design, choice of outcome measures, and recruitment of our research. Our questionnaire was pretested by eight academic volunteers and four target group representatives. Due to the short time between the onset of the pandemic and the first wave of data collection, the questionnaire was solely developed in the German language and conducted online via the survey tool Unipark provided by Questback AS [36]. In addition to self-developed items and those from prevailing surveys [37], e.g., COSMO [26], we included validated scales, e.g., the Copenhagen Psychosocial Questionnaire (COPSOQ) [38], and the short scale Social Desirability-Gamma (KSE-G) [39]. See Supplementary Material File for further details and sources [40–47].

Figure 1 shows the main subject areas of the online employee survey:

I) socio-demographics (e.g., age, gender);
II) workplace characteristics (e.g., professional activity, performing shift work);
III) the employee's perception of SARS-CoV-2 and COVID-19 in general (e.g., affective risk perception describing fear and worry about the coronavirus);
IV) the employee's evaluation of work-related stress due to COVID-19-induced changes in working conditions elicited by introduced infection control measures (e.g., perceived probability of contracting COVID-19 in the workplace, primary workplace location during the pandemic);
V) the employee's attitudes toward SARS-CoV-2-related OSH-measures for infection control in the workplace (e.g., 'protection of employees with plexiglas planes'; 'decoupled break times').

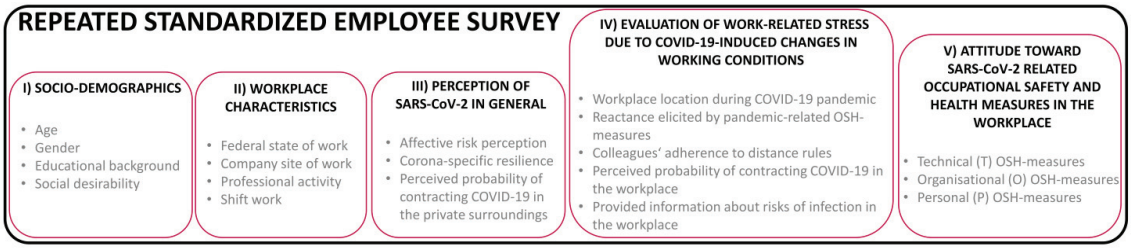

Figure 1. Main subject areas of the standardised online employee survey at baseline.

2.5. Outcomes

a) Perceived probability of contracting COVID-19 in the workplace: the subjectively perceived risk of infection with SARS-CoV-2 in the workplace was evaluated on a 7-point Likert scale ranging from 'extremely unlikely' to 'extremely likely' (1–7), similarly to Betsch et al. [48].
b) Perceived probability of contracting COVID-19 in the private surroundings: the subjectively perceived risk of infection with SARS-CoV-2 in the private surroundings was evaluated on a 7-point Likert scale ranging from 'extremely unlikely' to 'extremely likely' (1–7), similarly to Betsch et al. [48].
c) Attitude toward OSH-measures for infection control: at the company sites implemented OSH-measures were grouped according to the hierarchy of implementation according to the German SARS-CoV-2 Occupational Safety and Health Standard [12]: technical (T) (10 items), organisational (O) (6 items), and personal measures (P)

(10 items), see Supplementary Material File. Participants rated the perceived adequacy of each item along a 5-point Likert scale ranging from 'not at all suitable' to 'very suitable' (1–5). Mean scores for the technical, organisational, and personal measures were calculated for further statistical analysis. High values indicate a positive attitude. Cronbach's alpha was computed to evaluate the internal consistency reliability (each score's Cronbach's $\alpha \geq 0.77$).

d) Reactance toward implemented infection control measures in the workplace: similar to previous research [49,50], we asked participants to rate their feelings of frustration, annoyance, restriction of freedom, and disruption regarding implemented infection control measures explicitly in the workplace on a 7-point Likert scale from 'not at all' to 'very much' (1–7). A mean score of reactance was calculated for further statistical analysis (Cronbach's $\alpha = 0.92$). A high reactance score reflects the experience of an unpleasant emotional reaction triggered by the introduced OSH-measures in the workplace which is likely to reinforce the intention to regain restricted freedom [50].

Considered covariates included: age (complete years), gender (male, female, diverse), date of participation, nationality (German/non-German), educational background (categorised as primary, intermediate or high according to [51]), company site, involvement in shift work (yes/no), social desirability [39], trust in colleagues to adhere to distance rules (7-point Likert scale ranging from 'not at all' to 'always' (1–7)), affiliation to risk group for developing severe COVID-19 according to [52,53] (yes/no), provided information about potential risks of infection with SARS-CoV-2 in the workplace (5-point Likert scale ranging from 'inadequately' to 'very good' (1–5)), affective risk perception ('very low' to 'very high' (1–7), mean score across three items [26,54], Cronbach's $\alpha = 0.80$), COVID-19-specific resilience describing the ability to cope with difficulties caused by the COVID-19 pandemic ('very low' to 'very high' (1–7), mean score across four items [26], Cronbach's $\alpha = 0.70$), see Supplementary Material File S2.

2.6. Statistical Analysis

We described the baseline characteristics using R [55,56]. Descriptive results were reported as means ± SDs with interquartile ranges (IQR) for continuous measures including Likert scales and as percentages for categorical variables. Participants of diverse gender were not analysed separately due to the low number. Mean calculation for score computation was performed for previously validated scales according to their manual and for self-developed scores, e.g., attitude toward OSH-measures, according to the mean-across-available-item approach [57]. Non-parametric Kruskal-Wallis tests were performed to identify differences between the three occupational groups [58]. As we mainly focus on the differences between remote and on-site office employees, respectively between on-site office and assembly line/manufacturing employees, Mann-Whitney-U tests were further performed [58]. We report effect sizes as epsilon-squared (ε^2), with $\varepsilon^2 < 0.083$ representing a weak, $\varepsilon^2 < 0.268$ a moderate, and $\varepsilon^2 > 0.268$ a strong effect [59]. A two-sided p-value below 0.05 was considered statistically significant. For multivariate analysis, missing values of non-sociodemographic variables in included observations were replaced via predictive mean matching using the MICE package in R [60]. Results were similar when performing the analysis without observations with missing values, see Supplementary Material File S3. The scores reflecting the attitudes toward OSH-measures for infection control in the workplace (dependent variable) were non-normally distributed due to a ceiling effect located at 5 (highest response option). The IQR of all respondents' ratings on the attitude toward technical measures was 3.7 to 4.6 (skewness = −1.05). Therefore, the multivariate Tobit regression model was performed to identify factors associated with the attitude toward OSH-measures [61]. We controlled computed regression models for social desirability [39], 7-day incidence [62], educational background, and company site. Based on our survey modules, we investigated block-wise via forward selection to decide on the most reduced models for remote, on-site office, and assembly line/manufacturing employees [63]. Re-

gression models for technical OSH-measures are presented in the text, see Supplementary Material File for similar results on organisational and personal OSH-measures.

3. Results

3.1. Socio-Demographic Characteristics of Participants

The response rate was 22% and 2144 employees were included in the analysis, see Table 1. The CONSORT flowchart is attached as Supplementary Material File S5.

Table 1. Socio-demographic and work-related characteristics at baseline: overall, and compared between predominantly remotely working office, on-site working office, and assembly line/manufacturing employees.

Characteristics	Overall	Office Remote	Office On-Site	Assembly Line/Manufacturing
***N* (%)**	**2144 (100%)**	**358 (16.7%)**	**1451 (67.7%)**	**335 (15.6%)**
Gender (*n*)	2135	358	1442	335
male	1444 (67.6%)	204 (57.0%)	1003 (69.6%)	237 (70.7%)
female	691 (33.4%)	154 (43.0%)	439 (30.4%)	98 (29.3%)
Age in years (*n*)	2086	350	1411	325
Mean ± SD	43.9 ± 11.1	44.0 ± 10.7	43.9 ± 11.0	43.6 ± 11.9
IQR	(36.0–54.0)	(35.0–52.0)	(35.0–53.0)	(35.0–53.0)
18–29 years	271 (12.9%)	35 (10.0%)	183 (13.0%)	53 (16.6%)
30–59 years	1697 (81.4%)	285 (81.4%)	1155 (81.8%)	257 (78.8%)
60–67 years	118 (5.7%)	30 (8.6%)	73 (5.2%)	15 (4.6%)
Education [51] (*n*)	2141	358	1439	335
primary	250 (11.7%)	4 (1.1%)	117 (8.1%)	129 (38.4%)
intermediate	692 (32.3%)	69 (19.3%)	426 (29.6%)	197 (58.9%)
high	1199 (56.0%)	285 (79.6%)	905 (62.9%)	9 (2.7%)
Affiliation to risk group [52] (*n*)	2076	345	1396	326
yes	370 (17.8%)	69 (20.0%)	226 (16.2%)	75 (23.2%)
no	1706 (82.2%)	276 (80.0%)	1179 (84.5%)	251 (76.8%)
Shift-work (*n*)	2134	357	1434	334
yes	238 (11.1%)	0	45 (3.1%)	193 (57.6%)
no	1896 (88.8%)	357 (100%)	1398 (96.9%)	141 (42.4%)
Provided information about potential risks of infection with SARS-CoV-2 in the workplace (*n*)	2119	357	1430	323
Mean ± SD	4.3 ± 0.9	4.3 ± 0.9	4.3 ± 0.8	3.8 ± 1.0
IQR	(4.0–5.0)	(4.0–5.0)	(4.0–5.0)	(3.0–4.0)
Trust in colleagues to adhere to distance rules (*n*)	2139	357	1440	321
Mean ± SD	5.2 ± 1.4	5.3 ± 1.3	5.3 ± 1.3	4.6 ± 1.7
IQR	(4.0–6.0)	(5.0–6.0)	(5.0–6.0)	(3.0–6.0)
COVID-19-specific resilience (*n*)	2135	358	1435	333
Mean ± SD	5.4 ± 1.0	5.5 ± 0.9	5.4 ± 0.9	4.9 ± 1.2
IQR	(4.8–6.0)	(5.0–6.3)	(5.0–6.0)	(4.3–5.8)
Affective risk perception (*n*)	2140	358	1439	334
Mean ± SD	4.5 ± 1.2	4.6 ± 1.2	4.5 ± 1.2	4.4 ± 1.5
IQR	(3.7–5.3)	(4.0–5.3)	(3.7–5.3)	(3.7–5.7)
Perceived probability of contracting COVID-19 in the workplace (*n*)	2144	357	1441	335
Mean ± SD	3.3 ± 1.5	3.0 ± 1.5	3.2 ± 1.5	3.8 ± 1.7
IQR	(2.0–4.0)	(2.0–4.0)	(2.0–4.0)	(2.0–5.0)
Perceived probability of contracting COVID-19 in private surroundings (*n*)	2142	357	1441	335
Mean ± SD	3.8 ± 1.3	3.9 ± 1.2	3.8 ± 1.3	3.8 ± 1.5
IQR	(3.0–5.0)	(3.0–5.0)	(3.0–5.0)	(3.0–5.0)
Reactance elicited by occupational infection control measures (*n*)	2142	358	1440	335
Mean ± SD	2.7 ± 1.6	2.5 ± 1.6	2.7 ± 1.5	3.3 ± 1.8
IQR	(1.5–3.8)	(1.3–3.3)	(1.5–3.5)	(1.9–4.5)
Attitudes toward technical OSH-measures for infection control (*n*)	2142	357	1441	335
Mean ± SD	4.1 ± 0.7	4.3 ± 0.5	4.1 ± 0.6	3.6 ± 0.9
IQR	(3.7–4.6)	(4.0–4.7)	(3.8–4.6)	(3.0–4.3)

Table 1. *Cont.*

Characteristics	Overall	Office Remote	Office On-Site	Assembly Line/Manufacturing
N (%)	2144 (100%)	358 (16.7%)	1451 (67.7%)	335 (15.6%)
Attitudes toward organisational OSH-measures for infection control (*n*)	2138	357	1437	335
Mean ± SD	4.0 ± 0.7	4.2 ± 0.6	4.1 ± 0.7	3.6 ± 1.0
IQR	(3.7–4.7)	(3.8–4.7)	(3.7–4.7)	(3.0–4.3)
Attitudes toward personal OSH-measures for infection control (*n*)	2141	357	1440	335
Mean ± SD	4.4 ± 0.5	4.4 ± 0.5	4.4 ± 0.5	4.2 ± 0.6
IQR	(4.1–4.8)	(4.1–4.8)	(4.1–4.8)	(3.8–4.7)

3.2. Perceived Probability of Contracting COVID-19 in the Workplace

Figure 2 shows the perceived probability of contracting COVID-19 in the workplace for predominantly remotely working office employees compared with on-site working office employees and assembly line/manufacturing employees (Kruskal-Wallis-Test: Chi-squared = 49.828; $p < 0.001$). The risk perception differed between remote and on-site office employees (Mann-Whitney-U-Test: W = 283,346; $p < 0.002$; $\varepsilon^2 = 0.01$) and between on-site office and assembly line/manufacturing employees (Mann-Whitney-U-Test: W = 289,174; $p < 0.001$; $\varepsilon^2 = 0.02$): approximately one fifth of the remote office employees (17.9%) and of those working on-site (19.8%), and a third (33.3%) of the assembly line/manufacturing employees rated the perceived probability of contracting COVID-19 in the workplace as likely (≥5.0 on 7-point Likert scale), see Table 1. Figure 2 additionally shows the perceived probability of contracting COVID-19 in private surroundings (Kruskal-Wallis-Test: Chi-squared = 4.7752; $p = 0.09$).

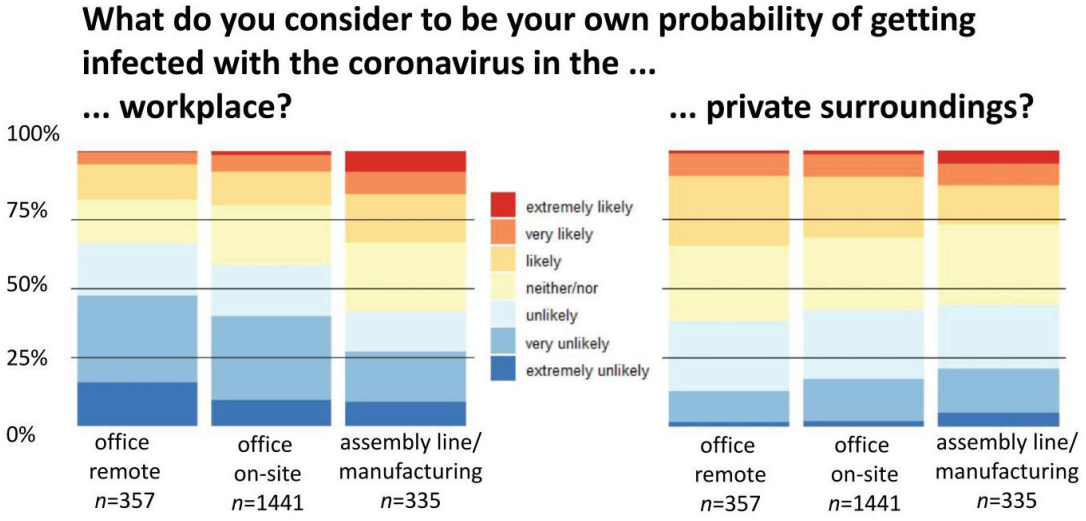

Figure 2. Perceived probability of contracting COVID-19 in the workplace and in private surroundings, compared by occupational group: office predominantly remote ($n = 357$), office on-site ($n = 1441$), and assembly line/manufacturing ($n = 335$).

Office employees working predominantly remotely perceived a higher risk perception in their private surroundings than in the workplace (W = 88,878; $p < 0.001$; $\varepsilon^2 = 0.12$). Those office employees who worked on-site reported a higher risk perception in private surroundings than in the workplace (W = 1,299,570; $p < 0.001$; $\varepsilon^2 = 0.05$). No difference was found for assembly line/manufacturing employees (W = 55,239; $p = 0.722$).

3.3. Attitudes and Reactances toward OSH-Measures for Infection Control

Figure 3 shows the employees' attitudes toward technical (A) occupational infection control measures for all three occupational groups (Chi-squared = 156.43; $p < 0.001$), as well as toward organisational (B) (Chi-squared = 99.558; $p < 0.001$), and personal (C) measures (Chi-squared = 28.209; $p < 0.001$).

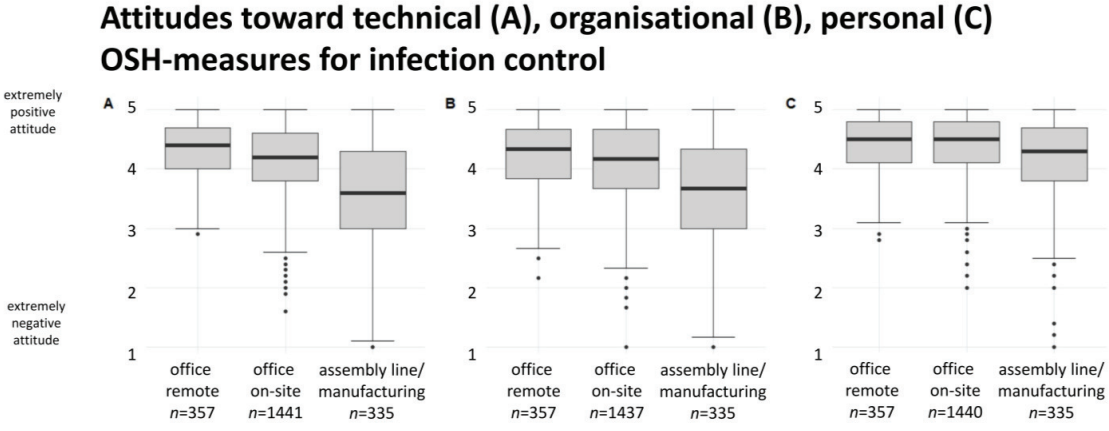

Figure 3. Boxplots showing the distribution of the assessed attitudes toward technical (**A**), organisational (**B**), and personal (**C**) OSH-measures for infection control, compared by occupational group: office remote, office on-site, and assembly line/manufacturing.

Mean scores for the attitudes were different between predominantly remotely and on-site working office employees toward technical (W = 216,787; $p < 0.001$; $\varepsilon^2 = 0.01$) and organisational (W = 237,942; $p = 0.034$; $\varepsilon^2 = 0.00$) but not for personal OSH-measures (W = 252,660; $p = 0.615$), see Table 1. Mean attitude scores toward technical (W = 149,881; $p < 0.001$; $\varepsilon^2 = 0.07$), organisational (W = 163,125; $p < 0.001$; $\varepsilon^2 = 0.05$), and personal OSH-measures (W = 198,262; $p < 0.001$; $\varepsilon^2 = 0.02$) were also different between on-site working office employees and assembly line/manufacturing employees.

Reported levels of reactance toward changed working conditions elicited by introduced OSH-measures for infection control in the workplace were different for all three occupational groups, see Table 1 (Chi-squared = 48.56; $p = 0.001$). Office employees working predominantly remotely showed a lower level of reactance compared to on-site office employees (W = 76,905; $p < 0.001$; $\varepsilon^2 = 0.06$). Further, on-site office employees showed a lower level of reactance than assembly line/manufacturing employees (W = 291,419; $p < 0.001$; $\varepsilon^2 = 0.02$). 9.5% of the remote, 10.5% of the on-site office employees, and 20.8% of the employees working at the assembly line/in manufacturing reported a strong reactance ($\geq$5.0 on a 7-point Likert scale).

3.4. Factors Associated with the Attitude toward Occupational Infection Control Measures

We found that a high COVID-19-specific resilience, high affective risk perception, having the feeling of being well-informed by the employer about potential COVID-19-health risks in the workplace, and a low reported level of reactance favour a positive attitude toward technical OSH-measures for infection control across all occupational groups, see Table 2. Associated with a positive attitude toward technical OSH-measures were the female gender for office workers and the male gender for assembly line/manufacturing workers. Trust in colleagues to adhere to distance rules showed a reinforcing effect when working on-site. Regarding attitudes toward organisational and personal OSH-measures, we found decreasing effects for gender but reinforcing effects for affective risk perception and reactance, see Supplementary Material File S4.

Table 2. Attitude toward technical OSH-measures for infection control.

Professional Activity		Office Remote (n = 336)			Office On-Site (n = 1347)			Assembly Line and Manufacturing (n = 311)		
Block	**Variables**	**Coef.**	**SE**	***p*-Value**	**Coef.**	**SE**	***p*-Value**	**Coef.**	**SE**	***p*-Value**
(I) Socio-demographics	Gender (vs. male) female	0.14	0.06	0.012 **	0.09	0.03	0.006 **	−0.26	0.11	0.015 *
	Age (vs. 18–29 years)									
	30–59 years	0.09	0.09	0.298	0.03	0.04	0.419	−0.06	0.13	0.646
	60–67 years	0.04	0.12	0.736	0.18	0.08	0.019 *	0.27	0.25	0.279
(II) General workplace characteristics	Shift work (vs. no) Yes	-	-	-	-	-	-	−0.18	0.10	0.061
(III) Perception regarding the pandemic-related impact in the workplace	Reactance	−0.08	0.02	<0.001 ***	−0.09	0.01	<0.001 ***	−0.08	0.03	0.003 **
	Provided information about risks of infection with SARS-CoV-2 in the workplace	0.07	0.03	0.024 *	0.09	0.02	<0.001 ***	0.14	0.05	0.005 **
	Trust in colleagues to adhere to distance rules	0.03	0.02	0.126	0.07	0.01	<0.001 ***	0.11	0.03	<0.001 ***
(IV) Employees' attitude toward COVID-19 in general	COVID-19-specific resilience	0.09	0.03	0.001 **	0.09	0.02	<0.001 ***	0.14	0.04	<0.001 ***
	Affective risk perception	0.05	0.02	0.035 *	0.11	0.01	<0.001 ***	0.10	0.03	0.002 **
Log-like and DF		−206.2137 on 652 degrees			−1017.34 on 2674 degrees			−365.5378 on 602 degrees		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; All models were controlled for social desirability, 7-day-incidence, company site, and educational background. No Hauck–Donner effect was found.

4. Discussion

In the present cross-sectional analysis, we revealed a lower perceived risk of infection and a higher positive attitude toward OSH-measures for infection control among predominantly remotely working office employees in comparison to on-site working office employees and assembly line/manufacturing employees. Within the three investigated occupational groups, we identified gender, age, reactance, level of information about potential COVID-19-health risks, trust in colleagues to follow distance rules, COVID-19-specific resilience, and SARS-CoV-2 affective risk perception as influencing factors for OSH-measures for infection control.

4.1. Perceived Probability of Contracting COVID-19 in the Workplace

According to the WHO and the European Centre for Disease Prevention and Control [7,9], employees in indoor settings with close and frequent physical proximity to colleagues or customers face a higher risk of infection in the workplace. An online survey among company experts for safety and health protection among different German industries confirmed that the perceived risk should be considered differently with special regard to the number of contacts with colleagues or clients in the predominant workplace and working environment [64]. However, research with a focus on different occupational groups within a company is limited [7,11,64]. The results of this study show a lower risk perception in the workplace among predominantly remotely compared to on-site working office and assembly line/manufacturing employees. The fact that on-site workers perceive a higher risk of infection with SARS-CoV-2 in the workplace was previously explained by on-site workers fearing transmission to vulnerable friends or family members in addition to their own infection [19,65]. Within the German COSMO trend study, employed participants (13 October 2020; N = 944) rated their perceived probability of contracting COVID-19 in general as 3.7 on a 7-point Likert scale [66]. COSMO participants further indicated a high risk perception when meeting in groups or enclosed spaces in private or professional settings [67]. Compared to this general employed German population, our participants working in the office perceived a lower risk of infection in the workplace but a higher risk of infection in private surroundings. This did not apply to assembly line/manufacturing

employees. Recent literature [68] has shown that personality traits and social patterns, e.g., eudaimonic and hedonic, influence attitudes toward infection control measures. With our data we could not investigate this any further.

Consistent with previous research [64,65,69], our findings therefore suggest target-group-specific OSH-measures for infection control under consideration of the workplace environment including, e.g., break rooms, canteens, and sanitary facilities.

4.2. Attitudes toward and Reactances Elicited by Occupational Infection Control Measures

A positive attitude toward preventive behaviour was previously shown to be associated with a higher probability of transferring those measures into action and acting according to COVID-19 policies [19,20]. We observed rather positive attitudes toward OSH-measures for infection control in our participants. It should be considered that successful safety cultures were shown to promote positive attitudes toward OSH-measures for infection control [70]. Before the COVID-19 pandemic, a concept of safety culture was established particularly in large companies or companies that are part of a corporate group [71,72]. Available human resources, communication structures or information channels, and high commitment of managerial staff to take responsibility enabled those companies to implement and adjust COVID-19 infection control measures rapidly [64,69,73]. It has been shown that even during the COVID 19 pandemic, the larger the organisation, the more likely it is to adopt flexible working conditions, such as remote working [74], and that frequent communication strategies promote compliance with infection control measures [23]. We recruited employees from a large company group already realising a clear concept of safety culture. A lack of research remains with similar studies conducted among companies of different sizes.

Regarding technical and organisational OSH-measures for infection control, the introduced measures elicited compulsive changes in the working environment and interaction with colleagues or leaders affecting primarily on-site employees' daily work organisation. In our study population, predominantly remotely working employees reported higher positive attitudes compared to on-site employees. This is consistent with findings from a survey among German employees after the first pandemic winter in April 2021, where those spending at least half of their working time remotely rated the OSH-measures as more appropriate than those on-site [65]. A lower personal relevance of the measures could be the reason here [30]. For example, ventilating common rooms, cleaning equipment more frequently, or keeping a distance from colleagues do not directly impact work routines when working remotely. However, the shift toward working remotely where possible was highly recommended, e.g., by the federal governments, required rapid adaptation to the new working conditions, and led to a reinforced blurring between work and private life [29,75]. The ongoing shift from traditional work characteristics toward the 'new normal' via rapidly digitalised work processes has been boosted due to physical distancing at work to limit the number of new infections [64,69,76]. Regarding the reactance toward changed working conditions triggered by the implemented infection control measures, we observed lower levels of reactance among employees working remotely compared to on-site employees. Employees working at the assembly line/manufacturing reported higher levels of reactance, similar to the level of reactance toward public life restrictions in German employees (mean = 3.3; 27 October 2020; n = 927) [66]. It was previously reported that on-site working employees felt that they must invest a lot of energy at work while experiencing profound protective regulations in their daily work organisation [75,77]. They further experienced limited opportunities to receive social support from family and friends due to current pandemic-related government restrictions [75,77]. Establishing flexible work arrangements within the scope of possibilities was shown to solve work-life conflicts but is limited to jobs independent of shift work and manufacturing schedules [75]. In line with the existing literature [75], we found more positive attitudes and lower reactances toward workplace policies among on-site office employees compared to assembly line/manufacturing employees. We explain our findings with lower involvement in shift work, more flexible

working arrangements, and easy access to formal internal information channels during working hours.

We identified an overall high positive attitude across the presently investigated occupational groups for personal OSH-measures. We found statistically significant but not practically relevant differences between the three groups (maximum difference of 0.3 points on a 5-point Likert scale). This might be due to the strong similarity of the personal measures to general behavioural policies in the private and public surroundings in Germany at that time, e.g., the DHM-AA formula [15,16].

4.3. Factors Associated with the Attitudes toward Work-Related Infection Control Measures

Within the three occupational groups, we found that low reactance, a high level of information about potential COVID-19-health risks, high trust in colleagues to follow distance rules, high COVID-19-specific resilience, and high SARS-CoV-2 affective risk perception promoted a positive attitude toward OSH-measures for infection control. This is consistent with previous findings [70,75,78]. Affective risk perception, as well as the amount of provided COVID-19-related health information, e.g., scientific facts about the pandemic or infection prevention, was shown to be strongly positively associated with engaging in preventive behaviours during the COVID-19 pandemic [78,79]. In contrast to the affective risk perception, the perceived probability of infection did not significantly influence attitude in our multivariate model. This is in line with the findings of a nationwide study in the Italian population, according to which affective risk perception seemed to explain protective behaviours better than the perceived probability of an infection with COVID-19 [80]. In the short-term, fear is the primary factor affecting attitudes toward infection control measures, but in the long run, communication that focuses on hope has been shown to be more effective in motivating adherence to OSH-measures for infection control and increasing persistence [81]. Knowledge about potential risks of infection in the workplace and understanding the need for preventive measures were also shown to reduce COVID-19-related stress factors and the feeling of frustration and restriction elicited by implemented OSH-measures [20,23,82,83]. Our findings confirm that the feeling of being well informed about potential health risks in the workplace by the employer strengthened attitudes toward implemented OSH-measures. Therefore, the employer can play an important role in providing trustworthy information, similar to public health education programs [23]. We can hypothesise that the reactances in assembly line/manufacturing employees were higher compared to office employees because they had limited access to digital communication channels and therefore received little information about potential work-related COVID-19-health risks during working hours.

A cross-sectional study revealed that good relationships with colleagues and leaders strengthened the positive perception of work [70], but in recent interviews with leaders, they reported that different experiences with the COVID-19 pandemic jeopardised team spirit [84]. Employers can support their employees in coping with pandemic-related challenges by maintaining, retaining, and protecting their resources. According to the Conservation-of-Resources Theory, providing this feeling of care might increase the employee's attitude toward corporate COVID-19 measures [85]. Psychosocial resources, including resilience, self-efficacy, and optimism were shown to positively impact employees' attitude toward their employers' actions [85], which we can confirm for COVID-19-specific resilience. Age was previously shown to be positively associated with engaging in preventive behaviour, such as mask-wearing in Germany [78] or more frequent preventive behaviour by the elderly than by younger people [79]. The elderly and women were further reported to generally perceive a higher risk of COVID-19 for their own health, and for friends and family [86]. Within our sample, the explanatory power of age was low. For gender, we found that men working at the assembly line/manufacturing tended to perceive a more positive attitude toward technical OSH-measures than women. We did not find this effect for organisational or personal OSH-measures.

4.4. Strengths and Weaknesses

The strengths of the study include its large sample size and examination of different occupational groups. On the one hand, the online format of the survey ensured accessibility of the survey to employees working remotely due to the COVID-19 pandemic [87]. On the other hand, due to the online format we may have systematically excluded people who do not have time, resources, internet access, or email access at work, as they change their workplace frequently, e.g., different workplaces across company sites. Therefore, employees working at the assembly line/manufacturing were less likely to participate than office employees. We were only able to conduct the survey using the German language due to the limited time between the onset of the pandemic and data collection. A majority of participants reported not being at increased risk for developing severe COVID-19 according to medical criteria [52]. Our evaluable response rate is 22%, even though we put great effort in reaching all employees via mail as well as via printmedia, e.g., posters and postcards. In comparison to the overall workforce in Germany of the company with which we cooperated (N = 113,700), our study sample showed an identical mean age but a lower proportion of women (33% instead of 49%). In comparison to data from the working population of the German census and COSMO [54,88], our study population was slightly younger and better educated and had more men and fewer part-time workers. With regard to selection bias, it should be noted that many employees with already-positive attitudes toward prevention infection control measures participated. Compared to other studies focusing on differences between industries [73,89], we investigated the employees of one large company with a well-established safety culture and focused on differences between occupational groups. Therefore, the generalisability of our findings is limited particularly when comparing our findings to other occupational groups and smaller companies or to companies outside Germany. Furthermore, more than 97% of our participants were German citizens; hence, it was not possible to explore the influence of cultural aspects in detail. The major strength of our study was the rapid realisation of the investigation which enabled our survey to be carried out in the early stages of the pandemic. Due to the cross-sectional nature of this data analysis of baseline data, we cannot provide information on a causal relationship. However, we repeated the survey throughout the course of the pandemic within the same company. Therefore, we can evaluate changes in the individuals' attitudes over time in future longitudinal analyses. We additionally distributed the same survey in other German companies and universities [33], to contrast our findings with findings in other employee samples. With regard to the mixed-methods approach we used throughout the project, the first results of the interviews conducted seem to confirm the findings of our employee survey from the leaders' perspectives [84].

4.5. Meaning of the Study, Implications, and Future Research

The here presented cross-sectional findings from the beginning of the pandemic lead us to the assumption that the perceived probability of SARS-CoV-2-infection, attitude, and reactance toward OSH-measures for infection control differ between occupational groups. According to the results of our study, among other factors, the provided information about potential risks of infection with SARS-CoV-2 in the workplace and the affective risk perception seemed to be key parameters for positive attitudes and low reactance towards occupational safety and health measures for infection control. To counteract any potential for conflict and to promote compliance with the introduced infection control measures in the workplace, it seems to be important to consider occupational-group-specific context factors when implementing OSH-measures for infection control. Positive attitudes might strengthen the successful implementation and acceptance of OSH-measures. If employees, leaders, and colleagues all value and support those preventive OSH-measures, and if the workplace characteristics make it easy to follow those measures, then the employees are likely to develop the strong intention to carry out this behaviour in the long run [22]. Here, we presented findings from the cross-sectional analysis of baseline data. We aim to complement these cross-sectional findings conducting a longitudinal analysis where we

address the impact of adjusted working conditions on attitudes toward OSH-measures for infection control over the course of the pandemic. Analysing follow-up data will further allow us to evaluate potential within-person and between-group changes regarding adjusted working conditions and alterations in attitudes.

5. Conclusions

The perceived probability of contracting COVID-19 in the workplace, attitudes toward technical, organisational, and personal OSH-measures for infection control, and resulting reactance, differ between remote and on-site working office and assembly line/manufacturing employees. Our findings provide a starting point for the occupational-group-specific implementation of OSH-measures in the workplace and expand the level of knowledge in attitudes toward infection control measures in the occupational setting. Occupational-group-specific contextual factors should be considered when implementing OSH-measures for infection control to promote employees' success in transferring their positive attitudes toward OSH-measures into protective behaviours in the workplace and therefore maintain the workforce's physical wellbeing during the COVID-19 pandemic.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph20010614/s1, The study protocol can be downloaded here: https://bmjopen.bmj.com/content/10/11/e043908 (accessed on 25 August 2022, doi:10.1136/bmjopen-2020-043908); Supplementary File S1: STROBE-checklist for cross-sectional studies; Supplementary File S2: Employee survey components; Supplementary File S3: Sensitivity analysis: results excluding observations with missing values; Supplementary File S4: Attitude toward organisational, respectively personal, occupational infection control measures; Supplementary File S5: CONSORT flow-chart.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Medical Faculty, University Hospital of Tübingen (reference number: 423/2020BO, 3 June 2020).

Informed Consent Statement: Our target group was involved in the design, choice of outcome measures, and recruitment of our research. Our questionnaire was pretested by eight academic volunteers and four target group representatives. Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data analysed during the current study are not publicly available due to German national data protection regulations. They are available on reasonable individual requests from the corresponding author.

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Stress and Wellbeing during the COVID-19 Pandemic: A Mixed-Methods Exploration of Frontline Homelessness Services Staff Experiences in Scotland

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Abstract: Staff working in homelessness services often find the work rewarding yet challenging, and the sector experiences high levels of staff burnout and staff turnover. During the COVID-19 pandemic, staff working in these services faced particularly stressful working conditions. This study explored the experiences of stress and wellbeing among those working in frontline homelessness service roles during the early stages of the pandemic in Scotland. Semi-structured interviews were conducted with 18 participants, 11 of whom completed the Maslach Burnout Inventory (MBI). Qualitative data were analysed using Framework Analysis in NVivo, informed by the Revised Transactional Model of occupational stress and coping. MBI data were analysed using descriptive statistics. The COVID-19 pandemic positively and negatively impacted participants' lives and roles. Organisational culture acted as a magnifying glass for pre-pandemic practices: for some, the pandemic brought teams and staff closer together, creating a better working environment. For others, it led to fragmentation and frustration. Participants discussed coping strategies and recommendations for the future to protect staff wellbeing. Quantitative data suggested that participants were not experiencing burnout, although some were at heightened risk. Future research should explore the longer-term impact of the pandemic on homelessness service staff outcomes.

Keywords: homelessness; wellbeing; staff; organisational culture; burnout; Scotland; occupational stress; COVID-19; Maslach Burnout Inventory

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1. Introduction

1.1. Overview of the Literature

Homelessness refers to situations where individuals or families do not have access to suitable, stable or permanent housing. This includes people who are sleeping rough, in temporary or insecure housing arrangements, people in residential treatment centres, and those who live temporarily with family or friends [1]. There are multiple reasons why a person could become homeless but childhood trauma, institutional care or relationship breakdowns are common reasons [2]. Relatedly, many people experience problems with mental health, physical health and/or substance use [3]. A range of homelessness services exist in Scotland to provide a combination of accommodation and support. These include hostels, outreach and housing support.

Working in the homelessness sector can be challenging for many reasons. Establishing relationships with people with acute, multiple, and complex needs can be difficult, requiring time, patience and empathy [4]. Homelessness workers often feel that they do not have enough time to meet the needs of their clients and keep up with the external pressures they face when attempting to secure housing and wider social and health services for their clients [5]. Staff also face the additional stress of working at a time when deaths due to

homelessness, drugs and alcohol remain consistently high [6–8]. The wellbeing of staff in frontline care roles, such as in the homelessness sector, can also influence the standard of care provided [9]. Staff often have to balance their own wellbeing with the challenges of supporting clients [10]. While there is no universal definition of wellbeing, in this study, we use the following definition: "the combination of feeling good and functioning effectively" [11,12]. We chose this definition as it is sufficiently broad and fits with the concepts relevant in this study, for example having control over one's life, a sense of purpose, and experiencing happiness [12]. People facing homelessness are some of the most marginalised people in society [13], so the factors that support staff wellbeing in times of stress and strain must be better understood in order to ensure that clients are provided with suitable care and support.

Many people in frontline caring roles are driven by a strong desire to make a difference, which can act as a strong motivator for their work [14]. Evidence of having made a difference can lead to staff feeling enthusiastic, emotionally invested, and committed to the work, regardless of the challenges faced in the role or the sector itself [15]. Attending to the needs of clients can, however, be time consuming, and the broader system of services can be challenging to navigate [16]. This can lead to frustration for staff, and role conflict and ambiguity due to working in a complex system, which is part of a climate of increasing demand and reduced resources [17]. People who enter the homelessness system have often faced stigma when trying to access services, which means that they may distrust the efforts of staff and find engaging in support difficult [18]. Delays and challenges in the staff–client relationship can also lead to staff feeling disillusioned with their roles. Over time, particularly if support and supervision are insufficient, staff can begin to feel as though they are not good enough [9]. Such experiences can be detrimental to staff wellbeing and lead to a gradual build-up of stress and strain [19].

Organisational and individual personal factors can contribute to staff wellbeing. Organisational factors include management support, positive team dynamics and reflective practices [20,21]. Reflective practice refers to formal or informal arrangements that support staff to reflect honestly and openly on the emotional components of their work [22,23]. These practices can take place within teams, with managers via supervision, or with external professionals. Individual factors such as personality traits, support networks, and preferred coping strategies can also influence staff resilience in managing the potential stress involved in the role [24]. Psychological resilience is described as the ability to bounce back from adverse experiences, adapting and maintaining a sense of wellbeing [25]. Social capital, the support networks and resources someone has available to cope with difficulties [26], may also be an important factor within homelessness services [16].

Despite the positive strategies that can be deployed to maintain staff wellbeing, a large body of literature points to the risk of staff burnout within the homelessness sector [19,27–29]. The concept of burnout is complex and the term is often used interchangeably with compassion fatigue, vicarious trauma and secondary traumatic stress [30]. Although there are links between these concepts, each has notable differences. Our focus in this paper will be on the concept of burnout. Maslach et al. (2001) suggest that burnout has three main dimensions: an overwhelming sense of exhaustion; feeling unable to manage; and feeling emotionally detached and cynical [19]. Burnout can have an impact on physical and mental health, with symptoms including persistent ill health, somatic symptoms, and poor mental health outcomes. Staff burnout contributes to high absenteeism and high turnover within the homelessness sector [31]. Burnout can occur in any role where there is a high workload, role conflict or ambiguity, and/or a feeling of being unsupported. It is not necessarily linked to working with people who have experienced trauma, or who face challenging life situations [30].

While working in a frontline homelessness role is already recognised as being potentially stressful, the COVID-19 pandemic created an additional, "formidable challenge" [32]. The COVID-19 pandemic was declared globally in March 2020 [33]. Governments across the globe began to impose lockdown restrictions to reduce transmission of the disease, with

the first case in Scotland being announced on 11 March 2020, and a nationwide lockdown starting on 24 March 2020 [34]. In many countries, including Scotland, people were only permitted to leave their homes for essential purposes such as obtaining food supplies and medicine [35,36]. Frontline care work, medical roles, and maintaining critical infrastructures such as utilities and food were deemed essential, and those holding these roles were asked to continue working as usual. On 31 March 2020, the Scottish Government published information for homelessness services [34], which included guidance around social distancing, use of personal protective equipment (PPE), ventilation, and hygiene. Frontline homelessness services also had to adapt quickly to provide shelter for those who did not have suitable accommodation in order to prevent transmission of the disease amongst a group who were highly vulnerable [28]. Across many high-income countries (e.g., UK, US, Canada, and Australia), vacant hotels were converted into emergency hostels. For many, the new homelessness hotels enabled co-location of services to provide essential care such as access to medication, mental health support and drug and/or alcohol harm reduction [37]. However, the layering effect of pre-existing stress within the sector, and the need for rapid change, provided a potential threat to staff wellbeing.

Disaster response and rapid change dominated the homelessness sector in many countries in the early months of the pandemic. Numerous international studies have been conducted to examine the wellbeing of frontline health care workers during the pandemic in a range of countries (e.g., [24,38,39]), but virtually no research has focused on frontline homelessness workers. Kerman et al. (2021) surveyed 201 frontline homelessness workers in Canada before and during the pandemic and found that for 79.5%, their mental health had worsened [32]. Many were working more hours during the pandemic, and, despite this, a high proportion were experiencing financial difficulty, compounding the experience of stress. The study also noted that 41% met the criteria for post-traumatic stress disorder and reported increased exposure to traumatic situations during the pandemic. While many studies indicate that organisational factors such as supervision and reflective practices can reduce the likelihood of worker burnout, the Kerman et al. study found that the working environment had little impact on stress outcomes during the pandemic [32]. Other research has highlighted the impact of COVID-19 on the homelessness sector in Canada, with safety concerns, increased workload, and lack of training and PPE being discussed [40]. However, no studies examining the experiences of homelessness workers during the COVID-19 pandemic have been conducted outside of Canada. The aim of this study was to address this gap by exploring the interplay of organisational factors and personal coping strategies for frontline homelessness workers during the early stages of the COVID-19 pandemic in Scotland.

1.2. Theoretical Approach

Over the last five decades, multiple models have been proposed to better understand the factors that contribute to stress, strain, and coping among those in frontline caring roles [41–44]. Our study drew on the Goh et al. (2010) Revised Transactional Model (RTM) of occupational stress and coping to understand study participant experiences [42]. In the RTM, stressful events (stressors) are not necessarily one-off instances of stress but the cumulative effect of working in a potentially high-stress environment. Goh et al. (2010) argue that self-appraisals of stress, strain, and coping are ongoing in a high stress working environment. As new events occur, there are constant feedback loops, where individuals consider the event, coping resources, and the extent to which the stress presents a threat to wellbeing [42]. The RTM proposes that when an event is perceived as threatening or stressful, an individual will consider the available coping resources they have to deal with the event. When stress levels are raised, emotional and/or problem-focused coping strategies are activated. If these coping strategies fail to resolve the stressor, then stress levels will increase when individuals experience another stressful event [42]. In the context of this study, the compounding of potential stressors (with the pre-existing strain being a primary stressor and the pandemic a secondary stressor) offers an opportunity to gain insights

into coping strategies and organisational factors to support staff emotional, psychological, physical and mental wellbeing during times of stress.

1.3. Study Aim

The aim of this mixed-methods study was to examine the experiences of frontline homelessness services staff, the strategies used to support coping, and their need for support and supervision, in order to provide recommendations for the sector. This study addressed the following research questions:

1. What challenges do frontline homelessness services staff in Scotland face in terms of stress, wellbeing, burnout and mental health during COVID-19?
2. How are staff coping, and what are their support needs?
3. What lessons can be learned for the homelessness sector in Scotland and beyond?

2. Materials and Methods

2.1. Study Design and Ethics

A mixed-methods approach was used, involving semi-structured interviews and completion of the Maslach Burnout Inventory (MBI). Ethical approval was granted by University of Stirling's General University Ethics Panel (GUEP; paper 903) and the Ethics Subgroup of the Research Coordinating Council of The Salvation Army (RCC-EAN200505). All data collection was completed remotely due to COVID-19 restrictions.

Potential participants were identified by creating a list of all third sector (not-for-profit) homelessness service providers in Scotland and emailing service managers with information about this study, asking them to suggest staff members who might be willing to participate and met the study inclusion criteria: those currently working in frontline roles (i.e., not management). Service managers passed on information about this study to their teams (by email, at team meetings, and individually) and were asked to either provide contact details for interested staff or ask staff to contact the research team directly. Word of mouth and Twitter were also used to recruit participants directly, with interested organisations/individuals asked to contact H.C., who then passed the information to one of the researchers (T.Pr., D.F. or P.M.).

2.2. Interviews: Recruitment, Process and Analysis

Semi-structured interviews were conducted by three researchers (T.P. (Tracey Price), D.F. and P.M.) during the period June–October 2020. Participants were contacted by email and invited to take part in either a telephone or online interview. The initial email provided a participant information sheet which detailed the purpose and process of this study. Written informed consent was granted prior to each interview. All interviews were audio recorded with permission and lasted an average of 60 min. The interview schedule (Supplementary File S1) covered participants' experiences of stress and wellbeing prior to and during the pandemic, as well as their coping strategies and support received, and recommendations for the future. After each interview, participants were given a debrief sheet, providing further information about this study and support available. Researchers captured their experiences and reflections in fieldnotes which supplemented data analysis, by informing the coding framework.

The interviews were transcribed in full and analysed thematically using Framework Analysis [45], informed by the RTM. The transcripts were combined into one dataset in NVivo and read in full by two researchers (T.P. (Tracey Price) and P.M.), then coded line by line. After coding the first four transcripts, the researchers met to discuss the initial framework and check analytic consistency. Finally, we introduced a deductive element, where the RTM framework and other relevant theories [46–50] were used to guide the development of analytic coding. The developing analytic framework was then used to code the remaining transcripts. H.C., P.M., T.P. (Tracey Price) and D.F. met regularly to discuss themes and their relationship to existing literature and the theoretical framework.

Finally, the data were sorted into relevant themes and illustrative quotes chosen (by H.C. and T.P. (Tracey Price)).

2.3. Quantitative Data Collection and Analysis

All participants were asked to complete the Maslach Burnout Inventory (MBI; [51]). The MBI is a validated 22-item measure of occupational burnout, and respondents rate each item on a seven-point Likert scale, from 'never' to 'everyday'. It views burnout as a continuum, from low to high, across three dimensions: emotional exhaustion (EE; feeling exhausted by one's work), depersonalisation (DP; being emotionally detached), and personal accomplishment (PA; feelings of competence and success in one's work) [51]. This study used the human services workers (MBI-HSS) version. To complete the measure, all participants were sent a link to the online survey. The responses were confidential: we did not ask for names or other identifiable information, so we are unable to match individual survey and interview responses. The MBI was used to triangulate the interview data and provide a greater understanding of participants' experiences by showing whether the MBI scores reflected participants' views and experiences. Informed consent for the MBI was granted by participation in the survey. Data from the completed MBI surveys were downloaded and scored using the MBI manual [52]. Each item was scored from 0 to 6 and then the scores for the items across the three sub-scales (EE, DP and PA) were added together, to provide sub-scale scores for each individual. These were then entered into Excel by D.F. and analysed using descriptive statistics. To interpret the scores, we used 'cut-off scores' [53]. Because Maslach and colleagues warn against putting too much stock in arbitrary 'cut-off scores' [54], we only used these cut-offs as a means of indicating general patterns in the data, where someone may be at higher risk of, or displaying indicators of, EE, DP or low PA. Each of the three sub-scores is interpreted separately, rather than being combined to form an overall burnout score. EE scores are interpreted as: low (0–16), moderate (17–26) and high (27+); DP scores are interpreted as: low (0–6), moderate (7–12) and high (13+); and PA scores are interpretated as: low (0–31), moderate (32–38) and high (39+) [53]. High EE and DP scores are indicative of burnout, whereas the opposite is true of PA, in which a low score indicates potential burnout.

3. Findings

A total of 18 individuals participated in an interview, and 11 also completed the MBI. Five participants were male, and 13 were female. Participants were from six organisations, with most working across central Scotland, and held various roles, including support worker/practitioner, housing support officer, nurse, keyworker, lead practitioner, and volunteer coordinator. The interview findings are presented first followed by the MBI findings.

3.1. Qualitative Findings

The data are organised into two thematic categories: firstly, pre-pandemic experiences, followed by experiences during the COVID-19 pandemic. Sub-themes within each category are described (using sub-headings). Pseudonyms have been used for each participant. Table 1 below details the themes and sub-themes.

Table 1. Themes and sub-themes.

Pre-Pandemic Experiences	Experiences during the COVID-19 Pandemic
Emotional impact of the role	Positive aspects of the pandemic
Pre-pandemic workplace culture	Working with clients during the pandemic
Relationships with clients	The impact of the pandemic on organisational culture
	Reflection, supervision and training
	Coping strategies
	Recommendations for the future

3.1.1. Pre-Pandemic Experiences

Participants described varying levels of stress experienced in their work prior to the pandemic. These experiences are seen as the 'primary stressor' in the RTM. Self-appraisal of stress was influenced by job demands, workplace culture, team dynamics, and communication. Participants discussed the demanding nature of their roles, working with people with complex needs as part of high caseloads.

Emotional Impact of the Role

Almost all participants had been drawn to their roles by a desire to make a difference. For some, this led to role conflict related to the complexity of the homelessness system, where it was not always possible to access accommodation or wider services for those in need. Empathy towards situations that clients were facing was viewed by many as being a part of providing a good standard of care, and this linked to the sense of making a difference. Some participants, however, experienced empathy as stressful, particularly where it had not been possible to access services for clients:

> *Feeling frustration that you can't get people access to services quick enough. That is also really difficult . . . Just it can be quite stressful, and quite upsetting.* (Sarah)

Several participants described how challenging they found it to explain to clients how the wider housing system worked and how frustrated it made them feel. Working in homelessness services itself was characterised as demanding by some participants. Wendy described the services as 'chaotic' and believed that the work done in homelessness services was viewed as insignificant by other sectors and professionals. Participants described not always having their knowledge valued when speaking with other professionals, which could reduce the support networks/resources available to them, a key element of social capital. Steve noted associated challenges of working in a sector that is 'undervalued', and the impact this can have on the staffing of services:

> *[. . .] some social workers do look upon support work as a sort of cobbled together half, you know, half-way professional, an inadequate bunch of, you know, just carers almost.* (Steve)

Two participants told us that, over time, they began to emotionally distance themselves from clients to cope with the frustration involved in feeling empathy within situations that were out of their control. Control, or lack of control, over the ability to access services, and help clients to achieve their aims, appeared to link to perceptions of stress. Likewise, being perceived as *less than* other professionals also contributed to feelings of not being in control and of frustration.

Several participants described indicators of burnout when they recounted their experiences of work pre-pandemic. One participant in particular used dehumanising language to describe a traumatic incident and viewed not taking up the emotional support that was offered as a strength. Those who described having worked in the sector for a long time tended to talk more about professional boundaries and emotional distance as a coping strategy. Despite the many challenges experienced, several described using self-care and support to ensure that practice remained emotionally warm and empathetic, describing their roles as 'fulfilling'.

Pre-Pandemic Workplace Culture

We asked participants several questions about their experiences of staffing, policies, and team working practices before COVID-19. We found varied experiences of workplace culture. Those who described culture in positive terms tended to discuss reflective cultures where it was acceptable to approach managers and admit to having a bad day. Staff valued managers' practices of 'cutting them some slack' by relieving pressure and allowing staff to rearrange their diaries accordingly. As well as having approachable and supportive managers, many participants described a positive and supportive team culture in general

which appeared to strengthen staff resilience and wellbeing. Those who described workplace culture in negative ways described the opposite: having to pretend to be okay and to demonstrate being excessively busy at all times.

Some participants described long-standing issues with high staff turnover in their service and having to take on additional tasks because of low staffing levels. Working in an understaffed service, alongside punitive absenteeism policies, resulted in people feeling that they had to come to work even if mentally or physically unwell, to avoid sanctions such as the threat of job loss and to keep the service going:

> *Quite a lot of the time, staff come into their work when it's quite obvious, whether that's physical or mental health, that they shouldn't be at their work, because they fear what will happen to them if they stay off. [Regarding the new absence policy] I think during COVID, you know, it could have waited. It didn't have to be done during that period of time when staff nerves were tense and things were so uncertain. And we all had enough going on without that kind of hanging over you and knowing you were going in for that.* (Rebecca)

For some participants, this was experienced as having low control over how to manage stress, leading to frustration. Several participants described turning to other team members for support as an alternative to approaching management. In some cases, participants described a division between staff and management with a 'them and us' culture. In less supportive team environments, some participants described frustrations with colleagues. This related to a lack of shared values and norms regarding the approach taken within the services. The frustration commonly came from a disagreement regarding drug/alcohol harm reduction practices and a concern about management's lack of response to undesirable or unethical practice within the staff team:

> *It can be difficult to swallow it down sometimes though like sometimes I want to just scream at management, like you, like certain people shouldn't fucking be here, if that is how they are conducting themselves, (a) how did they get the job in the first place, (b) how have they still got the job, and why is no one else freaking out?* (Chris)

Relationships with Clients

Participants generally talked about having good relationships with clients and building trust in spite of the challenges:

> *It's their own property so they feel more relaxed and you can sit there for an hour and a half and you just have this open conversation and then when they start building up the trust then they start telling you things about their life.* (Lynsey)

Relationships with clients were a motivator for many participants for doing the role. Some described time with clients as a welcome reprieve from workplace stress and something they experienced as fulfilling:

> *So, the way I cope with it is I take myself out of the situation and I will spend a lot more time going out visiting my service users.* (Lynsey)

The findings presented in this section indicate that many participants were experiencing the working environment and demands of the role as stressful before the COVID-19 pandemic occurred. Positive, reflective cultures tended to increase staff resilience to the experience of stress, and many participants spoke about valuing the approachability of managers to discuss challenging situations. Findings also indicate that there was a pre-existing division between staff and managers in some services before the pandemic. This appeared to relate to non-reflective cultures, where struggling to cope was viewed as a weakness, and there was pressure to keep going regardless of the emotional impact. In some instances, this led to strong relationships between team members, but in others there was discord within staff teams related to a lack of agreement regarding an approach to issues such as alcohol or drugs and concerns about unethical practice.

3.1.2. Experiences during the COVID-19 Pandemic

We now turn to participants' experiences during the COVID-19 pandemic, the 'secondary stressor' in the RTM. As anticipated, the pandemic disrupted participants' lives, creating a range of challenges in delivering services and to how staff were able to provide support to clients. For example, under the Scottish Government's COVID-19 lockdown restrictions, visiting clients who had newly acquired tenancies was no longer allowed, and many participants expressed worry about the ability of clients to access basic essentials such as food. We first examine positive aspects before exploring organisational culture and coping strategies.

Positive Aspects of the Pandemic

Despite the challenges and changes that the pandemic brought, some participants identified positive outcomes. One reflected that she had very quickly found ways to maintain client contact and been supported to establish an assertive outreach programme where she would shop for clients with no informal support networks who were shielding (those deemed clinically vulnerable were asked to stay at home) in new tenancies. Although the visits were limited to doorstep interactions, the participant reflected that these were important to maintain social contact with clients and ensure that basic needs were met. Additionally, the Scottish pandemic response of converting vacant hotels into emergency homeless accommodation had further positive outcomes, as Margaret highlighted:

> *We've been able to build really, really good relationships with people because we see them every day. And, you know, if we need something for them, we can just like go and knock on their door basically which has been so beneficial . . . with the hotels, and kind of bringing everyone into one space, we've been able to take more of the lead on that and so we've been able to really just build those relationships with people.* (Margaret)

Participants also described a greater focus on client involvement in how services were operating during the pandemic. Some participants discussed feeling empowered to provide feedback to their organisations and had participated in weekly online meetings with organisational directors. For some participants, being in direct contact with senior managers, and able to provide feedback, appeared to have led to increases in the number of support networks available to them (i.e., social capital). For some, this contributed to a sense of solidarity and a feeling of 'belonging' to the organisation. A few participants reflected that the shared experience of global 'crisis' had made people more aware of each other's vulnerabilities and life circumstances and there was a sense of 'we are all in this together'.

Working with Clients during the Pandemic

Despite the positive aspects of working during the pandemic, many participants talked about challenges related to new ways of working and ensuring continuity of support for clients. Some described feeling unable to control the risks posed by potential COVID-19 transmission. Low control over exposure to the virus (the secondary stressor) was described as stressful by many participants. As Chris and Wendy describe, trying to explain the seriousness of the pandemic to people who felt uncared for by society was very difficult:

> *They feel like society doesn't give a shit about them for the last twenty years. And now you want them to act as if they need to take responsibility and keep everyone else safe.* (Chris)

> *It's that kind of all the time "wash your hands, don't touch this" . . . it's like social distancing, you know, it's constantly having to be on alert . . . especially for the client group, they are not very good at social distancing. They are not particularly good at, kind of, looking after themselves. So, it's having to step up that.* (Wendy)

Participants described the early weeks of the pandemic as a time of uncertainty, where there had often been a lack of communication as to how to manage client care and support.

Some described having to use intuition in the absence of information from managers or the organisation, having to make decisions about how to work best with clients, manage workloads and other considerations, when usually support would be provided. Some participants described the requirement of having to use PPE, such as face coverings and gloves, as a barrier to providing emotional support to clients:

> *People are disclosing the most horrific things that have ever happened to them and, it does, it felt like a physical barrier between us, where if someone was to become upset, you know, in the right context you could tell the women was okay with that, you could go over and give them a cuddle or rub their back or, you know, appropriate touch, if you knew that the woman was okay with that. But you can't do that because of COVID.* (Rebecca)

Others described how difficult it was to explain the need for barriers and PPE which seemed to unintentionally convey the exclusion that many of their clients had experienced throughout their lives:

> *These are people who are used to exclusion. They have been excluded maybe throughout their whole life, or in parts of their lives, and now we have this kind of culture of exclusion because of COVID. And it's not malicious, it's just that it has to happen for health and safety, and it's to protect people. But often we find now that they kind of put a barrier up when faced with that exclusion because it's what they are used to in their past, and they maybe don't understand that what we are doing is trying to protect them and keep them safe. And keep us safe as well so that we can come into work every day and keep doing what we are doing.* (Alex)

Some staff described going to great lengths to ensure relationships were maintained as much as possible. These changes meant that staff had extra time to spend with clients, were innovative in how they could respond to clients' needs and were more consistent in their work with clients. At times, such adaptations required going against protocols to meet clients in person to ensure that clients' needs and staff–client relationships were prioritised. Going against these protocols was described positively by participants.

The Impact of the Pandemic on Organisational Culture

The pandemic appeared to have acted as a magnifying glass for pre-existing positive and negative organisational cultures and practices. First, we describe positive aspects, followed by negative aspects of organisational culture.

While the pandemic caused a range of challenges for staff, those working in organisations with supportive and reflective cultures, strong team bonds, and strong relationships with managers described their experiences more positively. Being able to approach managers for support as and when needed was described as helping to offset experiences of stress:

> *Management have sort of made themselves more open for like ad-hoc supervisions, I suppose like, you know, if you are struggling with something you can just call.* (Andy)

Participants described being able to open up about how they felt in relation to work, the pandemic, and the impact on their own wellbeing. In some settings, the pandemic had strengthened a focus on wellbeing and had further developed a culture where it was acceptable to admit to not being okay, and where there was an expectation that adaptations would be made to aid coping. Adaptations included being able to go home early, or juggle appointments, as necessary. This flexibility and the ability to be honest about coping led to a feeling of trust, where vulnerability was normalised and accepted. Often, this feeling of solidarity and shared human experience was extended to clients, and participants described being open with clients about their own emotions, leading to more reciprocity within relationships, and increased bonding between staff and clients. Ad hoc, responsive and non-judgmental check-ins from supportive managers helped to maintain a positive reflective culture, where people pulled together to navigate what emerged as a very human crisis:

> *Vulnerabilities, people acted, people act differently. It's funny, people were, you know, you see how the team, you know, I'm going to be the one who is going to do this, I'm going to be the one who will do that, right can you, and everything has kind of, I don't know how it all fell into place but it just did. It just, everything worked . . . I think when people are scared, then you see the real people.* (Wendy)

Where managers encouraged this, the organisational culture was experienced as embracing reflection and emotional honesty. This then produced a sense of gratitude and worth, key elements of social capital, which was extended to clients in a very human sense of bonding through crisis and adapting together. The sense of 'all being in this together' was experienced in well-functioning teams. We refer to this as solidarity and note that it seemed to be a contributing factor that supported coping and resilience among those interviewed.

On the other hand, some participants talked about the negative impact of the pandemic on organisations which were more hierarchical in their organisational form, and where there were clearer divisions between staff and management. According to participants, in these situations, the pandemic appeared to exacerbate pre-existing tension and strain, leading to a sense of further fragmentation between staff teams and managers and, between staff and clients:

> *The problems that we had became magnified. I am a great believer in when people go into crisis, organisations go into crisis. They don't tend to change, they tend to do more of what they do, and so the communication became an issue, kind of hierarchical, and people were, you know, understandably, everybody was scared. There was fear, and at the same time we were trying to deal with the clients, and for periods we were kind of mirroring their fear and uncertainty, and they were mirroring our fear and uncertainty. There were lots of decisions which sometimes led to a bit of chaotic practice.* (Mike)

Frustration was commonly reported around organisational policies, a lack of guidance about COVID-19 regulations, and a lack of support to guide practice changes. Some participants stated that policies should have been introduced to facilitate navigation of the changes brought about by the pandemic, and a lack of official guidance was a source of dissatisfaction. Where there was a pre-existing 'them and us' culture, this was experienced as exacerbating tensions, particularly because staff who remained on 'the frontline' believed that they were not consulted on the implications of this:

> *I just felt it was like "so you all get on with it, but we will not be here. We are not going to be in the office". So, I just think the support just disappeared. I felt as if it was like right, we are going to look after ourselves . . . A lot of the staff were really scared about what do we do?* (Lynsey)

> *The people who get paid the least, they are the people that are, like, working the hardest and working, you know, night shifts, and doing sleepover shifts. And they are the ones that are also putting their health and safety on the line.* (Margaret)

A sense of shared frustration about managers, and feeling a lack of control and autonomy, appeared to act as glue to unify some teams, creating stronger team bonds. However, this lack of autonomy seemed to create further separation between management and staff, resulting in closed groups. Some participants described feeling as though managers did not know what was happening within the service settings.

Reflection, Supervision and Training

Participants discussed particular aspects of organisational culture as mediating their experiences of stress during the pandemic. Aspects such as reflective practice opportunities, supervision, training, and the overall organisation ethos were viewed positively by most participants:

So, like, if something bad happened I was just like, I'd speak to her [Manager] and debrief and stuff, and she was like really supportive of me and then she was always reassuring me that I'd done my best. (Teresa)

Informal peer support, supervision, and reflective practice sessions between staff and within staff teams existed, as well as more formal supervision with line managers. For several participants, reflective practice was delivered by an external person, often a Clinical Psychologist. Some settings provided a range of opportunities for formal reflective practice:

[Organisation] do . . . reflective practice every week, where one of the local psychiatrists, psychologists . . . they do every week there was a chance and then there was a big one every month. (Colin)

Two participants talked about the potential downsides of reflective practice and supervision sessions. One noted that such sessions could increase stress in circumstances where there was insufficient time allocated within their workload. A few participants also described reflective meetings that took place in organisations where the culture did not support reflecting openly on emotions. In such settings, reflective meetings were described as 'tokenistic':

It [reflective meeting] hasn't happened for a wee while. It happened a couple of times and there was a lack of structure, there was a lack of information about what reflective practice could be or should be, or whatever [. . .] We are very hierarchical, top down, and there is a lot of blame flies around in this service. Sometimes it's deserved, you know, everybody makes mistakes, but as a culture that inhibits discussion. (Rebecca)

Another pointed out that communication concerning the purpose of reflective meetings had been unclear, and stated that the meetings had become somewhere to discuss problems, rather than solutions, which could exacerbate staff frustrations:

If the [Organisation] had maybe done one for a longer length of time, then that frustration and anger wouldn't have been there. Because they maybe would have known this is what reflective practice is for. It's to sit down and look at issues or aspects or something that has happened and, you know, could it be done better, and could we have worked in a different way? It became a blame game, you know? "This is your fault this happened", and that's not the culture you want. (Colin)

Participants who described positive reflective cultures in their workplaces tended to value ad hoc, informal reflection via impromptu discussions with managers:

There is always that opportunity where it's a real, it's a check in, you know? Where things are at. And they are always asking if there is any, you know, any issues with the clients, the team, and you do talk through each of your caseloads, for that reason. So, there is that stuff that is in place. As I say, there is the impromptu kind of stuff where you can just say "look I'm really struggling with this person" or, I need to just, or you just come in and debrief them what has happened. (Wendy)

Because of the COVID-19 restrictions, some supervision and reflective practice sessions had been provided online, rather than face to face. While participants were appreciative of such sessions, there was a dislike of the online format. Many described finding it difficult to engage, as described by Andy:

I've hated it. I hate being on a webcam [. . .] I certainly miss the face-to-face contact and being able to sit in a, you know, in an office and even just have a general chat. It might not be about work but just having that contact with the team, I certainly missed that. And I know quite a lot of the team were feeling the same, you know, they have said that over Zoom, you know, that they can't wait for the face-to-face meetings to resume. But I certainly find it helpful though. I think it's better than not, not having any contact. (Andy)

Participants much preferred face-to-face sessions and talked positively of the opportunities available during the summer of 2020, when restrictions eased and they could meet outside with colleagues.

Coping Strategies

We asked participants about the strategies they had used to help cope with the stress of the role prior to the COVID-19 pandemic, and to reflect on how these might have changed during the pandemic. Both before and during the pandemic, many participants expressed that they found it difficult to switch off from work. Several participants described using meditation, mindfulness, and breathing exercises to calm intrusive thoughts. Others told us that walking outside and being in nature helped to reduce feelings of anxiety. Several participants expressed that spending time with their pets, either at home or while outside, helped them to cope:

> *We recently rescued a cat and like my cat is my best therapist.* (Chris)

For many, physical exercise had been an important coping mechanism before the pandemic. The COVID-19 restrictions had meant that gyms were closed and participants described adapting to this by cycling or swimming outdoors as part of a suite of new coping strategies. Several participants were acutely aware of the strategies needed to support their own wellbeing, and saw regular breaks outside as important elements of self-care:

> *I have a policy of getting out of the building as often as I can. That's my, I have always had that, we get two half-hour breaks in our shifts and I'm quite renowned for making sure I get out. I've always done that, so I've carried on with that.* (Mike)

Some participants expressed that social contact with friends and family had helped with coping pre-pandemic and were acutely feeling the loss of social contact that had occurred as a result of COVID-19 restrictions. This tended to be particularly significant to those who were living alone. For these participants, time with clients and colleagues was an important source of social contact during the lockdown periods, at a time when only essential social contact was permitted. Many described using online platforms to stay in contact with family and friends. Several participants expressed that the support of household members was important to aid coping during the pandemic:

> *I'm just in a really fortunate position where I've got a really supportive husband, I've got a really supportive family and, like I said, I have got great managers and colleagues. I think if I didn't have that then yeah, this would be very different.* (Sarah)

Some workplaces were not permitting annual leave during the pandemic, and many participants described feeling exhausted and in need of a break. Steve talked at length about the challenges of annual leave during the pandemic and the impact this had on team members. For him, taking time off was an important way of dealing with stress. Relatedly, in other settings where annual leave had been permitted, some participants reported that they and other colleagues had taken decisions not to use annual leave because restrictions meant that travel plans were cancelled. Although these decisions had been taken voluntarily, many participants reflected that they were feeling exhausted and in need of time off to recuperate:

> *I wouldn't say it's been high stress but emotional exhaustion definitely . . . just feeling a bit I need a holiday, but I can't go anywhere . . . But yeah, I am thinking of taking some annual leave, even just to stay at home and, you know, keep the laptop and phone away.* (Andy)

Some participants felt that their coping abilities were beginning to reduce as a result of exhaustion:

> *I felt like my level of patience was . . . like my fuse was a lot shorter. So, I definitely had to work harder at work to be more present [. . .] which definitely made me exhausted. So, it was sort of just a big circle of emotions.* (Christina)

Some described operating on adrenaline at the start of the pandemic, feeling energised by the work, and able to deal with the fast pace of change. For several, this additional energy began to diminish over time:

> *The first few months it almost was yes, I don't even know how to describe it, it was just great, like I honestly just wasn't tired. I was like surprised at myself how energised I was. I literally like jumped out of bed every morning and was ready to go for the day. And then it just seemed to be at one point it just . . . came crashing down a little [. . .] I think yes just a little bit deflated, and I think I was yes, just definitely, emotionally exhausted is definitely how I would describe it.* (Margaret)

Participants talked about other ways of helping them cope with the stress and anxiety experienced as a result of the pandemic, including access to counselling, support from management and colleagues to maintain their usual coping strategies, and encouragement to take annual leave. Despite many positive examples of coping strategies, some participants described avoidant styles of coping, such as keeping busy to avoid thinking or feeling, and using alcohol after work as a way to mitigate stress:

> *I tend to find myself in ever repeating patterns of certain behaviours . . . Like I will address it and it will become unmanageable, or it will become less damaging for a period of time, and then something else will happen, or I will take my eye off the ball, or I will not be doing the physiological self-care stuff. And I will let something slip and rather than go to the gym, I will do something else that is not as good for me that is easier to do, you know, the lazy option, the quick fix.* (Chris)

One participant described frustration becoming dislocated and manifesting in other ways:

> *This morning I could have put this PC though the window because it was winding me up so much [. . .] I tear my hair out with IT stuff, then not, the actual, the challenging aspects of support work and homelessness work and addictions work doesn't stress me out . . . but that's maybe that's just stress in general manifesting itself in me getting wound up by this computer.* (Steve)

Recommendations for the Future

When reflecting on the lessons that could be learned from their experiences of frontline working during the pandemic, participants considered the recommendations that could be made. Several participants suggested that improvements should be made to pay and conditions within the sector, suggesting that this would help staff to feel more valued and appreciated. Many participants emphasised annual leave as fundamentally important to wellbeing and felt that there should have been policies to ensure that people were taking time off when entitled to do so. In a few circumstances, participants recounted that annual leave had not been permitted during the pandemic and recommended that this should not occur again in the future, due to the detrimental effect on staff wellbeing. Most participants also felt that staff wellbeing should be prioritised:

> *I've always struggled to understand why staff wellbeing . . . is an add on. It's not like a core function.* (Mike)

For some, supervision played a key role in maintaining wellbeing and ensuring a supportive organisational culture. Those who felt this way emphasised that their positive experiences were not universal across the sector, and that more should be done to ensure positive organisational cultures where staff wellbeing was seen as a priority. Other participants recommended that counselling and/or therapeutic services be made more readily available to staff. For several, this would contribute to feeling valued, and would also help to support coping skills:

> *Maybe some extra access to like maybe counselling services would have been appropriate, because I'd say a lot of people in my team have been struggling with depression and anxiety.* (Andy)

In one example, the offer of counselling for vicarious trauma had been made but not taken up, though the offer had been experienced as supportive. In one setting, staff had been given two wellbeing days that could be taken at short notice, which had been experienced as supportive, and something that one participant was keen to recommend.

In summary, participants recommended that organisational practices should ensure that staff feel valued and that their wellbeing is prioritised. Participants recommended that annual leave be actively encouraged, supervisory practices be strengthened, and access to therapeutic services increased. Participants also recommended that punitive absence policies should be not have been implemented at a time of stress and in future should be more understanding towards people's circumstances.

3.2. Quantitative Findings

Overall, participants showed low/moderate levels of emotional exhaustion (EE), low depersonalisation (DP), and moderate levels of personal accomplishment (PA), as measured by the MBI. Table 2 details the mean, median, and range for each dimension. When examining the scores, it is important to note that, whilst high EE and DP scores are indicative of burnout, the opposite is true of PA, in which a low score indicates potential burnout.

Table 2. Maslach Burnout Inventory (MBI) scores for participants (n = 11).

Dimension	Mean	Median	Range
Emotional exhaustion (EE)	16.9	18	3–31
Depersonalisation (DP)	4.4	2	0–11
Personal accomplishment (PA)	34	32	26–46

When examining the scores by each individual dimension, we found that, while most participants had low EE scores (i.e., 0–16), 3/11 had moderate scores (17–26), and 2/11 had high scores (27+). The median score of 18 for all participants is suggestive of moderate levels of emotional exhaustion, indicating that approximately half the sample (5/11) were either experiencing relatively high levels of emotional exhaustion, or were at 'risk' (i.e., experiencing 'moderate' levels). For DP, the mean and median scores suggest low levels of depersonalisation, while 2/11 had scores indicating moderate levels (7–12), and another 2/11 reported high levels (13+). For PA, the mean and median scores are suggestive of moderate levels of personal accomplishment (32–38), with 1/11 scoring very high (39+). Overall, while most scores suggested participants were not experiencing burnout, 2/11 scored at higher levels. The findings indicate that, at the time of data collection, participants were not experiencing burnout but may be at risk in the future if issues were left unaddressed.

4. Discussion

This mixed-methods study explored experiences of stress and wellbeing of third sector (not-for-profit) homelessness services workers during the early stages of the COVID-19 pandemic in Scotland. It is the first UK study to explore the views of those working on the frontline in homelessness services during the pandemic. As mentioned previously, a great deal of research focused on the experiences of frontline health care workers during the pandemic, with very little being focused on those working in homelessness services (e.g., [32]). Our findings suggest that the COVID-19 pandemic greatly impacted those interviewed and seemed to magnify both the positive and negative aspects of the frontline homelessness service role and organisational culture, within several homelessness services in Scotland. Prior to the pandemic, participants described their roles as demanding and involving having to work in challenging situations, as well as having good relationships with clients. They also described varying aspects of organisational culture. Previous research has also highlighted similar themes from those working within the homelessness sector (e.g., [4,5,10,17]). Our participants described situations where teams who were functioning well before the pandemic seemed to work effectively together during the

time of crisis, and bonds were further strengthened. Participants noted that this tended to occur in organisational cultures where reflexivity was embraced and strengthened by managers who were aware of the emotional needs of staff members, regularly checked in to ask how things were going, and proactively identified situations where support was required. Conversely, other participants described fragmentation between managers and staff before the COVID-19 pandemic, which they noted resulted in stress and challenging working environments. Participants in these services described feeling angry when, at the start of the pandemic, managers were able to work from home and staff remained on the frontline. Participants discussed these tensions in relation to a lack of communication that exacerbated a pre-existing 'them and us' culture between staff members and management, whilst appearing to strengthen relationships within staff teams. In some settings, formal reflective practice was provided but was experienced as tokenistic. In these settings, staff reported feeling unable to be honest about their emotions, their coping abilities, or any challenges faced within their roles. Some participants described taking breaks during the working day or annual leave as essential to coping with working during the pandemic, while others discussed punitive responses to absenteeism and not being allowed to take holidays.

Participants' descriptions of organisational culture during the pandemic is reminiscent of the 'blitz spirit' described by Furedi (2007) who noted that the sense of potential impending disaster during the London bombings of World War II were mitigated by a sense of solidarity, togetherness, and shared experience [55]. Our findings reflect this spirit of togetherness during the COVID-19 pandemic but illustrate that such feelings of solidarity were strongest among those who felt well supported by managers and able to freely express their feelings of vulnerability and any concerns. This finding is consistent with wider natural disaster literature where solidarity boosts resilience of populations and groups through a shared sense of reciprocal care, and a willingness to make sacrifices to promote the wellbeing of others [47,48].

Our quantitative findings are consistent with the qualitative findings. Although interviewed participants described coping generally, they identified a number of issues and challenges indicating potential risks for burnout in the longer term. Levels of personal accomplishment (PA), depersonalisation (DP), and emotional exhaustion (EE) indicative of 'burnout' develop over time. Our data indicate that several participants may have been at higher risk of burnout when data were collected, due to their moderate/high EE/DP scores, and low/moderate PA scores. The low levels of depersonalisation were also indicative of the qualitative findings. Typically, participants spoke about empathy and connection with their clients, in person-centred and rights-based language, albeit to varying degrees. There were a couple of instances of depersonalised, emotionally colder and distanced language, indicative of higher depersonalisation scores. The lower levels of personal accomplishment are representative of the general frustration which participants discussed in the interviews. They spoke about both COVID-19 specific barriers to providing care and helping clients progress, as well as concerns about more general organisational constraints and structural issues, such as a lack of available housing or non-trauma-informed external organisations. These frustrations are consistent with the lower levels of personal accomplishment in the Maslach Burnout Inventory (MBI), as participants felt there were several barriers constraining their capacity to make a difference. It is also important to note that, while studies examining burnout using the MBI in homelessness services are scarce, our findings show similarities with the limited evidence base (e.g., [56–58]).

Drawing on the Goh et al. (2010) Revised Transactional Model (RTM) [42], our study provides an understanding of the ways in which stressful events were experienced by participants. In the RTM, people's stress levels will be impacted by their coping strategies and available resources when they are faced with stressful events. In this study, pre-pandemic working conditions (the primary stressor), and individuals' available coping strategies, influenced their experiences of work during the pandemic (secondary stressor). Our findings have added the influence of control, social capital and solidarity to the model,

which acted as additional resources for our participants during a challenging time. Our findings indicate that someone's perceptions of their control over the stressor (i.e., levels of autonomy, control over clients' situations, and also over the impact of COVID-19) was influenced by the level of social capital they perceive they have (i.e., their support networks and resources). High social capital (i.e., good social networks) was found to come from approachable and adaptable managers who listened and responded to staff perceptions of their needs, as well as the needs of clients and the service. This seemed to result in feelings of control over the secondary stressor (the pandemic) which offset enough stress to make the potential primary stressor (pre-pandemic organisational context) feel less risky to staff wellbeing. Participants talked about how having control and a sense of solidarity in their teams facilitated feelings of being able to cope with the challenges experienced. Others described situations where they did not have these high levels of social capital, and therefore did not feel in control and the pandemic caused them to feel additional stress. These negative experiences appeared to be compounded by difficult working environments and unsupportive management.

While the pandemic intensified social bonds and solidarity in some cases, it also appeared to magnify the polarisation that occurred in others. This suggests that, while this study provides an important contribution to understanding staff wellbeing at a time of global crisis, it also provides an insight into coping more generally. Notably, interviews were conducted several months into the pandemic (June–October 2020). At this point, participants self-identified as being physically exhausted, with many indicating that they felt in need of time off to rest. Participants described a range of recommendations relating to organisational culture, such as improvements to pay and conditions, opportunities to take annual leave, and access to supervision and counselling. Previous studies have also highlighted the influence of organisational culture and the wider homelessness system on staff wellbeing [5,9,19]. This study adds to the evidence base by providing an insight into the additional challenges (as well as perceived positives) stemming from working in homelessness services in the UK during a global pandemic.

4.1. Implications for Policy, Practice and Research

In terms of policy and practice, our findings highlight the need for clear support structures for those working in frontline homelessness service roles, with relevance to the UK and beyond. Participants described stressors such as lone working, high workloads, and high levels of responsibility, whilst navigating a complex system, which have also been described in international studies. Although many of the challenges described by participants were not specific to the pandemic, they appeared to be exacerbated by it, suggesting a need to address concerns and difficulties post-pandemic. Service managers should be supported to work closely with staff to ensure clear communication and encourage a culture of flexibility and autonomy. Additionally, services should be encouraged and supported to develop a sense of solidarity between service managers, staff and clients. This can be supported by reflective cultures, team building, and good communication, all of which were highlighted by participants. Relatedly, services should provide opportunities for informal and formal communication with staff, to ensure staff feel listened to and supported. Fourthly, reflective practice appears to be important at an organisational level and can be embedded into organisational cultures. This includes reflective supervision, which should be provided by well-trained professionals who are external to the staff team and management, where possible. Some participants spoke highly of their organisation's reflective practice culture, whereas others described this as tokenistic. Embedding person-centred reflective practice at the organisation and sector levels could ensure staff are well supported in their roles. Finally, staff discussed the importance of time off. Staff should be protected from exhaustion, through encouraging (allowing) them to take annual leave and providing access to counselling and other supports. Given the policy focus on addressing homelessness in Scotland, as well as within the UK and internationally, there should be emphasis on supporting staff at the sector level, to ensure equity across organisations.

In terms of implications for research, it is important to note that this study was conducted in the summer of 2020, in the early phases of the pandemic, and therefore only provides a snapshot of participants' experiences and within a particular time and place. Given the ongoing nature of the COVID-19 pandemic, and the likelihood of burnout developing over a longer period, further research is required to understand the longer-term impact of the pandemic on the wellbeing of frontline staff working in homelessness services, and to explore changes over time. It would also be beneficial for future studies to examine in more depth the key themes raised in this study, such as the impact of reflective practice, good communication within teams, solidarity, and protection from exhaustion, on staff outcomes. It would also be beneficial to administer the MBI with a larger population of participants to assess levels of burnout in the sector more widely. Given the lack of research into the experiences of those working in homelessness services, future research in this field is essential.

4.2. Strengths and Limitations

This study provides insight into experiences of stress and wellbeing of frontline homelessness workers in Scotland during the COVID-19 pandemic. Despite the clear challenges that organisations and their staff were experiencing, we were able to interview 18 individuals who worked in a variety of roles in six different homelessness organisations across Scotland. The diversity of participants allowed us to capture a breadth of different experiences, providing a good understanding of work during the pandemic. The use of the MBI enabled us to capture data on different elements of burnout and triangulate our qualitative data. Using the RTM to inform our data collection and analysis also allowed for a greater understanding of the potential key factors influencing participants' experiences of stress and wellbeing.

It is important to note that, while our participants' experiences were varied, it is likely that those who were already experiencing high levels of burnout did not participate, due to feeling unable to participate in an additional work-related task, or because managers did not identify them for the research, or because they were absent from work. Our recruitment approach, of involving service managers as gatekeepers, may also have limited participants to those who were not yet experiencing burnout, and/or those who had more positive experiences. In some cases, managers passed on individual's contact details, and in others, participants emailed the study team directly. However, it was unclear as to whether they had been asked to do so by managers or had chosen to do so of their own accord. While it would have been beneficial to directly approach staff without involving service managers, generally their contact details were not in the public domain. This was the reason why we utilised the approach of asking service managers to make initial contact. Finally, only 11 of the 18 participants completed the MBI, which means that our findings do not relate to the whole sample. Participants may have felt that the MBI was too intrusive, or that they did not have time to complete it, or simply forgot to do so. Despite this, the small sample still shows variation in terms of scores and experiences, which corroborate our qualitative findings. Due to the very small sample, we are not able to draw any further conclusions from these data.

5. Conclusions

This study provided insight into the experiences of stress and wellbeing, and other related factors, of frontline homelessness service staff during the early stages of the COVID-19 pandemic in Scotland. The findings highlighted the positive and negative experiences prior to the pandemic, which were exacerbated by the global crisis. For some, the pandemic strengthened team bonds and enabled staff to provide clients with greater support. For others, the pandemic led to additional frustrations, poor communication, and fragmented teams, which appeared to have a negative impact on wellbeing. Participants identified several factors that should be prioritised, both in their organisations and across the homelessness sector in Scotland, to support staff wellbeing. These included reflective practice

cultures, access to counselling/support, open and honest team communication (particularly from management to staff), and ensuring staff are protected from exhaustion through ensuring they are able to take their annual leave. These recommendations are also likely relevant to other countries, given the similarities described in the literature from other countries. Future research should explore the longer-term impact of the pandemic on homelessness service staff outcomes and explore the most effective ways of providing support to try to mitigate staff stress and burnout.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19063659/s1, Supplementary File S1: Interview schedule.

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Socio-Demographic Composition and Potential Occupational Exposure to SARS-CoV2 under Routine Working Conditions among Key Workers in France

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Abstract: This study aims to describe the socio-demographic profile of so-called "key workers" during the first lockdown in France and to assess their potential occupational exposure to SARS-CoV-2 under routine, pre-pandemic working conditions. We used the French list of essential jobs that was issued during the first lockdown to identify three subgroups of key workers (hospital healthcare, non-hospital healthcare, non-healthcare). Based on the population-based "Conditions de travail-2019" survey, we described the socio-demographic composition of key workers and their potential work-related exposures (to "infectious agents," "face-to-face contact with the public," and "working with colleagues") using modified Poisson regression. In general, women, clerical and manual workers, workers on temporary contracts, those with lower education and income, and non-European immigrants were more likely to be key workers, who accounted for 22% of the active population. Non-healthcare essential workers (57%) were the most socially disadvantaged, while non-hospital healthcare workers (19%) were polarized at both extremes of the social scale; hospital healthcare workers (24%) were intermediate. Compared to non-key workers, all subgroups had greater exposure to infectious agents and more physical contact with the public. This study provides evidence of accumulated disadvantages among key workers concerning their social background, geographical origin, and potential SARS-CoV-2 exposure.

Keywords: COVID-19; essential workers; health equity; lockdown; socio-occupational disparities; worker protections; occupational health

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1. Introduction

The COVID-19 crisis brought the occupational hazard of contamination in the workplace to the fore as a large-scale public health issue [1]. The common view was that risks were linked to direct contact with people who were infected by COVID-19. Therefore, the occupations that were considered to be "on the front line" during the very first months of the epidemic were health professionals, and more specifically, hospital caregivers [2,3]. However, these occupations (physicians, nurses, care assistants) were concerned to a different extent depending on their actual working conditions. In addition, other less visible jobs were in contact with the virus through infected materials (cleaning staff, funeral workers) or brought into frequent contact with colleagues or the public, while some commuted to work through public transportation.

State restrictions in response to the first wave of COVID-19 rapidly brought worldwide attention to the broader concept of "essential workers". They were previously defined as workers who provide services, "the interruption of which would endanger the life, personal

safety or health of the whole or part of the population", according to the International Labor Organization (ILO) [4]. From the onset of the pandemic, many governments scrambled to identify the services and workers that they deemed to be essential, with varying terminologies [5]. In the United States, for example, all workers whose job served to "protect their communities, while ensuring continuity of functions critical to public health and safety, as well as economic and national security" [6] were designated as essential workers, even if they could work from home, and a narrower subgroup who had to provide their labor in person were considered as "frontline essential workers" [7].

In the US, pre-pandemic surveys showed that many of these potentially high-risk frontline jobs were held by individuals at the most disadvantaged intersections of gender, racial/ethnic minority status, and socio-occupational class [8]. Disparities in working arrangements (e.g., telework, onsite work, layoffs, and sick leave), as well as disparities in working conditions among onsite workers (e.g., regarding exposure to the virus), have therefore been hypothesized as a driving part of COVID-19 disparities among working-age adults. It has also been pointed out that a substantial proportion of those workers were often already at a heightened risk for poor health due to multiple systemic social and economic disadvantages that existed pre-pandemic [9]. These early observations are in line with the now-common view that COVID-19 is a "syndemic pandemic" embedded in inequalities in chronic conditions, such as existing non-communicable diseases, as well as inequalities in the social determinants of health [10,11]. Due to both the syndemic nature of the pandemic and the diversity of working arrangements and workplace exposures, occupational disparities in COVID-19 infection and outcomes are expected to be non-linear—in other words, not to follow a gradient along the socio-occupational hierarchy.

Whereas studies have found that working-class individuals may have been less protected by the lockdown measures than more privileged categories due to their professional obligations, their living conditions in overcrowded housing and densely populated areas, and their pre-existing comorbid health conditions [12], the lower social class has also been shown to be at a greater risk of income and job loss, which correlates with reduced workplace exposure [13,14]. Moreover, the impact of the lockdown on the middle class may have been mixed, as it may have protected those who could benefit from work-at-home arrangements or government-subsidized layoffs, while healthcare workers have been disproportionately exposed [15]. The extent to which work contributed to the social gradient of infection also depends on the policy context, in particular the stringency of the workplace measures (workplace closures and onsite health protection measures) that varied between and within countries and over time.

In France, the government imposed a strict 2-months lockdown on 17 March 2020, which was rated as one of the most stringent "lockdown style policies" by the Oxford COVID-19 Government Response Tracker [16]. In this country, "key workers" were defined merely as workers who continued to work on-site during the first lockdown [17]. Many industries were shut down or faced a sharp decline in demand and remote work was imposed on the majority of office workers. Even so, several million workers were designated as "key workers" who worked in the healthcare sector, as well as other services, such as food and agriculture (food workers, cashiers); sanitation (water treatment, waste collection, cleaning, funeral services); logistics (transportation, warehousing); or utilities (energy providers: electricity, oil, gas, computer services, construction) [17]. Working conditions are already known to be important social determinants of health [18]; in the absence of many other usual social interactions, they may have played an even more important role in explaining the disproportionate burden of COVID-19 among disadvantaged workers and within their households, but also, for example, among middle-class social and health workers.

While we know already that the racial division of work translated into a higher probability of working in jobs that were deemed to be essential among immigrant and minority populations [19], little is known in France about the diversity of sociodemographic profiles among workers who continued to work in person during the first lockdown and their work-related exposure to SARS-CoV-2.

Our study builds upon pre-COVID-19 employment survey data to provide insight into the social disparities between different subgroups of 'key workers', by describing their socio-demographic profile and assessing their potential occupational exposure to SARS-CoV-2, and by extension, to infectious diseases of respiratory origin. We hypothesize that minimal distinctions should be made, notably between hospital-healthcare workers, non-hospital healthcare workers, and other key workers outside of healthcare to better understand the social gradient of COVID-19 that was observed in the early pandemic at the intersection of gender, class, and race/ethnicity [12,15,20].

2. Materials and Methods

2.1. Data

We used the 2019 edition of the "Conditions de travail" survey (CT-2019) which is a periodic population-based cross-sectional study conducted by the French Ministry of Labor on a nationally representative sample of 24,951 working adults representing 27 million employees in the public and private sectors, as well as the self-employed [21]. We selected participants aged 18 to 64 years who were living in Metropolitan France (N = 23,231).

2.2. Socio-Demographic Variables

In addition to gender and age, we considered the following socio-demographic variables. Socio-occupational group was defined following the French classification of occupations and socio-occupational categories and grouped into farmers; self-employed (excluding intellectual occupations); senior executive professionals and professors; middle executive professionals; clerical workers; and manual workers. Clerical and manual workers were further split into skilled and low-skilled subgroups. The employment status variable distinguished private and public sector workers. The type of contract had four categories: apprenticeship, independent, permanent, and temporary contract. Educational level was converted to the corresponding International Standard Classification of Education (ISCED) [22]. Income level was defined based on declared monthly income deciles. Finally, geographic origin divided workers into: persons who were born in the French overseas departments (DOM); descendants of immigrants, including those who were born in Metropolitan France with at least one parent born outside Metropolitan France without having French nationality at birth; immigrants who were born outside Metropolitan France without having French nationality at birth; and the mainstream population, which consisted of other persons residing in Metropolitan France [23]. From there, we built a 14-level origin variable for which immigrants and the descendants of immigrants were divided into six geographic regions: Maghreb (Algeria, Morocco, Tunisia); all other African countries; Asia; European Union (15 countries); all other EU countries; and other countries.

2.3. Key Worker's Definition

We used a list of 35 occupations belonging to the health, food, public services, and logistics sectors, to be considered "key occupations" during the first lockdown in France [24]. The list does not include teaching, childcare, or construction workers, as those remained mostly locked down during the first wave of the pandemic. The key occupations were further categorized into three sub-groups: hospital healthcare workers, non-hospital healthcare workers, and non-healthcare essential workers (Appendix A Table A1).

Due to the aggregate level of information in the CT-2019 database on some occupations, such as funeral staff, salespeople, and public transport drivers, some of these groups contained workers who were likely not working onsite during the first lockdown. We performed a sensitivity analysis by removing these occupations to explore whether there was any change in the socio-demographic profile of key workers and their work-related exposure to SARS-CoV-2.

2.4. Work-Related Exposure to SARS-CoV-2

To estimate the percentage of potentially exposed workers, we used information on the routine working conditions prevailing right before the COVID-19 pandemic: for infectious agents: "At your workplace, are you exposed to infectious risks"?; for face to face contact with the public: "Are you in direct contact with the public? (users, patients, students, travelers, customers, suppliers, ...)", and then, in the case of a positive reply, "is the contact face to face"?; for physical contact with colleagues: "Do you work alone?". All of the exposure factors were coded as binary variables.

2.5. Modeling

To describe the sociodemographic profile of key workers, we first considered as independent variables the sociodemographic characteristics and their interactions, and as outcomes, being a key worker and belonging to a key worker sub-group. To model the probability of occupational exposure to SARS-CoV-2, we then selected being a key worker as the independent variable, and the outcomes were in turn the three occupational exposure factors.

In both models, the outcome of interest was fairly common (i.e., more than 10%) among the sociodemographic and occupational subgroups. As the log-binomial model did not converge in some cases, we performed a modified Poisson regression to estimate the prevalence ratio (PR) of being a key worker in the first model and being exposed to workplace exposure factors in the second model [25]. When possible, we ran both models and compared the results. Almost all estimates of PR were similar to one decimal place and, as anticipated, the confidence intervals were larger in the modified Poisson regression.

We also investigated the association between the intersections of gender, geographic origin, and occupational group with being a key worker through an 8-level variable that divided participants based on being male or not, born in Metropolitan France or not, and being a senior executive professional or not.

The data were weighted to be nationally representative of the working population in Metropolitan France. An extensive description of the sampling and weighting methods that are used in CT periodic surveys is available elsewhere [26]. Both the descriptive analysis and modeling were carried out using SAS software (Linux distribution), version 9.4 on SAS Studio interface, version 3.6, released by SAS Institute Inc., Cary, NC, USA.

3. Results

At the start of the pandemic, key workers accounted for 22% of workers in Metropolitan France. For this analysis, we divided those key workers into hospital healthcare workers (24%), non-hospital healthcare workers (19%), and non-healthcare essential workers (57%). The distributions of the main sociodemographic characteristics of key workers (taken as a whole and in different subgroups) are shown in Table 1, and the stratified multivariate modeling carried for each subgroup are shown in Table 2.

Compared to non-key workers, key workers as a whole were more likely to be female, of younger age, and born in the Maghreb. On the opposite, there was a negative association with being born in Asia, and, to an even greater extent, with upper occupational and educational levels (Tables 1 and 2).

Figure 1 shows that gender and occupational group had significant interactive effects on the likelihood of being a key worker, with female non-executive professionals having the highest probability, compared to male senior executive professionals who were born in France. However, being born in Metropolitan France did not meaningfully change the likelihood of being a key worker in an intersection of gender, geographic origin, and occupational group.

Table 1. Sociodemographic characteristics of the general active population, non-key workers, the three sub-groups of key workers, and all key workers.

	Non-Key Workers	Hospital HCW [a]	Non-Hospital HCW [a]	Essential Non HCW [a]	All Key Workers [b]	All Active Population [c]
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Total	17,156 (78.6)	2738 (5.2)	1009 (4.1)	2291 (12.1)	6038 (21.5)	23,194 (100)
Gender						
Male	8371 (55.1)	403 (17.2)	153 (15.5)	1286 (56.1)	1842 (38.9)	10,228 (51.5)
Female	8785 (45.0)	2335 (82.8)	856 (84.5)	1005 (43.9)	4196 (61.1)	13,003 (48.5)
Age group						
18–24	455 (7.1)	78 (6.5)	21 (7.0)	107 (11.1)	206 (9.2)	665 (7.5)
25–34	2971 (22.6)	651 (27.4)	177 (17.1)	433 (19.9)	1261 (21.2)	4236 (22.2)
35–44	4245 (25.2)	624 (24.6)	225 (22.1)	582 (23.4)	1431 (23.5)	5684 (24.8)
45–54	5840 (28.4)	883 (26.6)	324 (29.8)	758 (27.8)	1965 (27.9)	7816 (28.3)
55–64	3645 (16.8)	502 (15.0)	262 (24.1)	411 (17.8)	1175 (18.3)	4830 (17.2)
Occupational group						
Farmers	432 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	432 (1.4)
Self-employed	947 (7.0)	0 (0.0)	0 (0.0)	104 (5.3)	104 (3.0)	1051 (6.1)
Senior executive professionals and Professors	3838 (21.6)	251 (10.1)	152 (18.1)	24 (0.9)	427 (6.5)	4265 (18.3)
Middle executive professionals	5236 (28.0)	1262 (38.2)	440 (29.0)	279 (7.9)	1981 (19.3)	7217 (26.1)
Skilled clerical workers	2352 (12.3)	827 (30.1)	0 (0.0)	387 (11.4)	1214 (13.8)	3566 (12.6)
Skilled manual workers	1881 (12.6)	0 (0.0)	0 (0.0)	644 (30.8)	644 (17.4)	2525 (13.6)
Low-skilled clerical workers	1647 (10.1)	398 (21.5)	417 (53.0)	547 (28.2)	1362 (31.4)	3009 (14.7)
Low-skilled manual workers	821 (6.5)	0 (0.0)	0 (0.0)	306 (15.4)	306 (8.7)	1127 (7.0)
Employment status						
Private	11,118 (80.0)	858 (37.5)	763 (87.6)	1791 (90.8)	3412 (77.3)	14,555 (79.4)
Public	6038 (20.0)	1880 (62.5)	246 (12.4)	500 (9.2)	2626 (22.8)	8676 (20.6)
Type of contract						
Apprenticeship	405 (5.3)	38 (2.6)	22 (3.1)	59 (4.2)	119 (3.6)	525 (4.9)
Independent	1749 (10.7)	8 (0.2)	312 (26.8)	122 (5.8)	442 (8.5)	2195 (10.3)
Permanent	14,052 (74.4)	2490 (79.2)	618 (60.1)	1974 (78.7)	5082 (75.2)	19,160 (74.5)
Temporary	950 (9.6)	202 (18.0)	57 (10.0)	136 (11.3)	395 (12.7)	1351 (10.3)
Education level						
No formal education	835 (5.7)	84 (4.8)	60 (6.4)	254 (12.9)	398 (9.7)	1233 (6.6)
Primary or lower secondary education	802 (5.1)	96 (3.9)	56 (8.3)	205 (9.4)	357 (7.8)	1160 (5.7)
Upper secondary education	3883 (22.4)	601 (24.0)	199 (24.3)	817 (37.3)	1617 (31.6)	5508 (24.4)
Post-secondary non-tertiary education	3296 (19.1)	372 (15.3)	101 (13.3)	530 (22.4)	1003 (18.9)	4307 (19.1)
Short-cycle tertiary education or bachelor's or equivalent	5459 (30.3)	1242 (38.3)	365 (24.7)	429 (15.7)	2036 (22.9)	7511 (28.8)
Master's or equivalent or higher	2860 (17.4)	337 (13.8)	226 (23.1)	54 (2.3)	617 (9.1)	3481 (15.6)
Income level						
Decile 1 (lowest)	1649 (13.6)	118 (11.0)	211 (31.7)	271 (15.3)	600 (17.3)	2256 (14.5)
Decile 2&3	3104 (20.3)	513 (24.0)	221 (27.0)	690 (35.6)	1424 (31.1)	4535 (22.6)
Decile 4&5	3048 (17.4)	771 (27.2)	93 (6.0)	399 (17.9)	1263 (18.0)	4318 (17.6)
Decile 6&7	3395 (18.5)	718 (22.1)	88 (5.3)	468 (17.7)	1274 (16.4)	4674 (18.0)
Decile 8&9	3640 (19.6)	400 (10.5)	162 (12.3)	334 (11.0)	896 (11.1)	4541 (17.8)
Decile 10	1821 (10.6)	187 (5.2)	184 (17.6)	66 (2.6)	437 (6.1)	2262 (9.6)
Geographical origin						
Mainstream population	15,227 (85.2)	2472 (86.5)	897 (81.1)	2005 (84.6)	5374 (84.4)	20,632 (85.0)
DOM natives	170 (1.0)	46 (2.4)	7 (0.5)	27 (1.3)	80 (1.4)	250 (1.1)
Descendants of immigrant(s) from Maghreb	145 (1.4)	16 (0.9)	3 (0.7)	22 (1.5)	41 (1.2)	186 (1.3)
Descendants of immigrant(s) from all other African countries	33 (0.3)	3 (0.1)	1 (0.6)	6 (0.3)	10 (0.3)	43 (0.3)
Descendants of immigrant(s) from Asia	26 (0.3)	5 (0.2)	0 (0.0)	8 (1.0)	13 (0.6)	39 (0.4)
Descendants of immigrant(s) from European Union 15 countries [d]	282 (2.1)	28 (0.9)	14 (3.3)	33 (1.4)	75 (1.6)	358 (2.5)
Descendants of immigrant(s) from all other European countries	26 (0.2)	3 (0.3)	2 (0.2)	6 (0.2)	11 (0.2)	37 (0.2)
Descendants of immigrant(s) from other countries	17 (0.2)	4 (0.2)	1 (0.1)	0 (0.0)	5 (0.1)	22 (0.2)
Immigrants from Maghreb	262 (2.2)	30 (2.2)	16 (4.6)	56 (3.7)	102 (3.5)	366 (2.5)
Immigrants from all other African countries	198 (1.8)	53 (2.3)	19 (3.9)	28 (1.8)	100 (2.3)	298 (1.9)
Immigrants from Asia	155 (1.6)	8 (0.1)	6 (0.7)	24 (1.1)	38 (0.8)	193 (1.4)
Immigrants from European Union 15 countries [d]	293 (2.2)	25 (1.0)	23 (2.4)	33 (1.9)	81 (1.8)	375 (2.1)
Immigrants from all other European countries	91 (0.9)	13 (2.7)	4 (0.7)	8 (0.8)	25 (1.2)	117 (1.0)
Immigrants from other countries	74 (0.6)	12 (0.4)	7 (1.1)	9 (0.5)	28 (0.6)	103 (0.6)

[a] HCW: Healthcare workers. [b] All key workers = "hospital HCW" + "non-hospital HCW" + "Essential non HCW". [c] All active population = "Non-key workers" + "All key workers". [d] The OECD definition of European Union 15 countries (EU15): https://stats.oecd.org/glossary/detail.asp?ID=6805 (accessed on 14 June 2022).

Table 2. Estimated adjusted prevalence ratios (PR) for the association between socio-demographic characteristics and working as a key worker in each sub-group of key workers, compared to non-key workers (stratified multivariate models).

	Hospital HCW [a]	Non-Hospital HCW [a]	Essential Non HCW [a]	All Key Workers
	Adjusted PR [b] (vs. Non-Key Workers)			
Gender				
Male	Ref	Ref	Ref	Ref
Female	5.4 [c] (4.4–6.7)	6.3 (4.8–8.2)	1.1 (1.0–1.2)	1.8 (1.6–1.9)
Age group				
18–24	1.2 (0.8–1.8)	0.9 (0.5–1.8)	1.6 (1.2–2.3)	1.3 (1.0–1.7)
25–34	1.5 (1.1–1.9)	0.6 (0.4–0.8)	1.3 (1.0–1.6)	1.1 (1.0–1.3)
35–44	1.1 (0.9–1.4)	0.7 (0.5–0.9)	1.2 (1.0–1.5)	1.0 (0.9–1.2)
45–54	1.1 (0.9–1.3)	0.8 (0.6–1.0)	1.0 (0.9–1.2)	1.0 (0.9–1.1)
55–64	Ref	Ref	Ref	Ref
Occupational group				
Farmers	-	-		
Self-employed	-	-	15.9 (8.8–28.8)	1.5 (1.1–2.0)
Senior executive professionals and Professors	Ref	Ref	Ref	Ref
Middle executive professionals	2.4 (1.9–3.1)	1.1 (0.8–1.5)	6.1 (3.4–10.8)	2.0 (1.7–2.4)
Skilled clerical workers	3.1 (2.4–3.9)	-	18.5 (10.5–32.9)	2.7 (2.2–3.2)
Skilled manual workers	-	-	42.1 (24.4–72.5)	4.2 (3.5–5.1)
Low-skilled clerical workers	3.1 (2.3–4.2)	3.4 (2.6–4.6)	47.1 (27.1–82.0)	5.4 (4.5–6.5)
Low-skilled manual workers	-	-	41.9 (24.0–73.2)	3.7 (3.0–4.7)
Employment status				
Private	Ref	Ref	Ref	Ref
Public	4.6 (3.8–5.6)	0.4 (0.3–0.6)	0.5 (0.4–0.6)	1.1 (1.0–1.2)
Type of contract				
Apprenticeship	0.6 (0.4–1.0)	0.8 (0.4–1.7)	0.5 (0.4–0.8)	0.6 (0.5–0.9)
Independent	0.0 (0.0–0.1)	3.4 (2.7–4.2)	0.6 (0.4–0.7)	0.9 (0.8–1.1)
Permanent	Ref	Ref	Ref	Ref
Temporary	1.5 (1.1–2.0)	1.1 (0.7–1.6)	0.9 (0.7–1.2)	1.0 (0.9–1.2)
Education level				
No formal education	1.2 (0.7–2.0)	0.7 (0.4–1.0)	14.0 (8.2–23.9)	2.6 (2.1–3.3)
Primary or lower secondary education	1.0 (0.7–1.6)	1.0 (0.6–1.6)	12.0 (7.0–20.8)	2.4 (1.9–3.0)
Upper secondary education	1.7 (1.2–2.3)	0.9 (0.6–1.3)	11.0 (6.5–18.5)	2.4 (2.0–2.9)
Post-secondary non-tertiary education	1.1 (0.8–1.5)	0.5 (0.3–0.8)	7.6 (4.4–13.0)	1.7 (1.4–2.0)
Short-cycle tertiary education or bachelor's or equivalent	1.4 (1.0–1.9)	0.6 (0.4–0.8)	3.6 (2.1–6.2)	1.3 (1.1–1.6)
Master's or equivalent or higher	Ref	Ref	Ref	Ref
Income level				
Decile 1 (lowest)	0.9 (0.6–1.4)	0.8 (0.6–1.0))	4.7 (3.1–7.1)	1.6 (1.4–2.0)
Decile 2&3	1.4 (1.0–1.9)	0.5 (0.4–0.7)	7.0 (4.8–10.3)	2.0 (1.6–2.4)
Decile 4&5	2.0 (1.4–2.6)	0.2 (0.1–0.3)	4.4 (2.9–6.5)	1.5 (1.3–1.8)
Decile 6&7	1.6 (1.2–2.2)	0.1 (0.1–0.2)	4.1 (2.8–6.1)	1.4 (1.2–1.7)
Decile 8&9	0.9 (0.6–1.2)	0.3 (0.2–0.5)	2.4 (1.6–3.7)	1.0 (0.8–1.2)
Decile 10	Ref	Ref	Ref	Ref
Geographical origin				
Mainstream population	Ref	Ref	Ref	Ref
DOM natives	2.1 (1.3–3.4)	0.5 (0.2–1.3)	1.2 (0.7–1.9)	1.2 (0.9–1.7)
Descendants of immigrant(s) from Maghreb	0.7 (0.4–1.3)	0.7 (0.2–2.2)	0.9 (0.5–1.8)	0.8 (0.5–1.3)
Descendants of immigrant(s) from all other African countries	0.3 (0.1–1.3)	1.6 (0.2–12.3)	0.9 (0.3–2.4)	0.9 (0.4–2.2)
Descendants of immigrant(s) from Asia	0.5 (0.1–1.6)	-	2.2 (1.1–4.7)	1.4 (0.7-.2.9)
Descendants of immigrant(s) from European Union 15 countries [d]	0.4 (0.2–0.7)	1.5 (0.7–3.3)	0.6 (0.4–0.9)	0.7 (0.5–1.0)
Descendants of immigrant(s) from all other European countries	1.2 (0.4–3.9)	1.1 (0.3–4.0)	1.3 (0.6–2.9)	1.1 (0.7–2.0)
Descendants of immigrant(s) from other countries	0.9 (0.2–4.3)	0.6 (0.1–5.4)	-	0.5 (0.1–1.6)
Immigrants from Maghreb	1.4 (0.8–2.6)	2.5 (1.3–4.7)	1.5 (1.1–2.1)	1.5 (1.2–1.8)
Immigrants from all other African countries	1.2 (0.8–1.9)	2.0 (1.1–3.8)	0.8 (0.5–1.3)	1.0 (0.8–1.3)
Immigrants from Asia	0.1 (0.0–0.2)	0.4 (0.2–1.1)	0.7 (0.4–1.2)	0.6 (0.3–0.9)
Immigrants from European Union 15 countries [d]	0.5 (0.3–0.9)	1.1 (0.6–2.0)	0.8 (0.5–1.3)	0.8 (0.6–1.1)
Immigrants from all other European countries	2.6 (0.8–8.3)	0.9 (0.2–3.3)	0.9 (0.4–2.3)	1.4 (0.7–2.7)
Immigrants from other countries	0.6 (0.2–1.6)	1.5 (0.6–4.0)	1.2 (0.6–2.5)	1.1 (0.7–1.8)

[a] HCW: Healthcare workers. [b] The association of occupational group and income level is adjusted for gender, age, and geographical origin, while other associations are adjusted for gender, age, geographical origin, and education level. [c] Interpretation: compared with men, women are 5.4 times more likely to work as hospital HCWs than as non-key workers. [d] The OECD definition of European Union 15 countries (EU15): https://stats.oecd.org/glossary/detail.asp?ID=6805 (accessed on 14 June 2022).

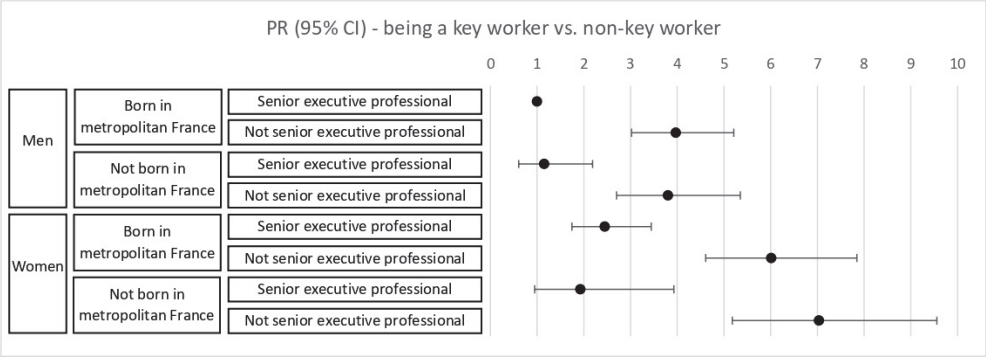

Figure 1. Estimated age-adjusted prevalence ratios (PR) for the association between intersecting socio-demographic characteristics (gender, origin, occupation) and working as a key worker.

Looking at different subgroups of key workers, we found more contrasted profiles. Among hospital healthcare workers, there was a higher percentage of females than among non-key workers, as well as higher percentages of the 25–34 age group, middle executive professionals, skilled and low-skilled clerical workers, public sector workers, those on temporary contracts, workers with upper secondary or short-cycle tertiary education or a bachelor's degree, those in the intermediate (fourth–seventh) income decile, and those from overseas France (Tables 1 and 2).

Among non-hospital healthcare workers, there was also a higher percentage of women than among non-key workers, as well as higher percentages of older participants, low-skilled clerical workers, private-sector workers, independent workers, those with a master's degree or higher, individuals in the extreme (highest and lowest) income deciles, and African immigrants. This group of key workers appeared to include workers from both ends of the social scale, for example, home carers and private-sector physicians (Tables 1 and 2).

Among non-healthcare essential workers, there was no gender imbalance. However, there was a higher percentage in this group than among non-key workers of those under 34 years of age and private-sector workers. All occupational categories, particularly clerical and manual workers, were more likely to be in the third group of essential workers, compared with senior executives. Concerning education and income level, working in this group exhibited a pronounced social gradient, being more likely among the least educated and poorest. Those with apprenticeship or self-employment contracts and the descendants of European immigrants were less likely to hold these jobs, while Asian descendants and Maghrebi immigrants were disproportionately employed in these occupations (Tables 1 and 2).

Modified Poisson regression modeling of the probability of being exposed to infectious agents, having face-to-face contact with the public, and working with coworkers indicated that, compared with non-key workers, the key workers in each subgroup were more likely to be exposed to infectious agents and to have physical contact with the public under routine working conditions. However, working with colleagues differed by key worker subgroup, as the hospital healthcare workers worked more often with co-workers, and non-hospital healthcare workers and non-healthcare essential workers worked more often on their own. The first group of key workers was particularly exposed to all three risk factors (Table 3).

Table 3. Estimated adjusted prevalence ratio (PR) of exposure to the three work-related exposure factors in each sub-group of key workers, compared to non-key workers (stratified models).

	Exposure to Infectious Agents		Face-to-Face Contact with the Public		Working with Colleagues	
	% Exposed	Adjusted PR [b] (95% CI)	% Exposed	Adjusted PR [b] (95% CI)	% Exposed	Adjusted PR [b] (95% CI)
Non-key workers	25.3 (24.8–25.9)	Ref	58.4 (57.8–59.0)	Ref	41.4 (40.8–42.0)	Ref
Hospital HCW [a]	89.9 (88.5–91.4)	3.5 (3.3–3.7)	95.0 (94.0–96.0)	1.5 (1.5–1.6)	62.9 (60.7–65.2)	1.6 (1.5–1.7)
Non-Hospital HCW [a]	75.0 (72.7–77.2)	2.9 (2.7–3.1)	91.4 (89.9–92.9)	1.5 (1.4–1.6)	19.5 (17.4–21.6)	0.5 (0.4–0.6)
Essential Non HCW [a]	34.7 (33.3–36.2)	1.4 (1.2–1.5)	72.2 (70.8–73.6)	1.2 (1.2–1.3)	37.7 (36.2–39.2)	0.9 (0.8–1.0)
All key workers	55.9 (54.7–57.0)	2.1 (2.0–2.3)	81.4 (80.5–82.3)	1.4 (1.3–1.4)	40.3 (39.2–41.5)	1.0 (0.9–1.1)
All active population	31.9 (31.4–32.4)		63.3 (62.8–63.8)		41.2 (40.6–41.7)	

[a] HCW: Healthcare workers. [b] Adjusted for gender, age, and geographical origin.

As explained in the methods section, a sensitivity analysis was performed by excluding funeral staff (N = 4), salespeople (N = 582), and public transportation drivers (N = 62) from the non-healthcare essential workers sub-group due to a coding inaccuracy. This exclusion did not substantially alter the sociodemographic profile or exposure to the three exposure factors among them, except that males became more represented in this key worker subgroup compared with females (Appendix A Tables A2 and A3).

4. Discussion

In the spring of 2020, about 22% of the active population in France could not be locked down because of the essential nature of their work activity, according to the data that was collected before the pandemic and based on the definition of key workers in use in the country. This is in line with other estimates of the share of key workers during the first lockdown in France [19,24], and close to the reported proportion in Italy (25%) [27]. Higher figures were reported in the US (43%) [7], in the UK (33%) [28], and in Europe as a whole (31%) [29]. This difference in the share of key workers may result from the stringency of the first lockdown in France, which is also the reason why we find that the key health worker and the key non-healthcare essential worker represent an almost equal share of key workers, whereas in the US, for example, healthcare workers represent 20% of frontline workers [7].

The National Bureau of Economic Research described frontline workers in the US as, on average, a less educated group, lower-paid than all workers, with a higher share of men, and including more racial and ethnic minorities (particularly Hispanics) and immigrants [7]. The Center for Economic and Policy Research provided a similar demographic profile of key workers in the US, except for an over-representation of women in essential services, especially healthcare, child care, and social services [30]. In a French study, women, immigrants, and people who were born in French overseas departments, as well as individuals with lower labor market protection (part-time, no contract, lower-paid) were found to be more likely to work in a frontline job [19]. In Europe as a whole, non-European immigrants were found to be overrepresented among key workers, particularly in low-skilled key occupations (e.g., personal care workers in health service, transport and storage laborers, drivers, food processing workers) [29]. Similarly, in the US, people of color, Black, and Hispanic/Latino workers in particular were at a high risk of being employed in key industries [31,32].

In line with the literature, we noted that although the set of key occupations was widely diverse, ranging from highly skilled jobs such as physicians to manual jobs such as drivers and construction workers, key workers had on average a disproportionately lower-income and were less educated. We also found that women were overrepresented in healthcare key occupations. Although many non-healthcare essential jobs are gendered (some predominantly male, such as public transportation drivers, firefighters, and police forces, and some predominantly female, such as cashiers and cleaners [33]), we found no gender differences among overall non-healthcare essential workers. Regarding origin, our results showed a specific pattern: DOM natives were overrepresented among hospital

healthcare workers; African immigrants (in particular, Maghrebi) among the healthcare workers outside the hospital setting; and Maghrebi immigrants, as well as descendants of Asian immigrants among non-healthcare essential workers.

Given that healthcare workers are at a particularly high risk of exposure to infectious agents due to the nature of their patient care work, their occupational health and safety have often been highlighted in the literature and various media. One systematic review synthesized the major work-related risk factors for COVID-19 among healthcare workers as: exposure to SARS-CoV-2 (caring for COVID-19-positive patients, working in high-prevalence regions); lack of personal protective equipment (PPE) (inadequate PPE, re-used PPE, unqualified handwashing); and workplace setting (inpatient settings, nursing homes, sharing the work environment with co-workers, longer working hours) [3].

On the other hand, little has been published on workplace risk assessment for non-healthcare essential workers. To address this knowledge gap, Gaitens et al. conducted a narrative review of the peer-reviewed and gray literature, as well as news sources. They summarized the work-related COVID-19 risks for nonmedical key workers as follows: inability to respect physical distancing (working on long production lines in close proximity to co-workers, encountering a high volume of customers or public, who may or may not be wearing masks, especially in the early days of the pandemic); limited availability of PPE and other safety supplies (poor hygiene, lack of training on health protocols); workplace characteristics (small, crowded, unventilated, cold and damp spaces); limited labor rights (lack of sick leave, incentives that may encourage workers to work while ill); and poor testing and contact tracing strategies (COVID-19 test shortage, non-reporting of exposure to infected co-workers) [5]. Further to these adverse working conditions, we could hypothesize that work pressure may lead to less compliance with prevention measures in these workplaces.

Based on a 2019 national survey and on the three work-related exposure factors that we identified in this study, we obtained similar results showing that key workers were likely at an increased risk of exposure to SARS-CoV-2 because they had a higher risk of exposure to infectious agents and face-to-face contact with the public when compared to non-key workers. Those who were most exposed to these health hazards were, as expected, the healthcare workers.

The key strength of this study lies in the fact that the CT-2019 survey is a large, established national survey that provides information on the working conditions of the entire labor force in France. This allowed us to study detailed occupational categories beyond the health sector and compare different subgroups of key workers with non-key workers. Another asset of the study is that the data were collected in the year before the onset of the pandemic and hence not long before the first lockdown. Given that the relevant working conditions of those who continued to work on-site during the first lockdown did not change much from the usual working conditions, the CT-2019 survey could be an appropriate source to study this period. Finally, in this study, we took an intersectional approach to investigate socio-occupational disparities in key jobs across genders and immigrants, compared to the general population.

Our study also has some limitations, the main one being the quantification of "exposure to infectious agents" and "working with co-workers". The question on exposure to infectious agents was not intended to measure specifically viral contamination or even exposure to a human reservoir of infectious agents, so some jobs that were in contact with other sources of infectious agents, such as animal reservoirs, were also classified as exposed (e.g., veterinarian). This may have overestimated the exposure prevalence in all the sub-groups of key workers. We used "not working alone" as the closest proxy for physical contact with co-workers. However, working alone in the context of a survey that is not designed to study COVID-19 exposures could imply working autonomously and without collaboration with co-workers, rather than no physical contact with them. Thus, some workers who had face-to-face contact with co-workers might have reported no contact since they work independently, and conversely, some workers with no physical contact with

colleagues might have reported working with colleagues since they work in a team setting to complete certain tasks. Finally, the CT surveys failed to include informal and undocumented workers who were likely to be more vulnerable to adverse working conditions and lack of adequate PPE if they continued to work and had no access to the social protection measures that were implemented during the pandemic, such as unemployment benefits in case of job loss [34]. It is unlikely that there were undocumented healthcare workers in the hospitals, however, we believe that there may have been undocumented non-hospital healthcare workers, and probably even more undocumented workers in non-healthcare essential services who continued to work on-site during the first lockdown in France.

Further studies are needed to capture the real-time dynamics of work-related SARS-CoV-2 exposure among different socio-occupational categories throughout the COVID-19 pandemic. Particularly, other exposure mechanisms, such as housing conditions, commuting modes and duration, and living in a densely populated area need to be taken into account to capture the mechanisms by which social inequalities unfolded [20]. Other groups of workers, such as educational and social work staff who were added to the list of key workers after the first lockdown and who have been shown to be at a high risk of exposure to SARS-CoV-2 in their work should also be considered in the further analysis [35,36]. This could ultimately lead to an estimation of the contribution of working as a key worker in the disproportionate COVID-19 infection that is found among healthcare workers and the working classes [37,38].

5. Conclusions

In this study, we provide a detailed description of the sociodemographic profile of the different subgroups of key workers in the French population. Compared to other workers, key workers in all subgroups have greater exposure to infectious agents and more physical contact with others. Of all subgroups, the non-healthcare essential workers were the most socially disadvantaged, while non-hospital healthcare workers were the most socially polarized and the least exposed to working with colleagues.

Although we observe a diversity of social backgrounds among key workers and heterogeneity in their potential work-related exposure to SARS-CoV-2, individuals from lower sociodemographic class are, on average, more likely to be exposed to SARS-CoV-2 by continuing to perform their jobs in person—jobs that most often put them into increased close contact with infectious agents and the public, even under routine working conditions. There is an urgent need to effectively protect these key workers and to ensure strict occupational health surveillance in their workplaces.

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Appendix A

Table A1. List of key workers in France during the first lockdown.

Group 1—Hospital healthcare workers
Hospital nurses
Caregivers
Hospital officers
Hospital physicians
Group 2—Non-hospital healthcare workers
Home carers
Physiotherapists
Pharmacists or pharmacy assistants
Private-sector physicians
Dentists
Private nurses
Midwives
Group 3—Non-healthcare essential workers
Cashiers or salespeople in "essential" businesses
Cleaners
"Essential" technicians
Bakers, confectioners
Public transport drivers
Garbage collectors
Employees and food workers outside the cold chain
Tobacconists
Firefighters
Butchers
Cab drivers
Ambulance drivers
Prison wardens
Veterinarians
Workers in the "essential" industry
Employees and food workers in the cold chain
Pork butchers
Funeral workers
Police forces
Truckers
Delivery drivers
Mail carriers
Cooks in communities
Gas station operators

Source: Observatoire régional de la santé d'Île-de-France, 2021.

Table A2. Sensitivity analysis: sociodemographic profile and the association between sociodemographic characteristics and being a key worker based on different classifications of the essential non-HCW sub-group of key workers.

	Essential Non HCW [a]		Alternative Essential Non HCW [b]	
	N (%)	Adjusted PR [c] (vs. Non-Key Workers)	N (%)	Adjusted PR [c] (vs. Non-Key Workers)
Gender				
Male	1286 (56.1)	Ref	1061 (64.6)	Ref
Female	1005 (43.9)	1.1 (1.0–1.2)	582 (35.4)	0.8 (0.7–1.0)
Age group				
18–24	107 (11.1)	1.6 (1.2–2.3)	54 (6.8)	1.1 (0.7–1.7)
25–34	433 (19.9)	1.3 (1.0–1.6)	300 (19.1)	1.2 (1.0–1.6)
35–44	582 (23.4)	1.2 (1.0–1.5)	418 (23.9)	1.2 (1.0–1.5)
45–54	758 (27.8)	1.0 (0.9–1.2)	565 (31.0)	1.1 (0.9–1.3)
55–64	411 (17.8)	Ref	306 (19.1)	Ref
Occupational group				
Farmers	0 (0.0)	-	0 (0.0)	-
Self-employed	104 (5.3)	15.9 (8.8–28.8)	46 (3.6)	7.3 (3.7–14.1)
Senior executive professionals and Professors	24 (0.9)	Ref	24 (1.4)	Ref
Middle executive professionals	279 (7.9)	6.1 (3.4–10.8)	241 (8.9)	4.6 (2.5–8.2)
Skilled clerical workers	387 (11.4)	18.5 (10.5–32.9)	385 (17.3)	18.4 (10.3–32.9)
Skilled manual workers	644 (30.8)	42.1 (24.4–72.5)	584 (42.1)	40.3 (23.4–69.3)
Low-skilled clerical workers	547 (28.2)	47.1 (27.1–82.0)	61 (3.5)	5.4 (2.8–10.2)
Low-skilled manual workers	306 (15.4)	41.9 (24.0–73.2)	302 (23.3)	43.0 (24.7–75.0)
Employment status				
Private	1791 (90.8)	Ref	1148 (86.4)	Ref
Public	500 (9.2)	0.5 (0.4–0.6)	495 (13.6)	0.8 (0.7–1.0)
Type of contract				
Apprenticeship	59 (4.2)	0.5 (0.4–0.8)	45 (4.7)	0.7 (0.4–1.0)
Independent	122 (5.8)	0.6 (0.4–0.7)	63 (4.3)	0.4 (0.3–0.5)
Permanent	1974 (78.7)	Ref	1448 (83.2)	Ref
Temporary	136 (11.3)	0.9 (0.7–1.2)	87 (7.8)	0.7 (0.5–1.0)
Education level				
No formal education	254 (12.9)	14.0 (8.2–23.9)	207 (16.2)	22.0 (13.5–36.0)
Primary or lower secondary education	205 (9.4)	12.0 (7.0–20.8)	137 (8.7)	14.8 (8.8–24.9)
Upper secondary education	817 (37.3)	11.0 (6.5–18.5)	612 (40.8)	15.0 (9.3–24.1)
Post-secondary non-tertiary education	530 (22.4)	7.6 (4.4–13.0)	345 (19.7)	9.1 (5.5–14.8)
Short-cycle tertiary education or bachelor's or equivalent	429 (15.7)	3.6 (2.1–6.2)	303 (12.8)	3.8 (2.3–6.2)
Master's or equivalent or higher	54 (2.3)	Ref	38 (1.9)	Ref
Income level				
Decile 1 (lowest)	271 (15.3)	4.7 (3.1–7.1)	153 (12.6)	5.3 (3.2–8.8)
Decile 2&3	690 (35.6)	7.0 (4.8–10.3)	364 (27.1)	7.4 (4.6–11.8)
Decile 4&5	399 (17.9)	4.4 (2.9–6.5)	320 (21.2)	6.1 (3.8–9.9)
Decile 6&7	468 (17.7)	4.1 (2.8–6.1)	404 (21.8)	5.8 (3.6–9.4)
Decile 8&9	334 (11.0)	2.4 (1.6–3.7)	308 (14.8)	3.6 (2.2–5.9)
Decile 10	66 (2.6)	Ref	46 (2.6)	Ref
Geographical origin				
Mainstream population	2005 (84.6)	Ref	1449 (85.4)	Ref
DOM natives	27 (1.3)	1.2 (0.7–1.9)	20 (1.2)	1.1 (0.6–1.8)
Descendants of immigrant(s) from Maghreb	22 (1.5)	0.9 (0.5–1.8)	14 (0.7)	0.4 (0.2–0.9)
Descendants of immigrant(s) from all other African countries	6 (0.3)	0.9 (0.3–2.4)	4 (0.3)	0.9 (0.3–2.6)
Descendants of immigrant(s) from Asia	8 (1.0)	2.2 (1.1–4.7)	1 (0.1)	0.3 (0.0–2.2)
Descendants of immigrant(s) from European Union 15 countries [d]	33 (1.4)	0.6 (0.4–0.9)	16 (1.1)	0.5 (0.2–0.9)
Descendants of immigrant(s) from all other European countries	6 (0.2)	1.3 (0.6–2.9)	4 (0.3)	1.7 (0.7–4.1)
Descendants of immigrant(s) from other countries	0 (0.0)	-	0 (0.0)	-
Immigrants from Maghreb	56 (3.7)	1.5 (1.1–2.1)	46 (4.7)	1.6 (1.1–2.4)
Immigrants from other African countries	28 (1.8)	0.8 (0.5–1.3)	20 (2.4)	0.9 (0.6–1.6)
Immigrants from Asia	24 (1.1)	0.7 (0.4–1.2)	12 (0.6)	0.4 (0.2–1.0)
Immigrants from European Union 15 countries [d]	33 (1.9)	0.8 (0.5–1.3)	25 (2.4)	0.9 (0.5–1.5)
Immigrants from all other European countries	8 (0.8)	0.9 (0.4–2.3)	4 (0.3)	0.4 (0.1–1.4)
Immigrants from other countries	9 (0.5)	1.2 (0.6–2.5)	8 (0.7)	1.6 (0.8–3.2)

[a] Essential non HCW: essential non-healthcare workers. [b] Alternative essential non HCW: essential non-healthcare workers without funeral staff, salespeople, and public transport drivers. [c] The association of occupational group and income level is adjusted for gender, age, and geographical origin, while other associations are adjusted for gender, age, geographical origin, and education level. [d] The OECD definition of European Union 15 countries (EU15): https://stats.oecd.org/glossary/detail.asp?ID=6805 (accessed on 14 June 2022).

Table A3. Sensitivity analysis: prevalence ratio of exposure to the three work-related exposure factors based on different classifications of the essential non-HCW sub-group of key workers.

	Exposure to Infectious Agents		Face-to-Face Contact with the Public		Working with Colleagues	
	% Exposed	Adjusted PR [c] (95% CI)	% Exposed	Adjusted PR [c] (95% CI)	% Exposed	Adjusted PR [c] (95% CI)
Non-key workers	25.3 (24.8–25.9)	Ref	58.4 (57.8–59.0)	Ref	41.4 (40.8–42.0)	Ref
Essential non HCW [a]	34.7 (33.3–36.2)	1.4 (1.2–1.5)	72.2 (70.8–73.6)	1.2 (1.2–1.3)	37.7 (36.2–39.2)	0.9 (0.8–1.0)
Alternative essential non HCW [b]	37.4 (35.5–39.2)	1.5 (1.3–1.6)	62.1 (60.3–64.0)	1.1 (1.0–1.2)	36.4 (34.6–38.3)	0.9 (0.8–1.0)

[a] Essential non HCW: essential non-healthcare workers. [b] Alternative essential non HCW: essential non-healthcare workers without funeral staff, salespeople, and public transport drivers. [c] Adjusted for gender, age, and geographical origin.

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Exploring U.S. Food System Workers' Intentions to Work While Ill during the Early COVID-19 Pandemic: A National Survey

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Abstract: With "stay at home" orders in effect during early COVID-19, many United States (U.S.) food system workers attended in-person work to maintain national food supply chain operations. Anecdotally, many encountered barriers to staying home despite symptomatic COVID-19 illness. We conducted a national, cross-sectional, online survey between 31 July and 2 October 2020 among 2535 respondents. Using multivariable regression and free-text analyses, we investigated factors associated with workers' intentions to attend work while ill (i.e., presenteeism intentions) during the early COVID-19 pandemic. Overall, 8.8% of respondents intended to attend work with COVID-19 disease symptoms. Almost half (41.1%) reported low or very low household food security. Workers reporting a higher workplace safety climate score were half as likely to report presenteeism intentions (adjusted odds ratio [aOR] 0.52, 95% confidence interval (CI) 0.37, 0.75) relative to those reporting lower scores. Workers reporting low (aOR 2.06, 95% CI 1.35, 3.13) or very low (aOR 2.31, 95% CI 1.50, 3.13) household food security levels had twice the odds of reporting presenteeism intentions relative to those reporting high/marginal food security. Workplace culture and safety climate could enable employees to feel like they can take leave when sick during a pandemic, which is critical to maintaining individual and workplace health. We stress the need for strategies which address vulnerabilities and empower food workers to make health-protective decisions.

Keywords: safety climate; disaster preparedness; presenteeism; food system; worker; food insecurity; COVID-19

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1. Introduction

After the 11 March 2020 World Health Organization COVID-19 pandemic declaration [1], the United States (U.S.) government deemed food system workers, i.e., those responsible for producing, processing, distributing, selling, and serving food, "essential" [2]. To maintain operation of the national food supply chain, many U.S. food workers attended work in person while "stay at home orders" were in effect during the early COVID-19 pandemic. Consequently, essential food workers experienced high levels of COVID-19 exposure and illness risks [3], largely due to inability to socially distance while working [4–6]. Presenteeism, a phenomenon wherein employees attend work despite symptomatic illness [7], is an important risk factor for workplace and community COVID-19 spread [8,9], especially in workplaces with limited social distancing. Previous research has found that the intent to work while ill (here termed "presenteeism intentions") is associated with actual presenteeism behaviors [10]. Anecdotal evidence suggests that many food system workers encountered barriers to staying home if ill [11]. This study explores factors associated with workers' presenteeism intentions to identify opportunities for preventing presenteeism, and therefore reducing workplace spread of COVID-19 and other infectious illnesses.

U.S. Food System Workforce: In the U.S. food system, approximately 21.5 million workers produce, process, distribute, sell, and serve food in mostly "non-relocatable" jobs [12,13]. Supplementary Table S1 provides food sector and subsector characteristics. Despite doing diverse tasks across sectors and jobs, many food workers share demographic and occupational similarities. Additionally, all of these workers jointly contribute to maintaining the food supply chain. Studying these workers as a group rather than in occupational silos provides insights relevant to this large cohort, their individual sectors, and food system functionality and resiliency.

Even before the COVID-19 pandemic, many food system workers experienced challenges associated with negative outcomes [14–16], including presenteeism [17]. Food system jobs are often characterized by: full-time wages at or below the poverty line ([18–20], Supplementary Table S1); low unionization rates, job insecurity, and at-will employment [21]; precarious tipped work [13] or piece work [22]; and lacking sick pay and health insurance [23]. These jobs exhibit high injury and illness rates relative to national averages, despite suspected widespread reporting suppression [24,25] and surveillance exemptions [26]. Many food jobs exist in the "gig economy", meaning they are commonly exempted from many labor protections [27] and occupational health surveillance [28].

Presenteeism: Early presenteeism research examined economic and productivity losses resulting from employees working while sick or injured [29]. More recently, studies have investigated the implications of presenteeism for food safety [30] and for worker and community health [7,31]. Pre-pandemic studies found that organizational factors (e.g., work policies or cultures), job characteristics (e.g., shift design, job demands), and personal characteristics (e.g., financial stability concerns, personal sense of duty, and perceived co-worker expectations) [17] can potentiate presenteeism.

A limited literature explores presenteeism among food system workers, identifying associations between presenteeism and high work demands; poor employer-employee communication; poor staffing; inadequate workplace policies (e.g., lacking paid sick leave or requiring doctors' notes) [30,32,33]; poor workplace safety climate [34]; job insecurity, job dissatisfaction, and hazardous working conditions [35]. During the COVID-19 pandemic, one study of restaurant workers has found that expanding paid sick leave at a large restaurant chain reduced presenteeism when compared to similar chains [36]. Other studies among the non-healthcare worker cohorts suggest that COVID-19 presenteeism is associated with household income, food security, and age [37], poor access to health benefits [37], and poor workplace safety climate [38]. Despite their importance for maintaining national food security, their high occupational vulnerability, and concerns about COVID-19 spread, little is known about how food system workers navigated decisions to attend work if ill during the early COVID-19 pandemic.

COVID-19 Presenteeism-Related Policies: At the time of survey, COVID-19 case rates and deaths were rising [39] and the Centers for Disease Control and Prevention (CDC) had issued guidance for sick workers to stay home or isolate [40]. However, concerns remained that exacerbated financial pressures and other factors could incentivize presenteeism [41,42]. In April 2020, the federal government implemented the first national sick leave policy [43] and augmented unemployment insurance [44]. The former provided paid sick leave for many food chain workers who had previously lacked this benefit, including part-time workers [43,45]. However, firms employing fewer than 50 or more than 500 people were excluded from this policy, and voluntary implementation was inconsistent [36]. Additionally, many processing workers were encouraged or required to work with COVID-19 symptoms [6,46] following a presidential executive order preventing closures of meat and poultry processing plants [47].

To our knowledge, no study has examined presenteeism intentions in a large, nationwide, food system worker sample. Here we explore workplace and non-workplace factors associated with food system worker COVID-19 presenteeism intentions during the early COVID-19 pandemic to identify opportunities to support food workers to remain home if ill or at risk of infecting others.

2. Materials and Methods

We drew data from the Johns Hopkins COVID-19 Food Worker Survey, developed during the early COVID-19 pandemic and deployed from 31 July 2020 to 2 October 2020. This cross-sectional, national, online survey of 3399 food system workers documented COVID-19 pandemic-related workplace experiences and conditions. Recruitment and survey design have been reported in depth elsewhere [3].

Study population: The survey included individuals who worked in any of six targeted food system sectors (production; processing; distribution; retail; service; assistance), who were literate in English or Spanish, who lived in the U.S., who were 18 years old or older, and who had attended a food system job in-person since 11 March 2020.

Of the 3831 who initiated the survey, 25.4% of the respondents did not answer the outcome question corresponding to presenteeism intentions; thus, their data were excluded from analyses. We also excluded participants who had previously contracted COVID-19, and/or did not receive a paycheck, producing an analytic sample of 2535 participants. Participants missing outcome data were more likely to identify as Hispanic/Latinx and/or work at organizations with fewer than 10 employees than those with outcome data. Missing outcome data was not associated with age, race, gender, U.S. census region, having worked in the past month, or degree of customer interaction. We discuss missing data patterns for independent variables and implications for interpretations in the discussion.

Sample size calculations determined that a sample of at least 1000 respondents would provide enough power to detect group differences using a 3% margin of error and 95% confidence for the outcome. The median survey completion time was 19.5 min.

Instrument: In brief, the 114-item instrument was created with input from workers and worker representatives and experts in survey design, disaster preparedness, and occupational health. We used validated scales where possible and included novel items to capture COVID-19-related perspectives about working conditions. Measures are summarized below.

Measures: Demographics included age, gender identity, race, ethnicity, highest educational attainment, household income, and geographic location. All questions included "don't know" or "not applicable" options and participants could skip any item beyond demographics. The survey was terminated if demographic responses did not satisfy inclusion criteria. Supplementary Table S2 presents survey items and coding.

Presenteeism Intentions: We derived our main outcome from the level of agreement with the statement: "If I was sick with COVID-19, but I was still able to work, I would go to work". The 5-point Likert scale was dichotomized to: workers who strongly agreed or agreed with the statement versus all others. As few COVID-19-specific survey items existed early in the pandemic, we crafted this item based on questions from existing disaster preparedness literature assessing hospital workers' willingness to work during disaster scenarios, including pandemic influenza [48].

Occupational Measures: Workers indicated their food system sector and subsector from an edited Food Chain Workers Alliance list (FCWA; a coalition of food worker-based organizations; [13]). Workers employed in more than one sector were asked to indicate the job in which they worked the most hours. Occupational characteristics included job tenure, full/part-time status, organization size, customer contact, work transportation, whether workers were told they were "required" to work by their employers, and union membership. Respondents specified all workplace benefits provided by their employers since the pandemic declaration from a select-all-that-apply list [49]. These were aggregated as frequencies and analyzed individually. We assessed quantitative work demands and workplace social support using medium-length scales from the Copenhagen Psychosocial Questionnaire III (COPSOQ III) [50], following published scoring procedures and then dichotomizing scores at the median into "high" and "low" categories. Higher work demands scores indicated more challenging levels of work demands (e.g., time pressure or many overlapping tasks). We assessed organizational safety climate using a 6-item scale [51] where high scores indicated that workers perceived their organization had a high

commitment to safety. We created a composite organizational safety climate variable by summing scale responses and dichotomizing at the median, including responses for all participants who had answered 5 or more (of 6) items.

Non-Occupational Measures: We measured food security since 11 March 2020, using a United States Department of Agriculture (USDA) Six-item Short Form Household Food Security Survey Module [52]. The composite categorical variable included responses of participants with 2 or more items (of 6) and was scored according to USDA classifications: high/marginal food security (raw score 0–1); low food security (2–4); and very low food security (5–6). Cronbach's alpha was >0.7 for all scales except quantitative work demands, which was 0.67 [53].

We measured attitudes regarding reopening the economy based on agreement with the statement, "It is worth the health risk to reopen the economy as soon as possible". The 6-point Likert scale was collapsed to 3 points: agreement; neither agreement nor disagreement; and disagreement.

Theoretical Approach: The Job Demands-Resources (JD-R) [54] and Total Worker Health (TWH) models [55,56] guided analyses. The JD-R model suggests that job resources can mitigate the negative health impacts of workplace demands [54]. We therefore hypothesized that resources such as organizational safety climate (defined as employees' shared perceptions of their organization's prioritization of worker safety [51,57]) and paid sick leave would reduce the likelihood of workers reporting presenteeism intentions. The Total Worker Health approach [56] considers external (i.e., non-workplace) factors that impact worker well-being. Our conceptual model (presented in Ceryes et al., 2021 [3]) includes workplace and non-workplace factors associated with food worker outcomes, including presenteeism, during the COVID-19 pandemic.

Statistical analyses: We used STATA 14 I/C (College Station, TX, USA) for quantitative analyses. Statistics included Chi^2 or Rank Sum tests (significance value $p < 0.05$) as well as Spearman's rank and Pearson's correlation coefficients to identify collinearity. We used bivariate logistic regression to assess correlations according to presenteeism intention status. Adjusted logistic regression models were used to examine associations with workplace characteristics. Variables associated with the outcome, presenteeism intentions, at the level of $p < 0.05$ were retained in the multivariable model. These were age, gender, food system sector, organization size, hourly status.

Additional covariate inclusion was informed by *a priori* conceptual associations (race, ethnicity, geographic location). We included food security status and perspectives on reopening the economy based on free-text data (described below) and bivariable associations ($p < 0.05$). The final model estimated associations between presenteeism intentions, workplace, and non-workplace characteristics while controlling for age, race, ethnicity, gender, food system sector, organization size, and hourly status. Akaike's Information Criteria (AIC) values were used to assess model fit, and variance inflation factors assessing multicollinearity were all less than four (mean = 1.43) [58].

Sensitivity analyses were conducted by stratifying on degree of customer interaction and whether workers were told they were "required" to work. We also controlled for clustering at the state level. Estimates did not meaningfully differ from our primary results (Supplementary Table S3).

Free-text Analyses: Many survey participants provided detailed responses to the open-ended question: "Do you have any other comments about the level of risk from COVID-19, or decisions about whether to go to work?". These comments often included discussion of presenteeism intentions; thus, we analyzed responses to elaborate on our quantitative findings [59]. This approach has been used previously in survey-based presenteeism studies [60]. Comments informed covariate selection by narrowing variables considered for analyses. For example, responses frequently mentioned food insecurity and perspectives on opening the economy; therefore, we retained those variables. We also used comments to choose between highly correlated variables (e.g., food security status over annual household income). Finally, the free text results informed interpretation and discussion of quantitative results.

The lead investigator (CAC) conducted two close reviews of free-text data, taking notes before coding responses and organizing them into themes [61], and excluding non-substantive comments (e.g., "N/A" or "No"). Atlas.ti (Version 8.0, Berlin, Germany) and Microsoft Excel (Washington, DC, USA) were used to sort, organize, and manage free-text data. Respondents offering comments were compared to those who did not and to the full sample to identify potential biases. We analyzed presenteeism-related text responses overall and by sector, by subgroups according to reports of presenteeism intentions or behaviors, and by benefits and working conditions. Qualitative memos tracked CAC's reactions to comments [62].

The Johns Hopkins Bloomberg School of Public Health Institutional Review Board considered this study exempt (category 2) (IRB No. 12549).

3. Results

3.1. Quantitative Results

Table 1 presents analytic sample demographics. Respondents were primarily female (64.8%), not Hispanic/Latinx (90.0%), white (86.0%), non-union (79.6%), working full-time (64.8%) and of average age 45.9 years (SD 11.2). Most worked in restaurant/service (43.3%) and retail (34.9%), with the fewest in distribution (2.4%). Almost all (95.9%) had worked in-person in the past month before taking the survey. Nearly a third (32.7%) were told they were "required" to work by their employers at some point between pandemic onset and the survey in August–September 2020. Almost half of respondents (41.1%) reported low or very low food security. Analytic sample demographics resembled those of the overall study population.

Table 1. Demographic and occupational characteristics for a national United States (U.S.) food system worker cohort during early COVID-19.

Demographic or Occupational Characteristic	*n* (%)
Age in Years	(*n* = 2535)
18–24	81 (3.2)
25–44	1054 (41.6)
45–65	1334 (52.6)
>65	66 (2.6)
Gender	(*n* = 2535)
Female	1641 (64.8)
Male	846 (33.4)
Other	48 (1.9)
Race	(*n* = 2527)
White	2196 (86.0)
African American	112 (4.4)
Other/Mixed race	242 (9.6)
Ethnicity	(*n* = 2440)
Not Hispanic/Latinx	2196 (90.0)
Hispanic/Latinx	244 (10.0)
Sector	(*n* = 2535)
Production	115 (4.5)
Processing	227 (9.0)
Distribution	60 (2.4)
Retail	884 (34.9)
Restaurant/Service	1097 (43.3)
Assistance	152 (6.0)
Household Income	(*n* = 2330)
<$25,000	642 (27.6)

Table 1. *Cont.*

Demographic or Occupational Characteristic	*n* (%)
$25,000–34,999	427 (18.3)
$35,000–49,999	427 (18.3)
$50,000–99,000	696 (30.0)
>$100,000	138 (5.9)
Food Security Status since pandemic declaration	(*n* = 2374)
High or marginal	1399 (58.9)
Low	505 (21.3)
Very low	470 (19.8)
Education	(*n* = 2353)
Up to/some high school	124 (5.3)
High school diploma/GED	789 (33.5)
Some college/associate degree	1104 (46.9)
Bachelor's/ advanced degree	336 (14.3)
U.S. Census Region	(*n* = 2375)
Northeast	427 (18.0)
Midwest	654 (27.5)
South	857 (36.1)
West	437 (18.4)
Union Status	(*n* = 2471)
Non-Union Member	1965 (79.6)
Union Member	506 (20.5)
Employer Size	(*n* = 2454)
1–10	316 (12.9)
11–49	813 (33.1)
50–499	1120 (45.6)
>500	205 (8.4)
Hourly status	(*n* = 2332)
Full Time	1510 (64.8)
Part Time	651 (27.9)
Other	171 (7.3)
Worked in the last month	(*n* = 2535)
Yes	2430 (95.9)
No	105 (4.1)
Customer Contact	(*n* = 2523)
Yes	1918 (76.0)
No	605 (24.0)
Safety Climate Score	(*n* = 2375)
High	1069 (55.0)
Low	1069 (45.0)
Work Demands	(*n* = 2466)
High	1360 (55.2)
Low	1106 (44.9)
"Required" to work	(*n* = 2420)
Required to work during COVID-19	792 (32.7)
Asked to work but not required	623 (25.7)
Both required and asked at different times	324 (13.4)
Neither required nor asked	681 (28.1)

Percentages may not add to 100% due to rounding.

Presenteeism: Of 2535 respondents, 8.8% agreed that they would attend work if sick with COVID-19, but these differed greatly by sector. Table 2 provides an overview of outcome prevalence. Supplementary Table S4 provides group comparisons between groups reporting presenteeism intentions versus not by variables of interest.

Table 2. Prevalence of presenteeism intentions in a national sample of U.S. food system workers during early COVID-19, by food system sector (N = 2353).

Food System Sector	Workers Reporting Presenteeism Intentions *n* (%)
All sectors	222 (8.8)
Production	28 (24.4)
Processing	24 (10.6)
Distribution	8 (13.3)
Retail	66 (7.5)
Restaurant	91 (8.3)
Assistance	5 (3.3)
	$p < 0.001$

Benefits: Of 2527 respondents, 27.7% reported paid sick leave access, and 30.1% reported "easier" access to sick leave since 11 March 2020. Fourteen percent reported that they had received free workplace COVID-19 testing since the pandemic declaration.

Multivariable Model: Table 3 presents bivariate (Model 1) and multivariable logistic regression (Models 2 and 3) results for variables of interest (organizational safety climate; work demands; access to paid leave; food security; perspectives about reopening the economy) and presenteeism intentions. These were adjusted for age, gender, ethnicity, race, full/part-time status, food system sector, and organization size. See Supplementary Table S5 for all models.

Table 3. Workplace and non-workplace factors associated with reporting presenteeism intentions in a national food chain worker sample during early COVID-19.

	Model 1 [+]	Model 2 [++]	Model 3 [+++]
	Odds Ratio 95% CI *p* value *n*	Odds Ratio 95% CI *p* value *n*	Odds Ratio 95% CI *p* value *n* = 1793
Organizational Safety Climate Score			
Low	Ref	Ref	Ref
High	0.61 0.46, 0.81 0.001 *N* = 2375	0.59 0.44, 0.79 <0.001 *N* = 2287	0.52 0.37, 0.75 <0.001
Quantitative Work Demands			
Low	Ref	Ref	Ref
High	1.91 1.42, 2.57 <0.001 *N* = 2466	1.95 1.44, 2.65 <0.001 *N* = 2370	1.49 1.03, 2.16 0.03
Access to paid leave			
No	Ref	Ref	Ref
Yes	0.83 0.60, 1.14 0.25 *N* = 2527	0.83 0.60, 1.14 0.25 *N* = 2249	1 0.67, 1.50 0.99

Table 3. *Cont.*

	Model 1 [+]	Model 2 [++]	Model 3 [+++]
Food Chain Sector			
Retail	Ref	Ref	Ref
Production	3.99 2.43, 6.54 <0.001	3.59 2.04, 6.34 <0.001	3.96 1.98, 7.92 <0.001
Processing	1.47 0.90, 2.40 0.13	1.49 0.90, 2.46 0.12	1.29 0.67, 2.51 0.45
Distribution	1.91 0.87, 4.18 0.11	1.81 0.81, 4.05 0.15	2.14 0.88, 5.16 0.09
Restaurant/Service	1.12 0.81, 1.56 0.5	1.07 0.76, 1.51 0.7	1.18 0.72, 1.93 0.51
Food Assistance	0.42 0.17, 1.06 0.07 *N* = 2535	0.48 0.19, 1.23 0.13 *N* = 2436	0.5 0.14, 1.74 0.28
USDA Food Security Category			
High	Ref	Ref	Ref
Low	2.33 1.65, 3.29 <0.001	2.31 1.61, 3.31 <0.001	2.06 1.35, 3.13 0.001
Very low	2.26 1.59, 3.22 <0.001 *N* = 2374	2.25 1.55, 3.24 <0.001 *N* = 2282	2.31 1.50, 3.13 <0.001
"It is worth the health risk to reopen the economy as soon as possible"			
Strongly/disagree	Ref	Ref	Ref
Neutral	1.29 0.89, 1.87 0.176	1.28 0.87, 1.86 0.21	1.44 0.95, 2.16 0.08
Strongly/Agree	2.27 1.56, 3.30 <0.001 *N* = 2114	2.23 1.51, 3.28 <0.001 *N* = 2030	2.43 1.58, 3.73 <0.001

[+] Model 1: Unadjusted; [++] Model 2: Controlled for age, gender, race, ethnicity; [+++] Model 3: Controlled for age, gender, race, ethnicity, organization size, hourly status. Ref = Reference.

After adjustment, respondents reporting high levels of organizational safety climate were half as likely to report presenteeism intentions, compared to those reporting lower scores (adjusted odds ratio [aOR] 0.52, 95% CI 0.37, 0.75). Workers with high levels of work demands had 49% greater odds of reporting presenteeism intentions relative to those reporting lower levels (aOR 1.49, 95% 1.03, 2.16). Food production workers had higher odds of reporting presenteeism intentions relative to retail workers (aOR 3.96; 95% CI 1.98, 7.92). Paid sick leave was not associated with presenteeism intentions.

Respondents reporting low or very low food security were more than twice as likely to report presenteeism intentions relative to those reporting marginal/high food security (aORs 2.06, 95% CI 1.35, 3.13 and 2.31, 95% CI 1.50, 3.13, respectively). Respondents who agreed or strongly agreed that it was "worth the health risk" to reopen the economy had higher odds of reporting presenteeism intentions relative to those who disagreed with this statement (aOR 2.43, 95% CI 1.58, 3.73).

3.2. Free Text Results

Overall, 13.5% of respondents answered the question, "Do you have any other comments about the level of risk from COVID-19, or decisions about whether to go to work?" and 460 comments were substantive. Responses ranged from 1 to 233 words, with 23-word median length. Production workers had the lowest median word count (13 words) and retail the highest (24 words). Workers who commented were less likely to work in food production or report annual household incomes below $15,000 or above $100,000. Workers who commented were more likely to work for tips and report very low food security status than those who did not (Supplementary Table S6). Table 4 provides illustrative quotations from free-text data, organized by themes and sub-themes.

Table 4. Illustrative quotations describing respondents' perceptions of factors related to presenteeism intentions from a national sample of U.S. food system workers during early COVID-19.

Themes	Illustrative Quotations
Workplace Factors	
Policies	
Lacking sick pay for COVID-19 symptoms or exposures	"Obviously no one wants to go to work sick, but it is necessary since the pay is so low and I don't get sick pay." (Retail worker) "If I was to be exposed to someone with COVID I would not tell my [employers] about it because they will not pay me to be off work. I cannot afford to be off work". (Retail worker) " . . . it is a 2 week or more wait for results. If you are tested you may not return to work until you get results. How many people with mild symptoms are going to be out of work for 2 weeks or more voluntarily?" (Restaurant worker)
Lacking financial support for testing	"The test cost as much as half of my weekly wage". (Retail worker)
Punitive attendance policies	"If you were sick or had any of the symptoms of COVID-19, if you didn't go to work they would "point" [penalize] you for that so if you have enough points you will eventually 'point out' [lose your job]". (Processing worker)
Culture	
Fear of retaliation for using sick leave	"Calling in sick is frowned upon. People who call in sick frequently get less hours [meaning less pay] and the worse [less desirable] hours". (Retail worker)
	"Even if you don't get fired for calling out . . . they'll find something else to fire you for . . . ". (Restaurant worker)
Employers discouraging use of anti-COVID-19 policies	"Boss told us not to get tested so we wouldn't have to miss work". (Retail worker)
Non-workplace Factors	
Economic Precarity	
Perceived food insecurity	"There is NO decision! . . . We have bills and children to feed . . . I cannot stay home!" (Processing worker) "What the **** am I gonna do, not feed my kids? . . . (pardon my profanity, it's necessary for emphasis, I can't really convey how strongly I feel about this)". (Retail worker)
Distrust of Public Health Messaging	
Perceiving COVID-19 as a non-credible health threat	"I think it's blown out of proportion and has very skewed and inaccurate testing. I don't think I'm anymore at risk than the seasonal flu". (Processing worker)

3.2.1. Workplace Factors

Policies: Many comments mentioned employers' policies relating to presenteeism and workplace COVID-19 spread. While a few workers described adequate sick pay if symptomatic or COVID-19- positive, others described insufficient policies and benefits, including lacking paid sick leave. Respondents also described barriers to quarantine and testing, including financial disincentives for disclosing COVID-19 exposure, unpaid isolation periods, and high test costs. Others described policies providing only partial sick pay, or policies requiring employees to find shift coverage, use personal vacation time, obtain doctors' notes, or abide penalty-driven attendance systems.

Culture: Even if employers had official policies supporting those who stayed home, employees described cultural factors which communicated an expectation to work even if symptomatic with COVID-19. Many workers expressed concerns about following anti-COVID-19 guidelines stemming from high levels of perceived job insecurity. For example, workers cited concerns about employer retaliation for using sick leave. Other comments described instances where policies meant to discourage COVID-19 presenteeism were unclear or not followed. Examples include instances of symptomatic co-workers continuing to work following symptom-checks, and managers ignoring COVID-19 symptoms rather than sending staff home.

3.2.2. Non-Workplace Factors

Economic precarity: Aside from workplace conditions, workers cited economic instability, stemming from insufficient wages, as a driver for presenteeism. Many comments mentioned the need to make ends meet, working paycheck to paycheck, and working to buy food for workers' families.

Distrust of public health messaging: Some respondents viewed COVID-19 disease risks as exaggerated or not a credible health threat and indicated this perspective would influence their decisions to attend work with COVID-19 symptoms.

4. Discussion

Our findings identify workplace and non-workplace conditions associated with food system workers' intentions to work while ill and provide insights into this decision. While our results are specific to the COVID-19 pandemic context, we believe they have relevance for both infectious disease outbreak planning and mitigating the spread of more quotidian contagions.

Given rapid changes in infection rates, resources available for worker protection, and scientific knowledge about COVID-19 throughout 2020 and 2021, it is important to view these results in their temporal context. This study occurred during the first four to six months of the pandemic. At this time, vaccines were unavailable, federal paid sick leave policies had been enacted, and eviction moratoriums and unemployment insurance enhancements were in place [63]. Because of rapid U.S. case-rate increases and news coverage emphasizing disease severity during these months [64], respondents may have perceived COVID-19 as more severe than other illnesses and planned to remain home. As the pandemic continued, many states prioritized "reopening". Essential and non-essential workers were encouraged to return to work, and supporting policies were relaxed or rescinded. Therefore, if repeated later in the pandemic, a similar study might show an even greater prevalence of presenteeism intentions among these workers.

4.1. Workplace Factors Associated with Presenteeism Intentions

Organizational Safety Climate: Workers who received a high safety climate scale score perceived that their employers valued and prioritized their safety at work. These workers were substantially less likely to report COVID-19 presenteeism intentions. This finding aligns with other pre- and mid-pandemic studies suggesting that safety climate influences workers' presenteeism decisions [38,65–67]. It also builds on previously established connections between safety climate and COVID-19 safety perceptions [3].

Organizational safety climate constructs include employees' shared perceptions of safety priorities, policies, and procedures; managerial commitment to safety; employee behavioral norms, and worker safety activity participation [51]. Free-text data elaborated on how these constructs could influence presenteeism intentions. For example, comments describing managers ignoring COVID-19 safety policies could indicate a lack of employee empowerment to participate in safety activities and policy enforcement. This lack of empowerment could possibly extend to employees feeling that they could not stay home if ill.

Organizational safety climate is often studied regarding its effects on injury prevention, but these findings suggest its underlying constructs could represent important intervention targets for reducing illness-related presenteeism. Improving safety climate could work synergistically with other workplace culture components known to be associated with reducing presenteeism, such as having strong workplace social communities, especially in circumstances of work–life imbalance [68].

Sick Leave: The lack of association between sick leave access and presenteeism intentions after adjustment was surprising. Workers' comments describing cultural and organizational barriers to using sick leave, even if it was "officially" established, provide one interpretation of this finding. Descriptions of retaliation and penalties barring workers from accessing sick leave indicate that some employees were not empowered to use it. Such barriers have been documented among restaurant workers [45], and we expand these findings to include other food system workers. Our results diverge from those of Schneider and colleagues' (2021), who found that increasing paid sick leave reduced COVID-19 presenteeism among restaurant workers at the Olive Garden fast-casual restaurant chain. We suggest the difference could again relate to empowerment. Because Olive Garden's paid sick leave expansion occurred following "significant public scrutiny". [36], their employees might have felt more able to access their newfound benefits than workers whose employers were not being scrutinized.

Work requirements: Notably, 32.7% of respondents reported being told they were "required" to work during the COVID-19 pandemic. Because these workers lacked a choice, this circumstance would not typically be considered presenteeism. Sensitivity analysis estimates of reported presenteeism intentions, stratified by requirement to work, did not meaningfully differ from our primary results. Research should assess the physical and mental health impacts of requirements to work during the COVID-19 pandemic.

Sector differences: After controlling for demographics and job characteristics, production workers were more likely to report presenteeism intentions relative to retail workers. This finding could relate to reduced risk perceptions due to these workers' open-air working environments and not typically interacting with customers. Alternatively, H-2A visa holders (meaning those in the United States on temporary agricultural work visas) might feel obliged to attend work while ill in order to remain in the country [69]. Research is needed to explore this association further. We did not identify other sector-specific differences or note differential comment content by sector, though production workers were less likely to provide comments than workers in other sectors.

4.2. External Factors Associated with Presenteeism Intentions

Food Security: Over 40% of respondents reported experiencing low or very low food security, despite working at in-person food jobs during the COVID-19 pandemic. After controlling for covariates, these workers were more than twice as likely to report presenteeism intentions than those with marginal or high food security. This finding, combined with many free-text comments that mentioned the need to work to buy food, suggests food insecurity was a major driver of presenteeism intentions in this population. Our findings align with Tilchin and colleagues' (2021) findings that perceived food insecurity was associated with a three-fold increase in intention to work sick among U.S. employees. They also align with other studies which highlight connections between presenteeism and financial instability during COVID-19 [70]. The paradox of food workers experiencing food insecurity while feeding the nation has been previously acknowledged in literature on

farmworkers [71], and we re-emphasize its inherent inequity here. We also note that these findings could help explain broader disparities in COVID-19 morbidity and mortality [72] during early pandemic waves.

Risk Perceptions: Workers who felt it was "worth the health risk" to reopen the economy were twice as likely to report presenteeism intentions. Comments suggested some respondents did not trust public health messaging about COVID-19's severity, and/or felt the benefits of working, including financial stability, outweighed COVID-19 exposure risks. This finding highlights the importance of effective and consistent public health messaging for reducing infectious disease spread.

4.3. Future Research and Recommendations

This study provides evidence about self-reported presenteeism intentions, and future studies are needed to measure actual presenteeism behaviors related to both physical and mental illnesses in this population. Longitudinal studies should further examine the potential association between workplace culture and presenteeism, especially whether shifts in workplace safety climate can decrease the spread of workplace and community infectious disease. Research is also needed to explore ways to empower employees to fully participate in developing and enacting policies, such as paid sick leave and symptom checks, especially in the context of top-down federal or state policy mandates and prolonged emergencies or pandemics.

This study suggests that worker food insecurity represents a major driver of COVID-19 presenteeism intentions. We therefore endorse instituting and evaluating policies that improve workers' overall financial stability to prevent presenteeism and accompanying disease transmission. These policies include raising food workers' compensation to a living wage, limiting "just in time" shifts, standardizing work schedules so that workers can plan for childcare and other needs, and providing reliable, full-time, benefitted work to those who want it [73]. Such actions would not only contribute to public health and food system stability but could also reduce food businesses' presenteeism-related economic losses, which are estimated to be substantial [29]. Finally, we advocate for heightened external accountability around workplace safety protocols and practices, including proactive worksite inspections and statutory worker protections, especially for "essential" workplaces. It would be informative to track presenteeism and its associated influences and outcomes in a longitudinal manner should a similar national disaster occur in the future.

4.4. Limitations

While this large national survey addresses the experience of a unique worker population that is critical to our food supply, there are some expected limitations. As with many other Internet-based surveys, our sample overrepresented white, female, and high-income individuals [74,75]. Despite efforts to minimize missing data, thus increasing sample size and diversity, few participants identified as African American and Hispanic/Latinx or other Black/Indigenous/People of Color (BIPOC) individuals. These groups are of great interest because they are believed to be more subject to the negative impacts of COVID-19 [76]. This study may have underestimated levels of risk factors or the existence of presenteeism intentions, especially among these populations. Future studies must focus on including these groups.

Use of free text data always presents the challenge of interpretation, especially when a single coder reviews the responses. However, our text analyses related directly to our validated scales and served the purpose of expanding, clarifying, and prioritizing those results.

This cross-sectional study was conducted during the early stages of the pandemic, when COVID-19 knowledge and risk perception were evolving and anxiety was high. Although the design does not allow for causal inferences, results during this critical period indicate participants' perceptions of causal relationships between several risk factors and presenteeism decisions. Social desirability bias could have reduced respondents' will-

ingness to report presenteeism intentions, though data collection using an anonymous, Internet-based survey has been shown to reduce this bias [77].

5. Conclusions

The COVID-19 pandemic has highlighted U.S. society's reliance on food system workers to maintain national food security. Despite their heightened risks for COVID-19 morbidity and mortality, many food system workers indicated they would attend work while ill during the early COVID-19 pandemic. Often, they felt that they had no choice. This research suggests that interventions targeting workplace safety climate and food insecurity among food system workers could reduce presenteeism, therefore protecting the national food supply and the public's health during the COVID-19 pandemic and in other disaster or infectious illness scenarios. Addressing barriers to staying home when ill, such as improving safety climate and mitigating or eliminating vulnerabilities such as food insecurity, could enable food system workers to make decisions that protect both themselves and their workplaces. Reducing presenteeism is critical for creating optimal worker health outcomes, public health outcomes, and maintaining a functioning food system.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph20021638/s1, Table S1. Food system sectors, wage and employment estimates, and main sub-sectors included in the survey with North American Industrial Classification System (NAICS) codes. Table S2. Survey questions used in a study of presenteeism intentions among a large national sample of food chain workers during the first 4–6 months of the COVID-19 pandemic. Table S3. Sensitivity analyses for associations between variables of interest and odds ratio for COVID-19 presenteeism intentions within a national sample of food system workers in the U.S. Table S4. Comparisons between groups reporting presenteeism intentions versus not and variables of interest in a national sample of food system workers during early COVID-19. Table S5. Model results for non-exposure variables considered for and included in the multivariable model. Table S6. Comparison of participants who self-selected to provide additional comments on their decision to attend work with non-commentors and entire sample.

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Institutional Review Board Statement: The Johns Hopkins Bloomberg School of Public Health Institutional Review Board considered this study exempt (category 2) (IRB No. 12549). All methods were conducted within IRB-approved guidelines and regulations. All participants provided written informed consent to take part in the survey.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data from this study are available upon reasonable request.

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Article

The Impact of the COVID-19 Pandemic on Occupational Stress in Restaurant Work: A Qualitative Study

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Abstract: The economic downturn due to the COVID-19 pandemic disproportionately impacted the food service industry—one of the largest workforce sectors in the United States. The purpose of this qualitative study was to explore the occupational stressors experienced by restaurant and food service workers during the COVID-19 pandemic through a detailed assessment of their lived experiences. Thematic analysis was used to identify patterns within data from sixteen semi-structured interviews with people employed or recently employed in the restaurant industry during July of 2020. Five themes were highlighted including fear of being exposed to the COVID-19 virus while working under inadequate safety policies, job insecurity, inconsistent pay and hours and a lack of health benefits and paid time off, all of which increased occupational stress and led to uncertainty if respondents would return to the restaurant industry. Hardships associated with the pandemic were mitigated by the support and connections fostered by the communities built within the restaurants. Results led to several recommendations to address the social and economic contributors to occupational stress at the structural and population levels which can be used in the current and post-pandemic workplace.

Keywords: restaurants; occupational stress; COVID-19

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1. Introduction

In March 2020, the COVID-19 pandemic spread to the United States triggering shelter in place orders that largely shutdown the U.S. economy and resulted in a 22% to 60% decrease in the national Gross Domestic Product [1,2]. This economic downturn disproportionately impacted the service industry which prior to the pandemic was one of the largest workforce sectors in the nation with roughly 13.5 million restaurant related jobs. In April 2020, unemployment rates in the leisure and hospitality industries were as high as 39.3% [3,4]. The food service industry has lost nearly 3.1 million jobs and more than 110,000 restaurants have or are projected to permanently close due to the economic fallout caused by the pandemic [5,6].

The pandemic and the associated economic impacts have led to unprecedented levels of occupational stress and adverse mental health outcomes [7]. Prior to the pandemic, 8 out of 10 people reported experiencing stress while recent reports show as high as 94% of workers are experiencing stress [8,9]. Workplace stress is a major factor in 80% of occupational injuries and workers with high stress have on average 46% higher health care expenditures resulting in an estimated loss of USD 200 billion annually in absenteeism, lost productivity, and health care costs [10–12].

Various studies have linked occupational stress in the food service industry to excessive workloads, lack of job control, and variable pay and schedules [13–15]. With mass layoffs and increased sense of insecurity among employees, several studies have shown that the pandemic is exacerbating these stressors [2,16–18]. Seventy-five percent of frontline workers reported that the pandemic has negatively impacted their mental health and as the economy slowly reopens, occupational stress among frontline workers in the restaurant industry continues to grow [19,20]. This is due in part to confusion about what health and

safety protocols are recommended and the differential enforcement of these protocols [21]. This, coupled with a lack of attention to workplace stress in general, has led to negative mental health effects in restaurant workers [22].

It is important to identify salient contributing factors to occupational stress to inform health and safety protocols in the reopening efforts. The goal of this study was to explore the occupational stressors experienced by restaurant and food service workers during the COVID-19 pandemic.

2. Materials and Methods

This study intended to collect data on the changes to occupational stressors in response to the COVID-19 pandemic. The aim was to identify common themes in the responses of participants through semi-structured interviews. A qualitative approach is appropriate for under-researched areas such as this when data can capture details of the lived experiences of the study participants [23]. This was an attempt to better understand the occupational health impacts of the pandemic and gain insights into the factors associated with stress. This study was therefore exploratory because the events of the COVID-19 pandemic were unpredicted. Interviews were conducted by researchers with experience and training in qualitative data collection and research ethics and the study was approved by the authors' Institutional Review Board for human subjects' research.

2.1. Data Collection

A total of sixteen interviews took place between June and July of 2020. Participants were selected through purposive sampling; all participants had to be employed at a restaurant at the time of the COVID-19 stay-at-home order. Thirty-nine individuals were sent the invitation and 41% (n = 16) responded. All individuals interested in participating were interviewed.

Semi-structured interviews using a research guide (Appendix A) consisting of nine broad questions with between one and three follow-up questions for each topic and several probing questions. The general topics covered were employment status and the financial impact of the pandemic, changes to health status, contributing factors to these impacts, and thoughts on the future of work in the restaurant industry. A brief demographic survey was given including age, race/ethnicity, annual income and wage, gender identity, and work position. Interviews averaged 27 min in length. All interviews were conducted through Zoom and recorded and then transcribed verbatim.

2.2. Data Analysis

Thematic analysis was used to identify patterns within worker experiences during the COVID-19 pandemic. Thematic analysis is a process in which data are reviewed several times to develop and revise a set of themes within the data [24]. Qualitative data were broken down into excerpts and given a 'code' that summarized the major idea. The lead researcher read all of the transcripts and generated an initial code book and additional researchers coded the excerpts with a subset of codes. Each excerpt was coded by two researchers independently to compare and validate the interpretations. The web application software Dedoose (Los Angeles, CA, USA) was used to track excerpt coding. When disagreements among codes emerged, coders discussed the disagreement until consensus was reached.

3. Results

3.1. Participant Overview

A total of sixteen (16) people were interviewed (Table 1). All participants were working in Chicago, Illinois prior to the pandemic. At the time of the interviews, stay-at-home orders were in their fourth month. Chicago had temporarily moved into 'Phase 4' of the reopening plan with restaurants permitted to have limited indoor dining and unlimited outdoor dining.

Table 1. Participant overview of restaurant workers interviewed (n = 16).

Sample Characteristics	*n*	% (Range)
Age (years)		
Mean ± Standard Deviation	35 ± 10	23 to 61
Median	33	
Female	9	56
Race/Ethnicity		
White/Caucasian	6	37.5
Black/African American	4	25
LatinX	2	12.5
Asian	2	12.5
Multiracial	2	12.5
Position		
Server/Bartender	12	75
Cook/Chef/Food Preparation	3	19
Manager	1	6
Annual Income		
USD 10,000–19,000	4	25
USD 20,000–29,000	1	6
USD 30,000–39,000	4	25
USD 40,000–49,000	4	25
USD 50,000–59,000	1	6
≥USD 60,000	2	13
Base Wage without tips (U.S. Dollars)		
Mean ± Standard Deviation	USD 7.68 ± 4.56	USD 4.65 to 22.00
Median	USD 6.40	

Almost half of the participants were laid off (n = 7) with the remaining participants employed either at a different job (n = 3) or employed at the same job (n = 6). The majority of the participants were making less money (n = 9) regardless of their employment status and were receiving unemployment insurance benefits (n= 10). Three participants did not have health insurance, five participants had employer-sponsored health insurance, three paid for insurance out of pocket, and five were on public insurance.

All but two of the participants (88%) reported having more stress during the pandemic but only half (n = 8) said they were having difficulty coping with their stress. All of the participants said that their mental health was worse since the pandemic but when asked to report on their mental health, few of the participants (n = 4) said they had "bad" mental health and most reported that their mental health was "OK" or "Good". Eleven participants reported that their physical health was the same or improved since the pandemic and twelve reported good physical health.

3.2. Thematic Analysis

There was a total of 206 excerpts identified as having relevant content across the 16 interviews with an average of 13 excerpts per interview. Five core themes and seventeen subthemes were identified and presented in Table 2 with corresponding excerpts or quotes from the interviews. Excerpts are also identified here within as parenthetical statements.

3.2.1. Community and Social Outlet

The idea that restaurants are a social outlet was mentioned by all but one of the participants. The workplace was described not only as a place for socializing with customers and coworkers, but also a social support system particularly during the pandemic. There was stress associated with the loss of this community due to the shutdown of the restaurant industry.

Table 2. Summary of themes generated from semi-structured interviews.

Themes	Subthemes with Corresponding Excerpts (Participant Race/Ethnicity, Gender, Position)
Community and Social Outlet	The workplace as a social outlet and support system "It just actually created more of a community. And whenever I would get frustrated with my own family, I would be able to talk to my coworkers who were affected in the same way." (Black, Female, Bartender) "Employees, and I've got a really cool crew to work with. Hours, they're okay, money's alright. It's just part time, so. It's really just the atmosphere, it's kind of family oriented, people look out for each other, and it's fun. Work isn't always work." (Multiracial, Male, Server) The industry as a whole was affected by the pandemic "We were the first to lose our jobs. We're gonna be the last to get them back." (Black, Female, Server) "[I]t was definitely a challenge because everyone was unemployed, and there's not really anything you can do, necessarily, to get a different job, 'cause all the restaurants are shut down. But then, at the same time, it potentially made it a little bit easier for unemployment and stuff, because there's not really the option to work. And even if you are looking for work, it's just not out there." (White, Female, Server) Stress related to loss of community "[I]t was really difficult at first, you know, not having that connection and being able to see those people." (Asian, Female, Server) "I wanna be leaving the house, I wanna be around, you know, the people that I work with, you know, I miss my regulars." So the social part of it, I think, is like a driving force for me to want to go back to work." (Multiracial, Female, Server)
Ethical Responsibility of the Restaurants	Steps to protect employees from the COVID-19 virus "I think it's easier for there to be a consistent protocol. So every restaurant kind of has to follow the same guidelines I think that's helpful, but I feel like most places and people that work there are doing everything they're supposed to do." (White, Female, Bartender) "I think if everybody had a distinct enforced rule and everyone, every single restaurant, every single bar followed this law, there could be a chance at it working, but no one's enforcing these." (White, Male, Bartender) Transparency and communication about standard operating procedures "[T]he ones I've seen that break the rules, they're just trying to get their money back up to the way it was, and they don't really care about wellbeing as much." (LatinX, Male, Server) "And so our owners were like informing us, sending us news articles and all this stuff. And then just kind of like sharing like a general kind of like what the fuck is happening kind of situation like with people. How to share like kind of like the burden of like trying to comprehend what is the future, what's going to happen." (Asian, Male, Server) Job protections and support from management and restaurants owners "[I]t's so easy to, like, fire people or lay them off in the restaurant industry . . . [Y]ou can just let go of your staff and then hire a whole new one, if you wanted to. So I don't know, that just seems a little wrong, but I don't know how to fix that." (White, Female, Server/Bartender) Policies related to customer interactions "I think the focus is on protecting customers, and I think that's just, like, a cultural thing in a lot of service industry, like, a lot of different bars and restaurants." (Multiracial, Female, Server) "There's certain rules that we enforce, and that's part of what adds more to my duties and to the stress. It's a lot more stress, policing people when they come in." (Black, Male, Manager)

Table 2. *Cont.*

Themes	Subthemes with Corresponding Excerpts (Participant Race/Ethnicity, Gender, Position)
Pandemic Related Health Concerns	Fear and anxiety of being exposed to the COVID-19 virus through work "And like for a lot of us to it's like if we get sick, what are we supposed to do? Like we can't go to work then, we can't work from home. It's like, yeah, you literally are just out of a job again. And so I know like that's like a concern even like for me like I don't want to get sick and then not be able to work. Because then I'm not making money." (Asian, Male, Server) Stress while working as essential workers "We've had some struggles. I've had some people literally want to fight me, because I told them you can't come in here like that. And they get so frustrated. So everything that happens like that, it comes back and affects you." (Black, Male, Manager) "Man when everybody else was down we were up, we were the ones that was doing everything, making sure everything got across the board. There was, there was no COVID relief funds for us. There was no health benefits for us. There was no up-raise and pay rate or salary." (Black, Male, Server) "Essential workers, yeah, we're essential if like no thank you, no pat on the back, like for real. Let me feel like I'm taken care of. Give me pride, give me assistance to do my job better. I gave my best." (Black, Female, Server)
Wage and Hour, Benefits, and Paid Time off	Pay scale including tipped wage and policies around pay "It just shows you how shitty the pay is if you can make more in unemployment." (White, Male, Line Cook) "Because that's one of the things like with tipped wages like a lot of the time your experience does give you an edge and does end up increasing your wages naturally. But if you were to move away from a tipped structure and you would need to see that reflected still like you would in other jobs." (White, Female, Server) "Yeah, the financial security that was already kind of iffy being a bartender/server, 'cause if you had a good night, you made money. If you had a bad night–so you never quite you could gauge what you would kind of make in a week." (Asian, Male, Server) Lack of consistency in pay and hours in general but also due to the impact of the pandemic "I'm doing more jobs than before, and less hours and less pay, still, you know, we have the place open." (LatinX, Female, Executive Chef) "Because there's so many hands in the pot and because people are so overworked, there's no way that we can go back and try to, on top of all our duties, be janitors or just sanitize everything." (Black, Female, Server) Financial insecurity due to changes in hours, layoffs, and fear about losing job "So some other friends that are going back to work have told me how they've worked the same shift and only made $100.00 where they used to make $500.00 or $600.00." (White, Male, Bartender) Lack of benefits such as employer-sponsored health insurance, sick days, and paid time off "[E]veryone should have health insurance, I think that should never be like a concern. So I think especially in the restaurant industry too, I think that's so crucial. Because it's such a hard industry in general and I feel like sometimes it can become like toxic in like mental, emotional, physical ways. Like no one should be coming into work sick because they're worried about like not being able to pay their bills, so." (White, Female, Food Prep) "No one should have to feel the pressure of having to come to work sick or to not–to miss work just because not do things because they have to go to work, essentially thing. So I want to see that change." (Black, Female, Server)

Table 2. *Cont.*

Themes	Subthemes with Corresponding Excerpts (Participant Race/Ethnicity, Gender, Position)
Thoughts of the Future	Unclear future in the short term with reduced staffing and closures "And also I'd say the uncertainty and the back-and-forth of like, "Okay well we're going to open now" and then we're not and now we're like half-open and now we're back to not open." (White, Female, Bartender) "Well now, this is like the new normal. So this is the new baseline. And we don't know where it's going to go." (Black, Male, Manager) Returning to the restaurant industry in general "I'm like I'm just surviving, I'm not thriving. I don't have insurance, I don't have like job security. [I]f it's slow I could be sent home. I could like go to work and maybe make money or not make money. Who wants to do that? I think I'm maybe a little past it all, maybe time to look into the next steps for sure." (Black, Female, Server) ""[Y]ou realize that you don't have a job. That line of work can't function unless people can be social . . . I mean, after all this, if I could find another job, I would love to just stop bartending 'cause I don't see it ever coming back to what it kind of was, at least not for a year or longer." (White, Male, Bartender) Returning to the restaurant industry during the COVID-19 pandemic "[I] also now may not go back to working in the restaurant industry because I don't personally feel comfortable with restaurants being open and like outdoor seating happening. Just because you are putting yourself at risk and like servers especially, I, yeah, I don't know. I kind of find it crazy that people are like back to serving." (White, Female, Food Preparation) "I am more likely to go back. Before the pandemic, I was thinking about quitting, but after this, and not knowing how another future employer might handle it, not knowing what's going to happen with the coronavirus itself, I believe in what they're doing and they've shown up so far." (Black, Female, Bartender/Server) Receiving support from the government and concern about the loss of safety nets and changes to entitlements "Financially, I'm okay right now, because I was able to get unemployment. If I didn't have unemployment, I would not be doing great right now." (LatinX, Male, Server) "And I'm super thankful for the extra 600.00 bucks a week, but really scared 'cause I'm not gonna be able to afford rent or really anything at the end of the month if this expires." (Black, Female, Server)

Most respondents (n = 9) discussed their work as a social place and one that they enjoyed because of these connections. For many, this was their attraction to the restaurant industry in general. Respondents explained that work never seemed like work and was fun. This community was shut down along with the restaurant industry and respondents discussed how they felt disconnected and isolated and missed their coworkers and regular customers (3a, 3b). Some respondents felt solace in being part of a community that was suffering through similar challenges while others felt competition and stress from so many people with similar skills being unemployed (2a, 2b). Participants (n = 6) that maintained communication with their managers and coworkers even in an informal manner were more comfortable returning to work and had a more positive experience (1a).

Many restaurants held food pantries to supply food or meals to their staff and some raised funds through public donations. However, a number of respondents felt uncomfortable taking the funds explaining that there were people that were worse off than them. One bartender even donated to support out of work people regardless of being out of work herself. Some restaurants also provided financial support through pay cuts for management and owners and by extending health care coverage. This fostered a positive connection and furthered the sense of loyalty within the restaurant. Participants (n = 3) that had this support said it impacted their decision to return to work.

3.2.2. Ethical Responsibility of Restaurants

The ethical responsibility of restaurants to their employees was mentioned by 14 of the 16 participants. This responsibility ranged from providing safe workplaces to general support for employee wellbeing.

There was a lack of clarity and communication about policies and procedures to prevent exposure to the COVID-19 virus, what steps were put into place, and how they would be enforced. There was conflicting and confusing information from federal agencies, local politicians, and the restaurants in which they worked (4a). Participants (n = 7) said this increased their stress and impacted their desire to return to work. However, when there were clear and effectively communicated standard operating procedures participants felt less stress (5b).

The responsibility of enforcement of the safety protocols was unclear and often fell to the servers. Participants (n = 7) found it difficult to enforce rules while at the same time providing a hospitable environment and this added to the stress they experienced at work. Respondents discussed the problematic nature of "policing" the behavior of customers (7a). There was also a lack of consistency with how the restaurants were complying with city-wide mask mandates and capacity recommendations (4b). Some participants (n = 8) perceived that this was financial and that the restaurant owners were putting money above their safety (5a).

Participants (n = 4) felt job insecurity. This precariousness seemed to be present even before the pandemic as respondents rationalized their feelings as something they've always felt. There was a sense that those brought back were the "chosen" few but remained easily replaceable. Participants said that they would be fired if they questioned the standards that the restaurant was implementing, or the hours and wages being offered. This made some participants look for other forms of employment (6a).

3.2.3. Pandemic Related Health Concerns

Twelve participants (75%) had health concerns related to the pandemic creating fear and anxiety. They also reported physical and mental health impacts from elevated stress working as frontline and essential workers.

As an essential worker, the inability to work from home increased occupational stress for some respondents (n = 3). Those that had returned to work said they were overwhelmed by how many people they had to interact with and their lack of control over their work environment. In addition, participants discussed the difficulties associated with being a frontline worker without the protections that other industries were afforded (9b, 9c). Participants feared becoming infected with COVID-19. One participant said they felt that it was "only a matter of time." This stress was compounded for participants that were uninsured (8a).

Participants discussed feelings of burnout indicating that they had been operating under stress for a prolonged time and losing their ability to tolerate the stress. Stress was related to the changing phases of the shutdown with uncertainty about when and if the restaurants would open and at what capacity and the resulting financial instability. Stress (n = 5) was also due in part to negative customer interactions that could easily escalate to yelling and even physical altercations (9a).

3.2.4. Wage and Hour, Benefits, and Paid Time Off

Pay, benefits, scheduling, and paid time off was mentioned by all but one of the participants. Participants noted reduced wages, inconsistent pay, and fewer hours due to low-capacity seating and other policies that restaurants were implementing. Participants also highlighted the general lack of benefits such as employer-sponsored health insurance and paid time off which impacted their health and stress.

For those participants (n = 9) that had returned to work, their hours and pay were less because of reduced staffing and seating capacity while the workload increased due to the

additional cleaning and safety measures. All of the participants were making less money or thought they would when they went back because of less tips (11a, 11b).

Lack of health insurance caused stress for some participants (n = 9). One participant calling the lack of insurance "dangerous" during a pandemic and some respondents said it impacted their decision to return to work. Lack of insurance was built into the structure of the industry and one participant explained that restaurants often kept staff part-time to avoid paying for health insurance. In addition, participants were concerned about not having paid sick days if they were to get sick as they would also be out of their pay for that time. Participants pointed out that there was a lot of pressure to work while sick because of this and they often did not seek medical care due to cost (13a, 13b).

Financial insecurity because of low wages caused challenges for participants trying to balance their many demands. One mother said that she had to choose between food, rent, and health insurance and another parent considered filing for bankruptcy in anticipation of continued economic hardships. Many participants (n = 7) mentioned government support was keeping them financially solvent and some made more money than had working in a restaurant (10a, 10c). These additional unemployment benefits were set to expire in July of 2021 shortly after the interviews were conducted and the loss of that financial security was stressful for many participants (17a).

Modifying the tipped wage structure was discussed with proponents (n = 3) and opponents (n = 2). One server said that working for tips "can almost drive a person crazy" explaining that having a consistent wage would help reduce his stress. Another server echoed these concerns saying that she felt that she was always struggling even though she was working every day. Regardless, there remained a sense that some servers would still prefer a tipped wage to a set minimum wage because they could make more money (10b).

3.2.5. Thoughts of the Future

All but one of the participants talked about their considerations for the future. There was uncertainty around returning to work both in if they would return and when and what type of environment to which they would return. Second, financial instability effected whether they would return to the restaurant industry in general.

In July 2020 when these interviews were conducted, the second wave of the pandemic was beginning. Therefore, respondents (n = 5) discussed being unsure of their future in the restaurant industry. Some had a place "saved" for them while others were less sure if they would have a position with which to return. Those that were returning were paid less either due to lower tips, less hours, or having to pool their tips with the entire staff including in some cases salaried employees. This uncertainty and lower pay added to respondents' anxiety about what would come (14a, 15a).

The majority of respondents (n = 10) were not returning to their previous job or contemplating leaving the restaurant industry. The reason for this switch varied from not feeling comfortable with safety protocols to perusing a different career. Others felt that there was no other position they could find and worried the restaurant industry would change for the worse. Participants discussed not wanting to "put all their eggs in one basket" and explained that the lowered capacity would result in less hours and fewer tips. There was also a feeling that the industry would change due to the lack of customer interaction (14b, 15b, 16a). Nevertheless, some respondents (n = 5) wanted to return to work as they missed customer service and their connections within the restaurants (16b).

When asked directly for suggestions of how the restaurant industry should change when reopening, the participants generally pointed to structural changes. Half of the participants suggested more clear health and safety precautions, better adherence to the protocols, and clarity in the enforcement. Five participants suggested higher wages or less reliance on tips and five participants suggested providing employer-sponsored health insurance.

4. Discussion

The lived experiences of restaurant workers outlined here highlight the financial and emotional stressors at the height of the COVID-19 pandemic. Our thematic analysis detailed concerns such as fear of being exposed to the COVID-19 virus while working under inadequate safety policies, job insecurity, inconsistent pay and hours, and a lack of health benefits and paid time off, all of which increased occupational stress. There was also uncertainty if these workers would return to the restaurant industry and what type of environment to which they would return. But ultimately, the most unique aspect was the community built within the restaurant between the staff, owners, and customers which kept people supported and connected during these unprecedented times.

Our findings are consistent with the science of occupational stressors which point to two distinct areas of what causes job stress: worker characteristics such as a workers ability to and style of coping and working conditions such as the workload, working conditions, and organizational structure [25]. Theoretical models of workplace stressors, although varied, attribute elevated stress to an imbalance between inputs (demands, costs, efforts) and outputs (gains, control, rewards) [26,27]. Recent studies of the restaurant and hospital sectors have shown that organizational practices such as increasing workloads without increased compensation and lack of transparency in revised operating procedures during the pandemic had led to more job insecurity, lowered job satisfaction, occupational stress, emotional exhaustion, and less organizational commitment [28,29]. Similarly, our participants reported decreases in job control with the continued shutdowns and lack of clarity in health and safety protections, decreases in rewards with less and variable pay and hours while at the same time experiencing increased work demands due to understaffing, increased duties, and efforts expended towards controlling customer behavior. Increasing social support has been shown to mitigate the effects of these imbalances which was also seen in our findings as the community aspects of restaurant work alleviated stress for many of our participants [30]. Finally, our findings were consistent with the understanding that role conflict and role ambiguity leads to higher levels of stress [31,32]. Our findings showed a disconnect between the expectations of the work prior to and during the pandemic and little if any effort to clearly define the new operating procedures and the responsibilities of enforcement.

These findings contribute to occupational health research by documenting perspectives on which factors within the restaurant are associated with elevated stressors. The factors we found such as the way individuals are paid, requirements for benefits, and financial, emotional, and physical stressors are inherent in the way restaurants have historically operated [33]. These structural components of work contribute to the occupational health disparities we see particularly in low-wage occupations such as food service [34–36]. They have been exacerbated during the pandemic adding to the existing disparities in occupational and mental health [22,37–39].

The role the pandemic has had on occupational health points to control strategies for the current and post-pandemic workplace. It is most effective to eliminate occupational hazards and focus on the social determinants of health which have broad and sustained impact [40,41]. Therefore, our recommendations for occupational health practice are to address social and economic contributors.

We recommend federal level safety protocols for protecting workers from COVID-19 which are transparently and effectively communicated. Compliance with these protocols should be monitored by restaurant management as opposed to staff. Several federal agencies have released guidance, however as we found and others have shown, implementation and enforcement of these guidelines is not mandated and often falls on restaurant staff [42–44]. Removal of the ambiguity in public interfacing procedures and policies will improve not only the occupational health and safety of restaurant workers but will also support the post-pandemic economy specific to the restaurant sector [45].

To address the financial insecurity and associated stress that participants reported, we recommend that the additional unemployment insurance is extended through the

pandemic and the subminimum tipped wage eliminated. Our findings and recent studies of stress perception in chefs showed that threats to or the perception of insufficient financial support from the government led to elevated stress [46]. A recent report from the Congressional Budget Office showed that increasing the minimum wage would lift working families out of poverty and lessen the racial and gender wage gap [47,48]. Raising wages can also benefit productivity and lower turnover leading to increased revenue for restaurants [49,50].

We recommended the expansion of employer-sponsored health insurance and paid sick time as it is imperative during this global pandemic. Our respondents reported having little choice but to risk their health and the health of the public by putting off medical care or going to work sick. Employer-sponsored coverage is not required for all restaurants nor is there a federal requirement for paid sick leave. These exceptions should be eliminated or the public options for health insurance extended to include more low-income earners. During the pandemic it was found that as many as 46% of uninsured adults avoided medical care because of cost and between 13% of frontline workers lack health insurance-restaurant workers having one of the highest rates of uninsured individuals [3,51]. These workers need social support to protect themselves as they provide for us as essential workers [52].

Finally, we recommend that the community created within the restaurant industry be leveraged into a network of support. Although restaurants do not fit within the traditional worker union model, there are several worker led organizations that have provided aid through the pandemic by giving financial support and advocating for enhanced worker protections [53,54]. Workers that were connected to an organization such as these were able to negotiate better safety protections, hazard pay, and work-share agreements that allowed for more people to stay employed [55]. These organizations whether formal or informal can be powerful assets to the restaurant community and organizational support has been shown to mitigate occupational stress [28].

There are limitations to this study. The study population represents a small fraction of restaurant workers and is therefore limited in its generalizability. Although small, our sample does represent a cross-section of the restaurant industry in a major urban market. Selection bias may be present exaggerating the observed effects. The sample size is relatively small for an interview based qualitative study however due to the narrow scope of the topics covered and the homogeneity of the work experiences, these data still allowed for data saturation to be achieved. Finally, in an attempt to capture a cross-section of the pandemic's effects, we collected data within a finite timeframe which didn't allow for additional data collection if data saturation was not achieved.

Despite these limitations, this study is among the few qualitative studies to report on the experiences of restaurant workers during the COVID-19 pandemic. Qualitative data can describe the social context that quantitative data often lacks and is becoming an increasingly important tool in occupational health research [56,57]. Qualitative methods are important in documenting the lived experiences of workers and importantly in documenting the psychosocial responses of workers which have been underrepresented in research assessing the toll of the COVID-19 pandemic [58].

5. Conclusions

This is one of the first studies to report on the stressors associated with restaurant industry during the COVID-19 pandemic. Results show that the restaurants are unique in many ways from the pay and benefits structure to the differential impact of the COVID-19 pandemic and the community that it fosters. These factors have led to challenges for restaurant workers during the restaurant shutdowns and subsequent reopening including financial and employment insecurity, health-related anxieties, and elevated stressors from ambiguous and sometimes dubious practices. These findings have implications for the reopening of our economy and the restructuring of the restaurant industry in response to the changing needs of its employees.

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Appendix A. Interview Script

The consent has been read to you. Have you had all your questions and concerns answered? If not, please ask me anything else you would like. If all your questions have been answered, do you provide your verbal consent to be in the research? And do we have your permission to record.

Topic 1: Employment Status and Financial Impact

To begin, we'd like to know if you are working and what the circumstances of your work are and how these changes have impacted your financial situation.

1. What is your current employment status?

- 1.1. Are you in the same job/type of work as before the pandemic?
- 1.2. How did COVID-19 affect your employment status?
  - 1.2.1. Are you still employed but with decreased hours, still employed but with increased hours, still employed but have moved online/remote, no change, other, etc?

2. How is you doing financially?

- 2.1. Are you making more/less/the same amount of money?
- 2.2. How difficult is it for you to pay your monthly bills?
- 2.3. Do you feel like you have more financial burdens than other people you know?

3. How have your financial responsibilities changed since the pandemic?

- 3.1. Are you providing homeschooling due to COVID-19?
- 3.2. Are you providing homecare (caretaking of elderly, disabilities, etc.) due to COVID-19?

Topic 2: Health Status

The next step is to determine your current health status and how it has changed due to the pandemic. Please answer these questions for your current circumstances.

4. How is your health since the pandemic has happened?

- 4.1. How is your overall physical health?
  - 4.1.1. Are you getting enough sleep?
  - 4.1.2. Are you engaging in physical activities and regular exercise?
- 4.2. How is your mental health?
  - 4.2.1. Are you having more anxiety, depression, etc?
- 4.3. Have you or any of your friends or family tested positive for COVID-19?

5. How is your stress level since the pandemic began?

5.1. Has stress made it hard to cope with things in your daily life?
   5.1.1. Have you been more upset or irritated than usual?
5.2. Has the pandemic made you feel less in control?
   5.2.1. Do you feel like you can't control the important things in your life?
   5.2.2. Are you less confident in your ability to handle your personal life?
   5.2.3. Do you feel like things are pilling up?

6. Have you been able to access care that you need?

6.1. Do you have health insurance?
   6.1.1. If you lost your insurance was it due to losing your job?
   6.1.2. Are you able to pay for supplemental insurance?
6.2. How has your engagement with medical care changed?
   6.2.1. Have you been engaging in normal preventative care if needed?
   6.2.2. Do you have access to or have you engaged in mental health services if needed?
   6.2.3. Have you used emergency care if necessary?
   6.2.4. Have you had to put any medical needs aside during the pandemic? If so, why?
6.3. Have you been able to assess COVID-19 related services?
   6.3.1. Were you able to get tested?
   6.3.2. If you or someone you know tested positive, were they able to get the treatment they needed?
   6.3.3. Were you able prevent disease by doing things such as sheltering in place, wear masks, etc.? Why or why not?

Topic 3: Contributing Factors and Future Directions

Now we'd like to hear how working in the restaurant industry may be impacting your experience and we'd like to hear from you about how the restaurant industry should reopen and restructure.

7. Do you think that working in the restaurant industry impacted your experience during the pandemic?

7.1. Were there things about the work that made it easier or harder in the past few months?
7.2. Is there anything the structure of the restaurant industry (benefits, pay scale, management structure) that made it easier or harder during the pandemic?
7.3. Does the social structure of the restaurant industry (close knit community) that made it easier or harder during the pandemic?

8. What resources have you accessed during this time?

8.1. Have you gotten unemployment benefits and if so, are you getting enough money to support yourself and your family?
8.2. Have you applied for and/or received any public funding or grant money?
8.3. Have you utilized other public resources such as food banks, school lunches, etc?

9. What are somethings that you'd like to see moving forward?

9.1. Will you return to the restaurant industry? Why or why not?
   9.1.1. Are you being asked to go back to work?
   9.1.2. If so, how does that make you feel? Are you happy to go back or do you have fears about getting the disease?
   9.1.3. What are they doing to maintain your safety when going back to work?
9.2. What about the restaurant industry should change as we reopen etc.?

Thank you!

Thank you for participating in the survey. This information will be used to understand how restaurant workers are uniquely impacted by the pandemic. It will also be used by the researcher in their research into how the restaurant industry is structured to support its workers. All of the information will be presented as a summary of the survey data and none of what you said will be connected to you directly.

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Article

Health and Well-Being of Church Musicians during the COVID-19 Pandemic—Experiences of Health and Work-Related Distress from Musicians of the Evangelical Lutheran Church in Finland

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Abstract: Earlier research has revealed contrasting gender results in standardized mortality ratios (SMR) for cancers and cardiovascular diseases of Finnish church musicians compared with the general population. In order to better understand the SMRs, our study examined gender differences in health and work-related experiences of church musicians with special focus on experienced stress and burnout on the one hand, and work engagement and mental well-being on the other. The data were collected by a questionnaire including both standardized measures and open-ended questions. Statistical methods (mostly χ^2 tests) were used for examining gender differences in the measures, and the open-ended questions were analyzed using theory-driven content analysis. The two sets of data complemented each other. Analyses of the standardized measures showed that church musicians have more burnout and distress than the general population but the results were not gendered. However, the open-ended questions revealed clearly higher distress in females than in males. Based on the contrast between the measures and the open-ended questions, we raise the question about how well females who have distressing work can recognize the stress factors and change them, especially if distress becomes a "normal state".

Keywords: self-rated health; burnout; work engagement; well-being at work; church musician; gender differences

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1. Introduction

In 2019 a surprising gender difference was found in the standardized mortality ratio (SMR) of Finnish church musicians. Although the SMR for both cancers and cardiovascular diseases was lower than the population average, the SMR among female church musicians was higher than among males in both disease classes. For cancer, the SMR for females was 0.90 (95% CI: 0.83–0.97) and for males 0.60 (95% CI: 0.54–0.67). The SMRs for cardiovascular disease were 0.75 (95% CI: 0.68–0.82) among females and 0.58 (95% CI: 0.54–0.64) among males [1]. The result contrasted with the population average, because at the time of the study, mortality from cardiovascular diseases in males was higher than in females [2,3]. Similarly, there were more cancer deaths at the population level in males than in females at the time of the study [4]. Why did the church musicians differ from the general population? In Finland, church musicians are highly educated, full-time professionals working in congregations in paid posts. Compared with the general population, the educational background most likely explains the lower SMR for both cancers and cardiovascular diseases in church musicians, but it does not explain the gender differences.

Even though the current work environment cannot explain deaths of earlier generations, the findings raised the question of the possibly gendered work environment of

Finnish church musicians. An earlier study found that 31% of church musicians have so much work that they at least sometimes cannot cope with it, and that approximately 20% of them have daily or weekly feelings of exhaustion and cynicism. The mean rates for cynicism and inefficacy were higher than among the clergy and among the general Finnish population. Further, the mean rates for exhaustion were higher than among the clergy, but slightly lower than among general population. The study also showed an increase in the number of exhausted church musicians [5]. Thus far there is, however, no study on health issues nor gender differences of Finnish church musicians. Our aim and main research question was, hence, to examine what kind of gender differences can be revealed in church musicians' health and work-related well-being. The supplementary research questions examine (1) how the church musicians experience their health; (2) what work-related distresses they have; and (3) what reasons they recognize for distress. To obtain a thorough view, we collected data using both standardized measures (quantitative data) and open-ended questions (qualitative data) concerning health and work-related experiences of the church musicians of the Evangelical Lutheran Church of Finland in 2020–2021. The project had a special focus on the time when the COVID-19 pandemic brought its own additional challenges to work by moving the normal events (e.g., services, group meetings, choir rehearsals) online or suspending them for an undefined time (e.g., visits to elderly people's homes, day care centres, schools, etc.). One of the biggest changes was the need to learn to stream the services. Further, the work in which workers normally encounter each other and the members of the congregation, turned into work done from home using telecommuting equipment.

Since the data was collected by a questionnaire, we studied **subjective experiences of health (self-rated health)**, which might be different from health evaluated and measured by medical experts. The experienced health of the Finnish general population is frequently studied and reported by the Finnish Institute for Health and Welfare (THL) [6]. We used these same measures in our study and compared our results with two reports provided by the institute [7,8]. In the various sets of data and reports of THL, the experiences of health are often divided into physical health and work-related well-being. The division is not exclusive, since there is strong interaction between work-related well-being and health. Physical health issues are further divided into lifestyle (nutrition, exercise and rest) and health (diseases, symptoms, risk factors and ability to act) [7,8]. Many of these issues are connected to the level of education [7] (pp. 179–182), but since all our participants were educated as church musicians, we assumed that the degree of education is very similar (if not the same) for all participants and cannot be used as an explanatory factor. Further, paid employment, which is one determinant of well-being [9], was common for all participants of our study.

Considering work-related well-being and following Maslach [10], we investigated two opposite perspectives. On the one hand, we examined positive experiences, such as work engagement, positive psychological well-being and mental health, and on the other hand, psychological distress and burnout experiences. Below, we examine the aspects of work-related well-being and mental health that are relevant for our study. The measures are described in Methods.

The ideas of **work engagement** are based on the job demands–resources theory [11]. It has been described as a combination of work characteristics (working conditions and physical, psychological, social and organizational resources at work), the resources of the worker (e.g., personal characteristics and resources [12], control, self-efficacy, optimism, resilience), situations in work and in personal life [13], and job resources [14]. Traditionally it means positive well-being experiences at work and a positive, fulfilling, cognitive-affective state of mind and motivation at work [15]. According to Bakker [16], it is a mental state in which a working person is "fully immersed in the activity, feeling full of energy and enthusiasm about the work". As a concept, work engagement is defined as a positive, fulfilling, work-related state of mind, and it is divided into three positive dimensions: vigour, dedication, and absorption [17]. Vigour encompasses the experience of high energy,

mental resilience, persistence and willingness to invest effort at work. Dedication includes, for example, experiences of enthusiasm, involvement, inspiration and pride as well as sense of significance and meaningfulness at work, and absorption is characterized by concentration, dedication and enjoyment from work [16,18].

Research has shown that it is easier for committed and dedicated employees who consider their work to be meaningful to cope with adversity [19]. Work engagement and its positive effects can also be reflected in private life [18,20]. According to Hakanen [18], women experience work engagement slightly more often than men, and the elderly more often than young people. A later study also found that work engagement was higher in female than in male teachers [21]. The connection between work engagement and stress is interesting, since there is evidence that female teachers have higher stress than male teachers, while male teachers' job satisfaction is higher than that of their female colleagues [22,23].

The term '**burnout**' has been used to characterize a psychological state caused by prolonged job-related stress. Burnout has been divided into three independent dimensions: exhaustion, cynicism and inefficacy [10], which have different causes and consequences [24]. The (emotional) exhaustion is described as being emotionally depleted and distraught. Cynicism (or depersonalization) can be seen as mental distancing from exhaustive and discouraging work. Inefficacy (or low personal accomplishment) indicates reduced personal and/or professional efficacy caused by chronic stress [25]. (Without going into details about development and validation of the survey (for research on that, see, e.g., [26]) we refer to the 4th edition of the survey [25]). According to [24], exhaustion is strongly related to job demands, whereas cynicism and inefficacy are related to a lack of job resources. Even though the three dimensions are independent, they are interconnected: as exhaustion increases and empathy decreases, one's sense of inefficacy also increases. An earlier study has also shown that burnout is negatively correlated with work experience (see [24] for a summary) and positively correlated with job dissatisfaction [27].

Taken together, it seems important to differentiate between the experience of work engagement and the experiences of workload and burnout. Work engagement can occur in spite of workload, and it can be a positive way to concentrate on work regardless of workload and negative psychological conditions. Conditions at home are important as well, since they can either balance the effects of work or make them even more stressful.

The concepts of **positive psychological well-being or mental well-being** include, for example, mental resources; abilities, opportunities and strengths; possibilities to influence one's life; hopefulness and optimism; existence of satisfactory social relations or social capabilities; positive perception of oneself and one's opportunities for development; positive emotions; and resilience. Positive mental well-being is a resource that can and should be developed and utilized, and it is a state of mind rather than absence of mental disorder [7,28]. Keyes states that positive psychological well-being can protect a person from somatic diseases, and it has also been shown to protect a person from suicide and learning difficulties [29]. Work-related mental well-being is closely connected with work engagement [28].

Mental health has been described as a diverse collection of non-specific symptoms of stress, anxiety and depression. Work is generally good for mental health, provided that the working conditions are convenient and the work itself satisfactory. Further, various issues in one's personal life are important in either preventing or increasing mental health problems (for a summary, see [30]).

Studies have shown that there are **gender differences** in experiences of health and well-being at work. Hammarström, Lundman & Nordberg [9] used Connell's relational theory of order [31] and stated that gendered experiences of health can be grouped into four categories, and three of them (becoming someone, being appreciated at work and having control over work) were work-related, while one (having good family relationships) was home-related. Gender differences in experienced workload and work engagement have also been explained by combining work engagement theory with gendered organization

theory [32]. The research showed that women might not have the same opportunity to be engaged in the workplace as men because of organizational structures and practices, worker agencies and cultural assumptions; it is easier for men to experience psychological meaningfulness, safety and availability at work, and these three psychological conditions lead to work engagement. Especially women who have family responsibilities and who have to overcome barriers present in the gendered organizations need to make extra effort to demonstrate work engagement [32]. Finally, a recent study [30] with workers in various professions showed that females tend to report higher psychological distress than males, but for different reasons [30].

2. Materials and Methods

2.1. Data Collection

The participants were contacted via the church musicians' trade union (Suomen kanttori-urkuriliitto) that informed all its members about the study by e-mail and sent the link to the questionnaire via the same e-mail. The church musicians were also informed about the research in social media (e.g., Facebook) in order to also recruit those who possibly had not read their e-mail or had ignored it. We received 99 responses. The number of union members still at work was 632, indicating that the response rate was 15.7%. Even though the response rate was low, the respondents were reasonably evenly distributed in the nine dioceses of Finland. The age profile was also close to that of all church musicians. Among the respondents, none identified themselves as non-binary/other, and seven (7.1% of the sample) did not disclose their gender. It is possible that at least some of those who did not want to disclose their gender were non-binary, but since this couldn't be determined, we excluded them from the sample. The size of the group would, in any case, have been too small to analyze. The final sample (92) included 22 males (23.9%; response rate, 10.6% of male union members) and 70 females (76.1%; response rate, 17.3% of female union members). The higher female response rate is in line with earlier studies [33,34]. The mean age of the females was 48.8 years (SD 9.01) and that of the males was 52.3 (SD 9.71) years.

2.2. Variables and Standardized Measures

As stated above, we collected both quantitative and qualitative data (mixed-methods approach) to obtain a thorough understanding of the participants' experiences of health and work-related well-being. The questionnaire included, first, questions about the participants' lifestyle, e.g., about the possibility of eating lunch during a work day, their sleep patterns, alcohol use, smoking and weight. To measure alcohol consumption, we used the 3-question AUDIT-C screen [35]. We also assessed the possibility for participants to combine work and family responsibilities through responses to the following seven statements: (1) When I come home from work, I stop thinking about my work; (2) When I am at work, I do not think about home issues; (3) I can easily differentiate between work and home even when I telecommute at home; (4) I feel that I am neglecting domestic issues because of my work; (5) I sometimes neglect my family when I am wholly absorbed in my work; (6) I often find it difficult to concentrate on my work because of domestic issues; and (7) I have more energy to be with children when I also go to work. The participants responded on a four-step scale: 1 = "yes, absolutely", 2 = "yes, mostly", 3 = "mostly not", and 4 = "absolutely not".

The questionnaire also collected data by standardized measures. Work engagement was studied with the 9-question version of the Utrecht Work Engagement Scale (UWES) [17,36]. Each of the three sub-scales included three questions. Vigour was assessed with, e.g., "At my work, I feel bursting with energy"; dedication with, e.g., "I am enthusiastic about my work"; and absorption with, e.g., "I am immersed in my work". Internal consistency was high in our data: Cronbach's alpha for vigour was $\alpha = 0.927$, for dedication $\alpha = 0.930$ and for absorption $\alpha = 0.887$. The 16-item Maslach Burnout Inventory (General Survey, MBI-GS) [25] was used to measure burnout experiences. The measure has 16 questions that form three subscales of burnout: exhaustion, cynicism, and professional efficacy. Both exhaustion (e.g., "I feel emotionally drained from my work") and cynicism (e.g., "I doubt the significance

of my work") were assessed with five questions, and efficacy was assessed with six questions, e.g., "In my opinion I am good at my work". All responses were given on a seven-point rating scale ranging from 1 ('never') to 7 ('daily'). The efficacy was coded as inefficacy (lack of professional efficacy) to have the scales in the same order. Cronbach's alpha for exhaustion was $\alpha = 0.934$, for cynicism $\alpha = 0.891$ and for inefficacy $\alpha = 0.844$, all higher than in [20] and showing high internal consistency. Positive psychological well-being was measured using the seven-question shorter version of the Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) [37]. The measure includes questions such as "I have been optimistic about the future" and "I have been thinking clearly". The participants evaluated their experiences on a 5-step scale (1 = always; 2 = often; 3 = now and then; 4 = seldom, 5 = never). Cronbach's alpha for SWEMWBS was $\alpha = 0.841$, which was high and close to that obtained in [37]. Finally, the 5-item Mental Health Inventory (MHI-5) was used to measure psychological distress [30,38,39]. It consists of five questions, two of which are related to positive mental health and three to negative mental health. The questions are as follows. "How much of the time during the last four weeks have you: (1) been a very nervous person?; (2) felt downhearted and blue?; (3) felt calm and peaceful?; (4) felt so down in the dumps that nothing could cheer you up?; and (5) been a happy person?". We recoded all the questions on the same-order scale so that the lowest responses on the five-point scale (1 = always; 2 = often; 3 = now and then; 4 = seldom, 5 = never) indicated that the participants had low mental health. Cronbach's alpha for MHI-5 was $\alpha = 0.885$; which was high and very close to that obtained in [30].

Further, the questionnaire included open-ended questions concerning experienced health of the participants (diseases and symptoms, physical condition, physical exercise), and their experienced ability to act, as well as the participants' experiences of work. They all were directly connected with the previous question; e.g., after the question "Has anybody mistreated you or behaved inappropriately or menacingly?", there was an option to tell more, and after asking "How has the COVID-19 pandemic affected you work?", we asked the participants to tell more about the changes. Hence, the open-ended questions were of the type "Please tell more", "Tell more if you like" or "Briefly describe". These questions provided us with voluntary responses of varying length. It was also possible for the participants to leave the response boxes empty.

2.3. Data Analysis

The data consisted of the responses to the above-mentioned questions, standardized measures, and responses to open-ended questions. The quantitative data were analyzed mainly by statistical methods. As stated, there was low number of male participants and there was clear gender imbalance among the participants. To make the comparison of the participant groups more reliable and to address the possible bias caused by systematic differences in using the scales, we applied the following procedure with the standardized measures UWES MBI-GS and SWEMWBS, as well as the 'combining work and home responsibilities' question. We first summed the responses over the dimensions of the measure and then categorized the church musicians into three groups (low, average and high) by using average and ± 1 standard deviation as cut-off points. The females and males were then compared by chi-square tests. With the MHI-5, we used the same cut-off point (52) as used in other studies e.g., [30], and for the body mass index (BMI), we used the cut-off points 25 and 30. In some analyses (e.g., the amount of sleep), we used the independent samples t-test. The cut-off points of the other measures are described in the Results section below.

The qualitative data (open-ended questions) were analyzed using a theory-driven analysis. Individual comments (single words or short expressions) concerning any issue that was related to the topic of the research (e.g., health or illnesses, stress, burnout, work load, working times, duties, ergonomics, management, harassment, family, congregation, sleep, eating, exercising, pandemic) were first extracted and classified; new classes were added as new content was found. During this process we extracted comments regardless of the original question; for example, whenever the participants wrote something about

their ergonomics, the comment was classified accordingly regardless of whether it was a response to the question asking about their health or about changes caused by COVID-19. The classes were then grouped according to the research questions and with the help of the theory as follows: Category 1 included comments on health; Category 2 included comments on workload, distress and burnout, and Category 3 included comments that gave reasons for the experiences in Category 2. Comments containing self-criticism, which were written solely by female participants, were collected outside the theoretical framework. They were included in Category 1 because they aways related to either eating, being overweight or exercising. Finally, we analyzed pandemic-related positive experiences that formed Category 4. Figure 1 shows the study in outline.

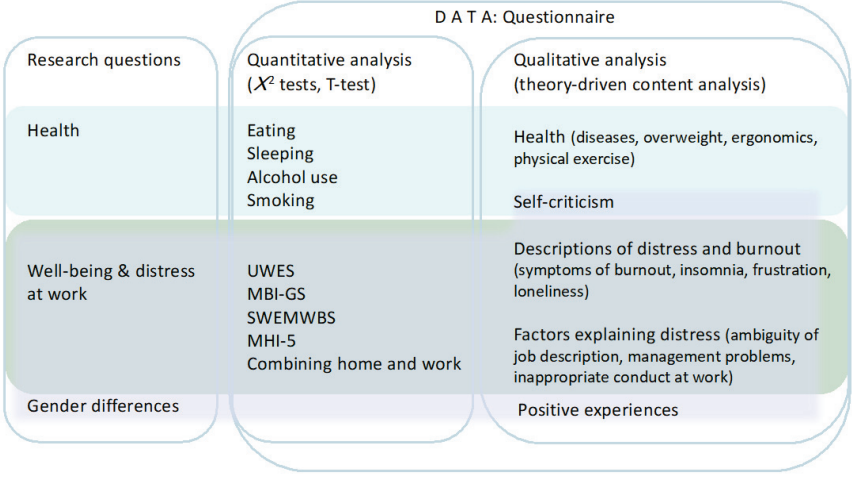

Figure 1. The study in outline: research questions, data, measures and analyses.

3. Results

We report, first, the quantitative data, and after that the responses to the open-ended questions. We begin the quantitative data analysis with health-related issues, and then report the responses to the standardized measures. By the analysis of the open-ended questions we want to deepen the understanding of the distresses and to explain the responses to the measures.

3.1. Results from Quantitative Data

More than 80% of the church musicians had time to **eat lunch** during work days often (every day or weekly), and 10% had time for lunch only once a month or even more seldom (Figure 2). The female church musicians **slept** 7 h and 32 min per night, whereas the males slept less (6 h and 47 min), and the independent samples t-test showed that the difference was statistically significant ($t_{89} = 2.93$, $p = 0.002$). For females, the duration of sleep was close to the average of females in Finland (7 h and 24 min), whereas the males slept 31 min less than the average male in Finland (7 h and 18 min) [7]. More than half of the church musicians reported that they often sleep enough, and the share of females feeling so was higher (68.2%) than the share of males (55.0%), yet the chi-square test showed that the difference was not statistically significant ($p = 0.088$). The share of both males and females who felt that they sleep enough was lower for church musicians than for Finns in general (females: 74.6%, and males: 78.0%) [7].

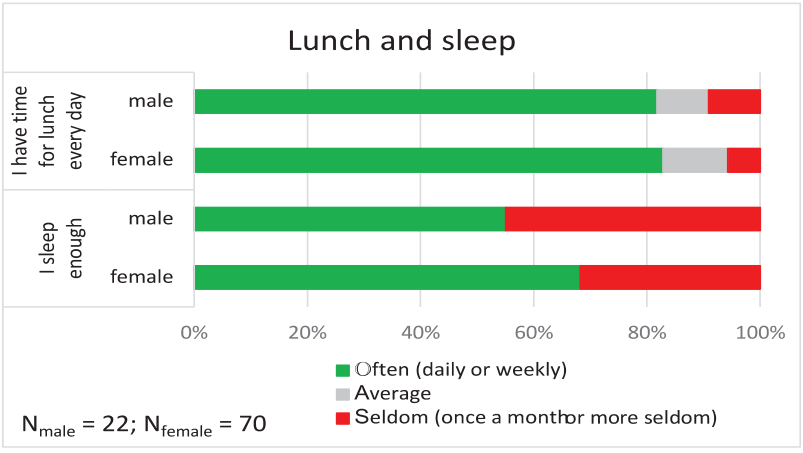

Figure 2. Lunch and sleep patterns of the participants. The share of participants with "often", "average" and "seldom" responses are shown separately for male and female church musicians (in percentages).

As stated, **alcohol use** at risk level was measured using the 3-question AUDIT-C screen, in which each question was scored between 0 and 4. If the sum of the scales, which in theory can be between 0 and 12, is equal to or higher than 5 for females and 6 for males, there is an increased risk of alcohol-related problems [40]. Of the female church musicians, 8.6% were at or exceeded the 5-point limit, while the percentage of male church musicians who were at or exceeded the 6-point limit was higher (18.2%), but the difference was not statistically significant ($\chi^2 = 1.60$, $p = 0.207$). Both male and female church musicians were, however, far below the averages (16% for females and 28% for males) found for a general population sample in Finland 2016 [41]. Further, the percentage of those who did not use alcohol at all was high both for females (28.6%) and males (31.8%). In the Finnish population the share of those who do not use alcohol at all is 20.3% of females and 15.7% of males [7].

Altogether, 14.3% of male church musicians and none of females **smoked or used snuff** daily (for the general population the figures are 15.6% of males and 10.7% of females) [7]. The majority of respondents did not smoke nor take snuff at all (87.1% of females and 57.1% of males), had stopped it (7.1% and 19.0%, respectively) or smoked/used snuff occasionally (5.7% and 9.5%, respectively).

For those 63 females and 21 males who responded to the height and weight questions, 34.9% of females and 28.6% of males had **body mass index** that was normal ($18.5 \leq \text{BMI} < 25$). Approximately one third (28.6% of females and 38.1% of males) were marginally overweight ($25 \leq \text{BMI} < 30$), and the rest (36.5% of females and 33.3% of males) fell within the obesity range ($\text{BMI} \geq 30$). The share of church musicians with normal weight was approximately the same as in the Finnish population [7], but the share of church musicians with $\text{BMI} \geq 30$ was higher for both males and females (Figure 3).

We analyzed the church musicians' experiences about combining home and job responsibilities and separating home and work. Since some of the seven statements estimated positively the ability to combine work and home and some others estimated the neglect of either work or home, we first harmonized the direction of the scales. We then averaged the responses over the questions and categorized the responses into three groups: often (low score: lower than mean − 1 st. dev.), average (mean ± 1 st. dev.), and seldom (high score: higher than mean + 1 st. dev.; see Figure 4). The results showed that combining work and home responsibilities was difficult for approximately one fifth (17.1%) of the female church musicians and one tenth (9.1%) of male church musicians, but the responses were not gendered ($\chi^2 = 0.847$, $p = 0.655$; $n = 92$).

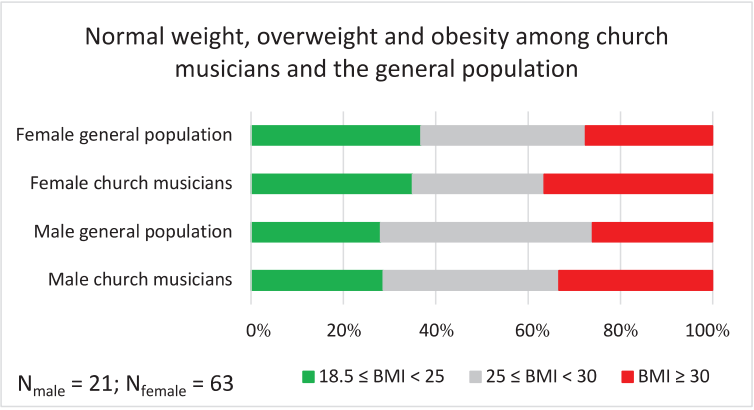

Figure 3. Proportions of respondents with normal weight, overweight and obesity among church musicians of the study and the Finnish general population (data shown as percentages).

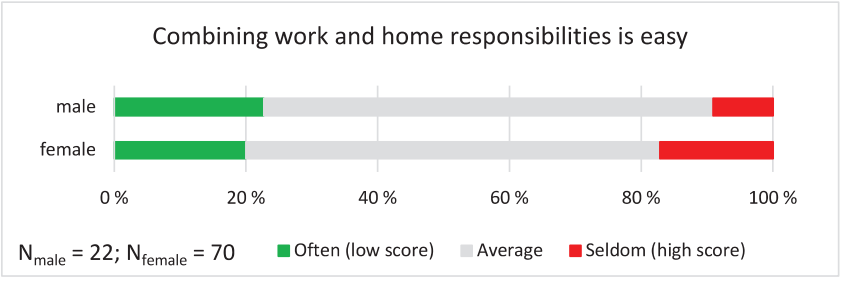

Figure 4. Combining work and home responsibilities. The proportion of "often", "average" and "seldom" responses are shown separately for male and female church musicians. On the scale between 1 and 4, the mean was 2.61, and the mean ± 1 standard deviation cut-off points were as follows: Often ≤ 2.167; Average 2.168–3.053; Seldom ≥ 3.055.

For the **Utrecht Work Engagement Scale** (UWES), we summed the responses over the three dimensions and grouped the sum score into three categories as previously explained (mean ± 1 standard deviation as the cut-off points; see Figure 5). Generally, the responses showed a smaller share of high (positive) and a larger share of low (negative) responses for males than for females, but the difference was not statistically significant ($\chi^2 = 1.802$, $p = 0.406$; $n = 92$). The responses showed that more than one fourth (27.3%) of the male church musicians and one fifth (19.1%) of female church musicians had low experiences of work engagement.

The participants' responses on the **Mental Health Inventory** (MHI-5) were summed and the sum scale modified to be from 0 to 100. Using the cut-off point 52, we determined the proportion of church musicians who had psychological distress on the level that is clinically significant and needs to be treated (see e.g., [30]). This analysis revealed the alarming result that more than one third (36.8%) of male and nearly one fourth (23.1%) of female church musicians were distressed, but the responses were not gendered ($\chi^2 = 1.117$, $p = 0.291$; see Figure 6). The figures were clearly higher than those of the general Finnish population (13.6% of males and 14.9% of females) [8].

On the shortened version of the **Warwick-Edinburgh Mental Well-Being Scale** (SWEMWBS), low scores indicate high mental well-being. The summed responses were grouped into three mental well-being categories (low, average and high) using the mean ± 1 st. dev. as previously described. The results were similar to the other measures reported above: most of the church musicians estimated their mental well-being as average, not high nor low (the grey portions of the bars in Figure 7), and there were no gender differences ($\chi^2 = 1.356$,

$p = 0.508$). Approximately one tenth (9.1%) of male and one eighth (12.9%) of female church musicians had low mental well-being. The proportions were smaller than in the Finnish population, in which the share of those who have low mental well-being is 16% of females and 17% of males [7].

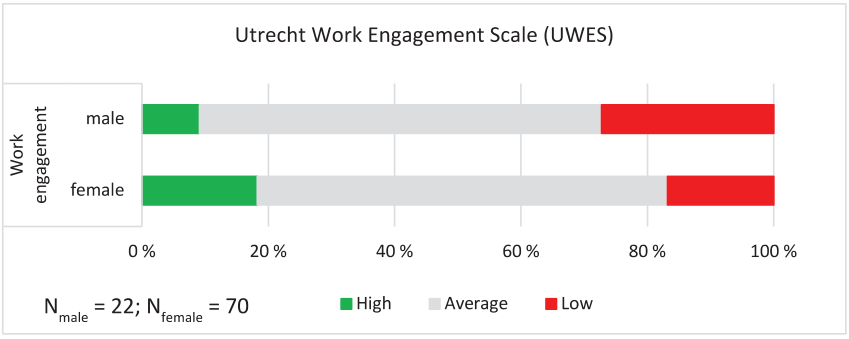

Figure 5. Work engagement. The proportions of "high", "average" and "low" responses shown separately for male and female church musicians. On the sum scale between 1 and 21, the mean was 14.852, and the mean ± 1 standard deviation cut-off points were as follows: Low ≤ 10.538; Average 10.539–19.165; High ≥ 19.166.

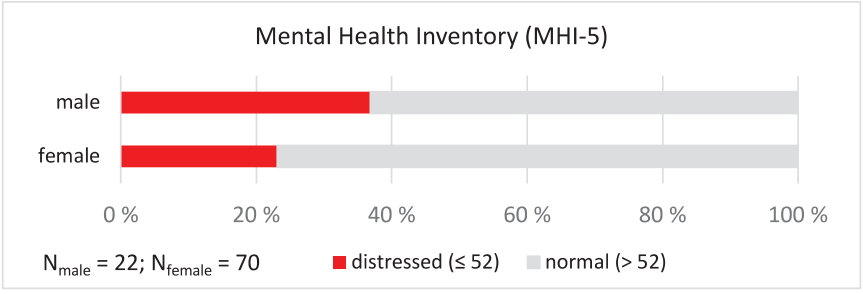

Figure 6. Mental Health Inventory. The proportions of distressed male and female church musicians.

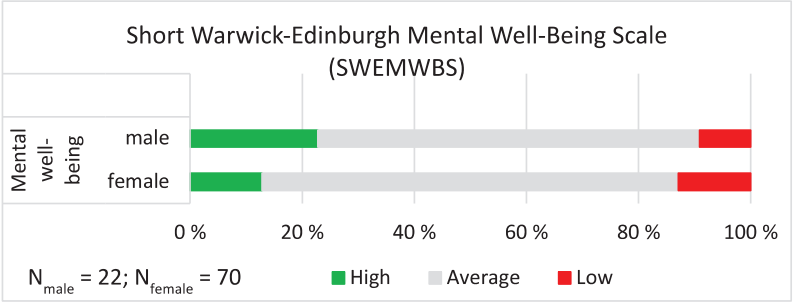

Figure 7. SWEMWBS. The share of high, average and low mental well-being shown separately for male and female church musicians. On the sum scale between 7 and 35, the mean ± 1 standard deviation cut-off points for mental well-being were as follows: High ≤ 12.811; Average 12.812–20.840; Low ≥ 20.841.

The responses on the three dimensions (exhaustion, cynicism and inefficacy) of the **Maslach Burnout Inventory General Survey** (MBI-GS) were averaged, and the averages were grouped into three categories (low, average and high) using the mean and standard

deviation as described. The three categories are shown in Figure 8 with the red sections of the bars representing high scores (indicating burnout) and the green sections indicating low scores. Ahola et al. [42] found previously that females score higher on exhaustion, whereas males score higher on cynicism, but in our study the responses were not gendered. The statistics for the three dimensions were as follows: Exhaustion ($\chi^2 = 0.075$, $p = 0.963$), Cynicism ($\chi^2 = 2.023$, $p = 0.364$) and Inefficacy ($\chi^2 = 2.679$, $p = 0.262$). The most concerning result was that a little more than one-sixth of the female (18.6%) and a little less than one-sixth of the male (15.2%) church musicians had high scores, indicating that they often had burn-out symptoms. Compared to the results of Ahola et al., the means on all three scales were higher in our study, indicating more burnout among church musicians [42].

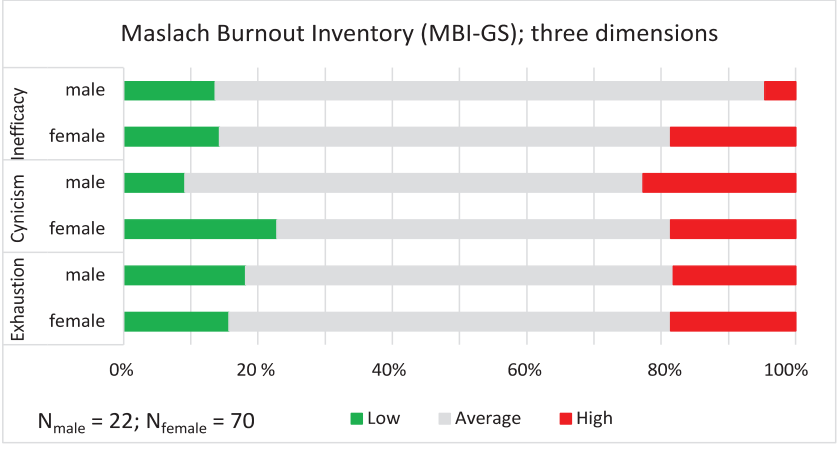

Figure 8. Maslach Burnout Inventory. The proportions of low, average and high burnout on three dimensions shown separately for male and female church musicians. On the average scales between 1 and 7, the mean and the mean ± 1 standard deviation cut-off points were as follows: Exhaustion; mean = 3.298; low ≤ 1.558; average 1.559–4.884; high ≥ 4.885; Cynicism; mean = 3.439; low ≤ 1.777; average 1.778–5.100; high ≥ 5.101; Inefficacy; mean = 2.993; low ≤ 1.812; average 1.813–4.172; high ≥ 4.173.

3.2. Results from Open-Ended Questions (Qualitative Data)

The above analyses did not reveal any differences between genders. They, however, revealed that, depending on the measure, from 9% to 37% of male and from 13% to 23% of female church musicians were not well, since they had low work engagement, low mental health, low mental well-being and burnout symptoms.

Since we wanted to analyze the working conditions more thoroughly, and especially experiences that can explain distress, we analyzed the data collected by open-ended questions. This analysis also focused on possible gender differences. As stated, we extracted individual comments (single words or short expressions) from the responses, collected them into classes and used theory-driven analysis to categorize them. Unlike the quantitative analyses, the analysis of these data revealed a clear difference between male and female church musicians: the females were more willing and capable to analyze and verbalize their work and their experiences than their male colleagues. This was the case even when the number of respondents was taken into account. Below, we describe the categories and provide some quotations (in italics) from the data. We also provide the number of comments in each category from female and male respondents as the absolute number (and in parentheses as a ratio of 100) to show differences between the groups (see Table 1).

Table 1. Main categories, subcategories, the number of responses and the share of 100, shown separately for male and female church musicians.

Main Category	Subcategories	Number of Responses from 70 Females (Share/100)	Number of Responses from 22 Males (Share/100)
Health		104 (149/100)	18 (82/100)
	Illnesses and symptoms	35	8
	Weight and eating	40	6
	Ergonomics	16	1
	Training and exercising	13	3
Description of stress and burnout		95 (136/100)	9 (41/100)
	Burnout and distress	79	5
	Loneliness	10	4
	Other	6	0
Reasons for distress and burnout		169 (241/100)	21 (95/100)
	Ambiguity of work description	45	8
	Poor management	48	8
	Changes and interruptions	32	0
	Inappropriate conduct at work	44	5
Positive comments		58 (83/100)	5 (23/100)

The number and ratio of comments on **health** (Category 1) was 104 (149/100) from females and 18 (82/100) from males. There were names of diseases (e.g., *scoliosis*; *osteoarthritis*; *coeliac disease*; *asthma*; *hypertension*), descriptions of poor ergonomics (*sedentary work*; *carrying instruments*; *steep stairs*), as well as comments on too little exercise (*too little exercise*; *no strength training*). The church musicians also wrote about increases in weight and their unhealthy diet (e.g., *my diet is unhealthy*; *too large portions*; *candies nearly every day*; *too much meat*; *too much salt*). A peculiar aspect of this category was the female church musicians' comments including strong self-criticism. The comments usually included two sentences joined by 'but'; the first sentence indicating something positive and the second one adding that more should be done. *I exercise a lot but there is not enough strength training; I cook healthy home food but eat too much delicacies; Even though I exercise many times a week, in the back of my mind I think that I should exercise more; I exercise a lot and I have no health problems, but the fact is that I weigh too much in relation to my height.*

The number of comments **describing distress and burnout** (Category 2) was 95 (136/100) from females, and the ratio was more than three times higher than the ratio of comments from males (9 comments; 41/100). As stated in Section 2.1, females normally respond more often than males, but for the Category 2 responses, the difference was strikingly large. The comments describing distress and burnout tell a stark truth about female church musicians' work experiences. The comments included direct words describing the phenomenon, such as *exhaustion*, *burnout*, *distress*, *depression* and *apathy*. *Insomnia* and *frustration* occurred frequently in the data and so did *feeling oneself worthless* or *insignificant*. Loneliness included both *working alone* (either at home or in the empty church) and the *absence of colleagues.* Further, *the meaning of work disappeared* when the church musicians were *not able to meet parish members*.

The **reasons for distress and burnout** (Category 3) were also included in the open-ended responses. In this category, the number and ratio of females' responses was higher (169 comments; 241/100) than males' (21 comments; 95/100), but the difference was smaller than in Category 2. As shown by the statistical analyses, a relatively equal proportion of female and male church musicians were unwell, and both groups were willing to elaborate the reasons. Category 3 included, first, comments about the ambiguity of job descriptions, telling that there was *too much work*, *extra work*, *haste*, *work without working hours* and *long working days*. Further, the church musicians did not know *what duties were part of their work*; they told about *scattered work* with *unrealistic expectations* and *constant increase of new work*. The most often repeated new work causing stress was *live streams*, and it is notable that

most of these comments (14 out of the total of 16) came from female church musicians. The streaming itself was a challenge (*pressure caused by live streams; live streams continue to be accompanied by ongoing inappropriate criticism and side directing*). Live streams also caused extra work (*huge amount of extra work on the internet; preparing for work tasks takes more time* [because of live streams]), and the church musicians felt that they were given no education nor support with the equipment and software that was new for most of them (*new things*, e.g., *streaming and video making, I have had to learn very quickly*; *the technical side of the live streams fell to the church musicians*; *no support from the superior*).

The second group of comments included managerial problems such as poor management, a lack of leadership and leaders who do not know the everyday reality. Managerial problems appeared also as a lack of support from superiors, inadequate communication and instructions as well as a poor workplace atmosphere. Further, the consequences of poor management could be seen as constant changes, difficulties in planning work and the impossibility of keeping to plans, and these all caused stress in both male and female church musicians. The comments about changes and interruptions were grouped separately, even though they could be seen as an aspect of the job description ambiguity or as managerial problems. All 32 comments came from the female church musicians, and the main content was that there is much planning but no guarantee that the plans can be carried out; thus, one should always have a plan B or be ready to improvise.

Comments concerning inappropriate conduct at work constituted the fourth group of comments. As with the previous comments, the number of these comments was also higher from females (44 comments; 63/100) than from males (5 comments; 23/100). The comments included *mistreatment* at work, *bullying*, *mischief*, *understating* and even *threats and intimidation* from both colleagues and superiors. *Inappropriate comments* could come from the members of the work community and sometimes also from the parish members. Both *sexist talk* and *sexual harassment* were mentioned twice by females.

The open-ended responses included also **positive experiences** concerning the effects of the pandemic on the work of the church musicians (Category 4). As with earlier comments, the females wrote more comments (58 comments; 83/100) than males (6 comments; 27/100). The most frequently occurring comments included the *decrease in the amount and fragmentation of work* as well as the *decrease in distress*. The church musicians could use *more time for exercising*, they *slept better*, they *felt better*, had *more time with the family*, and they had *time for practicing* and *creative processes*. As one church musician put it, *work during the corona was exactly what I had dreamed of all my life, and why in time I went to study. Me alone in the organ loft!*

4. Discussions

Our study revealed that some lifestyle aspects of the church musicians were on a better level than in the general population: the church musicians smoke and use alcohol less than the average population. It also showed that during the last year the experiences of church musicians' workload, burnout, mental health and engagement in work were mostly between the extreme ends of the continuum. Regardless of the measure we used in the analyses, there were always from 15 to 20% of church musicians who felt well, and we can conclude that they had personal characteristics and resources as well as behavioural strategies [19] that were strong and helped them manage their demanding working conditions in general and the changes caused by the pandemic in particular. However, depending on the measure, there were also between 9% and 37% of church musicians who were not well, and very often, there were more of those feeling unwell among church musicians than in the general population [7,8]. The proportion of church musicians who had high mental distress (37% of males and 23% of females) and burnout symptoms (15.2% of males and 18.6% of females) was especially alarming. The open-ended responses further explained these results through comments about health problems and experiences of distress, work load and burnout. An earlier interview study [43] also revealed various stress factors (the impossibility to manage the fairly limitless set of tasks,

fragmentation of work in terms of time and tasks and ambiguity of work boundaries) that were central in our study as well. Experiences of work are not constant every day but change according to events, job demands and job resources [16], and as stated, the work of church musicians includes much daily variation. In addition to these general stressors, our study revealed stressors related to the additional challenges caused by the COVID-19 pandemic, especially live-streams of the services.

Our basic question about the experiences of male and female church musicians was answered in our study, and the finding was that the experiences measured by the four standardized measures were not gendered, that is, we did not find differences in burnout, mental health and well-being. Unlike earlier studies [18,21], we did not find gender differences in work engagement. Neither did we find significant differences between male and female church musicians in eating, risky alcohol use, smoking or body mass index. Further, we did not find any difference between males and females in stress caused by combining work and home responsibilities, a finding that differs from earlier research results stating that males have high-level mental distress at work, whereas with females, the distress is related to the family-work imbalance [30].

The results from the quantitative and qualitative data were consistent for the male church musicians but not for the females. For the latter group, the qualitative data revealed distress, work load and burnout. Our study did not reveal reasons for the contrast, that is, we cannot say why female participants did not want to choose the 'daily' or 'very often' option in the direct questions about burnout or psychological distress, even though their experiences of distress were numerous, as the qualitative data showed. This finding, however, shows the importance of a mixed-methods approach, since the qualitative data revealed stressors that could not be identified by the quantitative measures.

The results are subject to several limitations. The number of respondents and the response rate was low, especially for male church musicians. Because of the small number of participants, the analyses did not show statistical significance, even though with some measures, there seemed to be a difference between male and female church musicians. Neither were we able to analyze the effect of age on the responses. Further, we did not in any way control the responses to the open-ended questions, and the activity of the females could be seen in those responses as well. However, we believe that the use of mixed methods compensated for the limitations caused by the small sample size, and the qualitative data provided us with rich, detailed and sensitive data describing the working conditions and the stressors of church musicians, something that would not have been possible to collect by using standardized measures only.

5. Conclusions

As a whole, the data showed that 37% of male church musicians and 23% of females had severe stress. These experiences were explained in the open-ended questions by the females: they reported clearly more often about their negative experiences than their male colleagues. Unlike the quantitative measures, the open-ended responses were in line with an earlier study showing that females report about their psychological workload more often than males [30]. Stress can be related to expectations [30], and the responses mentioned *unrealistic expectations* but did not reveal whose expectations should have been met, whether the female church musicians' own or those of others. However, there remain questions about why only females told about their experiences in the open-ended questions and why their stress was not reported in the quantitative measures in our study. We ask two hypothetical questions to direct future research, the first of which concerns recognition of stress: Is it possible that the female church musicians did not respond that they were unwell and felt stressed 'daily' or 'all the time' because they—at the average age of 50 and after having worked as church musicians for more than 21 years—were so used to the stress and to the bad feelings that it had become a normal state at work?

Research on work engagement and work-home balance has shown that work engagement is positively correlated with working overtime, which also can mean taking work

home. Research has also shown that those who invest a lot in work without receiving the appropriate appreciation are exposed to burnout (for a summary see [32]). In our study, only the female church musicians mentioned underestimation and disparagement in the open-ended responses, even though this was not seen in the standardized measures. From this follows our second hypothetical question: Is it possible that the female church musicians are so used to the challenges in combining home and work that they do not even recognize that it causes stress? The interpretation is in line with Connell's relational theory of order [31], especially with the component 'being appreciated at work'. The interpretation is, further, in line with the idea that females need to expend extra effort to demonstrate work engagement [32] and that they hit the glass ceiling [5] (pp. 83–88).

As stated, the starting point for our study was the finding that female church musicians' SMRs for cancers and cardiovascular diseases were higher than those of males. The results of the study could not explain earlier deaths, but analyzing qualitative data can reveal connections between stressors and causes of death; for example, one meta-analysis revealed a statistically significant connection between job-related distress and hypertension [44]. Another meta-analysis revealed that perceived psychosocial stress was associated with increased risk of stroke, and the risk was higher for females than males [45]. Further, stress and poor mental health of young adults has been shown to be associated with poor physical health, including, e.g., substance abuse disorders, smoking, minimal physical activity and neglect of nutritional guidelines, and poor health behaviours, which can lead to greater risk for cancers and other chronic health conditions [46]. Workers who have continuous work stress might not have enough time and resources to take care of their physical health. Especially stress that becomes a "normal state" can go unnoticed, and no alleviation can be found.

Because of the contradiction between the measures and the open-ended responses and because of the hypothetical questions raised by the results, we call for further research on work-related well-being of females. We also suggest mixed-methods approaches for collecting data in studies examining gender differences in appreciation and control at work as well as in connections between home and work.

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Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: The data (without responses to the open-ended questions) are available on request from T.K. The original questionnaire is available on request from T.K.

Conflicts of Interest: The authors declare no conflict of interest.

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Article

Early Care and Education Workers' Experience and Stress during the COVID-19 Pandemic

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Abstract: Early care and education (ECE) workers experience many job-related stressors. During the COVID-19 pandemic, ECE programs either closed or remained open while workers faced additional demands. We deployed a survey of the center-based ECE workforce in Washington State (United States) one year into the COVID-19 pandemic to assess impacts and workers' perceived stress levels. We describe the prevalence of reported impacts, including workplace closures; job changes; COVID-19 transmission; risk factors for severe COVID-19; the use of social distancing practices; satisfaction with workplace responses; perceptions of worker roles, respect, and influence; and food and financial insecurity. Themes from open-ended responses illustrate how workers' jobs changed and the stressors that workers experienced as a result. Fifty-seven percent of ECE workers reported moderate or high levels of stress. In a regression model assessing unique contributions to stress, work changes that negatively impacted home life contributed most to stress. Feeling respected for one's work and feeling positive about one's role as an "essential worker" contributed to lower levels of stress. Experiencing financial insecurity, caring for school-aged children or children of multiple ages, being younger, and being born in the United States also contributed to higher stress. Findings can inform policies designed to support the workforce.

Keywords: COVID-19; early care and education; occupational health; stress; workplace; public health

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1. Introduction

Early care and education (ECE) workers comprise a critical workforce that was especially vulnerable during the novel coronavirus pandemic. The sector plays an important role in the economy and in the development of young children [1,2]. Despite the vital role of ECE workers, the predominantly female workforce earns some of the lowest wages of all job sectors, receives minimal benefits, experiences high rates of turnover, and is more likely than the general population to rely on safety net programs such as Medicaid [3–6]. The ECE workforce also faces relatively high exposure to infectious disease and high rates of poor physical and mental health [4,7–10].

In 2020, the coronavirus disease (COVID-19) pandemic brought these dynamics to the national forefront [11]. Many ECE programs were forced to close due to the combined effects of decreased demand for care, mandated business closures, and preventative public health regulations that led to reduced revenue and increased costs [12,13]. Other programs remained open and grappled with how to serve children and families with considerable uncertainty and more demands related to meeting the needs of the children in their care [13]. Large numbers of ECE workers were laid off across the country; national data showed that the size of the workforce decreased by 35% between February and April 2020, and remained 16% lower a full year later [14].

Like other low-wage workers, such as those in food retail and processing, transportation, and other service sectors, ECE workers were considered "essential" throughout the pandemic. Essential workers, on the whole, experienced high rates of economic vulnerability, faced greater exposure to COVID-19, and reflected systemic racial inequities, given that many earned low wages and were people of color [15–17]. Research on experiences of essential workers, including assessments of perceived stress by employment type and characteristics, and the role of stress in mediating other poor outcomes, continues to emerge [18–20].

A growing body of research demonstrates that, even in typical times, many ECE workers experience a wide array of job-related stressors related to high job demands, limited job control, and minimal job resources [21]. ECE workers report that work-related time pressures, interpersonal dynamics, demands associated with meeting children's needs, non-teaching tasks, high rates of turnover among their peers, and perceived imbalances between effort and compensation are among the factors that are most influential in terms of their job satisfaction and general wellbeing [22,23]. Factors including age, teaching competence and efficacy, and a chaotic work environment have all been specifically associated with workers' stress [24]. Many of these stressors, and their accumulation, are associated with increased rates of burnout and turnover, as well as poor mental and physical health [8,24–27]. Higher stress experienced by workers is also associated with negative outcomes in teacher-child interactions [28–30].

Although many of the challenges faced by ECE businesses during the pandemic have been documented, the vast array of potential impacts of the pandemic on ECE workers have been less studied. A small body of early research from the United States reported changes relating to work schedules and responsibilities (e.g., more cleaning and virtual instruction), increased concerns about health and safety, poorer mental health outcomes, and decreased commitment to the ECE profession [13]. Most of these reports did not include the perspectives of workers who had left their jobs during the pandemic, however, and they reflected a range of ECE settings, samples, and methodologies [13]. More research on the breadth and impact of pandemic-related stressors for ECE workers is needed to inform efforts to strengthen the ECE system generally and in preparation for future disruptions.

In March 2020 in Washington State (United States), a statewide stay-at-home order mandated the closure of many businesses, but classified ECE programs as exempt essential businesses that could remain open [31]. Still, the capacity of open childcare programs in the state decreased by nearly half during the following month, before slowly increasing throughout the remainder of the year [32]. Guidance pertaining to ECE health and safety protocols, including social distancing, the use of personal protective equipment, and child-to-teacher ratios, was issued at multiple levels of government and changed frequently throughout the pandemic [33,34]. In this study we aimed to (1) describe the employment, financial, and health impacts experienced by the ECE workforce in Washington State during the coronavirus pandemic, and, (2) explore the relationship between these multifactorial impacts and ECE workers' stress levels.

2. Materials and Methods

We deployed a statewide survey of Washington State's center-based ECE workforce at a single time point (February to March 2021), approximately one year into the COVID-19 pandemic. The survey was originally designed to assess current working conditions and health among the workforce, but was amended during the initial stages of the pandemic to further explore how work and health was affected by changes in conditions during the pandemic. The survey relied on self-reporting to collect information about individual workers' personal demographic characteristics; characteristics of their ECE employment; employment impacts related to the coronavirus pandemic; and work-related health exposures, health behaviors, and outcomes, including stress. The survey asked about current conditions and experiences, as well as those experienced over the prior year.

The research team secured contact information with some descriptive data (e.g., position, race) from the state's ECE workforce registry for all individuals registered as working in a licensed ECE center with children under the age of six years as of January 2021 [35]. Providers registered as working with family childcare homes or school-aged programs were excluded because of differences in job characteristics. The study team emailed a survey invitation to individuals for whom contact information was provided that included a weblink to the survey and all information required for informed consent. Participants could request a hard copy of the survey as an alternative to the online survey and the survey was available in English and Spanish. The study team sent out a maximum of three survey reminders. The survey instrument included questions from validated and reliable tools [21,36–38], as well as those drafted specifically for the study with input from ECE stakeholder agencies from Washington State. It took an estimated 30 to 40 min for workers to complete the survey. Survey participants could enter a raffle for a chance to win one of 122 gift cards ranging in value from USD 20 to USD 500.

Before beginning the survey, participants responded to screening questions to confirm they had worked in an ECE center at some point during the prior year with children under the age of six years. Questions within the survey addressed the demographic and health characteristics of ECE workers and their households; characteristics of respondents' current or most recent ECE work; and pandemic-related impacts experienced over the prior year. Demographic and health characteristics included gender, age, race, ethnicity, country of birth, education level, household income, and various risk factors for severe COVID-19 [39]. Work characteristics included years of ECE experience and the following in relation to the worker's current or most recent ECE job: their position, the age of the children they cared for, their hourly wage and annual income, hours worked per week, and employer-provided benefits. Pandemic-related impacts included employment status at the time of the survey, any employment separations experienced over the prior year, and reasons for those separations; food and financial security; and changes in health behaviors (e.g., physical activity, alcohol, and food consumption). Respondents who reported that they remained in the same job throughout the year also reported on changes in the nature of their work (e.g., title change, change in pay or the number of children with which they worked), COVID-19 transmission in the workplace, perceptions of the workplace pandemic response, and perceptions of their role as an "essential worker".

Respondents' levels of perceived stress, as measured by the ten-item Perceived Stress Scale (PSS-10), served as the dependent variable. The PSS-10 is widely used for assessing "the degree to which respondents found their lives unpredictable, uncontrollable, and overloading" [40,41] (p. 387). Versions of the Perceived Stress Scale have been used in other studies of both childcare worker wellbeing [8,27,42] and COVID-19 pandemic impacts [43,44]. The use of this tool results in a score ranging from 0 to 40, with "low" stress defined as a score from 0–13, "moderate" ranging from 14–26, and "high" ranging from 27–40. The survey also included one open-ended question about how respondents' work had changed over the prior year. The Washington State Institutional Review Board approved the study protocol. The research team piloted the survey with five ECE workers and had the survey professionally translated into Spanish before deploying.

Using Stata version 14.0, the team conducted descriptive analyses of the variables, including frequencies and mean values for the full sample and stratified by position type (e.g., teacher, administrator, other) and employment status. Mean values of the PSS-10 were calculated by demographic characteristics, ECE work characteristics, experiences with various pandemic impacts, role perception, and aspects of health status. We conducted bivariate analyses to examine the relationships between perceived stress and these variables using chi-squared, ANOVA, and T-tests to test the statistical significance of these relationships where appropriate.

To assess the factors contributing to perceived stress, we conducted a multiple-step regression process. First, we grouped a priori potential stressors into four sets: basic demographics, ECE employment characteristics, COVID pandemic-related events and

conditions, and financial and food security. We developed a base model with demographics first, using a step-wise selection with a p value for inclusion of 0.1. We then developed one model each for employment characteristics, pandemic response, and economic security measures, each including the base model variables. Again, we used a step-wise procedure to select from among the variables in each category. Finally, we ran one full model, including all variables from the base model and the significant contributors to the three subsequent models. Each model had a different number of subjects included because of missing data; in particular, only those with current employment in ECE answered questions about pandemic workplace responses.

For qualitative data collected via the open-ended survey question, the team reviewed an initial sample of 20% of the responses and developed a codebook based on emerging themes pertaining to (1) changes in work tasks and responsibilities; (2) changes in other work characteristics; and (3) and expressed concerns, challenges, and stressors. Using the codebook, a team member then reviewed and coded all responses using Dedoose (version 9.0.17). Responses were reviewed by code and respondent position type (teachers, administrator, other) to summarize themes.

3. Results

Survey invitations were sent to 28,306 workers. Of these, 2442 workers participated and responded to a sufficient number of questions to be included in the analytic sample. ECE worker respondents were slightly more likely than non-respondents to be in an administrator position (20% compared to 10%) and white (66% compared to 59%).

3.1. Personal, Household, Employment, and Health Characteristics of Respondents

3.1.1. Personal and Household Characteristics

Almost all ECE worker respondents were female and slightly more than half were younger than 39 years old (Table 1). Seventy-one percent of those responding to the survey question about race identified as white (88% of whom identified as non-Hispanic white), 18% reported a Hispanic ethnicity, and 20% were born outside the United States. Slightly less than half had a Bachelor's-level education or higher and about half reported an annual household income less than USD 40,000.

Table 1. Personal, household, health, and employment characteristics of Washington State early care and education (ECE) worker respondents, February/March 2021 (n = 2442).

	% (n) [a]
Personal and household demographics	
Gender	
Female	95.3 (2259)
Age	
<39 years old	50.2 (1222)
Ethnicity	
Hispanic, Latino, or Spanish origin	17.9 (427)
Race	
White	71.3 (1725)
Asian	7.3 (177)
Black	3.6 (86)
American Indian or Alaska Native	1.7 (41)
Native Hawaiian or Pacific Islander	1.0 (24)
Other	9.0 (217)

Table 1. *Cont.*

	% (*n*) [a]
Multiple	6.1 (148)
Country of birth	
Born in the US	80.2 (1921)
Education level	
<High school, GED or high school graduate	28.7 (676)
Associates degree	25.7 (605)
Bachelors degree	33.0 (777)
Graduate or professional degree	12.5 (295)
Household income	
<40,000 USD	48.5 (1061)
Health	
Self-reported health	
Fair or poor	12.2 (296)
Good, very good, or excellent	87.8 (2131)
Perceived stress level [b]	
Low	43.3 (1045)
Moderate	52.2 (1259)
High	4.5 (108)
Experiences risk factors for severe COVID-19	
One or more first factors, including:	72.7 (1775)
Overweight, pregnant excluded	25.6 (540)
Obese, pregnant excluded	42.8 (903)
Hypertension	20.2 (478)
Heart disease or stroke	1.8 (44)
Diabetes	6.6 (159)
Asthma	20.3 (489)
Smoke $\geq$ 1 cigarette/day	6.1 (146)
>65 years old	3.6 (88)
Pregnant	2.2 (50)
Current or most recent ECE employment	
Position	
Administrator	24.4 (593)
Teacher	66.4 (1617)
Other	9.2 (225)
Years of ECE experience	
<10 years	54.6 (1327)
Age of child taught	
Infants (0 to 11 months)	6.7 (162)
Toddlers (12 to 29 months)	16.1 (389)
Preschoolers (30 months–5 years)	43.1 (1042)
Kindergarten or older	5.2 (126)

Table 1. *Cont.*

	% (*n*) [a]
Multiple age groups	28.8 (697)
Annual income from ECE employer	
≤30,000 USD/year	53.3 (1205)
Hourly pay rate	
≤13.50 USD/hour	11.7 (197)
$13.51–$18.00/hour	56.9 (960)
>18.00 USD/hour	31.4 (529)
Hours worked per week	
≥35 h/week	79.8 (1928)
Paid vacation leave offered by ECE employer	
No	30.0 (733)
Paid sick leave offered by ECE employer	
No	21.3 (520)
Health insurance coverage	
Through employer	39.0 (952)
Through another source	51.0 (1244)
Not covered	10.0 (243)

[a] Percentage is based on the number of respondents to the question; the number of respondents varied by question. [b] Assessed using the 10-item Perceived Stress Scale (PSS-10). Scores range from 0 to 40, with 0–13 classified as "low" stress, 14 to 26 as "moderate" stress, and 27 to 40 as "high" stress.

3.1.2. Health Characteristics

Twelve percent of respondents reported fair or poor overall health, but more than 70% reported at least one risk factor for severe COVID-19 identified by the US Centers for Disease Control and Prevention [39] (Table 1). Of the eight risk factors assessed, overweight or obesity were most prevalent, followed by asthma and hypertension. More than half of respondents (57%) reported moderate or high stress.

3.1.3. ECE Employment Characteristics

Slightly more than half of respondents reported fewer than 10 years of ECE experience. In their current or most recent ECE job, two-thirds of respondents worked in a teaching position (i.e., Lead, Assistant Teacher, or Aide), one-quarter reported an administrative position (i.e., Director, Assistant Director, or Program Coordinator), and the remaining reported their position as "other" (e.g., cook, owner, substitute teacher, other programmatic role). (Table 1). A plurality of respondents worked with preschool-aged children (30 months to five years old), followed by multiple age groups, toddlers between 12 and 29 months old, and infants younger than one year old. Five percent of respondents worked with children older than five years. Respondents generally worked at least 35 h per week at their ECE job and most earned USD 30,000 or less per year at this job. Among those who reported an hourly wage, 12% reported earning USD 13.50 or less per hour (the state's minimum wage in 2020); most reported earning between USD 13.50 and USD 18.00 per hour. Most respondents also reported that their ECE employer offered paid vacation and paid sick leave, but fewer than half received health insurance through their ECE employer. Administrators reported more ECE experience, more working hours per week, greater access to paid leave, and annual incomes that were, on average, 50% higher than teachers.

3.2. Employment, Financial, and Health-Related Pandemic Impacts

3.2.1. Changes in Employment and Work

Two-thirds of respondents reported that their ECE workplace closed at some point during the pandemic, but only 5% said it had not yet reopened at the time of the survey (Table 2). Thirty percent of respondents reported permanently or temporarily separating from their pre-pandemic ECE employer (e.g., they quit, were laid off or furloughed). Of those, more than three-quarters said the reason related to the pandemic, including the center closing (n = 273) or cutting their hours or position (n = 249), followed by not feeling comfortable working (n = 134), having to care for a family member (n = 66), or becoming too sick to work (n = 25). About half of respondents who experienced a separation eventually returned to the same or a different ECE job, and administrators were more likely than those in other positions to do so.

Table 2. Pandemic-related employment and financial security impacts experienced by Washington State early care and education (ECE) worker respondents, February/March 2021.

	All (n = 2442) [a]	Administrator (n = 593) [a]	Teacher (n = 1617) [a]	Other (n = 225) [a]
Changes in employment				
Employer closures during pandemic, % (n)				
Center closed and stayed closed	5.1 (121)	4.1 (24)	5.0 (78)	8.8 (19)
Center closed and reopened	61.2 (1450)	58 (337)	61.6 (962)	67.7 (147)
Center never closed	33.7 (797)	37.9 (220)	33.5 (523)	23.5 (51)
ECE employment status during pandemic, % (n)				
Did not work at ECE center before pandemic	1.1 (27)	0.8 (5)	1.2 (20)	0.9 (2)
No separation from employer	69.3 (1688)	83.3 (493)	63.5 (1025)	75.0 (168)
Permanent or temporary separation from employer	29.6 (722)	15.9 (94)	35.3 (569)	24.1 (54)
Experienced $\geq$ 1 job change, [b,c] % (n)	85.1 (1436)	91.7 (452)	82.2 (842)	83.3 (140)
Change in number of children cared for	79.0 (1309)	85.9 (420)	76.3 (765)	74.4 (122)
Increased	7.0 (90)	4.3 (18)	8.6 (66)	4.9 (6)
Decreased	93.0 (1200)	94.8 (398)	89.5 (685)	93.4 (114)
Change in hours worked	24.6 (594)	37.6 (184)	35.4 (356)	31.9 (53)
Increased	11.0 (265)	72.3 (133)	30.1 (107)	47.2 (25)
Decreased	12.7 (305)	26.6 (49)	64.6 (230)	47.2 (25)
Change in age of children cared for	21.3 (350)	22.0 (107)	21.7 (216)	16.2 (26)
Older children	44.8 (150)	55.1 (59)	37.0 (80)	38.5 (10)
Younger children	16.1 (54)	1.9 (2)	23.2 (50)	7.7 (2)
Wider range of ages	39.1 (131)	40.2 (43)	34.3 (74)	50.0 (13)
Change in pay	14.7 (354)	19.8 (97)	22.6 (226)	18.3 (30)
Increased	10.4 (250)	67.0 (65)	70.8 (160)	80.0 (24)
Decreased	3.0 (72)	25.8 (25)	18.6 (42)	13.3 (4)
Change in title/position	12.8 (213)	11.0 (54)	13.8 (138)	12.6 (21)
COVID-19 transmission in the workplace				
Tested positive for COVID-19	7.0 (154)	7.1 (39)	7.3 (105)	4.9 (10)
Experienced symptoms but not tested	8.5 (187)	7.1 (39)	8.8 (126)	9.9 (20)

Table 2. *Cont.*

	All (n = 2442) [a]	Administrator (n = 593) [a]	Teacher (n = 1617) [a]	Other (n = 225) [a]
Child or adult at center tested positive, % (n)	71.5 (1548)	69.2 (394)	72.4 (1011)	71.8 (140)
Highly concerned about contracting COVID-19 at work, % (n)	40.2 (961)	34.0 (200)	43.0 (677)	37.3 (81)
COVID-19 response in the workplace				
More than 10 children in the classroom,[d] % (n)	59.7 (1162)	61.5 (311)	60.5 (771)	48.5 (78)
Don't always work with the same group of children,[e] % (n)	40.0 (769)	60.7 (290)	29.6 (383)	65.3 (94)
Not confident parents adhere to policies/practices,[f] % (n)	24.0 (566)	15.4 (89)	27.1 (421)	24.7 (54)
Not confident staff adhere to policies/practices,[f] % (n)	18.7 (443)	10.0 (58)	22.1 (346)	17.1 (38)
Not confident in center policies/practices,[f] % (n)	18.6 (443)	8.3 (48)	22.9 (361)	14.4 (32)
Disagree with decision to close/open,[f] % (n)	17.3 (410)	8.8 (50)	20.6 (320)	17.9 (39)
Lack of timely information to share with families,[f] % (n)	14.3 (332)	9.3 (54)	16.5 (251)	12.1 (26)
Lack of easy access to cleaning materials,[f] % (n)	13.7 (323)	13.6 (79)	14.4 (222)	19.2 (20)
Lack of easy access to personal protective equipment,[f] % (n)	13.7 (322)	14.1 (82)	14.0 (216)	10.0 (22)
Changes in work negatively impact private life,[g] % (n)	26.4 (542)	27.4 (152)	26.2 (341)	24.8 (48)
Perception of ECE role during COVID-19 pandemic				
Hope to be working in ECE a year from now, % (n)	86.3 (1781)	92.0 (485)	84.3 (1130)	85.2 (161)
Do not feel respected for my work,[h] % (n)	29.6 (611)	25.1 (139)	32.4 (425)	24.1 (47)
Do not have influence concerning my work,[i] % (n)	52.7 (1038)	33.0 (180)	61.2 (757)	53.8 (99)
How I feel about my role as an "essential worker", % (n)				
Proud or grateful	62.1 (1274)	67.7 (371)	61.1 (785)	61.0 (116)
Conflicted, resigned, or upset	37.1 (752)	32.3 (177)	38.9 (500)	39.0 (74)
Financial security impacts				
Paying for the basics is hard,[j] % (n)	59.5 (1374)	45.5 (259)	65.0 (999)	51.4 (110)
Paying for the basics during the pandemic has become harder,[k] % (n)	62.3 (1427)	51.0 (288)	67.3 (1015)	55.9 (118)
Household experienced food insecurity in prior year, % (n)	33.1 (791)	21.6 (127)	37.7 (593)	30.6 (68)
Household used $\geq$ 1 safety net program in prior year, [l] % (n)	59.2 (1445)	47.6 (282)	63.9 (1034)	55.1 (124)

[a] Percentage is based on the number of respondents to the question; the number of respondents varied by question. [b] Respondents could provide more than one response or may have not responded, so percentage totals may not add up to 100%. [c] Only respondents who stayed at the same center without a separation could answer this question (n = 1688). [d] Refers to reports of "often" or "sometimes"; excludes responses of "never", which was the recommended best practice. [e] Refers to reports of "often" or "sometimes"; excludes responses of "always", which was the recommended best practice. [f] Refers to reports of "somewhat disagree" or "strongly disagree" to statements framed in the positive; excludes responses of "somewhat agree" or "strongly agree" or "neither agree nor disagree." [g] Refers to reports of "to a large extent" and "to a very large extent"; excludes responses of "to a very small extent", "to a small extent", and "somewhat." [h] Refers to reports of "rarely or never" and "occasionally" excludes responses of "often", "usually", and " most of the time." [i] Refers to reports of "never or hardly ever", "seldom", and "sometimes"; excludes responses of "often" or "always". [j] Refers to reports of "very hard", "hard", or "somewhat hard"; excludes responses of "not very hard" and "not hard at all." [k] Refers to reports of "somewhat harder" and "very much harder;" excludes responses of "not harder at all." [l] Safety net programs include: Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Medicaid, free or reduced-price school lunch, food pantry, and unemployment insurance.

Teachers were more likely than administrators or other staff to experience employment separations during the pandemic (see Supplemental Table S1). Those who experienced employment separations were generally younger, reported lower hourly and annual pay rates, had fewer years of ECE experience, were less likely to have an employer that offered paid vacation or sick leave, were less likely to have employer-provided health insurance, and had lower annual household incomes.

A substantial majority of respondents (85%) who remained employed at the same center throughout the pandemic reported at least one change to their job during this period (Table 2). Administrators were more likely than others to report an increase in work hours, whereas teachers were more likely to report a decrease.

3.2.2. COVID-19 Transmission and Pandemic Response in the Workplace

About 16% of respondents reported having tested positive for coronavirus or experiencing COVID-19 symptoms without being tested, whereas 72% reported a positive case within their workplace community (staff, children, or parents of children) (Table 2). Forty percent of respondents reported high concern about contracting COVID-19 at work.

Nearly 60% of respondents reported sometimes or often working with more than 10 children at a time despite the recommendation to limit groups to 10 or fewer as a preventative measure [45]. Forty percent of respondents reported not always working with the same group of children, another recommended best practice [34]; this was slightly less prevalent for teachers than administrators and those in "other" positions.

Between 14% and 24% of respondents reported negative sentiments about aspects of their workplace's response to the pandemic (see Table 2). Administrators were less likely to express negative sentiments than teachers and other staff. Slightly more than one-quarter of respondents reported that their family life had been negatively impacted by changes in work relating to the pandemic.

3.2.3. Perception of Role

A large majority of respondents (86%) reported they hoped to be working in the ECE field one year into the future (Table 2). When asked to select one of five possible statements that best expressed how they felt about their role as an essential worker, 62% selected a statement expressing pride or gratitude ("I am proud to be able to continue working under these conditions" or "I am just grateful to still be working/earning a paycheck"). The remainder of respondents selected a statement conveying that they felt conflicted, resigned, or upset ("I understand why we are considered essential, but feel conflicted about working", "I would rather not be working, but I have to earn a paycheck", or "I am upset that I have to work under these conditions").

3.2.4. Financial Security Impacts

Sixty percent of respondents reported that they found paying for basics such as food, housing, medical care, and heating at least somewhat hard to do and a comparable percentage reported that this had become more difficult during the pandemic. (Table 2) A third of respondents reported that their household experienced low or very low food security in the prior year, meaning that they were not able to afford the food they needed. Nearly 60% of respondents reported use of at least one safety net program, such as Medicaid, a nutrition assistance or charitable food program, or unemployment insurance. Teachers were more likely than administrators to report these financial insecurity impacts, and workers who reported a temporary employment separation or unemployment at the time of the survey were more likely to report these impacts than those who stayed at the same job throughout the pandemic (see Supplemental Table S1).

3.2.5. Health Behavior Impacts

When asked whether various health behaviors had changed during the pandemic, most respondents reported no change in their alcohol consumption, but slightly more than half reported a decrease in physical activity and 40% reported that their diet had worsened.

3.3. Perceived Stress

Respondents who were female, younger than 39 years old, non-Hispanic, born in the United States, and with lower household incomes reported higher levels of stress than their counterparts. Stress levels differed by race, with those identifying as Native Hawaiian or Pacific Islander reporting the highest mean stress level and those reporting an "other" race reporting the lowest levels. Levels of perceived stress are reported in Table 3 by some employment and health characteristics, and by pandemic impacts.

Table 3. Perceived stress level of Washington State early care and education (ECE) worker respondents by select employment and health characteristics, and by experience of pandemic-related impacts, February/March 2021.

	Perceived Stress, [a] Mean	*n*	*p*-Value
Current or most recent ECE employment			
Position			
Administrator	14.3 (6.4)	591	0.035
Teacher	15.1 (6.8)	1589	
Other	14.7 (6.9)	225	
Years of ECE experience			
<10 years	15.8 (6.9)	1309	0.002
≥10 years	13.7 (6.3)	1087	
Age of child taught			
Infants (0 to 11 months)	14.9 (6.7)	151	0.009
Toddlers (12 to 29 months)	15.2 (7.1)	381	
Preschoolers (30 months–5 years)	14.4 (6.7)	1034	
Kindergarten or older	16.5 (6.1)	126	
Multiple age groups	15.1 (6.7)	694	
Paid vacation leave offered by ECE employer			
Yes	14.7 (6.5)	1689	0.071
No	15.2 (7.2)	723	
Paid sick leave offered by ECE employer			
Yes	14.9 (6.7)	1904	0.482
No	14.7 (7.0)	508	
Health insurance coverage			
Through employer	14.6 (6.4)	943	0.422
Through another source	15.0 (6.9)	1230	
Not covered	15.1 (7.3)	236	

Table 3. *Cont.*

	Perceived Stress, [a] Mean	*n*	*p*-Value
Health			
Experience ≥ 1 risk factor for severe COVID-19 [b]			
No	14.3 (6.8)	658	0.009
Yes, including:	15.1 (6.7)	1754	
Changes in employment during pandemic [c]			
Employment status at time of survey			
Working at same center as before pandemic	14.4	1667	0.018
Working, but had experienced a permanent or temporary separation	16.0	550	
Unemployed	15.3	195	
Experienced job change(s) during the pandemic [d,e]			
One or more changes	15.2 (7.0)	991	0.036
No changes	14.6 (6.5)	1421	
COVID-19 transmission and response in the workplace [c]			
Believe you experienced illness due to COVID-19			
Yes, tested positive	15.2 (6.9)	150	<0.001
Yes, experienced symptoms but wasn't tested	16.5 (6.8)	186	
No	14.4 (6.7)	1829	
One or more person at center tested positive for COVID-19			
Yes	15.2 (6.6)	1538	<0.001
No	14.0 (6.9)	609	
Concern about contracting COVID-19 at center			
Highly	16.6 (6.6)	948	<0.001
Not at all or moderately	13.8 (6.6)	1417	
Disagreement with COVID-19 response in the workplace			
2 or more disagreements	17.4 (6.7)	586	<0.001
1 disagreement	15.9 (6.8)	275	
No	13.5 (6.3)	1324	
Changes in work have negatively impacted my family/private life			
To a large or very large extent	18.4 (6.4)	539	<0.001
To a very small extent, small extent, or somewhat	13.2 (6.1)	1497	
Financial and food security			
Experienced low or very low food insecurity			
Yes	13.7 (6.5)	1587	<0.001
No	17.0 (6.7)	780	

Table 3. *Cont.*

	Perceived Stress, [a] Mean	*n*	*p*-Value
Experienced difficulty paying for the very basics [f]			
Yes	16.2 (6.6)	950	<0.001
No	13.0 (6.4)	1357	
Experienced more difficulty paying for the very basics during the pandemic			
Somewhat or very much harder	15.8 (6.7)	1412	<0.001
Not harder	13.5 (6.4)	862	
Household used ≥1 safety net program in the last year [g]			
Yes	15.3 (6.8)	1431	<0.001
No	14.3 (6.7)	981	
Perception of role [e]			
Feels respected for work			
Rarely/never, occasionally, often	17.0 (6.3)	608	<0.001
Usually, most of the time	12.7 (6.2)	1437	
Has a large degree of influence concerning work			
Never or hardly ever, seldom, sometimes	15.5 (6.5	1032	<0.001
Often, always	13.7 (6.5)	930	
Feelings about role as an "essential worker" during the pandemic			
Conflicted or upset	16.8 (6.4)	750	<0.001
Proud or grateful	13.2 (6.3)	1261	

[a] Assessed using the 10-item Perceived Stress Scale (PSS-10); total scores ranged from 0 (low) to 40 (high). [b] Accounts only for risk factors including overweight or obese (pregnant excluded), hypertension, heart disease or stroke, diabetes, asthma, smoking ≥ 1 cigarette per day, age of 65 years old or older, and pregnant. [c] Based on current or most recent ECE employment. [d] Examined changes included changes in title, age or number of children cared for, pay, and hours. [e] Only respondents who reported staying at the same center throughout the pandemic without a separation answered this question. [f] Includes those who reported paying for the very basics to be "hard," "very hard," or "somewhat hard" as opposed to "not very hard" or "not hard at all. [g] Safety net programs include Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Medicaid, free or reduced-price school lunch, food pantry, and unemployment insurance.

Respondents' stress levels differed significantly based on their experience of all work-related pandemic impacts examined (Table 3). The biggest differences in reported stress levels occurred between those who felt that work changes had negatively impacted their family life and those who did not (mean PSS 18.4, considered moderate stress, compared to 13.2, which is considered low stress) and those who felt they were not respected for their work and those who felt they were (mean PSS 17.0, considered moderate stress, compared to 12.7, considered low stress).

3.4. Contributors to Perceived Stress

Table 4 presents the results of regression models, considering factors contributing to respondents' perceived stress levels. In the first model, considering differences by demographic characteristics, gender, age, and country of birth contributed significantly to the model, indicating higher stress among women, younger providers, and native-born workers. Variables tested, but not contributing to perceived stress included race, ethnicity, and educational level. In Model 2, which included base model demographic variables and

employment-related characteristics, only years of ECE experience and the age of children cared for contributed to the model; those with longer tenure had slightly lower reported stress and those caring for school-age children reported higher stress. Job position, hourly pay, hours worked, annual income, paid vacation, sick leave, and employer-provided health insurance did not contribute significantly.

Table 4. Effects of personal characteristics, employment conditions, pandemic impacts, and food and financial security on perceived stress among Washington State early care and education (ECE) worker respondents, February/March 2021.

	Model 1 (Base): Demographic Characteristics [a]	Model 2: Early Care and Education (ECE) Employment Characteristics [a]	Model 3: Pandemic-Related Impacts [a]	Model 4: Food and Financial Security [a]	Model 5: Combined Final Model [a]
n	2306	2266	1737	2174	1674
Demographic characteristics [b]					
Gender (reference: female)	1.65 (0.64) ***	1.99 (0.65) ***	0.89 (0.69)	0.92 (0.63)	1.06 (0.70)
Age (years old, continuous)	−0.14 (0.01) ***	−0.12 (0.01) ***	−0.10 (0.01) ***	−0.12 (0.01) ***	−0.09 (0.01) ***
Country of birth (reference: US-born)	−1.63 (0.34) ***	−1.79 (0.35) ***	−1.20 (0.37) ***	−1.87 (0.34) ***	−1.16 (0.38) ***
ECE employment characteristics					
Years of ECE experience (continuous)		−0.04 (0.02) **			−0.02 (0.02)
Age of child taught (reference: Preschoolers, 30 months to 5 years)					
Infants (0 to 11 months)		0.26 (0.58)			0.06 (0.59)
Toddlers (12 to 29 months)		0.08 (0.40)			0.03 (0.43)
Kindergarten or older		1.65 (0.63) ***			1.04 (0.63) *
Multiple age groups		0.48 (0.33)			0.71 (0.33) **
Pandemic-related impacts					
Changes in work during pandemic negatively impacted family/private life (reference: never/hardly ever, seldom, sometimes)			3.44 (0.33) ***		3.4 (0.34) ***
Usually or most of the time feels respected for work (reference: rarely/never, occasionally, often)			−3.25 (0.32) ***		−3.03 (0.33) ***
Often or always has a large degree of influence concerning work (reference: never or hardly ever, seldom, sometimes)			−0.38 (0.28)		−0.42 (0.29)
Experienced ≥1 risk factor for severe COVID-19 (reference: No)			0.58 (0.32) *		0.45 (0.33)
Feels proud or grateful about role as an "essential worker" during the pandemic (reference: Conflicted or upset)			−1.43 (0.30) ***		−1.39 (0.31) ***
Experienced more difficulty paying for the very basics during the pandemic (reference: No)					
Somewhat more			0.52 (0.30) *		−0.26 (0.36)
Very much more			1.35 (0.44) ***		0.13 (0.55)
Experienced one or more job changes in prior year (reference: No changes)			0.37 (0.30)		0.35 (0.31)

Table 4. *Cont.*

	Model 1 (Base): Demographic Characteristics [a]	Model 2: Early Care and Education (ECE) Employment Characteristics [a]	Model 3: Pandemic-Related Impacts [a]	Model 4: Food and Financial Security [a]	Model 5: Combined Final Model [a]
Food and financial security					
Experienced difficulty paying for the very basics (reference: No)				1.90 (0.31) ***	1.28 (0.37) ***
Experienced low or very low food security (reference: No)				1.87 (0.32) ***	0.42 (0.37)

[a] Statistical significance indicated as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. [b] These three demographic variables were included in all models regardless of p-value.

When testing the contributions of pandemic-related impacts among workers who continued to work, those reporting that work changes had negatively impacted their private life and those reporting increased financial insecurity during the pandemic had higher stress levels (Model 3). To a lesser degree, this was also true for those who experienced one or more risk factors for severe COVID-19. Those who felt respected for their work and those with positive feelings about their role as an "essential worker" (pride or gratitude) had lower stress levels than their counterparts. Negative feelings about workplace responses during the pandemic, having tested positive for or experienced COVID-19 illness, having experienced COVID-19 cases at the workplace, and employment status at the time of the survey (e.g., unemployed, employed but experienced an employment separation) did not significantly contribute to perceived stress in the model. Participants who experienced food insecurity in the previous 12 months or current difficulty paying for basic living expenses had higher perceived stress (Model 4).

When all significant contributors to perceived stress from the four models were combined (Model 5), the gender of the ECE worker no longer significantly contributed to perceived stress and, although tenure in childcare remained negative, it was no longer statistically significant. The effects of the age group served were similar, although with contributions to stress for both those serving school-age children and those caring for children across multiple age groups. The impact of work changes on home life and financial insecurity contributed to higher stress levels, whereas feeling respected and positive feelings about a role as an essential worker contributed to lower stress in the full model. Neither having risk factors for severe COVID-19, nor feeling that basic needs had become harder to pay for during the pandemic, nor food insecurity remained significant in the full model.

3.5. Open-Ended Descriptions of Work Changes

A total of 1462 respondents offered comments in response to the open-ended questions about ways in which their work and responsibilities had changed over the prior year. Three broad categories of findings emerged from these comments. First, respondents described new tasks and responsibilities related to preventative measures associated with the pandemic, including cleaning and sanitizing; health screenings; social distancing measures; more handwashing and use of personal protective equipment; and developing, researching, and enforcing new policies and practices. Many of these changes were described as time-consuming and frustrating since they added to, rather than replaced, other responsibilities (see Table 5 for illustrative quotes).

Table 5. Themes and illustrative quotes regarding work changes in the pandemic among Washington State early care and education (ECE) worker respondents, February/March 2021.

Theme	Illustrative Quotes
Workers faced many new **pandemic-related responsibilities**, including much more cleaning, sanitizing, and handwashing; health screenings; social distancing and the use of personal protective equipment; and developing, researching, and enforcing new policies and practices.	• "The increased cleaning is necessary but very time consuming and I worry about the constant exposure to breathing in bleach daily." (Administrator) • "Having to enforce mask wearing and social distancing with small children is a constant challenge and it is not always successful." (Teacher) • "SO MUCH retrieving of children from the school so parents aren't traveling the halls and rooms of the school. This is the single-most biggest time-waste and interference to our center's admin staff. We don't have money to [hire] extra staff, so we just have to work extra." (Administrator)
Workers experienced many **other job changes** due to changes in staffing and student enrollment: changes to titles and roles; working from home; transition to virtual learning and supporting school-age children; changes in hours; working with fewer children; center closures; and lay-offs, furloughs, or voluntary separations.	• "Working from home since June. Working harder and longer hours to guide the center through COVID" (Administrator) • "Adding the tasks involved with the older kids virtual schooling increased my responsibility immensely." (Teacher) • "We are working only 25 h a week and we used to work 40. Financially losing around $1000.00 a month . . . " (Teacher) • "I got laid off due to COVID because their weren't enough children going to the daycare and my boss couldn't pay me to work." (Teacher)
Stressors and challenges resulting from changes:	
Feeling overworked and without access to adequate breaks, leave, and planning time	• "I went from working with two other teachers to take care of 24 kids to now having 10 3–5 year old's by myself every day with no break." (Teacher) • "Also, we have numerous staffing/coverage issues, so many of us have to do planning and other prep. work outside of working hours (unpaid). Breaks are usually condensed into one period during the day, instead of spaced out." (Teacher)
More time-intensive and difficult interactions with families due to limited in-person opportunities and the need to enforce policies	• "Teachers have to communicate via instant messenger or email. It has made building relationships with parents a little challenging." (Teacher) • "I have to deal with parents who do not want to follow the guidelines on a regular basis and am often yelled at and belittled for trying to keep them, their child/children, other staff, and myself safe and healthy during this crisis." (Administrator)
Concern about contracting COVID-19 given the nature of ECE work, personal health circumstances, and insufficient adherence to preventative protocol in some cases	• "The stress of children coming in sick has been more so and with one year olds, most symptoms are so common from little colds to teething that it is difficult to tell if a child is a 'risk' or not." (Teacher) • "More anxiety about being exposed to illness and how being ill will lessen my hours and pay" (Teacher) • "The thought of bringing COVID to your own family." (Administrator)

Table 5. *Cont.*

Theme	Illustrative Quotes
Feeling unsupported based on a lack of needed supplies and guidance, and disrespected and undervalued by management, parents, and/or broader society	• "As a director I have to make important decisions with little to no guidance because of the nature of the pandemic" (Administrator) • "A lot of the staff feel very unappreciated as the community appreciates medical and grocery workers but we get over looked. We have been opened this entire time but we do not even get healthcare benefits or any hazard pay." (Administrator)
The need to provide additional emotional support to children, family, and other ECE workers, as well as concern about the impact of the pandemic on children in their care manifesting as behavioral problems	• "I have less emotional resources to cope with stress than before and the children are channeling lots of stress, making behaviors more ramped up. Technically we have less children than before but the emotional needs are far greater in the children who are there." (Teacher)
Feeling unable to provide high-quality or developmentally appropriate care	• "I went from what felt like education in 2019 to being told in 2020 that my job is to simply ensure the parents are happy and keep paying the center and that the kids are supervised" (Teacher) • "We can't have large group activities, we aren't supposed to let the kids share toys. It feels development ally inappropriate." (Teacher)
Work environment feels unpredictable and uncertain due to staffing shortages, changes to guidance, or reasons that are not communicated	• "Constant change of direction, polices, decision, and or without clear communication." (Other) • "A lot of changes and added stress moving children around to different classrooms. No consistent schedules. I don't know when I start, end or have lunch until the day before and then it will change the day of." (Teacher)
Feeling isolated and disconnected from the center community when working from home and practicing social distancing	• "I have spent an increasing amount of time alone (everyday all day alone) with students which is much more difficult then with a assistant teacher." (Teacher) • "Separated from other staff/teaching assistants – feels pretty lonely. Can't interact with parents anymore due to COVID. Really miss those interactions and chances to touch base." (Teacher)
Impacts on workers' personal life (e.g., schedule changes, overwork, loss of professional boundaries, exhaustion, risk)	• "Because my full-time job is so exhausting I have no energy after work and often cry" (Teacher) • "Increased responsibility taking me away from my children at home that are in need of behavioral support. (single mom, sole custody)" (Other)
Administrator-specific concerns and stressors related to staff and enrollment turn-over, supporting staff, and ensuring the solvency of the center	• "As an owner, my responsibilities have shifted to getting to find enough staff, trying to keep everyone healthy, and trying to maintain even when all is crashing. We closed one site and lost 40 childcare spots. The budget is a constant panic." (Administrator) • "I have all employees, children's and families responsible on my shoulder" (Administrator)

Table 5. *Cont.*

Theme	Illustrative Quotes
The cumulative effects of these things are very stressful and result in feeling overwhelmed and burnt-out.	• "More responsibilities, more work, more stress, no support, same amount of money (not a lot), more worry of personal safety and safety of others. The stress and demand to keep all safe is overwhelming." (Administrator) • "I have to take temps, do the COVID checklist, receive babies from the outside door and still be the teacher/caregiver/nurse/secretary/janitor/customer service representative. I literally cry when I'm driving to work at 5 am. It's too much for any human being." (Teacher) • "I love my job and what I do. But the amount of extra emotional support to the kids and families as well as the constant fear of contracting COVID and being expected to do more by the public/government while they don't support us financially takes a toll." (Teacher)

Second, workers described changes to their jobs that resulted from the dramatic reduction in ECE staffing and changes to student enrollment (Table 5). These included taking on different roles or responsibilities with or without a change in title or compensation. Notably, an estimated 10% of all respondents described changes associated with becoming responsible for supporting virtual learning with young children staying home from ECE temporarily or with school-age students being cared for at ECE facilities while their schools were closed. Respondents also described changes to hours or schedules, working with fewer children, and experiencing center closures, quitting, or being laid off or furloughed.

Finally, respondents described an array of challenges and stressors related to these job changes (Table 5). The most commonly described challenges and stressors included feeling overworked and not having access to adequate breaks, leave, and planning time. Workers also described more time-intensive and difficult interactions with families, concerns about contracting COVID-19 in the workplace, and feeling insufficiently supported or undervalued by management, parents, and society more broadly. Some workers highlighted demands associated with providing emotional support for children, and their families—which they described as particularly difficult when they felt unsupported themselves—as well as concerns about the impact of the pandemic on children in their care and how these impacts were manifested in more challenging behaviors. Relatedly, workers described feeling frustrated that they could not provide developmentally appropriate care. Many noted that the work environment felt unpredictable due to the constant change of protocols, schedules, and assignments. A smaller number of workers reported that they felt isolated and disconnected from the center community when working from home and practicing social distancing. Finally, some respondents explicitly reported that work-related changes impacted their home and personal life. In addition to these challenges reported by the sample broadly, administrators discussed demands related to staff and enrollment turn-over and hiring, the need to provide more support to their staff, a sense of burden for keeping everyone safe, and stresses associated with trying to ensure the financial solvency of their center. Many workers reported poignantly about the cumulative effects of all these factors resulting in overwhelm and burnout.

4. Discussion

The first aim of this paper was to describe the types and prevalence of impacts experienced by a large sample of ECE workers in Washington State during the coronavirus pandemic between 2020 and 2021. Two-thirds of the workers in our sample experienced temporary or permanent closures of their workplace and 85% reported one or more job alteration to adjust to the pandemic; in particular, those related to the number and age of

children they cared for, hours worked, and pay. The percentage of respondents who tested positive for COVID-19 (7%) was slightly higher than the estimated statewide incidence of COVID-19 as of 31 March 2021 as a percentage of the state population (4.7%) [46,47], and many reported high levels of concern about contracting COVID-19 at work. Forty to sixty percent of respondents reported child-to-adult ratios and cohorting practices that conflicted with the recommended best practices at the time and more than 40% reported one or more concerns or disagreements with the extent to which their workplace was instituting or adhering to preventative practices. Moreover, open-ended survey responses illustrated the breadth of ways in which workers' jobs and responsibilities had changed over the course of the year. Many workers felt they had essentially taken on entirely new jobs or were doing multiple jobs at once without a corresponding change in pay, preparation, or respect, and with higher exposure to risk. These findings align with and add to a review of other ECE workforce studies and reports from the United States conducted as of early 2021 and several studies published since then [13,48–52].

The second aim of the paper was to assess workers' stress levels during the pandemic and explore which of the multifactorial potential impacts were most strongly associated with stress. Our findings indicate that the pandemic has exacerbated the stress experienced by ECE workers—particularly those who are younger and least financially secure. Reported stress levels among ECE workers in our sample were higher than those reported in at least one statewide study of ECE workers prior to the pandemic, but lower than one other with a small sample using the same measure [24,42]. Younger workers in our sample reported slightly higher stress levels than older workers and workers born in the United States reported higher stress relative to their foreign-born peers. Furthermore, workers who cared for school-aged children and children of multiple ages reported higher stress levels than those who cared for ages five and younger. This latter finding corroborates our qualitative data and the widespread reporting of ECE workers being asked to care for older children to fill the gap left by K–12 school closures [13]; many workers in this new role felt as if they were doing work they were ill-prepared to do and, in some cases, described resentment because they felt they were doing the work of K–12 teachers who typically get paid more.

Of all the pandemic impacts examined quantitatively, changes in work that negatively impacted workers' personal lives contributed most to higher stress levels in our model. The link between stress and work-life balance has been reported on previously [53], but the open-ended responses illustrate the multiple ways in which ECE workers experienced this impact during the pandemic, including concerns about being exposed to the novel coronavirus at work and infecting family members, longer work hours and taking work home, working from home, and general exhaustion. Our results also demonstrate that feeling respected and proud or grateful about one's role as an essential worker is associated with lower levels of stress. The importance of feeling respected for one's work has also been highlighted in the pre-pandemic ECE workforce literature [54], and pride in or gratitude for one's role as an essential worker reflects characteristics of intrinsic and external motivating factors that have been shown to be important for job satisfaction in the field [55]. Open-ended responses illustrate the importance of these factors; many workers conveyed that their concerns and value as workers were disregarded by superiors, enrolled family members, and society more broadly—and often noted that although they were classified as "essential", they did not receive any recognition, support, or hazard pay for this role.

Even accounting for all other contributing factors, workers reporting difficulty paying for basics such as housing, food, and healthcare reported higher levels of stress than those who did not. This is notable, since 60% of the workforce sample reported financial insecurity based on this measure. The impacts of financial insecurity were experienced differently among the ECE workforce, with workers who experienced employment separations during the pandemic or unemployment reporting higher rates of financial hardship, and younger, less experienced workers being most likely to experience employment separations and loss of employment. It is somewhat surprising that, despite findings pertaining to economic insecurity, lower wages and incomes were not associated with higher stress levels; however,

other ECE workforce studies have similarly found wages not to be strongly associated with job satisfaction or other wellbeing outcomes, perhaps because other factors confound or mediate the relationship [23,42]. Unfortunately, food and economic insecurity impacts are likely to persist for this workforce unless systemic changes are made; other studies have documented rates of food and financial security at least as high as those identified in this study during non-pandemic times [56,57].

It is notable that some other factors, such as workers' positions, experience in the field, concerns with workplace responses, and job changes did not contribute to workers' self-reported stress levels in the full regression model, though years of experience did so in earlier stage of the analysis. Although it seems plausible that experienced workers might have more robust coping mechanisms for multi-tasking or dealing with challenging child behaviors that would reduce stress, other studies have similarly shown these characteristics not to be associated with stress when controlling for other factors [24]. Many respondents reported that they found workplace responses insufficient or unreasonable and described job changes as difficult, so the fact that these impacts did not emerge as significant in the full model may simply reflect the reality that workers faced many stressors during the pandemic. Open-ended responses also alluded to some stressors not assessed quantitatively in our study, such as difficult interactions with families, challenges associated with caring for children spanning different age groups, worry for children's wellbeing, and burdens associated with providing emotional support to others [21,22]. In particular, workers described the new and outstanding focus on pandemic-related protocols as draining. This theme aligns with prior research showing that significant sources of stress for ECE workers include menial and non-teaching tasks, time pressures, and having to make compromises in their caregiving philosophies [23]. Finally, respondents described feeling overworked and a sense of instability due to significant staff turnover during the pandemic, which aligns with findings from prior studies documenting negative impacts, including increased stress, on ECE workers remaining in high-turnover environments [22,24,26].

Given these findings, the fact that 86% of respondents reported that they hoped to be working in the ECE field in a year is surprising and hopeful. Considerable focus on the ECE workforce during the pandemic has centered on concerns that high demands, limited support, and low pay may lead ECE workers to leave the field permanently, which would have negative impacts for society as a whole [58]. Indeed, administrators in our study described significant difficulties in recruiting and hiring new staff during the pandemic. Although questions about the strength of the profession going forward extend beyond the scope of our study, our findings indicate that many workers are dedicated to the field despite experiencing stress in multiple ways.

These findings can inform recently proposed policy solutions and approaches aimed at improving the health and wellbeing of the ECE workforce in typical times and during public health emergencies such as the COVID-19 pandemic [4,13,59,60]. Specifically, these findings further the case for improved pay and leave policies that support a livable wage so that ECE workers can pay for their basic needs, remain with ECE employers for longer periods of time, and be appropriately compensated for the demands made of them. This change would also improve parity between ECE and other educational sectors and potentially aid in elevating the status of the field, thus conveying respect for the workforce. Our results also indicate that policies aimed at improving access to health care and health promotion supports are needed. Ensuring that ECE workers have affordable employer-provided health insurance is essential if workers are asked to continue in public-facing roles during a pandemic. Access to employee wellness programs could support workers in managing and preventing chronic health conditions which placed them at higher risk of severe COVID-19 during the pandemic. Mechanisms for the timely and adequate distribution of funding, materials, and comprehensible guidance for ECE programs during pandemics or other emergencies (e.g., aimed at reducing transmission and sustaining the programs) are also needed. Public health guidance should be informed by the perspectives of the workforce to ensure that they are feasible within ECE environments. This would reduce the stress

and frustration individual programs and their workers experience in trying to "make do" or research their own solutions. Finally, these findings lend support to growing efforts to develop and test interventions aimed at strengthening social support and the individual coping and emotional regulation skills of ECE workers to support worker wellness and foster higher quality care as a result [61].

This study has several notable strengths. First, it uses mixed methods to explore a wide array of possible pandemic impacts, including impacts as described by workers themselves, and uses an analytic approach to highlight which impacts are most strongly related to stress levels. Second, the study involves a large sample and allowed for the inclusion of workers who were both employed and unemployed one year into the pandemic. An official ECE statewide workforce registry comprised the sampling frame and respondents differed in relatively small ways from the broader workforce population with regard to several key demographic characteristics and the proportion experiencing employment separations during the pandemic. Still, the sample likely differs in some important ways from the ECE workforce in other US states or internationally. For instance, based on a 2012 summary of the ECE workforce in the United States, our sample is slightly more likely to work across multiple age groups, has somewhat higher levels of education but fewer years of experience, and a higher hourly wage [62]. Some of these differences may be explained by the timing of data collection during the pandemic.

This study also has several limitations worth noting. First, the cross-sectional design does not allow for the determination of causal relationships. For example, in some cases, job changes may have contributed to higher stress levels, whereas in others, high stress may have led to job changes, such as a decision to leave a job. All data were based on self-reporting and thus may be subject to social desirability bias, though the survey was designed to be confidential in order to address this concern. Furthermore, it is possible that workers who participated in the survey differed in important ways from workers who did not with regard to their experience during the pandemic. In particular, it is notable that ECE administrators from the workforce registry were slightly more likely to respond to the survey than were teachers, and may have been less impacted by the pandemic in some ways. Additionally, given the fluid nature of the pandemic, the data reported here reflect a particular point in time, rather than workers' experiences of the pandemic as a whole. For example, vaccines had not yet been made available to ECE workers at the time of the survey and that development may have lessened the stress for some workers who were concerned about infection. Finally, given the comprehensive and lengthy nature of the survey, the levels of missing data were higher than ideal for some questions.

5. Conclusions

This study adds to the research on the ECE workforce during the COVID-19 pandemic by describing the many impacts workers experienced, as well as workers' perceived stress. In particular, it is clear that the vast majority experienced at least one of the many cited job changes and a substantial proportion of workers also experienced separation from work and food and financial insecurity. Many reported concerns about exposure to the novel coronavirus, insufficient workplace responses, and various psychosocial impacts. Of all the impacts examined, economic insecurity, a perceived lack of respect, and dissatisfaction about their role as an essential worker, as well as the negative impact of work on their home life, contributed most to worker stress. These findings can inform policies designed to support and sustain the workforce going forward.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/ijerph19052670/s1, Table S1: Number and percentage of early care and education (ECE) workforce survey respondents by characteristics and pandemic employment status, Washington State, February/March 2021.

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Challenges in Working Conditions and Well-Being of Early Childhood Teachers by Teaching Modality during the COVID-19 Pandemic

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Abstract: While a global understanding of teacher well-being during the COVID-19 pandemic is beginning to emerge, much remains to be understood about what early childhood teachers have felt and experienced with respect to their work and well-being. The present mixed-method study examined early care and education (ECE) teachers' working conditions and physical, psychological, and professional well-being during the COVID-19 pandemic using a national sample of 1434 ECE teachers in the U.S. We also explored differences in working conditions and well-being among in-person, online, and closed schools, given the unique challenges and risks that ECE teachers may have faced by teaching in these different modalities. From the results of an online survey, we found that in the early months of the pandemic, many ECE teachers faced stressful, challenging work environments. Some were teaching in new, foreign modes and formats, and those still teaching in person faced new challenges. We found many common issues and challenges related to psychological and physical well-being across the three teaching groups from the qualitative analysis, but a more complicated picture emerged from the quantitative analysis. After controlling for education and center type, we found that aspects of professional commitment were lower among those teachers teaching in person. Additionally, there were racial differences across several of our measures of well-being for teachers whose centers were closed. Upon closer examination of these findings via a moderation analysis with teacher modality, we found that Black and Hispanic teachers had higher levels of psychological well-being for some of our indicators when their centers were closed, yet these benefits were not present for Black and Hispanic teachers teaching in person.

Keywords: COVID-19 impact; early care and education; early childhood teachers; well-being; job demands; teaching modality; racial disparity

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1. Introduction

It has been well documented that the majority of early care and education (ECE) teachers reported high levels of satisfaction with and commitment to their work before COVID-19 [1–3]. However, other barriers and challenges—disparities in wages, benefits, resources, and challenging working conditions—outweigh satisfaction and commitment and serve as job stressors [2,4–6]. Unfortunately, the COVID-19 pandemic has likely exacerbated challenges to teachers' work and well-being [7,8]. The pandemic necessitated rapid changes in teaching and student support—the demands of which fell squarely on the shoulders of teachers and leaders—and were intensified by a shifting landscape as schools and communities were pressed to re-open [9–12]. Such demands have resulted in

unprecedented stress, threatening the short- and long-term well-being of teachers, many of whom are coping with similar stress and demands in their personal lives [9].

Papaioannou et al. [13] have referred to the COVID-19 period as a triple pandemic, calling attention to not only the disease itself, but to the physical inactivity and mental illness that have followed. Numerous studies conducted during the pandemic have slowly revealed the deleterious effects of social restrictions, "shelter-at-home", and online learning on adults [14]. The general consensus of the empirical research on P-12 teachers conducted in various countries around the world, such as the U.K., the U.S., Brazil, Mexico, Australia, Spain, and Portugal, is that teachers have suffered a significant impact to their psychological, physical, and professional well-being [8,15–18]. For example, Swigonski et al. [8] found that physical and behavioral symptoms of stress among early childhood teachers in the U.S. were 2–3 times higher during the COVID-19 pandemic, and this is significantly higher than in the community at large. Similarly, Alves et al. [15] found that the pandemic has reduced teachers' perceptions of professional well-being, leading them to feel more uncertain about the future of their career.

The role of teachers and ECE centers/schools becomes even more significant in crisis situations such as the COVID-19 pandemic as students and families look to teachers for more psychosocial support [19]. For example, Ozmiz-Etxebarria et al. [19] found that preschool and primary grade teachers working in a university nursery school showed the highest ratings of psychological symptoms such as anxiety. Teachers and ECE centers/schools are expected to serve as the "great equalizer", providing additional social-emotional learning and educational opportunities for vulnerable students who are more likely to be harmed in such crises [20,21]. Thus, it is critical to broadly examine ECE teachers' working conditions and well-being during the pandemic, but holistic studies of working conditions and well-being remain sparse [15], particularly for U.S. teachers and U.S. ECE teachers more specifically [11,22]. However, few studies with national samples are available.

The onset of the COVID-19 pandemic meant that many ECE centers and schools transitioned to online learning, some closed altogether, and others remained open, precipitating substantial upheaval in the nature and scope of teachers' professional lives and work. While evidence shows that teachers' well-being has suffered due to the pandemic (e.g., declining well-being and satisfaction) [15], some studies are have revealed that these impacts may vary by different contextual and individual factors, such as teaching modality and the demographic characteristics of teachers. During the early months of the pandemic, some teachers suddenly found themselves employed without work, while others experienced increased workloads [23,24]. Teachers who remained teaching in person during the pandemic were at higher risk for contracting COVID-19 and at higher risk of severe illness if they did because of the chronic health conditions that accompany this vulnerable workforce [24,25]. The unique challenges and circumstances that surrounded the in-person work of ECE teachers likely influenced these risks as well. For instance, having a group of children in a small space, or having children in close contact during routine activities (e.g., diapering, feeding), likely made social distancing a challenge [23–25]. For ECE teachers, the additional tasks of taking precautions and constantly reminding young children to keep separated, wear masks, and wash hands was undoubtedly exhausting and stressful. For those one-in-four teachers at risk for severe illness, not remaining protected could have had lasting consequences, yet many ECE teachers may have felt financially compelled to continue to teach in person, given the low wages that many teachers receive, despite the risks [25].

Outside of worrying about their own health risks, some evidence suggests that teachers teaching online may have faced a unique set of stressors. For example, a study by Besser and his colleagues [26] demonstrated that a sudden transition to online teaching was related to higher levels of psychological stress among teachers. An international sample of 600 language K-12 teachers involved in online teaching also revealed high levels of stress related to additional workload, family health, loss of control over work decisions,

blurred professional and personal lines, concerns about their colleagues and most vulnerable students, social isolation, and the stress of online teaching itself [27]. Similarly, Allen et al. [28] found high levels of stress for K-12 teachers in the U.K. teaching online during the beginning of the pandemic; however, those teaching in person were shown to have higher levels of stress for longer periods of time. Although ECE teachers teaching online are likely to face similar stressors, there is limited evidence in how these conditions affected them.

Some teachers worked in schools that were completely closed for a time during the pandemic, although this group of teachers rarely received attention. Teachers reported worries related to financial and job security as well as the sustainability of their center during closure [8,17]. Other teachers were worried about their students: how they were managing the pandemic, how they were being taken care of, and how their social development was being impacted. These types of worries could be associated with higher levels of poor well-being such as stress and vicarious/secondary trauma [17].

The picture of teachers' working conditions and well-being differing by modality may be further complicated by teacher demographic characteristics and other contextual factors. Based on the well-documented fact that COVID-19 has disproportionately impacted people who are vulnerable, including children and adults from minoritized and under-resourced groups [29–31], we expected that teachers from underrepresented (e.g., racial/ethnic minority groups) and under-funded groups (e.g., private childcare centers, family childcare centers) were more likely to suffer from poorer working conditions and well-being during the pandemic. However, most extant studies during this period address racial/ethnic health disparities or educational inequality among underrepresented groups of children or the public—not teachers (see Souto-Manning and Melvin [32] for an exception). Limited empirical evidence has been collected across states documenting the shared and divergent impacts of the COVID-19 pandemic on the ECE workforce by teaching modality and the complex interplay among individual and contextual factors on teachers' work and various aspects of well-being. In particular, research on ECE teachers' physical well-being during the pandemic is scarce.

As one of the few exceptions, Collie's study examined these issues, but in primary and secondary education settings [9]. In this study, Australian teachers' gender, work experiences, and teaching modality were associated with differences in teacher working conditions and well-being. For example, teaching half remotely and half in person was related to greater stress. While teachers who have reduced work hours may have more time to address challenges in their teaching, it may also precipitate other concerns (e.g., concern about financial issues and job security due to reduced hours [9]). Despite its contribution, this study was conducted in primary and secondary school settings in Australia, which may not capture the unique demographic characteristics of the early childhood workforce (e.g., no variation in gender; more racial/ethnic diversity; varied educational level; more limited resources) in various settings (e.g., family childcare homes, private childcare, Head Start, public school, private school). In the U.S., Souto–Manning and Melvin [32] conducted an in-depth multi-method study to address these gaps by examining racial, occupational, and environmental factors on physical and psychological well-being among early childhood teachers of color in New York. However, the scope was limited to ECE teachers of color in one city.

The Present Study

While a global understanding of teacher well-being during the COVID-19 pandemic is beginning to emerge, much remains to be understood about what ECE teachers have experienced and felt with respect to their working conditions and well-being—particularly considering the wide range in responses of ECE centers/schools to the pandemic in the U.S. Most of the existing evidence is limited in scope (e.g., confined to one region or one particular aspect of well-being), rarely addressing issues specific to ECE teachers who were already vulnerable prior to the pandemic. Furthermore, given that there was

substantial variation in how teachers were teaching during this time, it is highly probable that teachers teaching in different modalities experienced different challenges in their working conditions and well-being and that these experiences might have differed across teachers' race, educational level, and program type.

Thus, in this study, we report on the challenges the COVID-19 pandemic via quantitative and qualitative analysis of national online survey data from 1434 ECE teachers in the U.S. We asked three research questions: (a) How did ECE teachers' working conditions and well-being differ by teaching modality (i.e., in-person, online, closed school)? (b) Were there teacher demographic and center-based differences in teacher well-being? and (c) Did teaching modality moderate the relationship between demographic and center-based differences and teacher well-being? The findings of this study could offer important implications for the field given the ongoing and unpredictable nature of the pandemic and its lingering effects.

2. Method

2.1. Participants and Settings

A total of 1434 ECE teachers serving children ages 0 to 5 (including Kindergarten) in 46 states in the United States completed an online survey in late spring to mid-summer of 2020. The overall racial/ethnic composition of the sample is similar to the population of early childhood teachers nationally [33], with a somewhat higher percentage of Hispanic teachers. The sample includes 58% White, 21% Hispanic, 14% Black, 3% American Indian or Alaska Native, 2% biracial, and 1% Asian. The vast majority of teachers in the sample were women (98.3%). The average age of the participants was 42 (*Range* = 17 to 80). The majority of teachers in the sample were fully paid (83%), but some were only partially paid (12%) or not paid at all (5%). Among those who were paid, the annual salary for fifty-one percent of the teachers was below USD 30,000. Fifteen percent of teachers received some form of public support, such as Medicaid, food stamps, or childcare subsidies. Seventy-three percent of participating teachers held an associate degree or higher, followed by some college but no degree (20%), and high school diploma or general education diploma (GED) (5%).

Participating teachers worked in Head Start programs (43%), childcare centers (34%), public schools (14%), family childcare homes (6%), and private schools (3%). They served infants and toddlers (24%), preschool or pre-K (38%), Kindergarten (6%), and children in multiage groups (31%). Teachers in the sample served children and families of diverse socio-economic status (SES): predominately low SES (54%), middle SES (15%), upper SES (7%), and mixed SES classrooms (24%). Of the 1434 early childhood teachers in the sample, approximately 29% reported that they were teaching in person, 28% were teaching online, and the remaining 43% were not teaching due to their centers/schools being closed.

2.2. Research Procedure and Analysis

After receiving Institutional Review Board (IRB) approval, we recruited early childhood teacher participants via various social media platforms (e.g., Facebook, Twitter). To ensure responses from various states and types of settings, such as private childcare centers, public schools, Head Start programs, and family childcare homes, stratified sampling (by state and setting type) was also integrated into the recruitment approach. This procedure involved producing a sample frame of ECE settings in each U.S. state and, from this, developing a contact list, which was first proportional to state population and then sought to preserve U.S. representativeness by setting type. These centers/schools were then first contacted to participate in the study. Once this procedure was complete, we also emailed state and national ECE organizations and agencies to distribute our survey more broadly.

Our interdisciplinary research team developed questions for an online survey that asked about their personal and professional background and the teachers' experiences and well-being at work during the COVID-19 pandemic. The questions included: (a) demographic and background information, including teacher race, education, income; (b) teaching modality (i.e., teaching online, teaching in person, school closed); (c) whether they experienced

changes in their work and well-being (i.e., negative change, positive change, no change); (d) if they experienced any change, what change they experienced (open-ended response); and (e) what they needed for improvement in their work (open-ended responses) and well-being (multiple choice). The online survey also consisted of previously validated scales to assess teachers' well-being. On average, it took 25–30 min to complete the online survey. Among teachers who completed the survey and who requested to participate, sixty teachers were randomly selected to receive a USD 50 electronic gift card.

2.3. Measures

Below, we briefly describe the key measures used for the quantitative analysis of the study. More detailed descriptions and the psychometric properties of each measure are organized in Table 1.

2.3.1. Working Conditions

This was assessed using three subscales from the Job Content Questionnaire (JCQ) [34]. The three subscales used in this study were physical job demands (related to the physical demands of the job), skill discretion (related to the variety of skills used for the job), and decision authority (related to the amount of job control). We also included questions asking teachers to report how they were paid (i.e., fully paid, partially paid, not paid) and if they had health insurance provided by their employer during the pandemic.

2.3.2. Teacher Well-Being

Psychological Well-Being. Teachers' psychological well-being was operationalized via ECE teachers' perceptions of: (a) depressive symptoms, (b) stress, (c) resiliency, (d) life satisfaction, and (e) secondary trauma. Teacher depressive symptoms were assessed with the 10-item Center for Epidemiologic Studies of Depression Short Form (CES-D-10) [35]. Perceived stress was measured using the Perceived Stress Scale (PSS) [36]. Teachers' resiliency was measured using the Brief Resilience Scale [37], and life satisfaction was assessed on the Satisfaction with Life Scale [38]. Lastly, teachers' secondary trauma was assessed using one of the subscales of the Professional Quality of Life Scale [39] We used a total score of each measure for data analysis.

Physical Well-Being. Teachers' physical well-being constituted a measure of (a) general health condition, (b) ergonomic pain, (c) food security, (d) Body Mass Index (BMI) [40] and (e) physical activity. To examine their general health status, we used a composite score of various dichotomous doctor-diagnosed symptoms that teachers reported. Ergonomic pain was assessed using the modified version of the Work-Related Musculoskeletal Disorders Scale (WMDS) [41]. The Short Form of the Food Security Survey Module was modified to assess food insecurity. Body Mass Index (BMI) [40] was calculated by dividing weight in kilograms by the square of height in meters. To measure physical activity, direct questions about how many days and hours were spent on vigorous physical activities and how much time was spent sitting on a weekday were asked.

Professional Well-Being. Professional well-being was assessed via two constructs: work commitment and intent to leave. Work commitment was measured using the Early Childhood Job Satisfaction Survey (ECJSS) [42]. Intent to leave the field/profession was measured via three items.

Table 1. Description of measures used in the study.

Construct	Study Variables	Instruments	Instrument Characteristics	Psychometric Properties
Job Demands	Job demands	The physical demand, skill discretion, and decision authority subscale of the Job Content Questionnaire (JCQ) [34]	JCQ consists of 11 items in three domains of stress: demands (4 items), skill discretion (related to skill variety) (3 items), and decision authority (related to job control) (4 items). Subscales measure participants' rating on how each statement was true of their work in ECE settings based on a 5-point scale: 1 (strongly disagree) to 5 (strongly agree).	The internal consistency for the scales of the original JCQ range Cronbach's $\alpha = 0.65$ to 0.79 [43]. Our study: JCQ physical demands subscale Cronbach's $\alpha = 0.71$.
Job Resources	Instrumental resources (wages and health insurance)	Questionnaire	One question asking teachers to report how they were paid (i.e., fully paid, partially paid, not paid) and one question asking teachers if they had health insurance covered by their employer during the pandemic (yes/no).	
Profess. Well-Being	Work commitment	Questionnaire from Early Childhood Job Satisfaction Survey (ECJSS) on work commitment [42]	ECJSS questions the range of personal and organizational factors related to employee satisfaction and work commitment in center-based ECE programs. Scores could range from 0 (low) to 10 (high levels of work commitment).	Overall consistency: Cronbach's $\alpha = 0.89$ [44]. Internal consistency for the commitment section: Cronbach's $\alpha = 0.80$ [45]. Our study: $\alpha = 0.74$.
	Intent to leave	Questionnaire	Three questions that asked participants to rate their intent to leave the field on a 5-point scale (1 (very unlikely) to 5 (very likely)).	Our study: Factor loadings = 0.84 for all three items. Cronbach's $\alpha = 0.82$.
Psych. Well-Being	Depressive symptoms	Center for Epidemiologic Studies of Depression Short Form (CES-D-10) [35]—shortened version [46]	10-item screening test asking respondents to reflect on the previous week and rate the frequency of symptoms on a scale of 0 (not at all or less than 1 day) to 3 (5–7 days).	CES-D-10; Cronbach's $\alpha = 0.65$–0.91; [47,48]. Our study: Cronbach's $\alpha = 0.75$.
	Personal stress	The Perceived Personal Stress Scale (PSS) [36]	PSS items include questions about stress and examine how unpredictable, uncontrollable, and overloaded respondents find their lives. Other items ask participants about feelings during the last month, and the frequency of their feelings on a 5-point scale (1 = rarely/never to 5 = very often).	PSS; Cronbach's $\alpha = 0.84$; test-retest reliability Pearson $r = 0.85$ [36]. Our study: Cronbach's $\alpha = 0.85$.
	Life satisfaction	Satisfaction with Life Scale [38]	Five items measuring global cognitive judgments of a person's life satisfaction on a 7-point scale based on how much they agree (1 = strongly disagree to 7 = strongly agree).	Test–retest reliability: Cronbach's $\alpha = 0.82$, coefficient Cronbach's $\alpha = 0.87$ [38] Internal consistency Cronbach's $\alpha = 0.74$ [49].
	Secondary trauma	A Subscale of Professional Quality of Life Scale (PROQOL) [39]	Thirty items organized in 3 subscales (compassion satisfaction, burnout, and secondary traumatic stress) that measure the negative and positive effects of helping others who experience suffering and trauma. Our study used the subscale of secondary traumatic stress.	Secondary traumatic stress scale Cronbach's $\alpha = 0.81$ [39].
	Brief Resiliency	Brief Resilience Scale [37]	Six items that assess one's ability to bounce back or recover from stress measured on a 5-point scale (1 (strongly disagree) to 5 (strongly agree)).	Internal consistency Cronbach's $\alpha = 0.80$–0.91; test–retest reliability $r = 0.62$ [37].
Physical Well-Being	General health risk	General Health Indicator Composite	Eleven binary items (no = 0 and yes = 1) Items ask about doctor-diagnosed symptoms (e.g., anxiety, depression, infectious disease, heart disease). Our study used a total score of health conditions by combining all items.	
	Ergonomic Pain	Modified Work-Related Musculoskeletal Disorders Scale (WMDS) [41]	Five binary items (no = 0 and yes = 1) that ask about experienced pain in neck, back, shoulder, knee, and other. Our study used a total score by combining all items.	WMDS; Cronbach's α (entire questionnaire) = 0.90; test–retest reliability Pearson $r > 0.75$ [41]. Our study: Cronbach's $\alpha = 0.80$.
	Food Security	Modified Food Security Measure (USDA) [26]	Five items that identify food-insecure households and households with very low food security with reasonably high specificity and sensitivity. Participants can score as high or marginally good security (0–1), low food security (2–3), very low food security (4–5). Two categories of "low food security" and "very low food security" mean food insecurity.	Reliability $\alpha = 0.75$, Cronbach's $\alpha = 0.91$ [50].
	Obesity	Body Mass Index (CDC) [40]	Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters.	
	Physical Activity	Questionnaire	Questions ask how many days and hours are spent on vigorous physical activities and how much time is spent sitting on a weekday.	

2.4. Data Analysis

We conducted an analysis of both qualitative and quantitative responses. For the analysis of qualitative data (i.e., open-ended responses in the survey), five members of the research team conducted a content analysis of the qualitative data (i.e., teachers' open-ended responses in the online survey). The first author served as master coder and assigned questions to four other researchers for analysis. She met with individual coders, conducted open coding, and developed the initial codes. We (the first author and four other coders) met multiple times to refine codes and categories and discuss any discrepancy until reaching consensus. We conducted reliability checks with 10–15% of cases per question and established an inter-coder reliability ranging from 90 to 100 percent agreement before independent coding. Cohen's Kappa ranged from 0.65 to 0.85 across the categories and coders. We compared categories of challenges in and needs for job demands and well-being during the pandemic across the three teaching modalities. While the response consolidation process resulted in more than ten categories, in this paper, we present the five most frequently reported responses from the content analysis. Similarly, the analysis of the quantitative data began with a descriptive analysis, and sample descriptive statistics are displayed in Table 2. Finally, an Ordinary Least Squares (OLS) regression analysis of the main effects of teachers' education level, race, and type of setting on the various studied aspects of physical, psychological, and professional well-being was conducted. This was followed up by a test of the moderation of teaching modality upon the effects of teacher race and well-being.

Table 2. Psychological and physical well-being of 1434 ECE teachers during pandemic.

Categories	Percentage OR Mean (Range)
Sample Demographics	
Teachers with Associates Degree or Higher	73%
Teachers by Center Type	
Family Childcare Home	5.6%
Childcare Center/Pre-K	34.4%
Head Start	42.8%
Public School	14%
Private School	3.2%
Teachers by Modality	
In Person	29.2%
Online	27.5%
Closed	43.3%
Teacher Race	
Black	14.3%
Hispanic	21.4%
White	58.3%
Other	6%
Psychological Well-Being	
Changes in Psych. Well-Being Due to Pandemic	
Mostly Positive	7.7%
Somewhat Positive	11.2%
No Change	32.8%
Somewhat Negative	43.0%
Mostly Negative	4.7%
Diagnosed with Depression	23%
Brief Resiliency	2.91 (1–5)
Life Satisfaction	24.64 (5–35)
Perceived Stress	25.60 (1–47)
Depressive Symptoms	8.38 (0–30)
Secondary Trauma	19.29 (3–50)

Table 2. *Cont.*

Categories	Percentage OR Mean (Range)
Physical Well-Being/Health	
Teachers with At Least One Area of Ergonomic Pain	79%
Total Reported Ergonomic Pain [a]	3.49 (0–19)
In-Person Teachers	3.91 (0–15)
Online Teachers	3.59 (0–19)
Closed Teachers	3.08 (0–14)
Changes in Health Due to Pandemic	
Mostly Positive	5.2%
Somewhat Positive	7.7%
No Change	66.5%
Somewhat Negative	17.7%
Mostly Negative	1.9%
Currently Overweight or Obese	76%
Diagnosed with Anxiety	31%
Diagnosed with High Blood Pressure	26%
Diagnosed with Asthma	20%
Experiencing Food Insecurity	1.07(0–5)
Professional Well-Being	
Work Commitment	8.51 (1–10)
Intent to Leave	2.19 (1–5)
Job Demands and Resources	
Physical Job Demands	2.91 (1–5)
Skill Discretion	3.93 (1–5)
Decision Authority	3.35 (1–5)
Employer-Paid Health Insurance During Pandemic	59%
Wages—Full Pay During Pandemic (Partial Pay)	83% (12%)

Note. [a] is an indicator of the product of both number of affected areas (max of 5 areas) and severity of pain (from 0 = no pain to 4 = unbearable pain), for a max range of 20.

3. Results

Of the teachers surveyed, approximately 29% reported teaching in person, 28% teaching online, while the remaining 43% were not working due to their centers being closed. As data were collected in the early phase of the COVID-19 pandemic, most of the teachers fit in one of these categories. Teaching modality significantly differed by type of setting: the majority of teachers in family childcare homes (82%) and in childcare centers/preschools (55%) taught in person, while 81% of public school teachers taught online. Fifty-four percent of Head Start teachers reported that their centers were closed during the pandemic and 39% of Head Start teachers taught online.

We found that in the early months of the pandemic, while many ECE teachers were committed to their work, moderately resilient, and tried to have a positive outlook, they still faced stressful, challenging work environments. Some were teaching in new, foreign modes and formats, and those still teaching in person faced new challenges. An understanding of these unique challenges begs an understanding of how they might have affected their overall well-being. Below, we examine this question with a specific focus on the status of ECE teachers' job demands, as well as their physical, psychological, and professional well-being and how it differed by teaching modality.

3.1. Working Conditions and Needs by Teaching Modality during the Pandemic

From the content analysis (see Table 3), we found that, regardless of teaching modality, early childhood teachers experienced significant challenges working with young children in the early days of the pandemic, characterized by limited resources and a lack of clear guidelines and regulations. Although some challenges were common, we found distinctive challenges faced between the in-person teaching group and the online teaching group. As the school closed group was not working during the pandemic, our analysis focused only on the in-person and online teaching groups.

Table 3. Content analysis summary: challenges in work and well-being.

In-Person Teaching Group			Online Teaching Group			School Closed Group		
Challenges in Work (or Job Demands)								
Rank	Freq	Content	Rank	Freq	Content			
1	19.57%	Working with children and families during a pandemic	1	34.52%	Difficulty supporting children via online teaching			
2	18.40%	Financial hardship	2	24.30%	Difficulty with parent involvement			
3	16.63%	COVID-19 fear and uncertainty	3	13.55%	Technology issues			
4	14.48%	Additional job demand	4	11.51%	Social isolation/feeling of disconnection			
5	13.89%	Too frequent changes in regulations and circumstances	5	9.21%	Barriers to resources and preparation for online teaching			
Needs for Work								
Rank	Freq	Content	Rank	Freq	Content			
1	19.91%	More COVID-19 resources	1	20.34%	Improved access and resources			
2	14.13%	Financial support	2	16.16%	Better parent involvement			
3	13.06%	More consistency	3	12.26%	Improved curriculum			
4	10.92%	None	4	9.96%	Improved communication and guidelines			
5	6.42%	More support for teacher	5	7.94%	More training			
Challenge in Psychological Well-Being								
Rank	Freq	Content	Rank	Freq	Content	Rank	Freq	Content
1	52.64%	Anxiety and fear of COVID-19	1	32.98%	Anxiety and fear of COVID-19	1	50.48%	Anxiety and fear of COVID-19
2	9.97%	Social disconnection	2	23.11%	Social disconnection	2	21.40%	Social disconnection
3	9.66%	Financial concern	3	10.92%	Depression and sadness	3	11.18%	Depression and sadness
4	5.61%	Additional job demands	4	6.09%	Loss of purpose	4	7.99%	Financial concern
5	4.67%	Lack of support	5	5.67%	Additional job demands	5	2.88%	Concern for students
Challenges in Physical Well-Being								
Rank	Freq	Content	Rank	Freq	Content	Rank	Freq	Content
1	22.68%	Stress/anxiety	1	31.82%	Weight gain	1	27.52%	Stress/anxiety
2	19.59%	Other illness syndrome	2	20.78%	Stress/anxiety	2	23.85%	Other illness syndrome
3	18.56%	Weight gain	3	14.29%	Other illness syndrome	2	23.85%	Weight gain
4	13.40%	Energy change	4	13.64%	Lack of physical activity	4	8.26%	Lack of physical activity
5	8.25%	Lack of physical activity	5	5.84%	Sleep change	5	7.34%	Sleep change
5	8.25%	Sleep change	5	5.84%	Energy change			

Respondents teaching in person reported many challenges at work: (a) challenges teaching and interacting with children and families in person during the pandemic; (b) financial hardships; (c) fears and uncertainty of becoming infected and passing it to their family; (d) additional job demands, and (e) too frequent changes in regulations and circumstances.

First, the major issue that many teachers encountered was related to the various challenges that arose in supporting and properly working in person with children and families during the pandemic while having to wear masks, implement social distancing, and frequently wash their hands. They also reported concerns about the current method of teaching not being optimal and developmentally appropriate for young children. It was difficult for teachers to help young children understand the situation and the importance of keeping masks on. One teacher stated:

> *I work with infants. Wearing a mask makes it difficult to show them facial expressions. Infants love to see people smile at them . . . The infants don't know the new teachers and don't feel as safe as they would with their original teacher*.

In addition, teachers were concerned that their interactions and communications with families were limited or restricted because of health concerns during the pandemic. At the time, many centers did not allow families to enter the building so teachers were not able to have any face-to-face communication with families.

The second most frequently mentioned challenge was financial in nature. Low enrollment seemed to be a major cause of the financial issues of the center/school. While lower enrollment led to some positive changes for teachers (such as reduced workload and more time and attention given to each child), it also led to reduced working hours and compensation, which raised concerns for teachers. Furthermore, centers/schools were required to purchase additional resources such as cleaning supplies and personal protective equipment, which were limited in availability. This resulted in additional financial burdens and stress on the center as well as teachers and was particularly the case in family childcare homes and private childcare centers that relied heavily on tuition as a main source of income. One teacher commented, "*The biggest challenges of teaching during the COVID-19 is not having enough kids to stay open, but being shut down for a while, because we had no kids*".

Third, although they tried to take all possible precautions, teachers who worked in person faced the great risk of becoming infected and passing it to their family. They reported that they were fearful and concerned about the possibility of contracting COVID-19 at work. Teachers mentioned that although they were aware of the lower risk of children being infected with COVID-19, they were afraid that a child could be infected without symptoms and inadvertently infect them. In addition, they were concerned that the supplies and resources provided were not often appropriate or sufficient to protect them from infection. One teacher said:

> *I have to go through and to breathe and communicate clearly with the face mask on. The gloves I feel are acceptable but the mask that the company provided is not appropriate. It is a t-shirt that someone made., It is super thin almost see-through if you put up to the light. When I have it on and breathe the clothing goes into my mouth. Not sure if it is protective enough*.

Fourth, additional job demands were identified as a major challenge. These mostly consisted of additional tasks related to the new health and safety measures for in-person teaching, such as difficulty finding appropriate cleaning, personal protective equipment, and materials (as they were often out of stock or in low supply); having to follow many new regulations regarding cleaning/safety, and having to do constant cleaning. Pick-ups and drop-offs to ensure safety became challenging and stressful for children, families, and teachers, which is evidenced in one teacher's response: "*It is hard because we have one or two teachers constantly running out to receive children from the car or take them to the car*".

Fifth, teachers reported that they experienced too many changes to their routines, staffing, and grouping and were never certain of what to expect the next day. Due to

low enrollment and staff shortages, centers/schools had to lower teacher–child ratios and merge different groups (resulting in challenges teaching multiple age groups). Feelings of being overwhelmed and uncertain sometimes stemmed from a lack of clear communication and guidance at the program, district, state, and national levels.

In response to the challenges they experienced, the in-person teaching group reported that they needed: (a) more resources, supplies, staff, and testing to cope with COVID-19-related challenges; (b) more financial support for the center/school, including better or additional (hazard) pay and benefits for teachers; (c) clearer, more equitable, and more consistent regulations and communication; (d) more emotional support, such as appreciation, respect, and acknowledgement; and (e) more positive attitudes and hope for their situation.

The online teachers also experienced many challenges, but these were substantially different from the challenges reported from the in-person teachers. They identified the following as their major challenges: (a) difficulty supporting children's learning via online teaching; (b) difficulty with parent involvement; (c) technology issues; (d) social isolation/feeling of disconnection; and (e) barriers to resources and preparation for online teaching.

Similar to the in-person teaching group, this group of teachers experienced challenges supporting children through online teaching. Many teachers in this group mentioned that it was difficult to get children to participate and engage in the lessons, and the overall rate of attendance and participation was low. Teachers also found it difficult to make activities engaging and developmentally appropriate through the online platform. These challenges often led to concerns about whether and how much children were learning through this format and how children were doing at home (e.g., they might miss signs of neglect or abuse). Some teachers commented that online teaching made it even more challenging to engage and support dual-language learners and children with special needs and expressed concern that online teaching would undermine equity and exacerbate learning gaps for children from marginalized groups. This was clearly evidenced in this teacher's response:

> *Connecting with young children over the screen is HARD. We are not able to address their needs/goals regarding behavior or social emotional play skills. It's all artificial. We are missing out on teaching them and addressing their needs during critical windows of development. Many of these kids just started getting services (special needs) and are going to kindergarten in the fall. It's just yucky all around.*

Second, difficulty with parent involvement was a common issue. Teachers acknowledged that the online teaching format relied heavily on parent involvement and empathized with parents that this added a significant burden for them. They often found it difficult to engage families already distressed from various hardships and additional work demands in their children's learning at home. One teacher expressed this concern:

> *Parents were totally overwhelmed by more demands and school expectations and they weren't able to do all the Zoom meetings and lesson activities. I felt like I tried to focus most of my support on the parents and let them know that I believe they are doing their best and that is OK.*

Third, unlike in-person teaching, the availability of and access to technology was an inevitable concern for online teaching. The technology-related issues that teachers experienced included limited access to the internet, unstable internet connectivity—especially for children living in rural or impoverished areas—and access to an appropriate computer and electronic devices necessary for online learning. As one teacher put it, "*The biggest challenge for me is attendance because they do not have access to the internet. Because I teach in a low socio-economic area, many of my students do not have access to technology and/or the internet*".

Fourth, many teachers found it difficult to engage children in social interactions and felt disconnected from their children in the online teaching format. They mentioned that it was difficult not to be physically present for children, show affection (e.g., they cannot hug, make direct eye contact, and play with children), and build and foster relationships. Lastly, teachers noted limited resources and a general lack of preparation necessary for quality online teaching. Although there were some online trainings offered to them, teachers still

felt unprepared and ill-equipped to teach online. They felt that it was difficult to find the right resources, feel effective, and maintain accountability.

To address these challenges, online teachers requested the following for improvement: (a) better access and recourse for online teaching, including technology and internet accessibility; (b) more parent involvement and better ways of engaging them; (c) improved curriculum and format optimized for online learning; (d) clearer and more consistent guidelines and communication, and (e) more training on online teaching. Analysis of the quantitative data (see Table 4 below) revealed no differences among our measures of working conditions by teaching modality.

Table 4. Main effects regression of psychological, physical, and professional well-being by modality and teacher race.

	Brief Resiliency	Life Satisfaction	Perceived Stress	Depressive Symptoms	Secondary Trauma	Work Commit.	Intent to Leave	Ergonomic Pain	Physic. Job Demands	Skill Discretion	Decision Authority
Constant	0.113	−0.308 **	0.139	0.241 **	−0.075	0.203 *	−0.128	0.012	0.042	−0.287 **	0.021
	(0.081)	(0.080)	(0.080)	(0.080)	(0.080)	(0.081)	(0.081)	(0.082)	(0.082)	(0.081)	(0.078)
≥Associates degree	−0.050	0.227 **	−0.054	−0.112	0.138 *	−0.082	0.089	−0.023	−0.118	0.244 **	0.200 **
	(0.064)	(0.064)	(0.064)	(0.064)	(0.063)	(0.065)	(0.064)	(0.065)	(0.065)	(0.064)	(0.062)
Childcare/Pre-K	(reference)										
Family childcare	0.044	0.103	−0.099	−0.081	−0.214	0.083	−0.057	−0.019	0.103	0.105	0.850 **
	(0.126)	(0.125)	(0.125)	(0.125)	(0.123)	(0.126)	(0.126)	(0.127)	(0.127)	(0.125)	(0.121)
Head Start	0.096	0.096	−0.097	−0.168 *	0.047	0.094	−0.068	−0.024	−0.011	0.168*	−0.337 **
	(0.074)	(0.074)	(0.074)	(0.074)	(0.073)	(0.074)	(0.074)	(0.075)	(0.075)	(0.074)	(0.072)
Public school	0.078	0.277 **	0.043	−0.106	0.366 **	−0.029	−0.019	0.110	−0.158	0.408 **	−0.149
	(0.096)	(0.096)	(0.096)	(0.096)	(0.095)	(0.097)	(0.096)	(0.097)	(0.098)	(0.096)	(0.093)
Private school	−0.201	0.179	−0.086	−0.163	−0.137	−0.053	−0.139	−0.541 **	−0.250	0.047	0.312 *
	(0.162)	(0.161)	(0.161)	(0.161)	(0.160)	(0.164)	(0.163)	(0.164)	(0.165)	(0.162)	(0.157)
School closed	(reference)										
School in-person	0.019	0.004	0.084	−0.003	0.089	−0.298 **	0.219 **	0.155 *	0.139	−0.038	−0.017
	(0.075)	(0.074)	(0.074)	(0.074)	(0.074)	(0.075)	(0.075)	(0.076)	(0.076)	(0.075)	(0.072)
School online	−0.081	0.011	0.081	0.100	0.097	−0.107	−0.034	0.052	0.046	0.076	−0.041
	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)	(0.068)	(0.067)	(0.068)	(0.068)	(0.067)	(0.065)
White teacher	(reference)										
Black teacher	−0.299 **	−0.009	−0.359 **	−0.275 **	−0.194 *	−0.201 *	0.218 **	−0.200 *	0.042	−0.018	−0.009
	(0.081)	(0.081)	(0.081)	(0.081)	(0.080)	(0.082)	(0.081)	(0.082)	(0.082)	(0.081)	(0.079)
Hispanic teacher	−0.343 **	0.326 **	−0.296 **	−0.309 **	−0.467 **	−0.136	0.020	−0.092	0.024	−0.166 *	−0.174 *
	(0.074)	(0.074)	(0.074)	(0.074)	(0.073)	(0.075)	(0.074)	(0.075)	(0.075)	(0.074)	(0.072)
Other race	0.063	−0.162	0.088	0.113	−0.114	−0.158	0.291 *	0.158	0.007	−0.120	−0.040
	(0.115)	(0.115)	(0.116)	(0.115)	(0.115)	(0.118)	(0.116)	(0.117)	(0.118)	(0.116)	(0.112)

Note. All outcome variables standardized. Standard errors in parentheses. ** $p < 0.01$, * $p < 0.05$.

3.2. Early Childhood Teachers' Well-Being by Teaching Modality during the Pandemic

Overall, a substantial number of teachers reported poor psychological and physical well-being. This is evidenced in both quantitative and qualitative responses. The content analysis identified the most frequently reported responses about perceived changes in well-being (see Table 3). Overall, early childhood teachers experienced remarkably similar psychological and physical well-being-related issues across the three teaching modalities. Across questions on psychological and physical well-being, five themes emerged: (a) more stress, anxiety, and fear of becoming ill with COVID-19; (b) weight gain and lack of physical activity; (c) increased feeling of social disconnection, depression, and sadness; (d) increased concerns about other illnesses as an existing or new health condition; (e) financial concerns.

First, stress, anxiety, and fear of becoming ill with COVID-19 were the most common across the three groups. Those who experienced negative changes in well-being reported high levels of anxiety and stress, often related to fear and uncertainty due to COVID-19. Anxiety and stress were replete and by far the most common challenge to well-being among our sample of teachers. Regardless of teaching modality, it was common that teachers were anxious and fearful of the possibility of contracting COVID-19. Stress was also frequently reported from teachers who were now juggling online teaching while also helping their own children with online learning. A teacher in the online group reported:

> *There is constant anxiety. Not knowing if I will lose more families; if I will be able to replace the ones I did lose any time soon; if I or someone in my family gets the virus and unemployment errors cause delays, will we survive financially*?

Second, weight gain and lack of physical activity were also prevalent concerns among early childhood teachers during the pandemic. This was common for all three groups, but it was especially prevalent for online teachers. They reported weight gain resulting from stress eating, unhealthy food choices, being in close proximity to food all the time, and increases in sedentary behavior. As one teacher noted:

> *I have gained about 20 pounds (during the pandemic). The added weight has affected my mobility. I have an increased level of discomfort with what formally was very mild aches and pains. I haven't been to the doctor, but I'm sure my blood pressure is out of whack. These may be contributing to what I believe is mild depression.*

Teacher weight gain was also partially due to increased sedentary behavior and a lack of physical activity, and this was a concern across modalities. As one teacher in this online group remarked, "*During the school year, I feel as if I prioritized my diet and exercise more. By spending 7.5 h a day (or more online), my body is very sore after sitting all day*".

Third, feelings of social disconnection, depression, and sadness were the next most prevalent theme across the groups. Teachers felt socially disconnected from their coworkers, students, friends, and family. Social disconnectedness was described as being lonely and feeling distant from loved ones (e.g., not being able to meet their family and friends). Missing their students was common for online teachers and teachers whose sites were closed. One teacher stated, "*I miss the children, I miss the job that I love, I miss my routine, and I miss interacting with my coworkers*".

Depression and hopelessness were commonly reported well-being-related challenges, especially for the online and school closed groups. Teachers connected these feelings of sadness and depression to being out of their routine, missing their kids at school, and feeling trapped—a finding that was not shared by the in-person teachers. A teacher teaching online wrote:

> *I'm a very productive person typically. Being cooped up at home has been very challenging to my happiness. Some days, I don't want to get off the couch. Some days, I am very productive and get everything done! I try to spend time in my yard and growing things in my garden. But when I run out of things to do, I get sad . . . It is difficult for me to put my foot down and refuse to go out when pressured by others as well.*

Fourth, increased concerns about other illnesses as an existing or new health condition were often noted as a challenge in physical well-being during the pandemic. Illnesses incurred pre-pandemic were exacerbated, and new ones arose. One teacher reported, "*I have Type 1 diabetes, and the stress causes my blood sugars to run high*". Another teacher says, "*stress has brought on migraines, which I had not previously experienced, and I've been having frequent chest pains*". Other illnesses included insomnia, reduced energy, restless sleep, and poor sleep patterns.

Fifth, financial concerns were also identified and there were slight differences among the three teaching modalities. Financial concerns seemed to be a more common issue for the in-person group and the school closed group. One teacher puts it, "*It's very frustrating financially. I know many people who are making about double in unemployment benefits than what we are making having to go to work every day and risk our health. My friend is getting over $1000 a week from unemployment, and we won't be getting any raises this year due to COVID. Teachers deserve competitive pay!*". However, financial issues were not as prevalent for the online teaching group.

In general, the quantitative analysis corroborated the findings of the content analysis on the range of challenges that teachers experienced related to psychological and physical well-being described above. With respect to psychological well-being, our quantitative data revealed that 31% of teachers in the sample reported doctor-diagnosed anxiety and 23% reported doctor-diagnosed depressive symptoms (see Table 2), with 35% having depressive symptom scores reaching clinical levels (based upon a recommended cut-off score of 11 for the shorter CES-D instrument). Forty-eight percent of teachers experienced somewhat or mostly negative changes in psychological well-being during the early months of the pandemic.

Regarding physical well-being, 20% of teachers reported experiencing somewhat or mostly negative changes in their physical health, with substantial numbers of teachers reporting chronic conditions such as being overweight or obese (72%), having high blood pressure (28%), or asthma (22%; see Table 2). With regard to physical activity, 63.56% indicated that they performed an average of 1.37 h of moderate to vigorous physical

activities every week. From an ergonomic perspective, 78% of the study participants reported having at least one area of work-related pain, and half (50.29%) indicated that pain interfered to some degree with their work.

Our regression analysis of the main effects of teacher race, center type, and modality, which is displayed in Table 4, reveal that ergonomic pain was highest for in-person teachers, as compared to teachers whose sites were closed, $\beta = 0.155$, $SD = 0.076$, $p < 0.05$. Regarding professional well-being, more than fifteen percent of teachers (15.40%) in the sample reported that they wanted to leave as a result of the current situation. Furthermore, work commitment was lower for in-person teachers, $\beta = -0.298$, $SD = 0.075$, $p < 0.01$, than teachers whose centers were closed, $\beta = 0.203$, $SD = 0.081$, $p < 0.05$, and there were similar differences among these two groups for intent to leave, with in-person teachers reporting higher intent to leave, $\beta = 0.219$, $SD = 0.075$, $p < 0.01$, than their closed counterparts, $\beta = -0.128$, $SD = 0.081$, $p =$ n.s. Teachers teaching virtually showed no distinct differences with respect to professional well-being as compared to teachers whose schools were closed.

Among those who wanted to leave, the major reasons for thinking of leaving were health concerns and a fear of contracting the COVID-19 or passing it to others (41.50%). The second most frequent reason was dissatisfaction with their current teaching assignment (e.g., they did not want to teach online or in person as it is difficult to work with young children in a developmentally appropriate way under these circumstances, etc.) and/or additional job demands (16.98%). Further, teachers wanted to leave because they did not feel that their field had provided enough job security amidst the crisis and were interested in looking for other career opportunities (15.85%).

With respect to teacher psychological well-being, while there were no differences between teachers by modality, we did find racial differences among teachers and these effects held in our moderation analysis (see Table 5), which we discuss below. First, the pattern of difference in psychological well-being was pronounced for Black and Hispanic teachers whose centers were closed. On average, Black teachers had lower personal stress, $\beta = -0.545$, $p < 0.01$, depressive symptoms, $\beta = -0.458$, $p < 0.01$, and secondary trauma, $\beta = -0.299$, $p < 0.05$, as compared to White teachers whose centers were closed, $\beta = 0.170$, $p < 0.05$, $\beta = 0.284$, $p < 0.01$, and $\beta = -0.085$, n.s., respectively. The same was true for Hispanic teachers in comparison to White teachers: Hispanic teachers reported lower personal stress, $\beta = -0.306$, $p < 0.01$, depressive symptoms, $\beta = -0.355$, $p < 0.01$, and secondary trauma, $\beta = -0.395$, $p < 0.01$, and reported higher life satisfaction than White teachers whose centers were closed, $\beta = 0.404$, $p < 0.01$. White teachers whose centers were closed had the poorest psychological well-being of the different racial groups—in particular, they had the highest levels of personal stress, $\beta = 0.170$, $p < 0.05$, and depressive symptoms, $\beta = 0.284$, $p < 0.01$, and Black and White teachers shared similarly low levels of life satisfaction, $\beta = -0.35$, $p < 0.05$, for White, $\beta = 0.003$, n.s., for Black, respectively.

However, these patterns shift when we look at those teachers teaching in person and virtually. Those Black teachers teaching in person exhibited large differences in personal stress, $\beta = 0.425$, $p < 0.05$, and depressive symptoms, $\beta = 0.362$, $p < 0.10$, from Black teachers whose schools were closed while, for White teachers, being in person or closed did not make a difference: personal stress, $\beta = 0.001$, n.s., depressive symptoms, $\beta = -0.087$, n.s., secondary trauma, $\beta = 0.104$, n.s., and life satisfaction, $\beta = 0.059$, n.s. Hispanic teachers teaching in person were similar to Black teachers, showing significantly lower life satisfaction than those whose centers were closed, $\beta = -0.381$, $p < 0.05$, and brief resiliency for those teaching virtually ($\beta = -0.405$, $p < 0.05$). Other notable findings for psychological well-being were the fact that teachers with an associate's degree or higher reported marginally higher life satisfaction, $\beta = 0.239$, $p < 0.01$, and lower depressive symptoms, $\beta = -0.111$, $p < 0.10$. Public school teachers, as compared to childcare center/pre-K teachers, had higher life satisfaction, $\beta = 0.279$, $p < 0.01$, but also marginally higher secondary trauma, $\beta = 0.366$, $p < 0.01$.

Table 5. Moderation of teacher race and psychological, physical, and professional well-being outcomes by modality.

	Brief Resiliency	Life Satisfaction	Perceived Personal Stress	Depressive Symptoms	Secondary Trauma	Work Commitment	Intent to Leave	Ergonomic Pain	Physical Job Demands	Skill Discretion	Decision Authority
Intercept	0.0905	−0.353 *	0.170 *	0.284 **	−0.085	0.170 *	−0.115	0.059	0.027	−0.297 **	0.019
	(0.085)	(0.085)	(0.085)	(0.085)	(0.084)	(0.086)	(0.085)	(0.086)	(0.092)	(0.085)	(0.083)
≥Associates deg.	−0.043	0.239 **	−0.049	−0.111 †	0.144 *	−0.088	0.094	−0.029	−0.116 †	0.249 **	0.201 **
	(0.064)	(0.063)	(0.064)	(0.063)	(0.063)	(0.064)	(0.064)	(0.065)	(0.063)	(0.064)	(0.062)
Childcare Center/Pre-K	(reference)										
Family CC home	0.064	0.076	−0.116	−0.088	−0.241 †	0.073	−0.055	−0.001	0.105	0.126	0.826 **
	(0.126)	(0.126)	(0.126)	(0.126)	(0.124)	(0.127)	(0.127)	(0.128)	(0.099)	(0.126)	(0.122)
Head Start	0.089	0.097	−0.092	−0.166 *	0.045	0.083	−0.060	−0.019	−0.013	0.166 *	−0.339 **
	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)	(0.074)	(0.074)	(0.075)	(0.081)	(0.074)	(0.071)
Public school	0.054	0.279 **	0.029	−0.117	0.366 **	−0.020	−0.035	0.104	−0.157	0.390 **	−0.130
	(0.097)	(0.096)	(0.096)	(0.096)	(0.096)	(0.098)	(0.097)	(0.098)	(0.098)	(0.097)	(0.094)
Private school	−0.221	0.194	−0.103	−0.183	−0.140	−0.041	−0.148	−0.551 **	−0.246	0.035	0.321 *
	(0.162)	(0.161)	(0.162)	(0.162)	(0.161)	(0.164)	(0.164)	(0.164)	(0.174)	(0.163)	(0.157)
School closed	(reference)										
School in-person	0.017	0.059	0.001	−0.087	0.104	−0.197 *	0.153 †	0.074	0.163†	−0.058	0.015
	(0.090)	(0.089)	(0.090)	(0.089)	(0.089)	(0.090)	(0.090)	(0.091)	(0.093)	(0.090)	(0.087)
School online	0.011	0.076	0.065	0.056	0.108	−0.086	−0.009	−0.005	0.066	0.136	−0.087
	(0.088)	(0.088)	(0.088)	(0.088)	(0.088)	(0.089)	(0.089)	(0.090)	(0.089)	(0.089)	(0.086)
White teacher	(reference)										
Black	−0.335 **	0.003	−0.545 **	−0.458 **	−0.299 *	0.009	0.152	−0.238 †	0.056	−0.033	−0.084
	(0.122)	(0.121)	(0.122)	(0.121)	(0.121)	(0.123)	(0.122)	(0.124)	(0.138)	(0.122)	(0.118)
Hispanic	−0.251 *	0.404 **	−0.306 **	−0.355 **	−0.395 **	−0.107	0.004	−0.229 *	0.044	−0.149	−0.144
	(0.100)	(0.100)	(0.099)	(0.100)	(0.099)	(0.101)	(0.101)	(0.102)	(0.102)	(0.101)	(0.097)
Other	0.153	0.042	−0.004	0.055	−0.066	−0.081	0.213	0.153	0.121	−0.002	−0.012
	(0.176)	(0.178)	(0.178)	(0.178)	(0.177)	(0.180)	(0.178)	(0.181)	(0.184)	(0.179)	(0.173)
Black * In-person	0.073	0.117	0.425 *	0.362 †	0.264	−0.357 †	0.187	0.042	−0.019	0.04	0.115
	(0.187)	(0.187)	(0.188)	(0.187)	(0.185)	(0.189)	(0.187)	(0.189)	(0.197)	(0.188)	(0.182)
Hispanic * In-person	0.143	−0.381 *	0.116	0.242	−0.228	−0.286	0.134	0.443 *	−0.046	0.211	−0.245
	(0.187)	(0.187)	(0.187)	(0.187)	(0.186)	(0.189)	(0.189)	(0.191)	(0.201)	(0.188)	(0.182)
Other * In-person	−0.256	−0.186	0.131	−0.036	−0.194	−0.229	0.332	0.001	−0.193	−0.174	−0.180
	(0.263)	(0.263)	(0.263)	(0.263)	(0.262)	(0.267)	(0.265)	(0.268)	(0.259)	(0.265)	(0.257)
Black * Online	0.059	−0.189	0.204	0.268	0.099	−0.384 †	0.012	0.077	−0.021	0.003	0.173
	(0.204)	(0.203)	(0.205)	(0.202)	(0.200)	(0.204)	(0.203)	(0.205)	(0.227)	(0.203)	(0.196)
Hispanic * Online	−0.405 *	−0.039	−0.099	−0.034	−0.123	0.138	−0.079	0.187	−0.027	−0.197	0.061
	(0.159)	(0.159)	(0.159)	(0.159)	(0.158)	(0.161)	(0.160)	(0.162)	(0.154)	(0.161)	(0.156)
Other * Online	0.002	−0.596 *	0.202	0.299	0.103	0.023	−0.158	0.001	−0.198	−0.250	0.159
	(0.298)	(0.298)	(0.298)	(0.298)	(0.302)	(0.308)	(0.296)	(0.303)	(0.263)	(0.300)	(0.291)

Note. All outcome variables standardized. Standard errors in parentheses. ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$.

With respect to professional well-being, there were also some notable findings. First, White teachers teaching in person had significantly lower work commitment, $\beta = -0.197$, $p < 0.05$, and marginally higher intent to leave, $\beta = 0.153$, $p < 0.10$. There were also a few differences with respect to physical well-being. As mentioned above, Black and Hispanic teachers at closed centers had marginally lower ergonomic pain than White teachers, $\beta = -0.238$, $p < 0.10$, $\beta = -0.229$, $p < 0.05$, $\beta = 0.059$, n.s., respectively, but Hispanic teachers teaching in person experienced sharply higher ergonomic pain as compared to White teachers, $\beta = 0.443$, $p < 0.05$, $\beta = 0.059$, n.s., respectively.

Finally, with respect to job demands by modality or race (or the interaction between the two), there was only one difference: teachers teaching in person reported higher physical job demands across the board, $\beta = 0.163$, $p < 0.10$, with no differences among racial groups. Other differences, not surprisingly, broke down by education level and center type; teachers with higher education levels reported marginally lower physical job demands but higher skill discretion and decision authority, $\beta = -0.116$, $p < 0.10$, $\beta = 0.249$, $p < 0.01$, $\beta = 0.201$, $p < 0.01$, respectively. Family childcare home teachers had high decision authority and Head Start teachers lower as compared to childcare centers/Pre-K, $\beta = 0.826$, $p < 0.01$, $\beta = -0.339$, $p < 0.01$, respectively. Public school teachers had higher skill discretion than childcare center/Pre-K teachers, $\beta = 0.390$, $p < 0.01$.

3.3. Addressing Challenges: Teachers' Reported Needs for Support

In concluding our analysis, teachers were also asked to rank the top three items needed to support their well-being out of a list of 22 possible choices. We combined some categories in arriving at 12 overall themes/responses. Among these, the five most frequently listed responses included: (a) higher wages (16.81%); (b) more resources for health and well-being (15.84%); (c) more coaching, mentoring, and professional development (including comprehensive safety training, 12.58%); (d) more daily breaks and paid leave (11.17%), and (e) more support for children with behavioral challenges and special needs (10.54%).

4. Discussion

Dramatic shifts in working conditions occurred for ECE teachers during the pandemic, as some remained teaching in person, while others taught online, and still others whose sites were closed were not teaching at all. Even before the pandemic, the ECE workforce was often characterized as a marginalized group because of their exposure to poor working conditions and their heightened risk of diminished well-being [1,4,8]. We sought to understand if and how these conditions changed during the early days of the pandemic and the role of teaching modality as well as teacher and center characteristics in any differences we found. Thus, this study examined the challenges, risks, and needs for early childhood teachers' work and well-being primarily as a result of these shifts in their work during the COVID-19 pandemic in the U.S. We sought answers to the following three research questions: (a) How did ECE teachers' working conditions and well-being differ by teaching modality (i.e., in-person, online, closed school)? (b) Were there teacher demographic and center-based differences in teacher well-being? and (c) Did teaching modality moderate the relationship between demographic and center-based differences and teacher well-being? The following discussion is organized along the lines of these three questions.

4.1. Differences in Working Conditions and Well-Being by Modality

Overall, while our findings are in line with those in recent COVID-19 studies mostly focused on K-12 teachers [8,9,18,19,27,28], they extend our understanding of the pandemic's effects on work and well-being by highlighting the unique effects that it has had on the early childhood teacher workforce. This was one of the first studies, to the authors' knowledge, to take a holistic view of ECE teacher work and well-being (i.e., psychological, physical, and professional well-being) using a large sample of teachers serving birth through Kindergarten from nearly all states in the U.S. Our mixed-method approach provided both the depth and breadth needed to fully explore this complex issue and the story we captured is a complicated one—both in terms of the nature of the challenges faced across the three teaching groups as well as the differences between racial groups we found.

Generally speaking, our sample of ECE teachers experienced challenges working with children both in person and online, but most of the challenges they experienced were different in type and intensity due to the unique circumstances of these different teaching formats. One clear distinction between these two modalities was the continued physical demands for in-person teachers and increased demands for new skills to teach virtually for online teachers. In addition to the increased physical job demands and constantly changing guidelines and regulations, in-person teachers had more concerns about financial restrictions due to low enrollment, the concomitant possibility of school closure, and fear of contracting COVID-19 at work. In-person teachers' financial concerns may be related to the fact that they are more likely to work in settings where income sources are not stable or are highly tuition-dependent (e.g., family childcare homes, private childcare centers). This echoes previous findings that, while the pandemic compromised ECE teachers' financial stability across all settings during the pandemic, it is possible that it disproportionately affected childcare teachers [8,51].

Conversely, as expected, online teachers had different concerns about technological issues, social isolation, as well as a lack of resources and support needed for online teaching. Early childhood teachers often use technology as a teaching tool to some extent (e.g., showing a video) [52], but the challenges in learning this new mode of teaching brought increased new skill demands as they faced challenges engaging children and families in an online format. The quantitative data also corroborate these findings in that in-person teachers perceived more physical demands while online teachers reported that their jobs required new skills and training (e.g., technology integration for online teaching). Due to these unique challenges and demands, the perceived needs of in-person versus online teachers were necessarily different.

These findings are consistent with previous studies on the challenges that teachers have experienced during the pandemic [11,17,28,53,54]. However, the current study adds

to the extant literature by demonstrating that these challenges can greatly differ by teaching modality. In addition, we extended the findings of previous studies by investigating teachers' needs directly. For example, the current study found that in-person teachers and online teachers needed vastly different types of resources in order to perform their teaching tasks (e.g., more cleaning supplies and financial support for in-person teaching vs. better technology, resources, curriculum, and training for online teaching). To provide appropriate resources and support, it is important to first assess what the challenges are for teachers, centers, and schools who are having potentially very different pandemic working experiences. Resources and support will need to be tailored to better meet the needs of teachers working under these very different circumstances.

While approximately half of the participating teachers perceived negative changes in psychological well-being, only approximately 20 percent of teachers reported negative changes in their physical health. This indicates that the COVID-19 pandemic appeared to more acutely impact psychological rather than physical aspects of well-being for most teachers. This was noteworthy given that COVID-19 is a major health-related issue. What is clear from our data, however, is that serious concerns remain about the overall health and physical well-being of ECE teachers. Among those teachers who experienced negative changes during the pandemic, teachers across all three teaching modalities shared anxiety and fear of COVID-19 and social isolation/disconnection as the greatest challenges related to their well-being. Concerns about weight gain and lack of physical activity as well as chronic health conditions were prevalent and common among those who reported a change during the pandemic among the three groups—chronic health conditions that, in some cases, were shared by the majority of our sample, including obesity, high blood pressure, and asthma, and that place them at higher risk for contracting and becoming very ill from COVID-19 [25,55]. This is remarkable, particularly for those teachers who continue to teach in person. These findings support and add to the limited extant evidence on teachers' concerns about diminished physical well-being during the pandemic [22,25,56].

Teachers in all three groups also had other issues in common, such as feelings of social disconnection, depression, and sadness, financial concerns, and additional job demands, although there were slight differences across the three groups. For example, financial concerns, additional job demands, and lack of resources and support were more prevalent challenges for the in-person teaching group than the others. Loss of purpose was more unique to online teachers, and concern for students was more common for school closed teachers, which may be related to fact that they were not able to directly interact with the children—an aspect of the job that has traditionally been a strong attractor to the profession.

4.2. Differences in Well-Being by Teacher and Center Characteristics, Modality

We found many common issues and challenges related to psychological and physical well-being across the three teaching groups from the qualitative analysis, but a more nuanced picture emerged from the quantitative analysis. Upon further examination of the effects of well-being by modality, we found them, to a degree, to be moderated by teacher race—in particular, for psychological and professional well-being. Our findings show that White teachers' psychological well-being was poorer on average and, across the measures of well-being, tended differ less by teaching modality. Black and Hispanic teachers, on the other hand, experienced large differences in psychological well-being indicators such as life satisfaction, stress, depressive symptoms, and secondary trauma depending on whether their centers were closed or they were teaching in person. When their centers were closed, Black and Hispanic teachers had better well-being, yet looked similar to White teachers when they were teaching in person. In contrast, White teachers experienced lower professional well-being outcomes (lower work commitment and higher intent to leave) when teaching in person versus closed, but Black in-person and virtual teachers experienced even larger negative effects on work commitment than White teachers. These findings corroborate and extend prior work [29,31,32] in that the COVID-19 crisis has had a disproportionate impact on vulnerable people, yet our findings reveal that this

impact was unique and complex in its effects on minoritized groups. Because few studies have examined race differences in well-being during the pandemic, there is little precedent for understanding these findings. What seems clear is that more concerted effort should be made to examine the differential effects of race on the pandemic ECE teaching experience.

4.3. Limitations

This study has some limitations. First, although the data were collected from a large group of teachers from 46 states in the U.S., they may not be representative of the national sample as the sample was not randomly drawn. It was also a one-time, cross-sectional study. Teachers, early childhood programs, and schools experienced and continue to experience rapid changes in COVID-19 prevalence, regulations, and guidelines as the pandemic continues, and this means that teachers' experiences may have changed drastically since our study was conducted. The present study only captured a snapshot of the early phase of the pandemic. The field would benefit from rigorous, longitudinal studies of the impacts of the pandemic on early childhood well-being to examine the "real impact of the COVID-19 pandemic and real changes".

Second, we did not examine hybrid teaching as a separate modality; teachers in our study were asked to select one of the three categories. Because our data were collected in the early phase of the pandemic, the hybrid option was not as prevalent, but became more so in the later phases of the pandemic. Including this group would likely reveal yet another set of unique challenges, which would warrant further investigation. Third, we relied solely on teacher reports on their perceptions of work and well-being during the pandemic. Although it is valid to use self-reports in this case, adding an objective measure such as a direct assessment or a doctor's report on health conditions would provide a more accurate picture of teachers' experiences and well-being. Fourth, our intent in this study was to examine challenges in working conditions and well-being; however, in order to offer clearer implications for improving teacher well-being, future studies should include a larger set of center-level context and climate variables such as effective communication, leadership, and professional development support.

4.4. Implications for Practice and Policy

The COVID-19 pandemic has disrupted all sectors of the workforce, particularly those considered as the frontline workers. Our study provides ample evidence of the various challenges and high demands that early childhood teachers face that would have a negative impact on their well-being and work during the pandemic. This calls for additional resources and support to address the urgent needs. Stressed, overworked, and depressed teachers have little hope of meeting the needs of similarly stressed, traumatized, or otherwise needy young children. Support and resources to improve teachers' psychological and physical well-being could include a physical wellness program, mental health services, and increased time for breaks and physical activity.

Regarding concerns about a high rate of obesity, weight gain, and lack of physical activity and energy, the American College of Sports Medicine [57] recommends that healthy adults aged 18–65 years should engage in moderate-intensity physical activity that increases the heart and respiratory rates for a minimum of 30 min five days per week. Given the evidence from recent studies, it is imperative for early childhood teachers to not only encourage physical activity in children but engage in it themselves throughout the day. This will be extraordinarily difficult for ECE teachers, who are typically not afforded time in the day to even take a 15 min restroom break. While additional funding will not solve these challenges alone, it could allow for the hiring of additional staff to help cover classrooms so that teachers may have time for breaks, exercise, or other leisure activities.

What is clear is that these supports cannot be monolithic; they need to be tailored to the unique challenges, demands, and needs at multiple levels and across various settings (e.g., centers, family childcare homes, public schools, online settings) and sectors of the early childhood workforce. This also includes increased training and support to prepare

teachers for different teaching modalities. In particular, support needs to prioritize teachers teaching in person, who face more job demands and health risks and likely come from family childcare homes and private childcare centers that do not have stable funding sources. Finally, we need to more closely investigate the differential impacts of pandemic working conditions on the well-being of different racial groups, as this study revealed some evidence that these differences were consequential.

More important than the realization of the incredible stress and strain we have placed upon the teachers of our young children is the need to acknowledge the sacrifices for the greater good that these teachers have given and provide these much-needed supports as a gesture of appreciation for these incredible sacrifices. In doing this, we also need to better recognize these frontline workers as essential—those workers who in many cases have risked, and continue to risk, their well-being and health to support children and families during these difficult times. This shift in perception and recognition, coupled with program, policy, and funding changes, can help to prioritize the needs of schools and ECE teachers, which will support their work and well-being.

5. Conclusions

While we see signs that the pandemic is waning—vaccinations are increasing and COVID-19 variants have receded for the moment—inviting a return to "normal", this does not absolve the field from ensuring that teachers are better prepared in the future to meet unique needs, whether pandemic-related or otherwise. For example, there has been an influx of online teaching in ECE due to the pandemic and these learning formats will likely persist long after the pandemic has subsided [7]. In our present circumstances, educators have learned how to adjust to weather this tumultuous time. It may not be a question as to if but when conditions worsen that they need to once again put these skills to action. For teachers working in person or online moving forward, we must continue to help them to address the physical and emotional demands of the profession. Even prior to the pandemic, we knew that teachers were suffering from a number of physical and health-related ailments due to stressful and strenuous working environments, poor wages and health benefits, and a lack of breaks [2,7]. Supporting teachers with plentiful and appropriate resources is an important pre-emptive step to ensuring that acute demands do not push our teachers and the profession over an edge from which there is little hope of recovery. The time is ripe to begin to seriously address the needs of this workforce to ensure that our educational systems are prepared for other challenges.

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Predictors of Burnout in Hospital Health Workers during the COVID-19 Outbreak in South Korea

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Abstract: This study aimed to identify the factors that influence the components of burnout—emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA)—among hospital health workers, including doctors and nurses, during the COVID-19 pandemic. We analyzed 200 healthcare workers' responses to the Employee Health Promotion Survey conducted at a general hospital in Seoul with over 200 hospital beds. The questionnaire included items about COVID-19-related burnout and its influencing factors. We performed three different multiple regression analyses using EE, DP, and PA as the dependent variables. The results show that sex, marital status, workload of treating suspected COVID-19 patients, fear of COVID-19 infection, anxiety, and depression predicted EE. The predictors of DP were job category, consecutive months of work in the current department, satisfaction with work environment, anxiety, and depression. The predictors of PA were the workload of directly interacting with patients, socioeconomic status, and job stress. For EE and DP, burnout was found to be worse in doctors and nurses than in other health workers; moreover, burnout was worse among nurses than among doctors across all three aspects of burnout. The findings can be used to establish tailored policies to address each burnout component.

Keywords: burnout; COVID-19; hospital health worker; doctor; nurse; emotional exhaustion; depersonalization; personal accomplishment; Maslach burnout inventory

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1. Introduction

According to a report by the World Health Organization (WHO), as of 15 September 2021, there were approximately 230 million confirmed cases of COVID-19 worldwide. In South Korea, 277,989 confirmed cases and 2380 deaths have been reported [1]. The WHO defines health workers (HWs) as "all people engaged in actions whose primary intent is to enhance health" [2]. These HWs constitute the core workforce when encountering infectious diseases such as COVID-19. As a result of their role in managing and maintaining medical services at the front line during the spread of infectious diseases, HWs—such as doctors, nurses, midwives, paramedical staff, hospital administrators, support staff, and community workers—face a higher risk of infection than the general public. Furthermore, these workers are exposed to risks such as psychological distress, fatigue, and stigma [3]. According to a report from the International Council of Nurses (ICN), as of February 2021 [4], the average infection rate across the ICN dataset ranges between 6% and 10% at different points in time and HW infection rates of up to 30% have been reported. In South Korea, 565 health practitioners tested positive for COVID-19 while treating patients between February 2020 and June 2021. Of these, 20.0% were doctors and 73.5% were nurses, with the higher number of the latter likely due to the distinctive nature of nursing tasks in the field of disease prevention and patient care [5]. High infection and death rates among HWs can affect the maintenance of the healthcare system.

Amid the prolonged COVID-19 pandemic, HWs are complaining about accumulated fatigue and mental stress, and are suffering from burnout due to constant labor shortages and insufficient benefits [6]. Burnout refers to "a psychological syndrome of emotional exhaustion (EE), depersonalization (DP), and reduced personal accomplishment (PA) that can occur among individuals who work with other people in some capacity" [7]. EE is the depletion of emotional resources, DP is developing a cynical attitude toward patients, and reduced PA is a negative evaluation of oneself [7]. The head of the Korean Health and Medical Workers' Union reported that HWs frequently quit their jobs because of extreme fatigue and exhaustion, and that many workers suffer from extreme physical and mental stress, which leads to depression and trauma. Moreover, HWs experiencing burnout can impact patients and colleagues as they have an increased risk of making wrong decisions [8]; burnout is therefore not an issue that only pertains to individual HWs. However, sufficient measures have not been taken to resolve the poor working conditions and heavy workloads for HWs [9].

Previous studies that analyzed burnout after the outbreak of COVID-19 limited their research subjects to single job categories, such as doctors [10–12] and nurses [13–15]. Such fragmentary analysis of burnout, with a focus on a particular job category, may be helpful for making policy decisions pertaining to a particular job category. However, these studies overlooked the actual clinical setting where multiple job categories are organically interconnected within one hospital and that burnout during a pandemic, such as COVID-19, affects the entire hospital. Although one study investigated the burnout of HWs from multiple hospitals [16], it was difficult for the researchers to build three individual models for the levels of EE, DP, and PA under the same conditions in one hospital and to identify relevant influencing factors.

For this reason, we aimed to differentiate our study from previous studies by including all HWs working at the same hospital. Departing from the previous pattern of analyzing job-oriented burnout, we employed an exhaustive analysis method focusing on the organization. This analytical approach can assist hospital personnel in charge of healthcare policy to gain a comprehensive understanding of the challenges confronting hospital HWs and to make efficient decisions. In addition, by implementing an employee burnout prevention policy that is applicable to all job categories, hospital HWs can perform their jobs more cost effectively. Thus, we aimed to provide a foundation and baseline data for establishing hospital-level policies on burnout prevention right at the early stages when encountering a pandemic such as COVID-19.

The overarching research question was: "What factors affect hospital HWs' burnout during the COVID-19 outbreak in terms of the individual burnout components?" The hypotheses were:

Hypothesis 1 (H1): *Sociodemographic characteristics and variables related to COVID-19, work overload, psychological conditions, and hospital resources will affect the EE of hospital HWs during the COVID-19 outbreak.*

Hypothesis 2 (H2): *Sociodemographic characteristics and variables related to COVID-19, work overload, psychological conditions, and hospital resources will affect the DP of hospital HWs during the COVID-19 outbreak.*

Hypothesis 3 (H3): *Sociodemographic characteristics and variables related to COVID-19, work overload, psychological conditions, and hospital resources will affect the PA of hospital HWs during the COVID-19 outbreak.*

2. Materials and Methods

2.1. Study Design

This retrospective descriptive study explored the factors affecting burnout among HWs at a Korean hospital during the COVID-19 pandemic.

2.2. Participants and Sample Size Calculation

This study's subjects included the participants of the 2020 Employee Health Promotion Survey for HWs working at a general hospital in Seoul equipped with over 200 hospital beds during the COVID-19 pandemic. Data were collected during the comprehensive wellness check from 6 January 2020, to 28 February 2020. The total number of employees in the hospital is 311, of which 210 responded to the questionnaire. The overall response rate was 64%. After excluding 10 people who did not submit their responses within the collection period, only 200 questionnaires were used as valid data in this study. The 200 responses that had already been collected were used for the final analysis. Using the G*Power 3.1.9.7 program [17], the minimum sample size for multiple regression analysis was calculated to be 183 based on a previous study [18] with a significance level of 0.05, a median effect size of 0.15, a power of 0.90, and a number of predictors at 18. Therefore, a sample size of 200 for this study was appropriate.

The composition of the 200 participants is as follows: 48 doctors, 83 nurses, 6 pharmacists, 28 health workers, 7 managers, 3 technical workers, and 25 service workers. The response rates by occupational group were: 100% for doctors, 52% for nursing, 100% for pharmaceutical workers, 100% for health workers, 26% for managers, 38% for technical workers, and 72% for service workers.

2.3. Instruments

2.3.1. General Characteristics

The questionnaire on general characteristics consisted of 13 items as follows: sex, age, education level, marital status, job category, working duration at the current job, working duration in the current department, number of rotating shifts within a month, workload of directly interacting with patients, workload of treating suspected COVID-19 patients, socioeconomic status, satisfaction with work environment, and current health condition. Age details were collected as an ordinal variable. Using Likert scales, we categorized and measured the following variables: education level, workload of directly interacting with patients, workload of treating suspected COVID-19 patients, socioeconomic status, satisfaction with work environment, and current health condition. Nominal variables with c classes were represented by $c - 1$ dummy variables, each taking on the values 0 and 1.

2.3.2. Fear of COVID-19 Infection

Fear of COVID-19 infection was measured using a revised scale based on the fear of MERS-CoV infection [18] scale. This scale consisted of one item: "I am afraid of being infected with COVID-19", which was measured using a 10-point Likert scale, whose values ranged from 1 (not at all afraid) to 10 (unbearably afraid). A higher score indicated a stronger fear of COVID-19 infection.

2.3.3. Job Satisfaction

Job satisfaction was measured using the Minnesota Satisfaction Questionnaire, which was developed by the Minnesota Industrial Relation Center [19] and translated into Korean by Lee and Park [20]. This questionnaire consisted of 20 items: 10 items about intrinsic factors and 10 about extrinsic factors. Using a 5-point Likert scale, responses were measured from 1 (very dissatisfied) to 5 (very satisfied). A higher score indicated a higher level of job satisfaction. Cronbach's α, the reliability indicator of the scale, was 0.88 in Lee and Park's [20] study, and 0.97 in this study.

2.3.4. Hospital Anxiety and Depression

Hospital anxiety and depression levels were measured using the Hospital Anxiety and Depression Scale (HADS) developed by Zigmond and Snaith [21], and standardized by Oh et al. [22]. The HADS consists of 14 items: 7 items about anxiety and 7 items about depression. Responses were measured on a 4-point Likert scale ranging from 0 (never) to 3 (frequently). A higher score indicated a higher level of anxiety or depression. As 8 was

suggested as the cut-off score in a previous study [22], we regarded scores above 8 as a manifestation of anxiety or depression. The Cronbach's α of the scale was 0.89 for anxiety and 0.86 for depression in Oh et al.'s study [22]. In this study, it was 0.687 for anxiety and 0.76 for depression.

2.3.5. Job Stress

Job stress levels were measured using the Korean Occupational Stress Scale Short Form (KOSS-SF) [23]. The KOSS-SF consists of seven subscales and 24 items as follows: job demand (4 items), insufficient job control (4 items), interpersonal conflict (3 items), job insecurity (2 items), occupational system (4 items), lack of reward (3 items), and organizational climate (4 items). Using a 4-point Likert scale, the scores were reverse-coded from 1 (strongly disagree) to 4 (strongly agree). The stress score of the KOSS-SF was calculated by converting the scores of the seven subscales into a 100-point scale and averaging them. The Cronbach's α for each subscale at the time of KOSS's development was as follows: 0.71 for job demand, 0.66 for insufficient job control, 0.67 for interpersonal conflict, 0.61 for job insecurity, 0.82 for occupational system, 0.76 for lack of reward, and 0.51 for organizational climate [23]. In this study, the overall reliability of the scale was 0.89, and that of each subscale was: 0.56 for job demand, 0.77 for insufficient job control, 0.77 for interpersonal conflict, 0.74 for job insecurity, 0.89 for occupational system, 0.81 for lack of reward, and 0.82 for organizational climate.

2.3.6. Hospital Resources for the Treatment of COVID-19

Hospital resources for the treatment of COVID-19 were measured using a revised scale based on Kim and Choi's scale of "Hospital Resources for the Treatment of MERS-CoV" [18]. That is, we replaced the term MERS-CoV used in their scale with COVID-19 as follows: "My hospital is equipped with facilities sufficient for preventing the spread of COVID-19", "My hospital applies the best infection control guidelines for preventing the spread of COVID-19", and "My hospital discusses how to prevent COVID-19 regularly". Based on a briefing on the supply management plan for COVID-19 by the Central Disaster and Safety Countermeasures Headquarters [24], the following two items were added: "My hospital supplies facemasks steadily" and "My hospital steadily supplies personal protective equipment (gloves, bodysuit, goggles, hood, etc.)". The scale consisted of five items, which were scored on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). A higher number indicated a greater availability of hospital resources for encountering COVID-19. The Cronbach's α was 0.81 in a previous study [18], and 0.84 in this study.

2.3.7. Support from Family and Friends

Support from family and friends was measured using a revised scale based on Kim and Choi's scale of "Support from Family and Friends", which focused on the MERS-CoV epidemic [18]. Based on their scale, our scale was revised by replacing the term MERS-CoV with COVID-19 as follows: "My friends will avoid me if they find that I have cared for COVID-19 patients", "My friends will support me caring for COVID-19 patients", "My family will avoid me if they find that I have cared for COVID-19 patients", and "My family will support me caring for COVID-19 patients". The scale consisted of four items and was measured using a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). A higher score indicated stronger support from family and friends. The Cronbach's α was 0.80 in a previous study [18], and 0.57 in this study.

2.3.8. Working Overtime and Compensation Related to COVID-19

The scale measuring working overtime and compensation related to COVID-19 consisted of 2 items as follows: "My hospital requires me to work overtime because of COVID-19" and "My hospital pays extra for working overtime because of COVID-19". Using a 4-point Likert scale, the responses were measured from 1 point (strongly disagree) to

4 points (strongly agree), and additional pay was reverse-coded. A higher score indicated a higher frequency of working overtime without proper compensation.

2.3.9. Burnout

Burnout was measured using the Korean version [25] of the Maslach Burnout Inventory Scale Human Services Survey (MBI-HSS) developed by Maslach and Jackson [26]. The MBI-HSS differs from MBI for medical personnel (MBI-HSS (MP)) [27] in terms of the choice of words in the items: "recipients" vs. "patients". Accordingly, we replaced the corresponding words with the Korean translations. Similarly, Jung's [25] Korean MBI-HSS version was used in a study of HWs at community health centers [28].

Both MBI-HSS and MBI-HSS (MP) consist of three independent subscales: EE, DP, and PA. Each questionnaire comprises 22 items: 9 items about EE, 5 items about DP, and 8 items about PA. The responses were measured using a 7-point Likert scale as follows: 0 points for "Never", 1 point for "Less than once a year", 2 points for "Less than once a month", 3 points for "2–3 times a month", 4 points for "Once a week", 5 points for "2–3 times a week", and 6 points for "Every day". High EE and DP with low PA scores indicated a higher level of burnout. The commonly used cut-off points of EE, DP, and PA are 27, 10, and 33, respectively [29].

Following the MBI advice that the sum of all subscale scores is not an ideal indicator of burnout [26,27], we calculated the scores per subscale and interpreted them separately. Cronbach's α, the test score reliability indicator for each subscale at the time of scale development by Maslach and Jackson [30], was 0.90 for EE, 0.79 for DP, and 0.71 for PA. The reliability of the subscales in this study was 0.92 for EE, 0.84 for DP, and 0.90 for PA.

2.4. Ethical Considerations and Data Collection

Before data collection, we obtained approval from the institutional review board (IRB) of the Seoul Medical Center regarding adherence to ethical guidelines and permission to view the responses (no. SEOUL 2021-01-002-003). The collected responses did not contain any information that could identify the participants. To avoid data leakage, we viewed the data only in the office of the hospital of the employee health promotion team. Moreover, the document file was encrypted with a password and saved on a computer that could only be accessed by the researcher. A total of 200 responses were retrieved and used in the analysis. The research data file will be disposed of three years after the research is complete.

2.5. Data Analyses

We used R and SPSS for Windows (version 26.0; IBM Corp., Armonk, NY, USA) to analyze the data. The data set included the following variables: general characteristics of the participants, burnout related to COVID-19, fear of COVID-19 infection, job satisfaction, anxiety, depression, job stress, available hospital resources, additional compensation for overtime work, and support from family and friends. The reliability of the scales was measured using Cronbach's α. Regarding the general characteristics of the participants, we calculated the frequency, percentage, mean, and standard deviation. To analyze the differences in burnout components (EE, DP, and PA) according to the general characteristics, we used the following tests: Student's *t*-test, Welch's *t*-test, analysis of variance, Kruskal–Wallis test, and Scheffe's post hoc test. Pearson's correlation test was used to analyze correlations. These test results were used to ensure that only informative variables were selected to avoid the curse of dimensionality. To explore the factors that affected burnout related to COVID-19, we performed three different multiple regression analyses, where the explanatory variables were the statistically significant variables from the difference tests and correlation analysis, and the dependent variables of burnout were the EE, DP, and PA scores.

3. Results

3.1. General Characteristics

Most of the participants were women, college graduates, and health practitioners. In terms of satisfaction with the work environment and health condition, they perceived it to be above average. The number of female participants was approximately three times higher than that of male participants. Regarding age, the ratio of participants under 40 and above 40 years was almost the same. Moreover, the number of married people was 1.6 times higher than that of single people. As for job type, nurses accounted for 41.5% and doctors accounted for 24.0%. The other health workers (OHWs) accounted for 34.5% of the participants. Of all participants, 73.5% belonged to a job category that required interaction with patients. Participants who were likely to interact with suspected COVID-19 patients accounted for 31.0%. Of all participants, 72.0% perceived themselves as having a middle or high socioeconomic status. Regarding satisfaction with the work environment, the ratio of satisfied and dissatisfied was approximately 6:4 (Table 1).

Table 1. General characteristics, other variables, and differences in COVID-19-related burnout (N = 200).

Variable	Value	*n* (%)	EE Mean ± SD	*t*, *W*, or χ^2 (*p*)	DP Mean ± SD	*t*, *W*, or χ^2 (*p*)	PA Mean ± SD	*t*, *W*, or χ^2 (*p*)
sex	male	47 (23.5)	19.30 ± 12.84	−4.80 (0.00)	8.60 ± 6.33	−2.85 (0.01)	29.02 ± 11.57	0.41 (0.68)
	female	153 (76.5)	28.69 ± 11.37		11.78 ± 6.81		28.30 ± 10.10	
age	<40	102 (51.0)	28.42 ± 11.08	2.28 (0.02)	11.68 ± 6.40	1.37 (0.17)	30.56 ± 8.53	2.92 (0.00)
	≥40	98 (49.0)	24.47 ± 13.33		10.36 ± 7.20		26.30 ± 11.77	
education level	high school	26 (13.0)	22.31 ± 10.98	7.48 (0.02)	11.23 ± 7.17	0.70 (0.71)	24.31 ± 9.78	7.11 (0.03)
	college	134 (67.0)	28.00 ± 12.84		11.23 ± 6.88		28.66 ± 10.26	
	graduate school	40 (20.0)	24.12 ± 10.74		10.22 ± 6.49		30.55 ± 10.94	
marital status	single	76 (38.0)	29.50 ± 12.20	2.74 (0.00)	12.14 ± 7.02	1.82 (0.07)	29.53 ± 8.26	1.21 (0.23)
	married	124 (62.0)	24.64 ± 12.14		10.35 ± 6.63		27.82 ± 11.55	
job category	doctor	48 (24.0)	25.67 ± 9.08	12.70 (0.00)	10.92 ± 5.33	4.52 (0.01)	32.25 ± 8.38	5.56 (0.01)
	nurse	83 (41.5)	31.30 ± 11.85		12.55 ± 7.09		27.86 ± 9.55	
	other health worker (OHW)	69 (34.5)	21.26 ± 12.82		9.28 ± 7.07		26.58 ± 12.09	
workload of directly interacting with patients	None	16 (8.0)	24.19 ± 12.08	9.06 (0.03)	12.12 ± 6.03	4.63 (0.20)	21.38 ± 9.90	15.12 (0.00)
	very few	37 (18.5)	21.57 ± 13.80		9.08 ± 7.57		24.70 ± 12.03	
	<1/4 of work hours	11 (5.5)	23.45 ± 10.97		9.45 ± 4.46		31.45 ± 7.02	
	≥1/4 of work hours	136 (68.0)	28.34 ± 11.74		11.56 ± 6.79		30.09 ± 9.71	
workload of treating suspected COVID-19 patients	none	40 (20.0)	20.70 ± 11.27	24.10 (0.00)	9.00 ± 6.35	10.22 (0.08)	26.45 ± 11.44	3.25 (0.36)
	very few	98 (49.0)	25.77 ± 12.10		10.61 ± 6.83		28.97 ± 10.60	
	<1/4 of work hours	33 (16.5)	30.09 ± 11.27		12.85 ± 6.66		30.67 ± 8.83	
	≥1/4 of work hours	29 (14.5)	32.79 ± 12.27		13.17 ± 6.85		27.07 ± 9.96	
socioeconomic status	high	26 (13.0)	24.38 ± 9.99	0.59 (0.56)	10.19 ± 5.39	0.18 (0.91)	34.88 ± 6.21	13.11 (0.00)
	middle	118 (59.0)	27.16 ± 12.04		11.19 ± 6.63		28.43 ± 9.45	
	low	56 (28.0)	26.04 ± 14.01		11.07 ± 7.83		25.57 ± 12.60	
satisfaction with work environment	very satisfied	7 (3.5)	18.57 ± 10.74	42.81 (0.00)	6.29 ± 5.41	31.15 (0.00)	23.86 ± 16.86	3.51 (0.32)
	satisfied	106 (53)	22.02 ± 10.83		8.86 ± 5.70		29.50 ± 9.97	
	dissatisfied	73 (36.5)	31.82 ± 10.40		13.73 ± 6.63		28.41 ± 9.66	
	very dissatisfied	14 (7.0)	36.43 ± 16.68		15.79 ± 8.43		23.29 ± 12.98	

Table 1. *Cont.*

Variable	Value	*n* (%)	EE Mean ± SD	*t*, *W*, or χ^2 (*p*)	DP Mean ± SD	*t*, *W*, or χ^2 (*p*)	PA Mean ± SD	*t*, *W*, or χ^2 (*p*)
current health condition	excellent	5 (2.5)	19.40 ± 9.32	41.34 (0.00)	6.80 ± 4.97	26.84 (0.00)	33.60 ± 9.66	2.35 (0.67)
	good	73 (36.5)	21.79 ± 10.89		9.55 ± 6.23		28.08 ± 11.00	
	average	84 (42.0)	26.46 ± 10.82		10.23 ± 5.77		29.01 ± 9.49	
	poor	35 (17.5)	35.51 ± 12.94		15.46 ± 7.62		27.51 ± 11.01	
	very poor	3 (1.5)	47.67 ± 5.69		25.00 ± 5.00		25.33 ± 19.66	

Variable	Mean ± SD (range)
working duration in the current department (mth)	50.08 ± 66.45 (0–300)
working duration in the current job (mth)	72.33 ± 75.83 (0–396)
number of rotating shifts within a month (day)	7.50 ± 9.64 (0–24)
job satisfaction	50.92 ± 13.75 (20–100)
anxiety	7.49 ± 2.78 (0–21)
depression	8.87 ± 3.34 (0–21)
job stress	49.09 ± 10.60 (10.71–90.87)
hospital resources for COVID-19	12.35 ± 3.22 (6–20)
support from others	10.32 ± 2.27 (4–16)
working overtime and compensation	6.38 ± 0.59 (5–8)
EE score	26.48 ± 12.36 (0–54)
DP score	11.03 ± 6.82 (0–30)
PA score	28.47 ± 10.44 (0–48)

3.2. Burnout and Other Variables

The mean EE, DP, and PA scores were 26.48, 11.03, and 28.47, respectively. These were worse than the means of a medicine group (n = 1104) provided for comparison in the fourth edition of the MBI manual [27], where the mean EE, DP, PA scores were 22.19, 7.12, and 36.53, respectively. The median fear of COVID-19 infection was 6 and its interquartile range (IQR) was 4. Regarding job satisfaction, the mean was 50.92, which was between "satisfied" and "slightly satisfied". Regarding anxiety and depression, the means were 7.49 and 8.87, respectively, almost or above the cut-off point (8 points). Regarding job stress, the mean was 49.09, which was close to the median. As for hospital resources for COVID-19 and support from others, the mean was close to the median and between "slightly disagree" and "slightly agree" (Table 1).

3.3. Difference Testing, Correlation Analysis, and Multiple Regression Analysis

Based on the mean difference test and correlation analysis of EE scores, the variables that were found to be statistically significant were as follows: sex, age, education level, marital status, job category, number of rotating shifts within a month, workload of directly interacting with patients, workload of treating suspected COVID-19 patients, satisfaction with work environment, current health condition, fear of COVID-19 infection, job satisfaction, anxiety, depression, job stress, and hospital resources for COVID-19. Based on the mean difference test and the correlation analysis of DP scores, the variables that were found to be statistically significant were as follows: sex, job category, working duration in the current department, workload of treating suspected COVID-19 patients, satisfaction with work environment, current health condition, fear of COVID-19 infection, job satisfaction, anxiety, depression, job stress, and hospital resources for COVID-19. Based on the mean difference test and the correlation analysis of PA scores, the variables that were found to be statistically significant were as follows: age, education level, doctor, workload of directly interacting with patients, socioeconomic status, job stress, and working overtime and

compensation. For all the mean difference tests and correlation analyses, the significance level of 0.05 was used.

We used the Durbin–Watson test to detect the presence of autocorrelations. The heteroscedasticity and autocorrelation consistent (HAC) covariance matrix estimation were used to overcome autocorrelations [31]. The variance inflation factor was used to test for multicollinearity. All variables had variance inflation factor (VIF) values between 1.118 and 2.465, indicating no multicollinearity.

Based on the multiple regression analysis of EE, the variables that were found to be statistically significant included sex, marital status, workload of treating suspected COVID-19 patients, fear of COVID-19 infection, anxiety, and depression. Significant variables for DP included nursing, working duration in the current department, and anxiety. When adjusting the significance level up to 0.10, satisfaction with the work environment and depression were included. Significant variables for PA included workload of directly interacting with patients, socioeconomic status, and job stress. The regression models of EE, DP, and PA explained 52.08%, 34.98%, and 14.94%, respectively, of the variance in their scores for COVID-19-related burnout (Table 2).

Table 2. Multiple linear regression analysis for burnout (N = 200).

Burnout Component	Variable	*B*	*SE*	*β*	*t* (*p*)		CI	*F* (*p*)	R^2	R^2 (adj)
EE	intercept	2.20	9.66		0.22	(0.82)		13.72 (<0.001)	0.56	0.52
	sex (female)	3.61	1.68	0.12	2.14	(0.03)	(0.29, 6.92)			
	age	−0.85	1.59	−0.03	−0.53	(0.60)	(−3.99, 2.30)			
	education level	0.33	1.21	0.02	0.28	(0.78)	(−2.05, 2.72)			
	marital status (married)	−3.07	1.45	−0.12	−2.12	(0.04)	(−5.92, −0.21)			
	nursing (yes)	−0.48	1.89	−0.02	−0.26	(0.80)	(−4.22, 3.25)			
	working duration in the current department	−0.02	0.01	−0.10	−1.63	(0.10)	(−0.04, 0.00)			
	number of shifts within a month	−0.08	0.08	−0.06	−1.00	(0.32)	(−0.24, 0.08)			
	workload of directly interacting with patients	−0.48	0.83	−0.04	−0.58	(0.56)	(−2.13, 1.16)			
	workload of treating suspected COVID-19 patients	2.05	0.76	0.16	2.70	(0.01)	(0.55, 3.54)			
	satisfaction with work environment	−1.59	1.26	−0.09	−1.26	(0.21)	(−4.07, 0.90)			
	current health condition	0.36	1.03	0.02	0.35	(0.73)	(−1.67, 2.39)			
	fear of COVID-19 infection	0.68	0.29	0.16	2.33	(0.02)	(0.10, 1.26)			
	job satisfaction	−0.07	0.06	−0.07	−1.09	(0.28)	(−0.19, 0.05)			
	anxiety	1.00	0.33	0.26	3.02	(<0.001)	(0.35, 1.65)			
	depression	0.96	0.29	0.26	3.37	(<0.001)	(0.40, 1.53)			
	job stress	0.13	0.09	0.11	1.49	(0.14)	(−0.04, 0.30)			
	hospital resources for COVID-19	0.16	0.27	0.04	0.58	(0.56)	(−0.38, 0.69)			

Table 2. *Cont.*

Burnout Component	Variable	*B*	*SE*	*β*	*t* (*p*)		CI	*F* (*p*)	R^2	R^2 (adj)
DP	intercept	4.10	5.60		0.73	(0.47)		9.92 (<0.001)	0.39	0.35
	sex (female)	0.68	1.25	0.04	0.63	(0.59)	(−1.78, 3.15)			
	nursing (yes)	−2.30	1.06	−0.17	−2.18	(0.03)	(−4.40, −0.20)			
	working duration in the current department	−0.09	0.01	−0.18	−2.84	(<0.001)	(−0.03, −0.07)			
	workload of treating suspected COVID-19 patients	0.66	0.45	0.09	1.47	(0.14)	(−0.23, 1.55)			
	satisfaction with work environment	−1.75	0.90	−0.17	−2.17	(0.05)	(−3.50, 0.01)			
	current health condition	0.20	0.74	0.02	0.31	(0.79)	(−1.26, 1.66)			
	fear of COVID-19 infection	0.13	0.16	0.04	0.62	(0.43)	(−0.19, 0.45)			
	job satisfaction	−0.02	0.04	−0.03	−0.42	(0.70)	(−0.10, 0.07)			
	anxiety	0.78	0.16	0.32	3.78	(<0.001)	(0.47, 1.10)			
	depression	0.32	0.17	0.16	1.76	(0.06)	(−0.02, 0.65)			
	job stress	0.04	0.05	0.06	0.68	(0.45)	(−0.06, 0.13)			
	hospital resources for COVID-19	0.02	0.16	0.01	0.13	(0.90)	(−0.30, 0.34)			
PA	intercept	42.64	10.58		4.03	(<0.001)		5.99 (<0.001)	0.18	0.15
	age	−1.54	1.62	−0.07	−0.98	(0.34)	(−4.74, 1.66)			
	education level	−0.78	2.07	−0.04	−0.51	(0.71)	(−4.87, 3.31)			
	doctor (yes)	0.70	2.62	0.03	0.32	(0.79)	(−4.46, 5.87)			
	workload of directly interacting with patients	1.94	0.89	0.19	2.44	(0.03)	(0.18, 3.70)			
	socioeconomic status	3.10	1.49	0.19	2.51	(0.04)	(0.15, 6.05)			
	job stress	−0.20	0.07	−0.21	−2.99	(<0.001)	(−0.35, −0.06)			
	working overtime and compensation	−2.22	1.54	−0.13	−1.67	(0.15)	(−5.25, 0.81)			

Note: Ordinal variables: education level, workload of directly interacting with patients, workload of treating suspected COVID-19 patients, satisfaction with work environment, current health condition, fear of COVID-19 infection, hospital resources for COVID-19. Integers 0 to $n - 1$ are assigned to the values of ordinal variables, where n is the number of values. Reference groups for dummy variables were sex (male), nursing (no), and doctor (no).

3.4. Hierarchical Regression Analysis

We performed three sets of hierarchical regression analyses (HRA) to see whether adding four different groups of variables significantly improved the model's ability to predict the burnout. For each analysis, the predictor variables were entered within four successive steps. The order in which groups of variables were added is as follows: sociodemographic group, COVID-19 group, work overload group, and psychological group. The groups for EE, DP, and PA were constituted by statistically significant variables in Table 2 for each component type. Thus, the composition of each group varies depending on the component type. A sociodemographic group can be constituted of sex, age, education level, marital status, socioeconomic status, current health condition, nursing, or doctor. A COVID-19 group can be constituted of fear of COVID-19 infection, workload of treating suspected COVID-19 patients, or hospital resources for COVID-19. A work overload group

can be constituted of working duration in the current department, number of rotating shifts within a month, workload of directly interacting with patients, satisfaction with work environment, job satisfaction, or working overtime and compensation. A psychological group can be constituted by anxiety, depression, or job stress.

Regarding EE, in the first step, the sociodemographic group accounted for 28.0% of variance in burnout ($p < 0.001$). In the second step, the COVID-19 group explained an additional 9.9% of the variance ($p < 0.001$). In the third step, the work overload group explained an additional 4.8% of the variance ($p < 0.05$). In the fourth step, the psychological group explained an additional 13.4% of the variance ($p < 0.001$).

Regarding DP, the group of the first step accounted for 14.8% of variance in burnout ($p < 0.001$). The groups of the second, third, and fourth step, respectively, explained an additional 4.7% ($p < 0.001$), 6.4% ($p < 0.05$), and 12.9% ($p < 0.001$) of variance in burnout.

Regarding PA, the COVID-19 group was not considered for the HRA since there is no statistically significant variable of the COVID-19 group in Table 2. In the first step, the sociodemographic group accounted for 10.6% of variance in burnout ($p < 0.001$). The work overload group in the second step and psychological group in the third step, respectively, explained an additional 3.5% ($p < 0.05$) and 3.8% ($p < 0.05$) of the variance in burnout.

4. Discussion

This study is significant in that it investigated the burnout of all HWs working at the same hospital during the early stages of treating the COVID-19 pandemic, and analyzed the factors of burnout from multiple perspectives in terms of its three components (EE, DP, and PA). This section explains burnout based on the significant variables of each component and proposes concrete strategies to mitigate burnout.

4.1. Situation of Hospital Health Workers in South Korea Compared to Other Countries

According to a survey of possible burnout for 2707 healthcare professionals in 60 countries in April 2020, 51% of respondents reported burnout [32]. In addition, in a systematic review analyzing 11 studies of healthcare professionals' burnout conducted mainly in April–May 2020, the prevalence of overall burnout was 49.3% to 58% [33]. In Korea, as a result of a regular survey of about 67,000 health and medical workers conducted by the Korean Health and Medical Workers' Union (KHMWU) in February 2019, before the outbreak of COVID-19, 70.6% of respondents complained of physical and mental burnout. This is even higher compared to the reported burnout rate during COVID-19 in other countries. As a result of a regular survey conducted in March 2021 by KHMWU in about 43,000 health and medical workers, 69.6% of the respondents complained of physical exhaustion, and 65.8% of them were mentally exhausted. Of the total respondents, 78.7% answered that their daily life had deteriorated, and 70.6% of the respondents answered that their psychological state also deteriorated [34,35]. As such, Korean HWs report chronic burnout every year, and they endure daily physical exhaustion and emotional labor.

4.2. Burnout Level of Korean Hospital Health Workers during the COVID-19 Outbreak

The results show that the Korean participants in this study had much greater risks for burnout in all three aspects (EE, DP, and PA) than other countries. Regarding the means of each component during the COVID-19 outbreak, the mean of the participants' EE was 26.48 points out of 54 points, DP was 11.03 points out of 30 points, and PA was 28.47 points out of 48 points. By comparison, a study conducted among frontline healthcare professionals who worked during the peak of the COVID-19 pandemic in Italy showed the following: 22.7 points in EE, 6.1 points in DP, and 37.5 points in PA [36]. In another study carried out among health professionals in Italy [37], the means were 22.3 points in EE, 4.7 points in DP, and 33.7 points in PA. Compared with these findings, the participants in this study scored higher in EE and DP and lower in PA, which may have resulted from the exceptional surge in COVID-19 infections in Korea. To illustrate, after the first confirmed patient was found in Korea in January 2020, the number of patients grew rapidly across the

local community due to a large-scale group infection centering on a religious organization in late February [38,39]. This led to an increase in the number of screening sites and the establishment of strong measures against the spread of COVID-19. Therefore, the surge in patients may have influenced the burnout levels of HWs in this study.

In EE and DP, burnout was found to be worse for doctors and nurses than OHWs; it was worse for nurses than doctors in all three aspects of burnout. The burnout levels of nurses are worse than those from large-scale studies in other countries. To illustrate, a study conducted among 2014 Chinese nurses in February 2020 showed 23.44 in the mean score of EE, 6.77 in the mean score of DP, and 34.83 in the mean score of PA [13]. Likewise, another large-scale study carried out among 12,596 Chinese HWs in April 2020 showed 19.1 in the mean score of EE, 5.5 in the mean score of DP, and 29.0 in the mean score of PA [15]. In addition, a study carried out among HWs in Saudi Arabia [16] showed that nurses scored high in EE (24.70 points) and DP (8.37 points) compared to other job categories including doctors, who scored 22.85 points in EE and 7.36 points in DP. In PA, nurses scored low (34.22 points) compared to doctors (35.70 points).

4.3. Factors Influencing Emotional Exhaustion (EE)

The results of this study show that the factors affecting EE include sex, marital status, workload of treating suspected COVID-19 patients, fear of COVID-19 infection, anxiety, and depression. The level of EE is likely to increase under the following conditions: being female, single, having frequent contact with suspected COVID-19 patients, a strong fear of COVID-19 infection, and serious levels of anxiety and depression. In the hierarchical regression analysis, the psychological group demonstrated the greatest predictive power of EE. Similarly, the results of a study conducted among medical and administrative staff at a tertiary hospital in Italy during the COVID-19 pandemic [40] showed that the factors affecting the levels of EE, which was measured using the MBI-GS (General Survey), included sex, living condition, workplace, length of working experience, occupation, pre-existing psychological problems, COVID-19-related traumatic events, increased conflict among colleagues, additional task assignment, increased workload, and interpersonal avoidance. According to the study, females and people living alone had a higher level of EE compared to males and people living with family/other relatives. Comparatively, people working in administration, non-COVID wards, and frontline services caring for patients with COVID-19 had lower levels of EE than those working in an intensive care unit (ICU), frequently interacting with COVID-19 patients, and having a higher probability of infection. The results of the present study are consistent with another study conducted in Italy [37], which showed that being female, being in contact with COVID-19 patients, and fear of COVID-19 infection predicted increases in EE. Furthermore, the results of the present study are consistent with the findings of family division and trait anxiety in a study conducted among physicians and nurses in northern Italy [40]. A study conducted in Saudi Arabia [16] also showed that direct involvement in the management of COVID-19 patents increased the levels of EE.

Among the three job categories, there was a statistically significant difference in the EE scores. The results of the post hoc test show that the EE score for nurses was the highest. It is necessary to identify factors that increase nurses' EE, such as anxiety, depression, fear of infection and death [13], and come up with measures to strengthen factors that decrease nurses' EE, such as self-efficacy and resilience [13].

4.4. Factors Influencing Depersonalization (DP)

The factors that affected DP as a sign of burnout included nursing, working duration in the current department, satisfaction with work environment, anxiety, and depression. DP was worse for nurses than for doctors and OHWs. DP increased when the period of continuous service in the department was longer and when the satisfaction with the work environment was higher. Furthermore, DP levels increased as the levels of anxiety and depression increased. In the hierarchical regression analysis, the psychological group

demonstrated the greatest predictive power of DP. A study conducted in Saudi Arabia [16] also found an association between DP and satisfaction with work environment and showed that DP levels are higher when working more than 8 h during the COVID-19 pandemic, when performing on-call duties, and when job duties are changed. In a study among health professionals in Italy [37], work hours were found to be one of the predictors of DP during the COVID-19 pandemic. In a study conducted in northwest Italy [41], DP during COVID-19 increased as the level of anxiety increased. The findings of this study are consistent with meta-analysis research [42], which reported that "greater experience through years worked" is one of the factors that decreases HWs' risk of adverse psychological outcomes during virus outbreaks.

4.5. Factors Influencing Personal Accomplishment (PA)

The factors that affected PA included the workload of directly interacting with patients, socioeconomic status, and job stress. The levels of PA increased when interacting more frequently with patients and when socioeconomic status was higher. Meanwhile, PA decreased when job stress was high. In the hierarchical regression analysis, the psychological group demonstrated the greatest predictive power of PA. The results of this study are similar to the findings of a study conducted in Saudi Arabia [16], which suggested that PA levels during the COVID-19 pandemic are positively associated with direct involvement with the care of COVID-19 patients. The findings of this study are also supported by research conducted among emergency workers in Italy [43], which reported that emotional stress and cognitive stress decreased PA. According to a meta-analysis study [42], lower household income was included as one of the risk factors that increased HWs' adverse psychological outcomes during virus outbreaks.

As it is ambiguous whether reduced PA is a result of or a manifestation of burnout [44], it is necessary to first consider the strategies that can be applied to both EE and DP. In this study, anxiety and depression were found to be predictors of both EE and DP. Therefore, first, it is necessary to discover the factors with the greatest impact on both anxiety and depression and, second, to establish and implement practical measures to relieve them. From an administrative standpoint, it is important to change the work environment so that hospital staff can feel that they are managing well autonomously without being overwhelmed by their jobs. This also helps them improve their work competency, job satisfaction, and mental health [45,46].

4.6. Comprehensive Strategies Considering the Three Components of Burnout

In addition to mitigating anxiety and depression, which are required for improving the levels of EE and DP, job stress is one of the factors that affects PA. Therefore, measures to lower psychological stress, simultaneously with anxiety and depression, should be considered. As preventive interventions, resilience, and social support were reported as mediator variables for psychological problems among HWs during the COVID-19 pandemic [47], it is essential to establish a policy that reflects these variables. To this end, it is imperative for individual employees and hospitals to collaborate and establish measures that can analyze and regulate the factors that cause anxiety, depression, and job stress during a pandemic by accurately diagnosing mental health conditions through counseling with professionals and operating a tailored counseling program.

It is also imperative to explore strategies to strengthen the resilience of hospital HWs to mitigate EE and DP, as well as to improve PA. Resilience can be defined as maintaining or recovering mental health during significant adversity, such as a potentially traumatic event, challenging life situation, major life change, or physical illness [48]. Furthermore, hardiness is a trait of resilience [49]. During the COVID-19 pandemic, resilience works as a protective factor and elicits a positive outcome by reducing burnout and stress [43] while improving performance, productivity, and satisfaction [50]. Therefore, by proactively introducing educational programs to improve and strengthen HWs' hardiness and by offering these programs regularly, it will be possible for hospital staff to proactively counter and regulate

their stress, stemming from work-related burden and interpersonal relationships, during a traumatic event such as COVID-19.

4.7. Response Policies at the National and Hospital Level

Currently, Korea is monitoring the mental health of frontline pandemic responders at the national level. The South Korean government launched the National Center for Disaster Trauma (NCDT) and began to operate the "COVID-19 Integrated Psychological Support Team" within a month after the COVID-19 pandemic began in January 2020. As the number of complaints about burnout related to COVID-19 increased among HWs and government officials, the NCDT and Korean Society of Traumatic Stress Studies published guidelines on psychosocial care for infectious disease management [51] and distributed them in March 2020. In addition to the guidelines, the Ministry of Health and Welfare and NCDT announced plans in May 2020 to provide burnout prevention education, counseling, and burnout management programs based on tailored consultation with individuals and organizations to prevent and monitor the job stress and burnout of COVID-19 responders [52].

In this study, satisfaction with the work environment was found to be a predictor of the levels of DP. Similarly, a safe and healthy working condition was found to mitigate DP in a study conducted among nurses in Malaysia [53], and a large-scale study conducted among nurses in China during COVID-19 also showed a significant statistical difference in DP depending on the level of work safety [13]. Moreover, a systematic review listed many attributes of the work environment that can mitigate DP as follows: pleasantness of tasks, value/meaning of work, emotional reward, and making a difference [54]. Thus, organizational management can mitigate the levels of DP by focusing on the following aspects: work hours, work environment, work patterns, work speed, work autonomy, education and training, communication within the organization, violence and discrimination, accidents and diseases, and work incentives [55].

According to this study's findings, the workload of direct patient care was found to be a conflicting factor in improving EE and increasing PA. A high frequency of direct encounters with suspected COVID-19 patients increased EE, while a heavier workload of direct patient service improved PA. Thus, by expanding minimum contact systems and equipment, the burden of direct contact with suspected COVID-19 patients can be reduced. However, PA decreased because of a decrease in the workload of the direct patient service. Therefore, to maintain proper levels of PA, it is important to imitate and take advantage of direct patient services by providing contactless channels for HWs to sufficiently communicate with patients. For example, South Korea creatively developed and operated drive-through screening centers and walk-through screening centers [56,57]. The walk-through system is an efficient system that uses a booth to minimize the physical contact between the HWs and patients, protecting the medical staff with minimal protective equipment and shortening the testing time. Such a minimum contact system can help prevent passive treatment behavior due to a decrease in contact because of fear of infection. Nevertheless, it cannot be denied that reduced contact between HWs and patients can pose a danger to patients. Therefore, the degree of non-contact should be determined in line with the patient's safety.

Burnout is a critical problem that adversely effects not only HWs, but also patients and the overall healthcare environment. When employee burnout is not properly monitored, it leads to intention to leave, reduced job performance, missed care, general health problems, mental health problems, and reduced job satisfaction; from the patients' perspective, it can lead to poor quality of care, poor patient safety, adverse events, negative patient experience, medication errors, infections, and patient falls [58]. Therefore, preemptive burnout management is essential for hospital employees as well as for the effective treatment, care, and safety of patients. It is necessary to provide the opportunity for COVID-19 responders to debrief on their psychological experience and manage their mental health from the early

stage of an outbreak of an infectious disease, since previous studies have shown that HWs display psychological trauma caused by epidemic outbreaks [59–61].

As such, the central and local governments' countermeasures against the COVID-19 pandemic, which have continued from its early stages, are timely policies for reducing the burnout of COVID-19 responders and further preventing post-traumatic stress disorder (PTSD). These findings are in line with the WHO guidelines that highlight mental health and psychosocial support for HWs during the COVID-19 pandemic [62], as well as with the U.S. CDC guidelines [63] on how to cope with stress and build resilience for healthcare personnel and first responders.

4.8. Limitations and Suggestions for Follow-Up Studies

This study had the following limitations. First, this study limited its scope to the situation at one medical institution in one country during the COVID-19 outbreak, so caution should be exercised in generalizing the findings. Although this study's findings cannot be applied to hospitals with different sizes and conditions, the research method used in this study can help identify the influencing factors of burnout components at different hospitals. Second, this study excluded some factors that can influence the burnout of hospital employees during a pandemic such as COVID-19. For example, other variables such as job demand, job control, value congruence, role conflict, decision latitude [58], or the presence of psychological comorbidities [33] should be considered in a follow-up study.

Based on the study findings, we suggest a stepwise approach that identifies the predictors of burnout components (EE, DP, and PA), selects the most vulnerable job category based on the identified predictors, and then manages the target job category, preferentially improving predictors that can exert a favorable influence on other job categories. We also suggest that follow-up studies should identify biomarkers and somatization in the workforce responding to infectious diseases by referring to the psychosomatic symptoms of burnout [64], biomarkers such as salivary cortisol, or biochemical parameters such as HbA1C [65].

5. Conclusions

During a pandemic of a novel infectious disease such as COVID-19, the government and hospital healthcare policy managers should consider the potential for burnout in HWs who first encounter patients and provide treatment. The results of this study show that, in the early stages of the response to COVID-19, the burnout (EE, DP, PA) levels of doctors and nurses at a general hospital were worse than that of other hospital HWs in EE and DP; the burnout levels of nurses were worse than those of doctors in all three aspects. The factors that affected EE related to COVID-19 were sex, marital status, fear of COVID-19 infection, anxiety, and depression; DP was affected by nursing, working duration in the current department, anxiety, and depression; and PA was affected by workload of directly interacting with patients, socioeconomic status, and job stress.

This study is significant for several reasons. First, this study referred to results from an exhaustive survey conducted among employees at one medical institution, who experienced the early stage of COVID-19; therefore, it was possible to identify and explain burnout mechanisms based on the characteristics of diverse job categories and work environments. Second, this study performed three different multiple regression analyses using EE, DP, and PA as the dependent variables, and identified significant factors for each component to enable the establishment of tailored policies according to the burnout component. The multi-perspective approach of this study can help establish macroscopic and comprehensive countermeasures at the institution level.

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Data Availability Statement: The datasets generated and analyzed during the current study are not publicly available due to personally sensitive records but are available from the corresponding author upon reasonable request.

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Prolonged Stress Causes Depression in Frontline Workers Facing the COVID-19 Pandemic—A Repeated Cross-Sectional Study in a COVID-19 Hub-Hospital in Central Italy

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Abstract: The COVID-19 pandemic has severely tested the mental health of frontline health care workers. A repeated cross-sectional study can provide information on how their mental health evolved during the various phases of the pandemic. The intensivists of a COVID-19 hub hospital in Rome were investigated with a baseline survey during the first wave of the pandemic in April 2020, and they were contacted again in December 2020, during the second wave. Of the 205 eligible workers, 152 responded to an online questionnaire designed to measure procedural justice, occupational stress (effort/reward imbalance), sleep quality, anxiety, depression, burnout, job satisfaction, happiness, and turnover intention. Workers reported a further increase in workload and compassion fatigue, which had already risen during the first wave, and a marked reduction in the time devoted to meditation and mental activities. A low level of confidence in the adequacy of safety procedures and the need to work in isolation, together with an increased workload and lack of time for meditation, were the most significant predictors of occupational stress in a stepwise linear regression model. Occupational stress was, in turn, a significant predictor of insomnia, anxiety, low job satisfaction, burnout, and intention to leave the hospital. The number of workers manifesting symptoms of depression increased significantly to exceed 60%. Action to prevent occupational risks and enhance individual resilience cannot be postponed.

Keywords: emergency; infectious disease; organizational justice; stress; loneliness; compassion fatigue; meditation; prayer; insomnia; mental health; perspective study

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1. Introduction

The pandemic of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has dramatically tested health services all over the world. Since being hit by the first wave of the epidemic in the spring of 2020 [1] and the second wave in the autumn of the same year [2], Italy has been one of the countries most affected. For health care workers (HCWs) the two waves posed different problems. In the first phase of the outbreak, the sudden overload of work, the lack of protective equipment, fear of infection, insufficient knowledge of safety procedures, and uncertainty about treatment criteria were among the major problems [3,4]. In the second phase, once the shortage of devices had been resolved, the new safety procedures had been assimilated, and the therapeutic protocols had been consolidated, the psychosocial problems related to the on-going epidemic became evident. At the same time, public opinion towards HCWs was beginning to rapidly move in a more negative direction [5].

Since the early months of the COVID-19 epidemic, numerous scientific papers have considered the possibility that frontline HCWs are being affected by post-traumatic stress, anxiety, depression, and burnout. During epidemics, intensivists are among the most vulnerable HCWs on account of infections and mental health problems [6]. Residents have the greatest difficulties in adapting to the new security measures [7]. After Lai et al. [8] estimated the prevalence of distress in Chinese HCWs to be 71.5%, extensive research has also led to a large number of systematic reviews and meta-analyses [9–13] that have confirmed a high prevalence of occupational distress and mental health problems in HCWs treating COVID-19 patients. In frontline HCWs, the pooled prevalence of anxiety has been estimated to range from 23.2% [11] to 32.0% [10] and that of depression from 22.8% [11] to 28% [10]. However, all the studies included in these reviews were cross-sectional or, at best, retrospective. Psychic symptoms in HCWs were generally compared to "normal values", administrative staff, or external samples; moreover, many studies lacked a control group [14]. Overall, a lack of pre-/post-longitudinal studies made it impossible to distinguish the effect of the pandemic from that of all other pre-existing stressors in hospital work. Only exceptionally, in fact, did researchers have mental health data collected before the pandemic to compare with those recorded during the pandemic. For example, Kok et al. compared data on the prevalence of burnout before of the pandemic with those recorded during the pandemic peak in ICU personnel from a university medical center, having a 50% response rate at follow-up. The study indicated that overburdening of HCWs during an extended period of time had increased the symptoms of burnout [15]. Burnout, however, is a morbid condition that occurs after exposure to chronic stress and is therefore not the first indicator of mental health that can be altered by an epidemic [16]. There are conflicting findings on the epidemiology of burnout among HCWs working in COVID-19 wards: some studies have found a reduction in burnout rates, for example in US neurosurgeons [17], in French geriatric facilities [18], and in Chinese frontline nurses, compared with ordinary ward workers [19]. The mental health of HCWs can vary according to many factors and is hardly homogeneous for all groups of workers, even in the same company or department. A survey conducted in March–April 2020, on the staff of an Italian local health unit, showed that the levels of occupational stress, anxiety, and depression during the first phase of the epidemic were on average no higher than those recorded over the years in the cohort. However, HCWs who had unprotected contact with COVID-19 patients and even more those who had SARS-CoV-2 positive nasopharyngeal swab had an increased risk of insomnia, anxiety, and depression compared to their colleagues [4].

As noted, in the absence of pre-/post-studies, further longitudinal study is needed to distinguish psychological symptoms during and after the infectious disease outbreaks [20]. With the onset of the pandemic, many researchers have carried out short-term longitudinal studies (one to three months) on specific topics relating to the mental health of HCWs. The studies published so far have been conducted online and anonymously, without the possibility of tracking respondents; consequently, the surveys carried out at different moments of the pandemic do not represent longitudinal studies, in which the incidence of mental disorders can be evaluated, but repeated cross-sectional studies, with comparison of prevalence and mean values. All these studies have a very short duration, from one to three months, and have had a very low response rate: the number of participants was always much smaller than the total achievable population, and participation decreased very rapidly over time. For example, Sasaki et al. performed a prospective online cohort study of a population of 4120 full-time employees, measuring psychological distress in the last 30 days by the Brief Job Stress Questionnaire. The two-months longitudinal study recruited a mixed population of 996 people, 111 of whom were HCWs [21]; the participation dropped to 83 HCWs vs 863 controls in the eighth month [22]; on both occasions the HCWs had a higher mean stress score than the controls. Several research groups have observed that stress and anxiety levels tend to decrease in the transition between the attack and the stationary phase of the pandemic. Chew et al. performed a three-months repeated survey of residents in Singapore, recruiting two small groups of responses corresponding,

respectively, to 49% and 39% of the people contacted and showing a reduction of perceived stress and perceived stigma levels compared to baseline [23]. Cai et al. observed a reduction in acute symptoms of stress recorded online by nurses in a large Chinese hospital in January and February 2020, corresponding to the attack and stationary phases of the pandemic [24]. Other researchers focused on sleep quality [25] and the effectiveness of cognitive behavioral therapy to prevent symptoms of stress [26]; on resilience [27,28]; on the relationship between leadership style and psychological safety and distress [29], and on the gradual adaptation of personnel to new safety procedures, with a reduction in anxiety and stress levels [30,31].

The summary of the prospective studies available so far shows that the evidence on the association between pandemic and mental health of HCWs is still limited. Repeated long-term cross-sectional studies are needed to determine how the mental health of frontline workers evolved during the different phases of the pandemic. These studies should consider several aspects of mental health at the same time, rather than focusing on a single psychological aspect or phenomenon.

In this article we report the results of a repeated cross-sectional study on the frontline workers of one of the two COVID-19 hub hospitals in Latium, Italy. The baseline survey, conducted during the first wave of the pandemic (April–May 2020), found that most workers reported high work-related stress; one out of three reported insomnia; one out of four experienced anxiety, and the majority reported depressive symptoms [32]. The workers expressed a modest level of confidence in their safety measures and reported a significant reduction in physical activity, meditation, and relaxation—the commonest ways of increasing resilience. Younger trainee workers (residents) expressed a significantly lower level of confidence in prevention measures than anesthesiologists, and this lack of organizational justice was associated with increased occupational stress [33].

Eight months after that study, when the second wave of infections was producing its effects, we set out to assess the condition of the workers who had continued to work in the hub hospital. This investigation was carried out before the start of the vaccination campaign. Our primary objectives were to assess the wellbeing and mental health of the workers after the first ten-month struggle with the virus and to evaluate the extent to which their attitude towards the pandemic had changed. Our ultimate aim was to identify the measures that would be most effective in preventing prolonged stress from impairing the health of workers.

2. Materials and Methods

2.1. Participants

All the workers in the anesthesiology department of the "A. Gemelli" University hospital in Rome (n = 205) who were directly involved in caring for suspected or confirmed cases of COVID-19 were emailed to invite them to participate in our survey. Their answers were collected anonymously on the SurveyMonkey online platform. Participation was completely voluntary and not economically incentivized. Participants were enrolled between 14 December 2020, and 5 January 2021. A reminder mail was sent twelve days after commencing the investigation.

Of the 205 eligible workers, 152 completed the survey (participation rate = 74.1%). Participants were mainly young (70.4% under 35 years of age), female (93, 61.2%) workers. Of those taking part, 105 were physicians and 47 were nurses (30.9%). About a quarter of the participants (34, 22.4%) had been working in the hospital for less than one year; about a quarter (42, 27.6%) had worked there for 1–3 years, and half of the participants (76, 50%) had been employed in the hospital for more than three years. Many of the workers who had responded to the first survey, conducted eight months earlier, had quit their jobs. Forty workers (26.3%) had not participated in the previous survey, while over half of the participants (87, 57.2%) confirmed that they had already answered at baseline. Most participants (80, 52.6%) reported unprotected exposure to SARS-CoV-2 patients (Table 1). Six of them reported having had a false-positive antigen test at the periodic screening all

hospital workers undergo, and 26 (17.1%) had contracted COVID-19. Most of the workers who had contracted the infection had mild symptoms that did not require treatment (16, 61.5%) or were completely asymptomatic (7, 26.9%); only 3 had mild symptoms that required home treatment.

Table 1. Characteristics of the population.

Variable	1st Wave		2nd Wave	
	N	%	*N*	%
Gender, male	85	47.2	59	38.8
Age, <35 years	104	57.8	107	70.4
Physician	154	85.6	105	69.1
Reporting unprotected exposure to COVID-19 patients	46	25.6	80	52.6
Participated in the previous survey	-	-	87	57.2
Reporting a false-positive swab test	-	-	6	3.9
Reporting COVID-19 disease	-	-	26	17.1

The survey was conducted in accordance with the Helsinki Declaration. The Catholic University Ethics Committee approved the study (ID 3292).

2.2. Questionnaire

The questionnaire used in this study consisted of a series of ad hoc questions, referring to the specific working conditions, obtained from the suggestions of a focus group composed of qualified anesthetists and from a panel of validated questionnaires. In this second survey, some changes in the ad hoc section were made in order to identify specific conditions of the second phase of the epidemic. To avoid the lengthening of compilation times, two of the standardized questionnaires already used in the baseline survey in extended form were administered in reduced form.

The questionnaire was composed of 43 questions divided into 6 sections. The average time required for completion was 5 min. The questionnaire contained a section (11 items) regarding socio-demographic factors that could influence the outcome, e.g., gender, age class, length of service, type of work, and accident status (unprotected contacts with COVID-19 cases, positive oropharyngeal tests, previous infection). The second section (10 items) investigated the main changes in occupation and lifestyle caused by the epidemic.

Work-related stress was measured with the Italian version [34] of the "Effort Reward Imbalance" (ERI) questionnaire [35,36]. Responses were graded on a 4-point Likert scale from 1 = "strongly disagree" to 4 = "strongly agree". The effort subscale was based on three questions (e.g., "My job has become more and more demanding"); the total score ranged from 3 to 12. The reward subscale was based on seven questions (e.g., "I receive the respect I deserve from my superior or an equivalently qualified person"); consequently, this score ranged from 7 to 28. Internal consistency reliability scores of the two effort and reward sub-scales in this study were 0.751 and 0.820, respectively (good) [37]. The difference between efforts and results was measured as a weighted ratio of effort and reward. Values above one were considered indicative of distress.

The fourth section contained three questions on procedural justice (PJ) regarding the regularity of safety procedures. This was measured using the Italian version [38] of the Colquitt Scale [39–41] by means of 3 items (e.g., "Are these procedures error-free?"). Each question was answered according to a 5-point Likert scale, from 1 = "I totally disagree" to 5 = "I strongly agree", thus producing a scale ranging from 3 to 15. In this study, the reliability of the questionnaire, measured by Cronbach's alpha, was 0.665 (acceptable).

The next section, concerning positive and negative aspects of work, contained a question on job satisfaction, expressed on a 7-point Likert scale ranging from extremely dissatisfied to extremely satisfied, according to Warr et al. [42]; a question about happiness, on a 10-point scale, according to Abdel-Khalek [43]; a question on burnout, on a 6-point

scale, according to West et al. [44], and finally a question regarding the possibility of leaving the hospital (yes/no).

Psychological symptoms were measured with the Italian version [45] of the "Goldberg Anxiety and Depression Scale" (GADS) [46], composed of 18 binary items on anxiety (9 items) and depression (9 items). Typical questions were: "Have you had difficulty relaxing?" for anxiety, and "Have you felt lethargic?" for depression. Persons with an anxiety score of 5 points or more, or a depression score of 2 or more, were classified as potentially anxious. In this study, the reliability of the GADS subscales, measured by Cronbach's alpha, was 0.784 for anxiety and 0.693 for depression (acceptable).

Sleep quality was measured with the 2-item version of the "Sleep Condition Indicator" (SCI-02) [47,48], which aims to assess insomnia according to the Diagnostic Statistic Manual 5 (DSM5). Each question was graded on a 5-point Likert scale, ranging from 4 to 0. The final score ranged between 0 and 8, with higher values indicating better sleep quality. Cronbach's alpha was 0.814 (good). A score of $\leq$4 revealed possible insomnia disorder.

2.3. Statistics

The variables were analyzed in descriptive terms, mean and standard deviation for continuous variables, and frequency for categorical variables. The results obtained in the second wave were compared with those of the first wave by Student's t test for continuous variables, Mann Whitney's test for ordinal variables, and chi square test for categorical variables. The comparison of the observations conducted at the baseline (T_0) and at the follow-up (T_1) was carried out both by including all the workers, and by excluding from T_1 those workers who were not present at T_0.

The role of pandemic-induced changes on occupational stress level was investigated using a stepwise linear regression model. The independent variables included in the model were gender, age, physical activity, meditation, procedural justice, workload, monotony, compassion fatigue, isolation at work, and social loneliness. The perceived effort–reward imbalance was set as a dependent variable. In the stepwise method based on the *p*-value of F, the model starts by entering the variable with the smallest *p*-value (PIN $p < 0.05$); it then adds the second strongest predictor with the smallest *p*-value for F and so on. Variables already in the equation are removed if their *p*-value becomes larger than the default limit (POUT $p > 0.1$) due to the inclusion of another variable.

The relationship between perceptions of justice and stress and outcomes was studied by simple linear regression analysis for continuous variables (sleep quality, anxiety, and depression) and logistic regression for binary variables (sleepless, anxious, depressed, satisfied, happy, with burnout, willing to leave work).

Analyses were performed using IBM/SPSS 26.0 (IBM Corporation, Armonk, NY, USA).

3. Results

When questioned about changes in their work due to the pandemic, workers reported a significant increase in workload and compassion fatigue resulting from the need to inform relatives of the death of a patient. These problems, which had already been described in the survey conducted during the first wave, were reported with a significantly increased frequency in the second wave (Table 2). The difference with what was observed at the baseline remains highly significant, even excluding from the calculation the workers who did not participate in the first survey. Most workers complained of having to work in isolation, and of being severely isolated in their social life (Table 2). Workers also reported a major change in public opinion between the first and second phases of the pandemic. Nine out of ten (87.4%) observed that in the first phase of the epidemic, between March and May 2020, people expressed appreciation and trust in HCWs, while in the current stage (December 2020), 91.0% believed HCWs were viewed less favorably than in the past.

Table 2. Changes reported during the COVID-19 outbreak and prevalence of high stress, insomnia, anxiety, and depression during the 1st and 2nd waves.

Reported Effect	1st Wave		2nd Wave			2nd Wave *		
	N	%	*N*	%	*p*	*N*	%	*p*
Increased/greatly increased workload	94	52.2	126	88.1	0.000	91	85.8	0.000
The work became more repetitive and monotonous	54	30.6	43	30.1	0.589	34	32.1	0.485
More frequent need to inform of the death of a relative	56	36.7	88	61.6	0.000	65	61.3	0.000
Isolation at work	-	-	72	50.4		53	50.0	
Isolation in life	-	-	115	80.5		84	79.2	
Time for physical exercise was shorter/much shorter	141	88.3	117	81.8	0.099	84	79.2	0.395
Time for meditation was shorter/much shorter	87	48.3	97	67.9	0.000	67	63.2	0.003
High stress (effort/reward weighted ratio >1)	139	77.2	118	83.1	0.192	91	85.8	0.105
Insomniac (SCI08 score $\leq$16; SCI02 score $\leq$ 4)	79	43.9	57	40.1	0.499	64	60.4	0.561
Anxious (GADS anxiety score $\geq$5)	45	25.0	45	31.3	0.212	32	29.9	0.442
Depressed (GADS depression score $\geq$2)	89	49.4	90	62.5	0.019	68	63.6	0.028

SCI08 = Sleep Condition Indicator; SCI02 = Sleep Condition Indicator, short form, two items; GADS = Goldberg Anxiety and Depression Scale; * excluding workers who were not present at T_0.

As for the factors that increase resilience, free time spent on physical activity and meditation was reduced or seriously reduced for most of the participants (81.8% and 67.9% for physical and spiritual activities, respectively) (Table 2). About one-third of the participants (31.5%) did not believe that meditative prayer could lead to spiritual wellbeing or that it was an important part of life. A favorable attitude towards prayer had a weak correlation with occupational rewards (Spearman's rho = 0.180, $p = 0.03$).

The perception of justice in safety procedures (range 3–15) yielded an average value of 7.90 $\pm$ 2.26, considerably lower than the maximum. The average value was located at the 53rd percentile. In the survey conducted during the first wave, the perception of justice was measured on a scale containing a larger number of items than was used in the second wave. In the first survey, the mean response was found to be in the 53rd percentile (Table 3). The two observations, therefore, do not register a change in the HCWs' perception of organizational justice and correctness of security measures.

Table 3. Mental health indicators (perceived justice, occupational stress, sleep quality, anxiety, depression) in anesthesiologists during the 1st and 2nd waves of the COVID-19 outbreak.

Variable	1st Wave Mean $\pm$ s.d. (% max)	2nd Wave Mean $\pm$ s.d. (% max)	*p*	2nd Wave * Mean $\pm$ s.d. (% max)	*p*
Procedural Justice **	31.8 $\pm$ 7.3 (52.8%)	7.9 $\pm$ 2.3 (52.7%)		7.8 $\pm$ 2.4 (52.0%)	
Effort	8.6 $\pm$ 1.9 (71.7%)	9.6 $\pm$ 1.7 (80.0%)	0.000	9.6 $\pm$ 1.6 (80.0%)	
Reward	16.5 $\pm$ 3.6 (58.9%)	16.0 $\pm$ 4.1 (57.1%)	0.251	16.0 $\pm$ 4.2 (57.1%)	
Job stress	1.31 $\pm$ 0.49	1.54 $\pm$ 0.63	0.000	1.54 $\pm$ 0.61	0.001
Sleep quality *	21.2 $\pm$ 8.2 (66.2%)	4.78 $\pm$ 2.38 (59.7%)		4.91 $\pm$ 2.44 (61.3%)	
Anxiety	3.04 $\pm$ 2.29	3.39 $\pm$ 2.45	0.193	3.39 $\pm$ 2.35	0.222
Depression	1.98 $\pm$ 1.82	2.74 $\pm$ 2.06	0.000	2.58 $\pm$ 1.78	0.007

* Excluding workers who were not present at T_0; ** the questionnaire was administered in a reduced form in the 2nd survey.

An analysis of the occupational stress perceived by workers indicated, on average, a prevalence of the effort made to work over the material and intangible rewards received. Effort (range 3–12) was on average 9.64 $\pm$ 1.66, i.e., about 80% of the maximum. Effort increased significantly in the second wave compared to the first ($p < 0.001$). Reward (range 7–28) was 16.01 $\pm$ 4.08, close to 57% of the maximum score; no significant increase was observed compared to previously recorded reward levels. Consequently, mean ERI was

1.54 ± 0.63, and the vast majority of workers (118, 83.1%) were in a state of distress. The situation confirmed and underlined what had been observed in the first phase, with a very significant statistical increase in occupational stress (Table 3).

The average quality of sleep, measured by the SCI02 (range 0–8), was low (5.22 ± 2.39, 65% of the maximum score), and a large number of workers (105, 73.9%) suffered from insomnia. The number of workers who could be classified as "suffering from insomnia" was substantially similar to the estimate made in the first wave. Mean anxiety and depression scores, measured with GADS, were moderately high for anxiety (3.39 ± 2.45), and particularly high for depression (2.74 ± 2.06). According to the diagnostic criteria of the questionnaire, 45 workers (31.3%) were likely to suffer from clinically relevant anxiety syndrome and 90 (62.5%) from depression. Compared to the first wave, there was a slight but not significant increase in mean anxiety scores, whereas the increase in the mean score and number of cases for depression was very significant (Tables 2 and 3).

The mean score for occupational satisfaction, measured as indicated by Warr et al. on a scale ranging from extremely dissatisfied to extremely satisfied, was 4.05 ± 1.48, corresponding to "I am uncertain". A total of 51.4% of the workers were moderately, very, or extremely satisfied. The average score for happiness in life, measured on a scale from 1 to 10, was 6.46 ± 1.97. When asked how often workers experienced burnout—an occupational condition characterized by emotional exhaustion, depersonalization and a low sense of personal achievement—the average response was 3.56 ± 1.58. This level corresponded to the "several times a month" option.

To the question "Have you thought about leaving this job?" 60 workers (42.6%) answered affirmatively.

The association between occupational changes brought about by the pandemic and work-related stress was studied by stepwise linear regression. The resulting model, which explained a significant share of the variability ($R^2 = 0.34$), indicated that stress was dependent on lack of procedural justice, increased workload, isolation at work (having to work alone), and lack of time for meditation and relaxation. Gender and age were not included in the model. Similarly, monotony, compassion fatigue, social loneliness, and physical activity were excluded from the model (Table 4).

Table 4. Second wave. Stepwise linear regression analysis. Relationship between job changes and perceived work-related stress (ERI).

Variable	ERI	
	Standardized Beta	*p*
Procedural Justice	−0.310	0.001
Workload	0.270	0.001
Isolation at work	0.199	0.007
Meditation	−0.151	0.034
Determination coefficient of the model (R^2)		0.343

Variables excluded from the model: gender, age class, monotony, compassion fatigue, social loneliness, physical activity.

The relationship between perceived justice, occupational stress, and mental health outcomes was studied using simple linear regression models. Effort was a highly significant predictor of low sleep quality, anxiety, and depression (Table 5).

Table 5. Second wave. Health outcomes associated with procedural justice and occupational stress. Linear regression analysis adjusted for age and gender.

Variable	Sleep Quality		Anxiety		Depression	
	Standardized Beta	*p*	Standardized Beta	*p*	Standardized Beta	*p*
Procedural justice	0.169	0.062	−0.110	0.220	0.065	0.453
Effort	−0.349	0.000	0.345	0.000	0.364	0.000
Reward	0.059	0.521	−0.067	0.464	−0.151	0.091

Effort significantly increased the odds of being diagnosed as insomniac, anxious, depressed, or burned out, and it significantly reduced the odds of being satisfied and happy. On the other hand, the perception of procedural justice had a protective effect on insomnia, while reward significantly increased the odds of work satisfaction. The intention to leave the hospital was significantly predicted by effort, while reward was a strong protective factor (Table 6).

Table 6. Second wave. Health outcomes associated with procedural justice and occupational stress. Multivariate logistic regression model adjusted for age and gender.

Variable	Insomniac [1]		Anxious [2]		Depressed [3]	
	OR (CI95%)	*p*	OR (CI95%)	*p*	OR (CI95%)	*p*
Procedural justice	**0.794** (0.646, 0.977)	0.029	0.950 (0.766, 1.177)	0.639	0.980 (0.805, 1.193)	0.838
Effort	**1.780** (1.342, 2.360)	0.000	**1.858** (1.360, 2.539)	0.000	**1.363** (1.063, 1.748)	0.015
Reward	1.053 (0.942, 1.178	0.365	0.951 (0.841, 1.075)	0.421	0.956 (0.857, 1.067)	0.420
Variable	**Satisfied [4]**		**Happy [5]**		**Burned out [5]**	
	OR (CI95%)	*p*	OR (CI95%)	*p*	OR (CI95%)	*p*
Procedural justice	1.006 (0.806–1.257)	0.955	0.911 (0.755, 1.100)	0.334	1.083 (0.873, 1.344)	0.467
Effort	**0.515** (0.375, 0.706)	0.000	**0.771** (0.604, 0.983)	0.036	**1.918** (1.398, 2.631)	0.000
Reward	**1.277** (1.115, 1.463)	0.000	1.103 (0.991, 1.227)	0.073	0.940 (0.834, 1.060)	0.312
Variable	**Intention to leave**					
	OR (CI95%)	*p*				
Procedural justice	1.049 (0.859, 1.281)	0.639				
Effort	**1.413** (1.077, 1.852)	0.012				
Reward	**0.792** (0.699, 0.896)	0.000				

Notes: [1] = SCI02 score ≤4; [2] = GADS anxiety score ≥5; [3] = GADS depression score ≥2; [4] = moderately, very, or extremely satisfied; [5] = dichotomized at the median.

4. Discussion

This study, which is the second cross-sectional survey on frontline workers in a COVID-19 hub hospital in Rome where the baseline interview took place during the first wave of the outbreak [4], illustrates how the mental health of these workers evolved in relation to the pandemic. The high workload, isolation at work, uncertainty about safety procedures, and the sharp reduction in the time devoted to meditation and relaxation have led to a significant increase in occupational stress, which for over 80% of workers

is characterized by a discrepancy between the effort made to work and the material and immaterial rewards received as a result of work.

At ten months from the outbreak of the COVID epidemic, the share of workers who felt they had been overworked, had reduced time for meditation, and had suffered compassion fatigue significantly increased compared to baseline. This continual state of tension has led to a high rate of sleep and anxiety disorders and low levels of job satisfaction and happiness. Between the first and second wave of the pandemic, the most alarming factor is the increase in cases of depression. More than 60% of workers had a score exceeding the cut-off level, corresponding to a 50% chance of being diagnosed as "depressed" when examined by a specialist. Over 40% of workers considered quitting their job, and about a quarter of those who took part in the first survey no longer worked in the hospital.

Our study demonstrates the effect the COVID-19 pandemic has had on the mental health of intensivists. To the best of our knowledge, this is the first study that has used a long-lasting, repeated, cross-sectional design to evaluate changes in the level of mental health induced by the prolonged duration of the pandemic. This is also one of the few studies that has not focused on a specific parameter of mental health, but it has sought to assess the complex set of factors that include the perception of justice of safety procedures, specific stressors related to the pandemic (such as compassion fatigue), individual resources, and relaxation techniques to understand the variation in occupational stress and the consequences of sleep, anxiety, depression, burnout, job satisfaction, and happiness in life. We are convinced that our study can make a substantial contribution to the consolidation of evidence concerning the effects of the pandemic on the mental health of HCWs.

Some of the factors found to be associated with occupational stress in our survey were reported in previous research. For example, excessive workload [49], isolation or lack of support at work [50], the lack of procedural justice, or insufficient information about the outbreak and protective measures [51] were found to increase stress in frontline HCWs. Our research revealed that lack of time for meditation was strongly associated with stress. It is well known that meditation can significantly increase workers' resilience [52], and meditative prayer has been used to prevent burnout in workers [53]. Mindfulness techniques have been used to support HCWs struggling with COVID-19 [54]. Moreover, in our study, a positive attitude towards prayer was associated with greater reward; this result is in agreement with the observation of a Taiwanese team, indicating the positive effect of religion on psychological resilience in HCWs during the pandemic [55].

The effects found in our cohort correspond to those reported by other researchers: insomnia [56], anxiety [11], burnout [16], reduced happiness [57], lack of job satisfaction, and turnover intention [58] are common in HCWs. Many of these outcomes remained constant in our cohort between the first and second wave, and it is not easy to understand whether they were a result of the pandemic or were already present in the population. However, we observed a significant increase in workload and compassion fatigue, and a further reduction in the time devoted to meditation and mental activities, between the first and second waves. These factors were accompanied by an increase in what were already very frequent cases of depression, especially among the younger sector of the population. In fact, this has now become the dominant condition, concerning 6 out of 10 HCWs.

The observations conducted led us to suggest and implement preventive measures. To reduce the workload, the first, elementary measure is the increase in the workforce; though it is difficult to have highly skilled people when the epidemic poses an immediate need. An emergency measure implemented, in this as in other hospitals, was to hire the trainees on a fixed-term contract. These young workers have made an essential contribution to therapeutic activities; however, although carefully prepared and specifically trained on the new security measures needed to deal with the pandemic and supported by the work of a team of experienced workers, they perceived an average level of informational justice lower than other workers, and this increased their occupational stress [11]. The sudden assumption of responsibility and the abrupt change in work habits were certainly very strong stressors. Experience shows that, out of pandemic, a training course should be

provided, which should include capacity building on the management of major accidents and the development of specific skills, such as wearing safety clothing and working in it.

During a pandemic, personnel policy should become more flexible and play an important role in moderating occupational stress. When it is not possible to limit the effort required by a protracted emergency, rewards for workers must be increased. The rapidity of an epidemic makes it necessary to immediately create incentives for productivity and make work attractive; otherwise, if the inertia of bureaucracy prevails, there is the possibility of observing, as in this case, that many workers have left the company between the first and second wave, and many others intend to do so. The loss of skilled personnel is a real threat.

A specific effort must address the mental health of frontline workers. During the pandemic, the workers who requested it received free psychotherapeutic support. However, the use of this aid was only episodic and certainly late. The dramatic experience of the pandemic has taught us that, regardless of it, a continuous effort to promote health should be conducted in all major hospitals. Teaching sleep hygiene, developing relaxation techniques, promoting physical activity, and meditation and prayer should always be done. At critical moments, psychological support should be offered, especially to counter the compassion fatigue and interference with family and social life that epidemics pose.

The main strength of this study lies in its prospective design, the only one that enables us to record how the perception of stress and the mental health of workers have evolved in relation to the pandemic. The analysis of stress and mental health at various times of the pandemic and after its conclusion will help to disentangle the effect of the epidemic from that of other common stressors in health care activities. Several epidemiological studies based on repeated cross-sectional models have been announced or have published baseline reports [59–63]. This study is the first to document the mental health differences of HCWs at the start of the pandemic and after ten months, when the second wave had its effects and vaccines were not yet available. Another strong point is the fact that it has recruited intensivists from one of the two COVID hub centers in Central Italy. Many HCWs have been struggling with one or more COVID-19 patients and could be defined as "frontline workers"; the sample examined in this study, however, is composed of a small group of workers who worked exclusively and continuously with COVID-19 patients. The increased prevalence of depression symptoms we have observed is certainly an effect attributable to working conditions during the pandemic. The weakness inherent in the survey method is that no objective verification can be made of the reliability of the answers provided. The brevity of the questionnaire was a further limitation: it had to be very short because the frontline workers had very little time to devote to responding, and if they were interrupted during the survey, the system prevented them from continuing the compilation. For this reason, in this second survey, we adopted the short form of the procedural justice and sleep quality scales, in order to restrict compilation time to within 5–7 min without omitting to measure the variables of interest.

The protection of mental health in HCWs is of paramount importance for ensuring quality care [64,65]. We are convinced that preventive intervention is urgently required and that, in addition to individual support action aimed at increasing resilience, this should include a series of structural provisions designed to increase the workforce, optimize production flows, lower workloads, and provide greater rewards.

5. Conclusions

The long duration of the pandemic has exposed the frontline HCWs to an unprecedented strain. Excessive and prolonged workload, isolation, uncertainty about safety measures, lack of time for meditation have resulted in widespread distress and this in turn was associated with various signs of impaired mental health. The prospective nature of this study allowed us to demonstrate the increased prevalence of depression in intensivists, who are a key figure in the treatment of patients affected by COVID-19. A set of organizational and supportive measures are needed to increase the well-being of workers and the quality of care.

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Article

"It's Been Ugly": A Large-Scale Qualitative Study into the Difficulties Frontline Doctors Faced across Two Waves of the COVID-19 Pandemic

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Abstract: This study aimed to gain an uncensored insight into the most difficult aspects of working as a frontline doctor across successive COVID-19 pandemic waves. Data collected by the parent study (CERA) was analysed using conventional content analysis. Participants comprised frontline doctors who worked in emergency, anaesthetic, and intensive care medicine in the UK and Ireland during the COVID-19 pandemic (n = 1379). All seniority levels were represented, 42.8% of the sample were male, and 69.2% were white. Four themes were identified with nine respective categories (in parentheses): (1) I'm not a COVID hero, I'm COVID cannon fodder (exposed and unprotected, "a kick in the teeth"); (2) the relentlessness and pervasiveness of COVID ("no respite", "shifting sands"); (3) the ugly truths of the frontline ("inhumane" care, complex team dynamics); (4) an overwhelmed system exacerbated by COVID (overstretched and under-resourced, constant changes and uncertainty, the added hinderance of infection control measures). Findings reflect the multifaceted challenges faced after successive pandemic waves; basic wellbeing needs continue to be neglected and the emotional impact is further pronounced. Steps are necessary to mitigate the repeated trauma exposure of frontline doctors as COVID-19 becomes endemic and health services attempt to recover with inevitable long-term sequelae.

Keywords: COVID-19; frontline workers; healthcare workers; qualitative research; moral injury

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1. Introduction

The 2019 Novel Coronavirus (COVID-19) pandemic has caused global devastation with over 4.9 million deaths reported to the World Health Organisation (WHO) at the time of writing (October 2021) [1]. The critical role of frontline doctors and healthcare workers (HCW) more broadly during the pandemic cannot be understated. However, this has not come without cost; it has been predicted that at least 115,000 of the recorded deaths due to COVID-19 have been in HCW [2]. In addition to infection risks [3,4], substantial evidence has illustrated the psychological impact of working on the COVID-19 frontline, with high rates of psychological distress and traumatic stress being found in HCW globally [5–10]. These findings mirror morbidities observed in frontline staff during previous infectious disease outbreaks [11], which reflect high risk of long-term psychological sequelae without timely intervention [12,13].

Various guidelines have been issued during the pandemic with recommendations on how to protect HCW wellbeing [14–18]. However, many of these were developed rapidly when little was understood about the experiences of those working on the COVID-19

frontline [19]. Research has since shown that there is a misalignment between what frontline staff perceived as being important and the recommendations that were prioritised in these initial wellbeing guidelines [18], emphasising the importance of attending to the lived experiences of HCW during the pandemic in order to better understand how to mitigate the inevitable impact of working on the frontline [18,20].

Qualitative evidence reporting on HCW experiences during the first wave of the COVID-19 pandemic highlighted the occupational and psychological pressures associated with working on the frontline [20]. Common themes included high workloads; fear of infection to self, family and loved ones; inadequate personal protective equipment (PPE); lack of training to cope with changing occupational demands; and moral injury (the distress experienced in response to clashes with moral codes [21]) [20,22–30]. These themes transcend the COVID-19 pandemic, echoing those drawn out from HCW experiences during previous infectious disease outbreaks such as Ebola and SARS [20]. Similar challenges have also been recorded in the quantitative literature and have consistently been shown to be associated with poorer mental health outcomes for HCW including post-traumatic stress and psychological distress during the COVID-19 pandemic [9,10,31].

Qualitative research to date has primarily explored HCW experiences in the COVID-19 pandemic using traditional semi-structured interviews, but there is evidence to suggest that important insights are being missed, potentially due to participants self-censoring their accounts [23]. Stigma [32], loyalties, and fear of legal/organisational repercussions could result in HCW concealing the less socially desirable aspects of the pandemic during interviews [23]. Gaining insight into these experiences, no matter how 'ugly', is crucial in order to learn from the pandemic and mitigate future risks.

Bennett et al. [23] were able to gain "uncensored access to their stories" (p. 6) by encouraging HCW to anonymously audio-record their experiences in the Covid-19 pandemic using an online platform, enabling the researchers to discover new themes not previously identified in the literature. 'Positive phenomena' of the pandemic, such as increased social support and post-traumatic growth [24–26] were absent from the accounts recorded by Bennett et al. [23], indicating that when unprompted by a researcher, HCW may focus primarily on the negative aspects of working during the pandemic. This highlights the benefits of an added layer of anonymity when collecting sensitive qualitative data, as limiting researcher interaction is proposed to reduce the risk of social desirability bias [33], and emphasizes the need to attend to the experiences which matter most to HCW, the challenges of the frontline. However, the findings have limited transferability and resonance as their sample size was small (n = 54) and participants were recruited through social media [34]. Further research which captures a larger more representative sample is needed.

Another limitation of the current qualitative evidence base is the paucity of research exploring HCW experiences specifically during the second wave of the pandemic [30]. At the time of writing (October 2021) the UK experienced successive pandemic waves with the disease now becoming endemic, the first in Spring 2020 and the second in Winter 2020, with the deadliest day and the highest number of hospital admissions being observed during the second wave [35,36]. Although the National Health Service (NHS) has been strained over many years [37,38], the pressures experienced in the second wave were unparalleled, with three quarters of doctors reporting that the second wave had been busier than the first [39], making it uniquely significant as a period of study. This raises significant concerns for wellbeing as the third wave approaches.

Looking to evidence from quantitative research, findings suggest that the second wave had clear psychological repercussions for frontline doctors in the UK and Ireland. From the first to the second wave the prevalence of psychological distress for this group increased from 44.7% to 53.2% and psychological trauma from 22.7% to 28.4% [7–9]. Without qualitative inquiry it is difficult to understand the meaning behind these findings. Further research is needed to gain a deeper understanding of the experiences of frontline doctors across both the first and the second wave of the COVID-19 pandemic and, more specifically, accounts of the challenges they faced, unprompted and in their own words.

Study Aims

This study aimed to gain an uncensored insight into the most difficult aspects of working as a frontline doctor in the UK and Ireland across both the first and second wave of the COVID-19 pandemic.

2. Materials and Methods

This is a qualitative sub-study of the COVID-19 Emergency Response Assessment (CERA) study [7–9,40], delivered by the Trainee Emergency Research Network. CERA is an ongoing longitudinal study investigating the presentation and prevalence of distress in frontline doctors during the COVID-19 pandemic in the UK and Ireland. Data for CERA has been collected using online Research Electronic Data Capture (REDCap) surveys which have been distributed to participants during acceleration and deceleration phases of the pandemic. The present study reports on qualitative data gathered during the second wave of the pandemic as part of the fourth CERA survey distributed to participants.

2.1. Measures

From the fourth CERA survey [8], all data from the General Health Questionnaire (GHQ-12) [41] and the Impact of Events Scale-Revised (IES-R) [42] and demographic questionnaire were extracted and used to describe the sample. The qualitative data used for primary analysis in the study was taken from a single open-ended question, detailed below.

2.1.1. Qualitative Measure

The qualitative data used in this study was derived entirely from a single open-ended question, which asked: 'Please tell us what aspects of working in the pandemic you found particularly difficult?'. This question was designed to elicit reflections on challenges experienced across the pandemic and was not limited by character or accompanied by any prompts. The question was positioned towards the end of the survey.

2.1.2. Quantitative Measures

Quantitative data collected during the fourth CERA survey has been reported in full elsewhere [8]; however, demographic material of those who answered the single-item question stated above was collated for those who participated in this sub-study. Demographic information included participants' gender, age range, ethnicity, parent speciality, and seniority level.

The GHQ-12, a 12 item self-report measure developed to screen for psychological morbidity [41], has demonstrated high internal reliability and validity across a range of populations [43,44].

The IES-R is a 22 item self-report measure which is used to screen for traumatic stress [42]. The IES-R has been found to have high internal consistency and construct validity [45] and has been widely used during this and other pandemics to screen probable post-traumatic stress symptoms in HCW [10,46].

2.2. Participants

The CERA study recruited medical doctors working in emergency medicine (EM), in the intensive care unit (ICU) and in anaesthetics (AN) during the sampling period (first wave of COVID-19 pandemic) in the UK and Ireland; non-doctors and those not working in EM, ICU or AN during the sampling period were excluded [7–9,40]. Full details of the initial recruitment procedure can be found in the CERA study protocol [40].

To be included in the present study, participants needed to have completed the fourth CERA survey [8], provided a text response to the qualitative question and have indicated consent to both of the following statements 'I agree for the CERA data to be shared with other ethically approved research projects (yes/no)' and 'I agree for anonymised data to be shared with other researchers (yes/no)'. Those who did not consent to both of these statements were excluded from the present study.

2.3. Procedure

The fourth CERA survey opened in the UK on 28 January 2021 and closed on 11 February 2021, and in Ireland it opened on 1 February 2021 and closed on 15 February 2021 [8]. Data from participants who indicated consent to both statements were collated and anonymised by the CERA principle investigator (TR) before transferring to the principle investigator of this study (SH) for analysis. All data were stored in accordance with the University of Bath Data Security and Confidentiality Policy and the Data Protection Act 2018.

2.4. Planned Analysis

This study followed an interpretivist paradigm to facilitate an inductive sensemaking process, adopting the perspective that the nature of reality is socially constructed [47]. Analysis was guided by Hsieh and Shannon's [48] conventional content analysis approach to allow categories to flow directly from the data. Content analysis was chosen as it permits the analysis of large amounts of data [49] and has been widely used to understand HCW experiences during the pandemic [28–30].

Analysis was conducted by SH, with input from EJ an experienced qualitative researcher in the field and health psychologist. First, SH engaged in multiple readings of the data for familiarisation and initial impressions were noted. Next, SH coded the first 100 extracts to develop a coding scheme; this was checked by EJ to ensure fit to the data. This scheme was then applied to code the entire dataset using NVivo 12 Pro (QSR International Pty Ltd., Doncaster, Australia) with new codes added if data did not fit within the existing scheme. EJ then double coded 100 extracts to increase robustness of the analysis and any divergent opinions were reviewed and codes revised. Finally, codes were categorised, and these categories were latently analysed to develop themes.

SH kept a reflexive diary throughout analysis to help improve trustworthiness of interpretation [50]. SH has had no contact with participants and does not know any frontline doctors personally. However, SH has had experience working on a similar research project and was mindful that prior familiarity can influence interpretation of the data [51]; SH ensured reflection on this during analysis.

2.5. Ethical Approval

CERA was sponsored by North Bristol NHS trust and received ethical approval from the University of Bath (reference: 4421) and the Ethics Committee at Children's Health Ireland at Crumlin and received regulatory approval from the Health Regulation Authority and Health and Care Research Wales (IRAS: 281944). The present study was granted ethical approval by the University of Bath Psychology Research Ethics Committee (references: 21–138) and was sponsored by the University of Bath and North Bristol NHS trust.

3. Results

Of the 1719 participants who responded to the fourth CERA survey [8], 1384 provided consent for their data to be shared with this study (80.5%). Of those, four did not provide a text response and one indicated that the open-ended question was not applicable. A total sample of 1379 participants remained (80.2% of the original sample) all of which were included in analysis.

3.1. Sample Characteristics

Demographic and psychometric data are reported in Table 1. All seniority levels were represented, with 42.8% of the participants male and 69.2% were white. Nearly a third of participants (32%) had an IES-R score indicating the presence of post-traumatic stress symptoms ($\geq$24). To assess pattern of missing data in the IES-R and GHQ-12, Little's test of Missing Completely at Random (MCAR) [52] test was performed and was found to be non-significant for items in the IES-R $\chi^2 = 719.7$, DF = 858, $p = 1.000$ and the GHQ-12 $\chi^2 = 179.2$, DF = 221, $p = 0.982$, indicating that the data were MCAR. Due diligence manual calculation

and imputation of the median score did not alter the descriptive statistics for the total questionnaire scores. Listwise deletion was therefore used during analysis.

Table 1. Demographic and psychometric data.

Demographic Information	*n* = 1379 (%)
Age	
20–25	32 (2.3)
26–30	282 (20.4)
31–35	286 (20.7)
36–40	218 (15.8)
41–45	189 (13.7)
46–50	144 (10.4)
51–55	124 (9.0)
56–60	74 (5.4)
61–65	25 (1.8)
66–70	5 (0.4)
Gender	
Male	590 (42.8)
Female	742 (53.8)
Other	5 (0.4)
Missing	42 (3.1)
Ethnicity	
White	954 (69.2)
Mixed or Multiple ethnic groups	35 (2.5)
Asian or Asian British	160 (11.6)
Black, African, Caribbean or Black British	25 (1.8)
Other ethnic group	15 (1.1)
Missing	190 (13.8)
Seniority	
Junior doctor	390 (28.3)
Middle grade doctor	261 (18.9)
Senior doctor (consultant grade)	560 (40.6)
Other senior doctor	104 (7.5)
Other doctor grade	64 (4.6)
Parent Speciality	
Emergency medicine	570 (41.3)
Anaesthetics	535 (38.8)
Intensive care medicine	137 (9.9)
Other	185 (13.4)
Psychometric Measures	
IES-R	
Median (Q1,Q3)	16 (7.30)
Range	0–88
PTSD is of clinical concern $\geq$ 24 *n* (%)	441 (32.0)
Probable PTSD $\geq$ 33 *n* (%)	275 (19.9)
Missing *n* (%)	98 (7.1)
GHQ-12 (0-1-2-3)	
Median (Q1,Q3)	16 (12.20)
Range	1–36
Missing *n* (%)	42 (3.0)

Note: PTSD, Post-traumatic stress disorder. Junior doctors: F1, foundation year 1; F2, foundation year 2; ST1–3, general practitioner trainee/specialist trainee years 1–3, F2-ST3, clinical fellow. Middle grade doctor: ST4–8, specialist trainee/clinical fellows years 4–8. Senior doctor: consultant/associate specialist/staff grade/general practitioner/certificate of eligibility for specialist registration.

3.2. Analysis of Qualitative Data

Responses to the single open-ended question ranged from 1 to 575 words, with a median of 21 words per response (IQR = 10,37). Four main themes were identified: I'm not a COVID hero, I'm COVID cannon fodder; the relentlessness and pervasiveness of COVID; the ugly truths of the frontline; and an overwhelmed system exacerbated by COVID. Themes, categories and example quotes can be seen in Table 2. Participants have been identified by gender and professional grade, and when differing viewpoints have been identified in text the corresponding quote numbers have been provided.

3.2.1. I'm Not a COVID Hero, I'm COVID Cannon Fodder

This theme relates to frontline doctors feeling as though their wellbeing had been disregarded during the pandemic and encompasses two categories: exposed and unprotected; and "a kick in the teeth". The first speaks more to doctors' perceptions of safety on the frontline, whereas the second encompasses doctors' reflections on the actions of those external to the frontline.

Exposed and Unprotected

Many participants reported feeling unsafe and inadequately protected on the frontline, with fears of infection and transmission being commonly reported. Accounts of staff becoming infected, seriously ill and in the worst cases dying illustrate the palpable threat to safety. Perceived risks included inadequate PPE; staff and patient none-compliance with hospital safety measures; and delayed vaccinations. Those who spoke of the vaccine rollout conveyed the unfairness of how it was handled, with non-frontline staff appearing to be prioritised, and second vaccinations cancelled at short notice. This left a minority questioning the integrity behind the reason for the vaccine delays. These actions as well as inactions, resulted in anger, anxiety, and the feeling that frontline staffs' safety had been overlooked.

"A Kick in the Teeth"

Participants felt as though the actions and attitude of the Government, NHS trusts and the public were not in support of frontline workers and did not reflect the gravity of the situation. Reports included feeling as though the Government had not acted enough nor acted in the best interests of frontline staff, with frustrations around poor leadership decisions, not enforcing tighter restrictions, PPE procurement, and delaying second vaccinations.

Similar criticisms were raised regarding the lack of support and poor decisions made by NHS trusts, with additional concerns relating to the lack of clear communication from "invisible" management teams. Of particular concern to junior doctors was the disruption to their training; exams were cancelled, training opportunities depleted, and pressures to complete training requirements continued, in the face of what felt like little understanding and support.

Lastly, some participants expressed anger and hurt that people continued to break lockdown rules, noting a change in general attitudes towards the pandemic; particularly distressing was those who deny the pandemic's existence. Overall, there was a real sense of alienation from non-HCW, with frontline staff feeling disregarded, betrayed, and left to fight the COVID-19 pandemic alone.

Table 2. Themes, categories, and example quotes.

Theme	Categories	Example Quotes
1. I'm not a COVID hero, I'm COVID cannon fodder	Exposed and unprotected	i. "Still having PPE below WHO standards i.e., no FFP3 masks for standard use, no protective eye wear—I had to buy my own goggles and using those plastic aprons while the Far Eastern doctors have full body suits to do even swab. Plus no negative pressure zones in my ED." (#112, M, other senior doctor) ii. "Did not feel good when loads of patients generating aerosol I was seeing and a lot of staff getting infected." (#113, M, middle grade doctor) iii. "Angry about how vaccine has been handled . . . Feel I agreed to first dose under false pretences, having gained informed consent for second dose at 3 weeks I don't understand how they can then move the goalposts (we would surely lose registration if we did similar to patients with any medication) I believe this strategy is dangerous at an individual level for clinicians who are more at risk than if they had 2 doses and at a population level with risk of mutation . . . I believe it has been done purely to improve numbers for media purposes and I am so angry that having put our lives at risk for a year we are being forced to be less protected than we could be in terms of ppe and vaccine." (#114, F, senior doctor) iv. "I feel, at times, that I am considered totally expendable and that if I die or become ill not only will it have been preventable with political will, I will simply be an inconvenient statistic. I'm not a COVID hero, I'm COVID cannon fodder." (#115, F, other senior doctor)
	"A kick in the teeth"	v. "Knowing the government was failing in so many ways to support us—failed test & trace, failed PPE procurement, weak messaging, permitted non-compliance with mask-wearing and distancing, set a poor example (Barnard Castle, etc.). We as healthcare providers were alone and utterly unsupported. Apart from the weekly round of applause that was a pointless gesture and felt like a kick in the teeth." (#116, M, junior doctor) vi. "Slow decision making from senior leaders invisibility of some of the executive team who should have been leading us, whilst they still blocked decisions we were making." (#117, F, senior doctor) vii. "In my experience I think the training programmes have had little sympathy or relaxation for how COVID affects training—all the official guidance says there will be extenuating circumstance but when it comes to progression only the most minor of issues are allowed to be attributed to COVID." (#118, F, Other doctor grade) viii. "The poor and frankly disrespectful way NHS Trusts have treated junior doctors (cancellation of leave, asking to work "voluntary" shifts, cancelling vaccine appointments for 2nd dose) has me feeling undervalued, disrespected and constantly angry." (#119, M, junior doctor) ix. "Have felt frustrated when seeing the public blatantly avoiding and not following the rules. It feels a bit disrespectful to ourselves and my colleagues some of whom have sadly lost their lives due to COVID." (#120, M, senior doctor)

Table 2. *Cont.*

Theme	Categories	Example Quotes
2. The relentlessness and pervasiveness of COVID	"No respite"	i. "Unrelenting. Groundhog day." (#132, M, senior doctor) ii. "I am already very tired, worn out, burn out, and this looks like it will never end." (#133, F, junior doctor) iii. "A major incidence is fine but this has basically been a nearly 12 month major incident. Not one person I have spoken to hasn't wished for a positive lateral flow test even if their PCR swab is negative just so it would mean a day or two extra off work." (#134, F, middle grade doctor) iv. "The difficulties of a heavy rota with very little exposure to social activities outside of work (which I personally used as a coping mechanism) has made my risk of burnout increase by a magnitude!" (#135, M, middle grade doctor) v. "Working with it consistently at work, then when at home it I'm being on news, tv and all anyone can talk about. No escape." (#136, M, middle grade doctor) vi. "I am working in the vaccine clinic which I find really enjoyable, no unpleasant events or PTSD." (#137, F, senior doctor)
	"Shifting sands"	vii. "The second/third wave has been much more difficult. Normal presentations have continued at a similar level to normal. Everyone is exhausted and worn out. I've found COVID deniers particularly upsetting." (#138, M, senior doctor) viii. "I was in ED in the first wave and saw a lot of traumatic and distressing scenes . . . This third lock down I've been working (in a different department) have had it relatively easy in comparison to the first wave and to my colleagues. This has left me with feelings of guilt that I'm not doing enough, and working in a different hospital has left me wishing I was where I was before doing the job I did in the first wave so I can help my friends and support them." (#139, F, junior doctor) ix. "It's been much better for the 2nd wave. We've changed how we manage the anaesthetic workload & we feel more in control of our work. The work is stressful & sad but it is a shared experience & we are talking about it with each other." (#140, F, senior doctor)

Table 2. *Cont.*

Theme	Categories	Example Quotes
3. The ugly truths of the frontline	"Inhumane" care	i. "There's one patient who was only comfortable on 60 litres optiflow but we were running out of oxygen and I insisted he change to CPAP to conserve supplies. He needed intubation and then died and I feel guilty that his last conscious memory was of me torturing him with the CPAP mask. A young mother was admitted to ICU on CPAP and we'd just been given an ipad to help families video call: I kept asking the nurses to help her speak to her family but they delayed until it was too late and we had to intubate her, she died without saying goodby (goodbye)." (#121, F, senior doctor) ii. "People on CPAP getting agitated and needing to physically pin them down and give sedation when you don't think there is much hope of them getting better." (#122, M, middle grade doctor) iii. "Communicating bad news to relatives over the phone." (#123, F, senior doctor) iv. "Telling someone that their loved one is going to die over the phone, and then inviting them in to watch them die, when they have't (haven't) seen them for weeks is really traumatic for all." (#124, F, senior doctor) v. "I feel guilty all the time now, as I don't feel like I can be the doctor I would like to be or the doctor I wish would look after my loved ones." (#124, gender unknown, junior doctor) vi. "The patients are becoming in general increasingly difficult—verbal and physical abuse, spitting, hitting us, threatening us with legal action and a family charged into A&E looking to find me with violent intent obvious. This is not uncommon and becoming increasingly common." (#125, F, middle grade doctor)
	Complex team dynamics	vii. "Team bonding has been more difficult since we cannot go out together, we have to keep heing (being) aware of the distance, we cannot share food etc." (#126, M, junior doctor) viii. "My own biggest challenges have been the moral distress of watching colleagues struggle, and worrying about their wellbeing—this has been accentuated by the fact that my own world has been too busy in other related matters to be able to directly offload their workload, leading to feeling inadequate for prolonged spells." (#127, gender unknown, senior doctor) ix. "Shortage of staff. Decreasing staff morale. Cracks in the team." (#128, M, Consultant) x. "The consultant body was extremely against supporting the rota, and this has made the department toxic to work in. This behaviour has filtered down to trainees, staff grades and allied staff. It's been ugly." (#129, M, middle grade doctor) xi. "Pressure to play a meaningful role—my jobs meant I haven't encountered many patients with COVID and therefore I feel I am not playing my part." (#130, F, junior doctor) xii. "The constant noise about how tough the ITU guys have had it has genuinely pissed me off (and I know that is totally unreasonable) because I look at my own specialty (EM) and I think about how bloody awful the last 5 years have been over wintertime—we've had patients dying on our corridors and all the trust ever seemed to want to do was apportion blame, so it got hidden and it was frankly fucking soul destroying- so when I'm asked to feel for my colleagues in the ITU I get that I should be sympathetic (and I can see how hard this is for them) but I don't really feel as though I have anything left . . . Sorry, I know I'm meant to feel differently and I would if I could. I don't think I would say this in an open forum though." (#131, M, senior doctor)

Table 2. *Cont.*

Theme	Categories	Example Quotes
4. An overwhelmed system exacerbated by COVID	Overstretched and under-resourced	i. "This has been one of the worst winters I've ever experienced in my 12 years as a doctor. The bed crisis is shocking and we've gone back to the bad old days of patients being on trolleys in A&E for 12 h just waiting for a bed. We waited 8 h for an ITU bed last week, it's unacceptable." (#101, F, other senior doctor) ii. "Intensity of long shifts in COVID ICU with very high workload, overstetched [overstretched] staffing. Worst week I palliated 3 patients in one week on call. Felt very sad and a little traumatised." (#102, M, senior doctor) iii. "Working in hospitals that run near 100% capacity near 100% of the time (prior to the outbreak) and then expecting and trying to take a service that has little slack and stretching it further. It's been relentless and exhausting, sometimes you are left feeling that despite doing our best we should be doing better but can't given the circumstances/resources." (#103, M, junior doctor) iv. "The numbers of unwell patients—many not suffering from COVID 19—who are attending hospital. Many are more unwell than they would have been in 2019 as the out-patient investigations are not happening quickly enough." (#104, F, senior doctor)
	Constant changes and uncertainty	v. "Ever changing protocols with little to no indication from seniors (consultants or managers) regarding these changes prior or even subsequent to them—nurses definitely seemed to be more in the know than ED registrars." (#105, F, middle grade doctor) vi. "Frequent changes in work area and pattern. Fear of criticism or litigation when working outside normal practice." (#106, F, senior doctor) vii. "I have been moved across 3 hospitals within 12 months, requiring me to move home each time. We have been treated like pawns with no thought to how it affects our personal lives." (#107, M, middle grade doctor)
	The added hinderance of infection control measures	viii. "Wearing PPE, I feel suffocated and experience physical symptoms (headache, overheating) and increased anxiety and brain fog, leading to slow decision making and insecurity and stress." (#108, F, middle grade doctor) ix. "Trying to communicate with patients when wearing a mask especially the elderly as they can't hear and unable to lip read. You can't smile at them to reassure them." (#109, F, other senior doctor) x. "Angry infection control sisters bursting into handovers to tell us only four, not five people are allowed in a room, compromising safe handovers and making us feel like terrible people." (#110, gender unknown, junior doctor) xi. "Limited space for breaks and to eat meals due to social distancing measures. Lack of computer space for the same reason" (#111, M, middle grade doctor)

Note: Participants are identified by #, participant number; M/F, gender; professional grade. CPAP stands for continuous positive airway pressure and comprises a mask and hose/or a nose piece to deliver air pressure to patients [53].

3.2.2. The Pervasiveness and Relentlessness of COVID

At the time of the fourth CERA survey the pandemic had been on-going for just under a year, with many participants working across both the first and the second wave. This theme captures participants reflections on the enduring nature and inescapability of the pandemic, comprising of two categories: "no respite"; and "shifting sands".

"No Respite"

Numerous participants described their workload and the pandemic more generally as "relentless" and "never ending". Accounts indicate that over duration of the pandemic there were limited opportunities to decompress outside of work due to numerous factors including cancellation of annual leave, restrictions to recreational activities, and external pressures such as home schooling. This left many "in the unsustainable position of emotional loading with no outlet" (#119, M, junior doctor) with reports of burnout symptoms, exhaustion and general psychological distress being common. Especially impactful was the loss of social interaction with friends, family, and work colleagues, leading to some doctors' feeling lonely and isolated. Added to these pressures was the reality that COVID was everywhere, at work, at home, in the media—there was "no respite" and "no escape".

In contrast, a small minority of participants reported no difficulties during the pandemic with a few describing positive experiences, indicating that although the majority found the pandemic relentless and challenging, others did not (see Table 2, quote 2.vi).

"Shifting Sands"

Some participants reflected on their experiences across the different waves of the pandemic. Within these reflections were comments indicating that the first wave felt more uncertain and the second more relentless, with one person stating "Last year, the unknown and unceratainty (uncertainty). This year the never ending" (#139, F, senior doctor). Some noted a change in roles across the pandemic, often resulting in increased or reduced feelings of usefulness. Others compared difficulty levels across the waves, the majority of whom reported the second wave as being more difficult. Reasons included increased deaths, younger patients, the relentlessness, and feeling less supported. Nevertheless, a small proportion did report seeing improvements compared to the first wave such as less uncertainty, improved processes, and increased team cohesion.

3.2.3. The Ugly Truths of the Frontline

This theme embodies the 'ugliness' of working on the COVID-19 frontline, capturing the emotive, distressing and often unseen challenges doctors faced. This theme contains two categories: "inhumane" care and complex team dynamics.

"Inhumane" Care

Many participants discussed the unpleasantness of providing patient care during the pandemic, with challenges including complex decision making, increasingly younger patients, and the acuity of illness. Care for COVID patients was repeatedly depicted as being futile due to limited treatment options and the difficulties with delivering a "good death". Accounts were often candid, detailed, and emotive, leaving a sense that participants wanted the reader to truly 'see' the realities of working on the frontline. This included care being described as "torture", "brutal", and "inhumane", indicating the torment some doctors felt about the patient experience during the pandemic.

An important factor related to this was the visitation restrictions, meaning families were not able to be involved in patient care in the way they would normally expect to be. Some participants comments on this were brief and related to communication challenges, whereas other participants' reflected on the distressing nature of breaking bad news down the telephone as well as watching patients suffer, and in the worst cases, die alone (see Table 2, quotes 3.i, iii, iv). Feelings of guilt and sadness were common, with

some participants indicating that they had been traumatised by their experiences caring for patients.

However, it was not just the patients who experienced "inhumane" care on the frontline, as a small minority of participants disclosed experiencing mistrust, aggression, and abuse from patients and relatives. Furthermore, several participants reported problems with patients and relatives not complying with infection control measures in hospitals, placing staff at unnecessary risk.

Complex Team Dynamics

A common depiction within accounts was the sense that participants felt both literally and/or figuratively distanced from their colleagues during the pandemic. Factors related to this included the pressure of working in an emotionally charged environment as well as the separation of colleagues due to social distancing, shielding, and redeployments. Of those who spoke of their colleagues, the majority expressed concerns for their physical and emotional wellbeing, and with this often came a sense of responsibility as well as powerlessness to help. It was clear from some accounts that it was incredibly upsetting to see their colleagues struggling.

On the other hand, others expressed fractious relationships, with repeated reports of lower team morale and colleagues being snappier with one another. Frustrations ranged from minor to more serious, with some reporting feeling unsupported by colleagues' actions such as none-compliance with infection control measures, and others reporting instances of "bullying" and "aggression". A common perception expressed was that some of the team had not "pulled their weight", resulting in frustration for those who felt like they were contributing more to the pandemic efforts, and expressions of guilt and uselessness for those who felt as though they had not done enough. From these accounts, there was a sense that for some only those who were working directly on the frontline (i.e., treating COVID patients in ICU) were considered the true 'heroes' of the pandemic.

3.2.4. An Overwhelmed System Exacerbated by COVID

This theme represents organisational challenges frontline doctors faced with regards to their working environment during the COVID-19 pandemic. This includes pre-existing problems in the NHS as well as the addition of new challenges related to the pandemic. This theme consists of three categories: overstretched and under-resourced; constant changes and uncertainty; and the added hindrance of infection control measures.

Overstretched and Under-Resourced

Many participants reported problems with understaffing and high workload. Factors related to this included increased volume of high acuity patients and the loss of staff to redeployment, sickness and shielding. This was reported as placing unprecedented demands on those left working on the frontline including working long hours and picking up additional shifts. Difficulties with capacity and physical resources were also frequently reported and predominantly pertained to the ED. Participants spoke of lack of flow and overcrowding in ED resulting in corridor medicine and some needing to treat patients in ambulances. Accounts detailed non-COVID patients who presented to services either as acutely unwell due to delaying seeking medical treatment or with ailments that would be better treated in the community. With not enough space and resources for everyone, concerns regarding the standard of care being provided and growing waiting lists were voiced.

Constant Changes and Uncertainty

Participants described being required to work flexibly, with "constantly changing" guidelines, rotas, and roles. Accounts indicate that these changes were happening frequently, rapidly, and often without clear communication or consent. Descriptions of feeling uncertain were common, and it was clear that for some the changes made them feel on edge and out of control.

The Added Hindrance of Infection Control Measures

Although necessary, infection control measures seemed to make an already difficult job even harder. Many participants reported challenges with wearing PPE including inconvenience, severe discomfort and difficulties communicating. Less cited, but seemingly just as disruptive, were the social distancing measures at work, making handovers and debriefs more difficult as not all team members were allowed to be in the room at once. Accounts indicate that participants were not able to perform to the best of their abilities due to these constraints.

4. Discussion

The aim of this study was to gain an uncensored insight into the most difficult aspects of working as a frontline doctor in the UK and Ireland across the first and second wave of the COVID-19 pandemic. Qualitative data from a large sample of frontline doctors was analysed and four key themes were identified. Themes encompassed participants' concerns that frontline staff safety and wellbeing had been repeatedly overlooked; the relentlessness of the pandemic; the distressing and often 'ugly' nature of patient care and teamwork; and the organisational challenges which often impeded frontline doctors' work performance. These findings offer a comprehensive and highly emotive account of the most difficult aspects of working as a frontline doctor during the COVID-19 pandemic that has not yet been reported to this extent. Findings communicate a sense that, for many, the relentlessness of a second wave, without reprieve, was more challenging physically and emotionally, representing worrying findings given the current context of an approaching third wave.

Findings from this study echo themes drawn out in earlier, first wave qualitative research [22–30], providing evidence of the persistence of these problems into the second wave of the pandemic, indicating that little has been done to address serious concerns about working practices raised from the first wave [20,22,24]. Yet evidence from these uncensored accounts highlight that these pressures had only intensified during the second wave, owing in part due to the length of time participants had been exposed to them and the lack of time to rest and recuperate. Previous research has shown that increased time spent working on the COVID-19 frontline is associated with higher levels of stress [54], and this resonated with accounts from doctors in this study. Reflections on the "relentlessness" of the pandemic were common, and this represented a primary stressor for participants in the second wave, with many voicing a clear and desperate need for respite.

Another key source of stress for participants was the fear of becoming infected with the virus. This has been a constant theme in HCW experiences throughout the research [20,22–24,26,27,29,30], transcending different countries, different pandemics [20], and now different pandemic waves. Consistent with research conducted during the first wave [22,24,30], participants reported not having access to adequate PPE during the second wave, highlighting the continuation of this problem across the pandemic, which will have exacerbated raised concerns about personal safety and transmission to families, key predictors of mental health in a recent longitudinal study [9]. This finding is also concerning given evidence that appropriate use of PPE offers adequate protection from infection [55], raising the difficult question as to whether enough was done to protect the many frontline staff who lost their lives during first and then further in the second wave, having already protested at life-saving PPE shortages [7,56,57].

Participants also expressed discontent and perceived betrayal at the increased exposure to risk during the second wave as the UK Government extended the gap between vaccination doses from three to 12 weeks [58]. This meant that many doctors faced delays to their second vaccination [39], despite evidence at the time indicating that the immune response was weaker following only one vaccine dose compared to two [59]. Due to the paucity of qualitative research reporting on HCW experiences in the second wave, reflections on the vaccination delays are not represented in previous research and add a unique contribution to the literature; participants' accounts conveyed the fear and anger

some felt in response to this decision, with a sense that the vaccination delays as well as other perceived risks, such as PPE provision, exemplified that the UK Government placed little to no importance on frontline staff safety.

Similar sentiments regarding the UK Government's handling of the pandemic have been found elsewhere in the research, with studies describing feelings of anger and feeling let down by those in authority [19,23,60]. A recent qualitative study conducted by French et al. [60] equated these feelings to moral injury, adopting Shay's [61] definition which is characterised as a betrayal of perceived morality by a person in authority. This definition resonates here, with many participants describing feeling unsupported and disregarded by the Government, NHS trusts and non-clinical management teams. French et al. [60] state that "if moral repair is to take place across the public sector, it will be vital for those leading the country to acknowledge and atone for their mistakes" (p. 5), arguing that without moral repair, other strategies to support HCW recover from the pandemic may be less effective. The incidence of betrayal-based moral injury found in the present study indicates that this phenomenon warrants further consideration when designing post-pandemic recovery strategies; furthermore, the finding that betrayal experienced may vary by seniority level, such as the impact junior doctors felt the pandemic had on their training, suggests this may need to be tailored by professional grade.

Accounts in the present study also point to instances of perpetration-based moral injury, which is characterised by feelings of guilt associated with actions or inactions which violate an individual's moral code [21]. This can be seen in participants' descriptions relating to patient care. Higher reported exposure to moral injury has been found to be strongly associated with increased levels of anxiety, depression, post-traumatic stress symptoms and alcohol misuse [31]; however, to date no validated treatment for moral injury exists [62], indicating a clinical need which urgently needs addressing. An array of psychological models designed to target moral injury have been proposed [62,63], but further research trials are needed to explore the efficacy of these interventions to devise an evidence-based model of care.

Another concerning finding from the present study relates to frontline doctors' perceptions of peer and public support. The qualitative literature on social support during the COVID-19 pandemic has been mixed, with some research suggesting that HCW felt in receipt of more support from their colleagues and wider society during the pandemic [24–26], and other studies noting a more complex relationship between HCW and social support [23,64]. Those who participated in this study align more closely with the latter, as accounts regarding social support were overwhelmingly negative. This may reflect anonymous uncensored responses without concerns for potential consequences. Social support has been shown to be a protective factor for adverse mental health outcomes in HCW during the pandemic [10,65], with one third of junior and senior doctors reporting it as a key coping strategy [66], highlighting the need for implementation of formal and informal peer interventions for all professional grades to ensure that frontline doctors feel supported going forwards.

The COVID-19 Clinician Cohort study (CoCCo) [19] developed empirically grounded recommendations and a model of psychological care derived from the accounts of psychologically distressed frontline doctors, purposefully sampled to represent a range of personal and professional characteristics. This model encompasses and addresses concerns raised by and echoed here, with emphasis placed on meeting basic needs such as ensuring access to adequate PPE and allowing doctors time to decompress, as well as facilitating access to peer support and specialist interventions. This stepped pathway of care provides the most coherent model to date that can be implemented into services to better support frontline doctors into the future; however. policy makers and clinical managers need first to recognize the absolute necessity of intervention.

The public health implications of the findings from the present study cannot be overemphasised. Many of the challenges reported by the frontline doctors here have been shown to be associated with higher rates of psychological morbidities in HCW during

the COVID-19 pandemic [9,10,13] and research has found that doctors with poorer mental health are more likely to report providing suboptimal patient care [67] and making major medical errors [68], highlighting the importance of nurturing a psychologically well healthcare workforce. Moreover, factors such as high workloads, the Government's handling of the pandemic, and inadequate PPE have been commonly cited as reasons that frontline doctors as well as HCW more broadly are considering leaving the profession [69–71]. As waiting lists continue to grow and a third wave approaches, preventing a staff exodus is vital. It is therefore crucial that frontline doctors' voices are not only heard but responded to, representing a further call to action, a repetition of many such earlier calls, to ensure the physical and psychological safety of frontline doctors.

Strengths and Limitations

This study reports on one of the largest qualitative datasets relating to frontline workers experiences in the COVID-19 and other previous pandemics. Similar to the study conducted by Bennett et al. [23] which claimed to gain "uncensored access" (p.6) to HCW stories, participants did not meet with researchers, and instead provided qualitative responses using an online platform. This allowed for a breadth of raw and unprompted responses, which ensured findings represented the difficulties which mattered most to frontline doctors. Findings amplify the concerns raised in previous research and add considerable value to the literature by highlighting the persistence of these problems into the second wave. Moreover, the sample represented a diverse range of personal and professional characteristics, including individuals commonly under-represented in qualitative research such as men [72] (42.8%) and those from ethnic minority backgrounds [73] (excluding white minorities; 17.0%), increasing confidence in the findings reported here as well as their relevance to these groups.

However, as 52% of NHS doctors are male [74], their views are still not adequately represented in the present study. Considering that psychological risk has been shown to vary by gender [6,10,31], it seems pertinent that greater effort is taken to engage male HCW in future qualitative research to better understand the full breadth of experiences during the pandemic. Furthermore, as this study focused solely on the difficult experiences of frontline doctors, findings may not represent the views of HCW more broadly. Evidence has shown that mental health outcomes in the pandemic vary by professional group [5,6,31], meaning further research is needed to gain insight into the experiences of other HCW groups following two waves of the pandemic.

5. Conclusions

Frontline doctors faced a multitude of challenges across the COVID-19 pandemic, many of which had been identified as being problematic during the first wave [22–30] and continued to persist into the second despite repeated calls to action. The 'ugly' and uncensored truth reflects these, and possibly many other frontline doctors feel angry, betrayed and unsupported—through vaccination delays, inadequate PPE and working through the strain on a system already overburdened.

These problems urgently need addressing as COVID-19 becomes endemic and health services attempt recovery, where the repeated exposure to these challenges and absence of reprieve are likely to bear long term consequences. Action is needed to ensure that frontline doctors feel supported, moral injuries are repaired, and further risks to safety and wellbeing are mitigated.

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T.R. and E.C. J.D. was the primary supervisor of S.H. and had oversight of the whole project. All authors have read and agreed to the published version of the manuscript.

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The COVID-19 Clinician Cohort (CoCCo) Study: Empirically Grounded Recommendations for Forward-Facing Psychological Care of Frontline Doctors

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Abstract: This study aimed to develop empirically grounded recommendations and a coherent model of psychological care derived from the experiences and psychological care needs of COVID-19 frontline doctors, using semi-structured interviews and thematic analysis. Participants were UK frontline doctors specialising in Emergency Medicine, Anaesthetics, or Intensive Care (n = 31) purposively sampled for maximum variation on gender, specialty, ethnicity, and trauma-related distress; most worked in ICU during the pandemic (71%). Four themes were derived: (1) 'coping strategies', participants used many, including exercise, mindfulness, and "wait until it gets really bad"; (2) 'sources of support', participants valued embedded psychological support, digital services, and informal conversations with colleagues or family, though there was little opportunity; (3) 'organisational influences on wellbeing', participants reported a love–hate relationship for concepts like 'wellbeing', seen as important but insulting when basic workplace needs were unmet; (4) 'improving engagement with support', analysis suggests we must reduce physical and psychological barriers to access and encourage leaders to model psychologically supportive behaviours. Doctors' frontline COVID-19 working experiences shine a 'spotlight' on pre-existing problems such as lack of physical resources and access to psychological care. Empirically grounded recommendations and a model of incremental psychological care are presented for use in clinical services.

Keywords: COVID-19; frontline workers; healthcare workers; qualitative research; trauma; psychological support; occupational health; guidelines

1. Introduction

The psychological impact of Coronavirus Infectious Disease 2019 (COVID-19) on frontline doctors has been well documented. With up to 54% experiencing clinical levels of psychological distress [1], many report being affected by trauma symptoms, fears of contamination, moral injury, disruption of normal supportive structures, and work pressure [2–5]. These factors are associated with long-term psychological sequelae [6,7].

Guidelines to address the psychological needs of healthcare workers (HCW) amidst the COVID-19 pandemic have been developed and advocated by national professional bodies and Royal Colleges [8–12]; however, these resources were written at the outset of the pandemic when little was known about the impact and likely trajectory, and were not

empirically underpinned or substantiated by COVID-19 specific research. We are now in a better position to develop guidelines tailored to the clinical characteristics of this group at a time when psychological support is pivotal to long-term mental health.

A recent qualitative study reported that preferences, experiences, and coping styles of COVID-19 HCW should be considered when developing "programs developed to mitigate stress" [13] (p. 1) with a recent meta-analysis indicating that more "high-quality qualitative research is urgently needed" particularly with frontline HCW whose "voices have not yet been adequately represented" [14] (p. 25). Billings et al. [14] indicate qualitative research should underpin clinical guidance, and while subsequent qualitative studies have explored frontline HCW experience of working and caring for patients during the COVID-19 pandemic [15–22] drawing out similar themes to those reported in other pandemics [14], few qualitative studies have specifically sought to develop or directly inform guidance [23]. The initial COVID-19 mental health response has recently been criticised for underutilising qualitative enquiry, overlooking lived experience, and focusing on general populations such as HCW [24]. Further qualitative research focusing on specific groups, such as doctors, underpinned and shaped by patient and public involvement, has been recommended to strengthen the COVID-19 mental health research response [24]. However, this paucity of research remains.

Doctors are likely to benefit from specialist services and interventions tailored to their needs due to the well-documented barriers they perceive to accessing psychological support [25] and the high rates of burnout and distress already prevalent in this group [26]. The unrelenting pressure of working during the COVID-19 multi-wave pandemic is only likely to have exacerbated these issues further, yet no specific care pathways or models of care have been developed to address this.

Study Aims

The aims of this study were to develop an empirically-grounded set of recommendations and model of future-facing psychological care de-rived from the experiences of psychologically distressed doctors working on the frontline during the COVID-19 pandemic.

2. Materials and Methods

The COVID-19 Clinicians Cohort (CoCCo) study is a follow-on study from the 'COVID-19 Emergency Response Assessment', also known as CERA (IRAS: 281944) [1,27–29]. CERA is a five-phase longitudinal study which sought to examine the prevalence and nature of distress in frontline doctors during the first wave (Spring 2020) and second wave (Winter 2020) of the COVID-19 pandemic [1,27–29].

Participants in the CoCCo study were recruited from the parent CERA study participant pool. The CoCCo study has been approved by the Health Research Authority (20/HRA/6315) and University of Bath Psychology Research Ethics Committee (21-001).

2.1. Measures

Participants in the CERA study completed quantitative measures of psychological distress, a demographic questionnaire and further questions pertaining to personal and professional characteristics (see CERA study for further details [1,27,28]). From the CERA study battery of measures, data relating to gender, specialty, ethnicity (individual demographic items), and traumatic stress (Impact of Events Scale-Revised, IES-R) were extracted to select a purposive sample for the CoCCo study (see Section 2.2).

The IES-R [30] is a 22-item measure commonly used to measure post-traumatic distress following a pre-specified traumatic incident and has been used to evaluate the impact of infectious disease outbreaks on hospital staff [31]. The IES-R has been found to have excellent internal consistency ($\alpha = 0.96$) and construct validity when correlated with the PTSD checklist ($\alpha = 0.84$) [32]. The IES-R has been widely used during the COVID-19 pandemic to assess levels of trauma in frontline workers [33,34].

2.2. Participants

Doctors of all grades and seniority working in either the emergency department, anaesthetics or intensive care unit (ICU) in the UK and Republic of Ireland during the acceleration phase of the COVID-19 were eligible for inclusion in the parent study, CERA. Non-doctors, or those working in other specialty areas were excluded from the CERA study.

All medical specialties included in the CERA study were eligible for inclusion in the CoCCo sampling strategy due to these specialties having highest likelihood of exposure to patients with COVID-19 with consequent exposure to aerosol generating procedures (high disease exposure risks and PPE requirements). In addition, these specialties were more likely to be subject to redeployment to high intensity working environments and were the core specialties involved in frontline work, a factor predictive of psychological distress [35].

2.3. Procedure

In survey four of the CERA study, participants were asked to consent to be contacted for future research studies and share information. All those who indicated agreement to both formed the CoCCo sampling pool and were sent a link to study information and online consent to take part in the interview-based CoCCo study.

Of those who consented to participate, a purposive sample of doctors was selected for maximum variation on four characteristics: gender, specialty, IES-R score, and ethnicity. These factors have been associated with higher levels of traumatic stress [1,2,27,28,33–35]. Those with IES-R scores 24 or above (indicating clinical levels of distress) were eligible to take part, as these doctors were more likely to have experience of psychological distress and demonstrate care needs.

The interviews sought to elicit an understanding of perceived psychological needs and preferences in relation to psychological care; the topic guide was informed by scope of study aims, the current evidence base and input from the PPI group. The guide consisted of four sections: describing experiences on the frontline; identified psychological needs and support already accessed; preferences relating to psychological care (past/present/future); positive experiences of the pandemic. The latter served as a psychological buffer for potentially difficult elements of the interview, and to offer the opportunity to explore other relevant aspects through a non-problem focus.

Semi-structured interviews using the topic guide were conducted by telephone or video call by five trained qualitative researchers (AP, JI, EW, JD, LI) with health services research, clinical, and health psychology backgrounds. Participants with high IES-R scores were interviewed by clinical psychologists in the team. At the end of the interview participants were debriefed about the study and sent information on sources of support.

Interviews were recorded using encrypted devices and stored securely and separately from personally identifiable data. All data are stored in accordance with the University of Bath Data Security and Confidentiality Policy and the Data Protection Act 2018.

2.4. Analysis

Framework analysis was applied to the data, following the seven steps outlined in Gale et al. [36] including a rapid analysis of main themes (concurrent with data collection) prior to detailed thematic analysis [37], as described in Table 1. The rapid analysis form was developed using the interview topic guide to capture the main points from each interview and to aid thematic analysis. Interviews were audio recorded, transcribed verbatim, and anonymised by a professional transcription service. Transcripts were checked for accuracy and coding facilitated using NVivo 12 Pro (QSR International Pty Ltd. and thematic analysis applied to the transcripts by AP and KB. Interviews continued until data saturation was achieved, in that no new themes were being generated from the data.

Table 1. Framework analysis steps.

Stage 1.	Transcription: Audio recordings were transcribed verbatim and pseudonymised. Detailed notes were taken by each interviewer (all authors), structured around the topic guide and questions to produce a rapid coding matrix.
Stage 2.	Familiarisation with the interview: Two authors familiarised themselves with the interview by reviewing the rapid coding notes and full transcript.
Stage 3.	Coding: AP developed a matrix in NVivo 12. The initial coding process involved systematically reading (and re-reading) the rapid coding notes and full transcripts for each participant, assigning data to relevant question headings and identifying key subthemes within each component.
Stage 4.	Developing a working analytical framework: Qualitative team met to discuss in detail the findings as enabled by the rapid analysis matrix, to agree on the key themes.
Stage 5.	Applying the analytical framework: All transcripts were imported into NVivo 12 and the analytical framework established. Each transcript was coded by systematically assigning data to a node in the analytical framework. The framework was revisited after 20 transcripts and additional sub-codes created to aid differentiation of distinct meanings emerging within themes. Ten transcripts were double coded by three researchers (EW, KB, JI)
Stage 6.	Charting data: Drawing on the full analysis in NVivo, AP, and KB created a table of the key themes with illustrative quotes and reviewed it with all authors.
Stage 7.	Interpreting the data: During regular team meetings (10 meetings over the analysis phase), and via circulation of written materials with the Clinical Advisory Group, impressions and interpretations of the data, coding, and the analytical framework were discussed and agreed. This process was ongoing throughout the analysis process.

Ten transcripts (32%) were double coded to improve robustness of the analysis and minor discrepancies resolved through discussion—15% of transcripts were recoded blind by a second coder and high agreement between codes was reached, supporting the validity of the results. All coding and recoding was discussed between qualitative team members, debating minor differences until consensus was achieved.

All analytical decisions were shared and discussed by the qualitative research group using a consensus process to agree the final coding and thematic framework and reported in accordance with the COnsolidated criteria for REporting Qualitative research (COREQ) reporting checklist [38].

2.5. Development of Recommendations and Model of Psychological Care

The identified themes derived from interview data formed the basis of an initial set of recommendations and illustrative model of psychological care, which was developed by the research team through an iterative process. The recommendations, model of care, and a summary document of themes and quotes were then distributed to the PPI panel who were then invited to comment on the face validity, salience and personal relevance of the recommendations. All members of the PPI committee provided individual input via email correspondence, and once all feedback had been received, the recommendations and model were adapted and consensus agreement gained from the PPI group for the amended version. The refined versions of the recommendations and model, and summary document of themes and quotes were then distributed to the expert advisory group (EAG) for consultation via email, with feedback invited on the clinical relevance, broader context, and practical implications of the recommendations. Once amended, members of the EAG and PPI approved the final version.

The EAG comprised senior clinicians and researchers in the field representing Health Protection Research, Psychiatry, Emergency Medicine, Clinical Psychology, Intensive Care, Occupational Medicine and Staff Wellbeing.

2.6. Patient and Public Involvement

A PPI panel comprising six frontline doctors of different specialties, seniority, ethnicity and gender were appointed to advise on all aspects of the study, including research design and recommendation development. All PPI members were offered renumeration for their time.

3. Results

Of the 346 CERA [1,27,28] participants who gave consent to be contacted for follow-on studies, 44 consented to interview (12.7%), and 36 were contacted to take part, as per our sampling frame requirements. Five people who consented were contacted for an interview but did not respond.

Thirty-one interviews were conducted with doctors (age range 27–59) from 26 different hospital Trusts across England and Wales. Interviewee characteristics are shown in Table 2. Twenty-two (71%) doctors (all but one of the anaesthetists) were redeployed to or worked in an intensive care unit (ICU) during the pandemic. IES–R scores ranged from 24–74 (mean 43.8, SD 13.3). Interview length ranged from 16 to 68 min (mean 41 min).

Table 2. Characteristics of the doctors interviewed.

Characteristic (*n* = 31)	*n* (%)
Specialty	Anaesthetics = 14 (45%) Emergency Medicine = 13 (42%) Intensive Care = 4 (13%)
Gender	Female = 19 (61%) Male = 12 (39%)
Seniority	Consultant or equivalent = 10 (32%) Middle grade doctor = 14 (45%) Junior doctor = 7 (22%)
Ethnic Origin	White = 23 (74%) Black and Minority Ethnic background = 8 (26%)
IES-R Score	Range 24–74; Mean 43.7 (SD 13.3)

3.1. Main Themes

Analyses generated six key themes: 'accounts of challenging frontline situations', 'impact on staff', 'coping strategies', 'sources of support', 'organisational influences on wellbeing', and 'improving engagement with support'. The first two themes mirror findings reported extensively elsewhere [15–22], making no novel contribution to knowledge in the field. In this paper, we report only the latter four themes (Table 3), which are aligned with our study aims, and underpin development of recommendations and a model of care to support clinicians' wellbeing. This is important, as our interviews showed many of the challenges described—such as excessive workload, fatigue, and burnout—existed before the pandemic. By illuminating and heightening these entrenched issues, the COVID pandemic shone a spotlight on the need for change.

> *"In some ways maybe having had this peak is a perfect opportunity to incorporate more into the workplace, because clearly it took until breaking point for us to even acknowledge that we have an endemic problem within the profession."* (#115, F, Intensive Care)

> *"There's already a significant degree of burnout and exhaustion, and I think that one of the worst things about this pandemic was that it was on top of that; a lot of people were already working by running on empty almost and then this happened."* (I#121, M, Anaesthetist, ICU)

Themes are presented with illustrative numbered quotes in Tables 4–7; participants are identified by gender (F, M), specialty (Emergency Medicine EM, Intensive Care Medicine ICM, Anaesthetics An), and whether they had experience of working in the ICU.

Table 3. Themes and subthemes.

Theme	Sub-themes	Includes
A. Coping strategies. Positive and less positive coping strategies	(1) Storing things up (2) Wait until it gets really bad (3) Psychological help is for others not me	(1) Coping by disconnecting (2) Not realising how bad things have become (3) Others might benefit/need support more
B. Sources of support. Formal and informal support available.	(1) What helped at work and outside work (2) What didn't help at work and outside work	(1) Peer-peer support, senior support, embedded psychological therapists, clinical debrief, apps, family and friends. (2) Peer-peer, senior informal contact, no time to access support.
C. Organisational influences on wellbeing. Factors which supported or impeded wellbeing.	(1) Positive influence: Organisational (2) Negative influence: Thoughts on 'resilience'	(1) Environmental changes and 'the little things', managerial support. (2) Negative environmental changes had a big impact, poor managerial decisions.
D. Improving engagement with support. Psychological treatment preferences identified by clinicians.	(1) Facilitators and treatment preferences. (2) Barriers to access	(1) Embedded psychological support, someone who understands us, trust and anonymity, leadership role models, normalising psychological reactions, confidentiality of what is shared. (2) No time off, loss of trust, lack of signposting, too much information, stigma, culture and consequences

3.1.1. Coping Strategies

Participants described using a range of strategies to cope with the current circumstances including exercise, getting outside, being more open with feelings, mindfulness, and journaling. Exercise was a common strategy, which could be related to participants' stated need to 'keep busy' to cope with what they were going through (A1). Journaling was mentioned by two participants who found this was useful as a way of offloading thoughts and experiences. Being more open with feelings was mentioned as a way of engaging with others and reducing isolation. Other participants reported drinking alcohol, smoking, and eating as their way of coping (A2).

More specific psychological coping strategies included 'storing things up' and 'waiting until things got really bad', and believing that psychological support was more needed by others than themselves.

Storing things up: Many participants described feeling compelled to keep going during the height of the pandemic; they felt they could not take time to process events so stored things up in a box for later. Some viewed this as a positive strategy (A3). Clinicians also described feeling disconnected from the emotions they would usually have towards very ill or dying patients. Others expressed fear for what would happen following the current peak of the pandemic and questioned whether they would be able to cope.

Wait until it gets really bad: Some participants described having insight around when to access psychological support, but if it was a limited resource, felt they should only use it with a clear and definite 'need'. Others described how they felt unable to tell when it was time to ask for support and that, traditionally, doctors were not good at this (A4).

Psychological help is for others not me: There were several comments that clinicians were better at recognising and attending to others' needs than their own, and set aside their own needs if others needed support more (A5).

Table 4. Illustrative quotes for Coping Strategies theme.

Quote Number	Illustrative Quote
A1: Exercise	*A1: "I would rather go for a run or see my family, or bake, or do something creative rather than sit and breathe quietly with my eyes shut." (#106, F, An, ICU)*
A2: Drinking	*A2: "To be perfectly honest with you more drinking, not to stupid quantities where I feel like I've needed to go and get help, but to quantities where I wouldn't want . . . when I have children I wouldn't want to be drinking as much as I am drinking now." (#127, M, EM, ICU)*
A3: Store it up.	*A3: "There's been a lot of stuff I've seen that hasn't been very pleasant, and obviously in the moment you think about it and you're upset about it, but I have somewhat just packaged that up and put it to the one side." (#103, F, An, ICU)*
A4: Wait until it's bad.	*A4: "I found it very easy to just think to myself I've just got to get on with this, this is it's normal to be feeling really anxious and to not be sleeping. I know that burnout is a concept that exists but that can't be happening to me." (#122, M, An, ICU)*
A5: Psychological help is for others	*A5: "I am fine,.. I don't need that service as much as other people, so I'm not going to use that resource. I don't want to be the one who is taking up a resource unnecessarily and wasting somebody's time." (#109, F, EM)*

3.1.2. Sources of Support

Participants described a range of formal and informal sources available to them, either at work or outside, some of which were more beneficial than others. Participants' perceptions of sources of support are described as 'what helped' and 'what didn't help'.

What helped

Talking to colleagues: There were strong and consistent descriptions of the value of support from colleagues during the pandemic, with descriptions of affection for teammates and co-workers, and the support they had given and received during intensely stressful times. Being able to take time out, share concerns, and discuss the challenges with colleagues (especially senior ones) was universally seen as beneficial. It helped to unpack what had happened and to allay anxiety. Participants found this informal support helpful both in terms of acknowledging experience but also exploring strategies (B1). Often this support was the most valuable and had the biggest positive impact on their ability to cope. They missed post-shift informal breakfasts or trips to the pub and opportunities to 'decompress'.

Embedded psychological therapists: Participants described embedded psychological support services available during the pandemic as positive, though rarely used. They liked knowing that someone was there if they needed them and valued their availability and continued presence as it removed some of the barriers to access; but availability could be an issue (B2).

Accessing specialist support: While very few participants reported accessing formal psychological support through work, those that did found it helpful. Some participants had already contacted counsellors and psychologists outside work prior to the pandemic and resumed or continued this contact. This was helpful in setting their experience in a wider context and normalising their reactions (B3).

Apps and phone services: Some participants reported using mental wellbeing apps, telephone support services, and phone messaging app groups promoted by their Trusts or organised within clinical groups, and some found them valuable for managing ongoing mental wellbeing. Participants were mostly aware of what was available but did not always engage with it (B4).

Friends and family: Informal positive support, including friends and family, was described by many participants as very important, especially from partners. Friends were an important outlet for feelings and distraction but talking about work was only useful if they were also medics, so the complex medical context was understood.

What did not help

No time to attend or to talk: There were frequently barriers to accessing more formal support at work, including the appropriateness of sharing emotional difficulties with other colleagues and the ability to get away (B5). While peer-to-peer and senior colleague support could be extremely beneficial, some participants felt that these interactions were not regarded as a good use of their time (B6).

Table 5. Illustrative quotes for Sources of Support theme.

Quote Number	Illustrative Quote
B1: Talking to colleagues	*B1: "We're a really good team, so just making sure that everybody is feeling okay, and actually talking about our experiences, . . . share those experiences that have been difficult, I think that really helps. [. . .] being in a good team has to be the winning thing really." (#114, F, ICM)*
B2: Embedded support	*B2: "you see the psychologists are just normal people, getting a tea in the tearoom. They are really accessible, and then when people start crying at work they just sidle up and say, "Are you okay?" And I think that's really good." (#103, F, An, ICU)*
B3: Specialist support	*B3: "I've had two sessions with her [psychologist] just over the phone and that's been quite good. Working in acute specialties, you are at the pointy end of quite a lot of drama and quite a lot of situations which might stick with you and impact on your mental health and actually maybe you need a little bit of time to process, and it's helpful to talk through." (#107, F, An, ICU)*
B4: Resources	*B4: "Our Trust has an excellent wellbeing resource page, . . . plus everywhere you look now there's guidance on resilience and wellbeing." (#105, F, An, ICU)*
B5: No time to attend . . .	*B5: "Most of the time on my shift I can't just drop out for things, if you manage to time your break for that time you can do it, if you don't then you can't, or you will just end up being tied up in a complex case that you can't walk away from. In that sense they were quite inaccessible to me." (#109, F, EM)*
B6: ... or to talk.	*B6: "Often at work if you talk for a few minutes it's like, "Right get on now," and there's not really any time . . . and we're policed constantly. It's always like you're on a time limit, you never really get to sit down and have that chat, and we can't see each other outside of work." (#110, F, EM)*

3.2. Organisational Influences on Wellbeing

Broader external factors which either supported or impeded clinicians' wellbeing included organisational structures, values and attitudes, and responses to differences between COVID waves. These themes contextualise the personal and clinical experience within wider organisational factors.

Positive influences: The concept of wellness or wellbeing activities at work came up fairly frequently. Most people were aware of services or activities provided through work under the label of 'wellness', including resilience training, meditation, or organised sports. Participants invariably had a love/hate relationship with this concept—some found it useful and supportive, and others found it meaningless, irritating, and insulting. Those that appreciated the support often connected this service to an overall ethos of caring about staff and their mental wellbeing (C1).

"It is the little things": When asked about what support has been most helpful, all participants identified small gestures of kindness or changes to the work environment that made a significant impact on their wellbeing. This was often connected to a feeling of being cared about, looked after, valued, or making being at work easier or more comfortable. Small things seen as crucial to proper functioning included being able to meet basic human needs for hot food and drink, comfortable chairs, rest areas, walls with pictures or supportive messages, free parking, plentiful scrubs, and working hot showers (C2).

Negative influences: There were many examples of bad communication, poor leadership, and accounts of the impact of government and press handling of the pandemic that left participants feeling frustrated and angry. While some people reported that their Trust was supportive and helpful, others were left feeling undermined, threatened, and let down (C3).

Resilience: A significant number of participants commented on the futility of being offered guides to healthy eating and resilience by their Trusts as this missed the point and

was insulting. They would be looking after themselves if they could, but the demands of their situation prevented them from doing so and these initiatives failed to address the underlying causes of stress. Resilience was not something they considered they lacked (C4, C5).

COVID timeline: Generally, participants felt that despite the uncertainty and newness of the first wave in March 2020, it was in many ways easier to manage than what came afterwards (C6). The relentlessness, lack of preparedness, and changing patient demographic in the second wave in winter 2020 was harder on staff (C7).

Table 6. Illustrative quotes for Organisational Influences on Wellbeing theme.

Quote Number	Illustrative Quote
C1: Positive influences	*C1: "We had loads of things around the hospital like decompression rooms or quiet rooms where you just go and be quiet, and they would put colouring books and coffee machines there so you could sit and reflect on what had happened, which was really helpful." (#102, F, An, ICU)*
C2: The little things	*C2: "I think a huge thing about morale in the NHS actually it is the small things, . . . the things that really get people down or really lift people's spirits are not very big, it's free tea and coffee. There are no rest facilities for doctors anymore, so if there's a chair that pulls out and a blanket or a pillow, that really lifts people's spirits. It's really little stuff like that." (#103, F, An, ICU)*
C3: Negative influences	*C3: "It felt at times very vulnerable and just a little bit maybe sacrificial you didn't have any control over anything really, you were just given what you were given and had to work with it, and it would constantly change, and I think it felt like there was a lack of respect from people at managerial and senior levels as to what we were actually doing." (#107, F, An, ICU)*
C4: Resilience	*C4: "If you say resilience to a doctor, . . . you've lost them already . . . someone wants to [talk to] me about resilience and they have not just done the week that I have just done, walk a week in my shoes and then talk to me about resilience." (#105, F, An, ICU)*
C5: Resilience	*C5: "It's just I think the word resilient should never be used, because it's just become a swear word, . . . you're upset about the fact that you can't manage your childcare, and your shift, and your pay has been cut . . . what you need is some resilience training [laughs]. Just makes us all so angry." (#104, F, An)*
C6: COVID 1st wave	*C6: "The first wave with the redeployment of staff we had lots of staff, ... we worked 24 h, we had packs of teams that worked together, so we did feel like we had enough staff." (#111, F, EM)*
C7: COVID 2nd wave	*C7: "I felt like this time we had months to prepare, and actually when it arrived it was bigger than was anticipated, we were totally overwhelmed, and people were not redeployed up until the 11th hour." (#115, F, ICM)*

3.3. Improving Engagement with Support

Facilitators and treatment preferences

Access and support options: Opinions on how psychological support should be accessed included online, face-to-face, one-to-one and in a group, and as more formal access to safe spaces to talk. One-to-one support was often suggested because of a need for safety of information and trust. Group sessions were felt to be useful if with colleagues; small groups were favoured over large ones to maximise how much each person could contribute. Online sessions were understandable in the context of the pandemic, but most preferred face-to-face if available. They valued talking therapies in various formats (D1, D2).

Supporting emotional wellbeing: Participants felt a system for supporting emotional needs would be helpful, either as brief clinical reflective sessions at the end of a shift or through increasing awareness and asking about colleagues' wellbeing (D3). Some participants felt that if support was built into inductions or made more visible within the hospital setting, then more people would access it. Teaching clinicians about the signs of emotional distress and when/how to get support would also be beneficial.

Someone who understands: Many participants felt quite strongly that talking with someone who had been through similar experiences would be important or preferred. This would remove the need to describe in detail or relive the distressing things they had dealt with, and there would be an awareness of what they had experienced (D4).

Embedded psychological support: Although very few participants had availed themselves of embedded psychological support (i.e., a psychologist working within the service), it

was generally regarded as a favourable model which could help in normalising clinicians' reactions to their exposure to trauma (D5).

Anonymity/independence: For some participants, the independence of support was important, and they would rather engage with services that were not connected to the workplace. This would remove worry about stigma and concern that colleagues, managers, or superiors would judge them negatively for having accessed support (D6). It was also connected to feeling safe, to get the most out of any support accessed, and to explore their feelings in an honest way (D7).

Leadership: Participants ranged from trainees to consultants and most mentioned how leaders can influence engagement with support services. Examples of good leadership, including modelling and demonstrating care about the mental wellbeing of oneself and one's staff, improved morale overall (D8).

Normalising psychological reactions: Participants were clear that there needed to be measures to make it acceptable to reveal and discuss psychological reactions to the challenges they faced at work and that leaders, education, and embedded psychologists could start this conversation (D9). However, there was also a feeling that this was changing, and a few gave examples of how normalising discussions about mental health had helped to make access easier and less daunting.

Barriers to access

Timing and not knowing what is available: The biggest barrier to accessibility was timing—shift work and long hours made finding the time to attend support sessions more challenging (D10). Some participants expressed wanting to access support once the current surge was over. Also knowing what support was available and which would suit best was another problem, especially when clinicians were already overwhelmed with information (D11).

Stigma, culture, and consequences: The stigma associated with seeking support for mental wellbeing was cited as a barrier to engaging with available support by many. There was some recognition that this stigma was slowly changing, but there were several clear examples where participants or others had been shamed for accessing support. They described how seeking support might be seen as a sign of weakness, and how medics are often required to 'put up and shut up' when it comes to their own mental wellbeing. This was combined with concern of the impact on their future career (D12, D13, D14).

Table 7. Illustrative quotes for Improving Engagement theme.

Quote Number	Illustrative Quote
D1: Safe place	*D1: "The concept of a safe space where you can take timeout that's actually recognised as timeout is absolutely something that should exist." (#130, F, An, ICU)*
D2: With colleagues	*D2: "I think it would be helpful to be with colleagues, I find that shared experience and the people around you, like the team that supported you through it, having them around for the aftercare is quite helpful." (#113, F, ICM)*
D3: Clinical debrief	*D3:"There would probably be scope for something more proactive, so for example a structured debrief at the end of every shift." (#122, M, An, ICU)*
D4: Someone who understands	*D4: "I think it is trust that you can just say how you feel, and also the fact that they would understand how you felt, because they understand it, because they have been through it, which really helps." (#102, F, An, ICU)*
D5: Embedded support	*D5:"It's just the visibility of it is important because it normalises it . . . it's okay to not be okay, . . . there's not necessarily anything wrong with you or anything that needs treating. It's just you have seen something horrible and you want to have a cry about it. So I think the real presence and visibility of that kind of [psychologist] support is really useful." (#103, F, An, ICU)*
D6: Anonymity	*D6: "I know some people have deliberately avoided going through work in case there's any stigma attached to that when it comes to annual review or anything like that," (#124, M, An, ICU)*
D7: Safety of information	*D7: "Have a blanket measure to help everybody, a safe place to talk, knowing that if I say something somebody is not going to come back to me and say "you said this, why did you say it?"" (#129, M, EM)*
D8: Leadership	*D8: "People who I admire clinically and professionally also trying to step up and actually look after our welfare themselves as individuals and taking on a little bit more of a welfare role, that's been nice, when I am sure they themselves have actually been experiencing all the same things I am experiencing." (#107, F, An, ICU)*

Table 7. *Cont.*

Quote Number	Illustrative Quote
D9: Normalise psychological reactions	*D9: "Sometimes I want to be able to say something like I felt like this, and it's awful I felt like this, but I did feel like that, why?" (#127, M, EM, ICU)*
D10: Timing	*D10: "How are we supposed to get protected time in the context of the NHS being under unprecedented pressure, to do things that are good for our wellbeing? (#112, F, EM)*
D11: What's available?	*D11: "It feels a bit like the support is there, but you need to go looking for it, as opposed to being encouraged to actively engage with it, I think." (#122, M, An, ICU)*
D12: Stigma	*D12: "I feel like there's a fair amount of stigma about mental health, about mental wellbeing, and admitting if you're struggling or finding things difficult, and I don't know if I would have gone for fear of being stigmatised for it." (#109, F, EM)*
D13: Culture	*D13: "It is just a toxic culture within medicine . . . which comes from the top down . . . It makes speaking up about having difficulties very difficult . . . within that acute specialties umbrella there's almost a macho. . . . it's a very masculine thing of heroism . . . but there's something there about people think that they should be somehow superhuman and not [affected] in a normal way by some of the very abnormal things that we're involved with." (#117, F, EM, ICU)*
D14: Consequences	*D14:"I understand why they are not accessing the mental health support services. There's so many reasons, one is the perception of failure if you have a mental health problem, second is you don't want your employer to know if you're struggling in any way because they are helping your progression to your endpoint of being a consultant, no one wants to admit failure as a doctor." (#105, F, An, ICU)*

4. Recommendations and Model of Psychological Care

As detailed in Section 2.5, the qualitative data and identified themes derived from the data formed the basis for an initial set of recommendations and model of psychological care, which was then iteratively refined and shaped by the PPI panel and EAG until consensus was achieved. Amendments and adaptations suggested by the PPI and EAG were minor and broadly related to practical implications and wording adjustments (e.g., suggestions regarding the use of a 'welcome pack' to raise mental health issues; recommended evidence-based interventions, e.g., TRiM [39]; wording of particular recommendations such as 'clinical reflective spaces'). No substantial deviations were made from the original recommendations. Box 1 reports the final set of recommendations developed to underpin the future care and support needs of doctors working on the frontline, encompassing basic needs of sustenance, information and communication, embedded support, and psychological interventions.

On review, the final recommendations (Box 1) and illustrative model were closely aligned with the model of care, as set out by the British Psychological Society (BPS) 'Psychological needs of healthcare staff document' [9], which highlights the proportionate incremental demand with each step of a hierarchy of wellbeing. This model specifies the importance of meeting 'basic needs' for all and 'psychological intervention' for the few who are likely to need it; the model offers 'stepping up' the hierarchy to more specialized interventions when required. With the permission of the BPS and collaboration with lead author of the document [9] (JH), the BPS model of psychological care was further populated and refined and using empirical evidence generated from this study (see Figure 1) in order to provide an illustrative model of psychological care based on the recommendations derived from this study. All 'steps' of the BPS model were retained (with minor title changes); however, more comphrensive details from the recommendations were provided in each 'step', with accompanying quotes from the qualitative data to highlight doctors' voiced concerns in their own words.

Box 1. Recommendations for psychological care of frontline doctors.

(1) Basic needs and physical resources for all staff

Sustenance (provision of both hot and cold food and drinks), rest, and sleep should be addressed and reflected in local guidelines and shift patterns to account for the need to rest and recharge between shifts for all staff (Figure 1. step 1). Working contract allowance for rest periods should be honoured and exercised by all staff grades and specialities. Designated quiet staff rest or 'decompression' areas should be provided and protected for all staff. Basic safety needs should be addressed through adequate provision of PPE.
A culture of care and shared responsibility for staff wellbeing should be actively promoted and facilitated by all clinical leaders. Staff should feel safe to speak up about their wellbeing without fear of repercussion and should be made to feel that their wellbeing is important to peers and clinical leaders. Key to psychological safety is strong role modelling from senior leaders who should regard discussion about wellbeing or acts to improve wellbeing in self or others as positive action to be encouraged, acting with humility, showing genuine care, and helping to foster a strong sense of team belonging. This should be supported through access to confidential spaces to reflect and seek collegiate or senior support.

(2) Information and communication

Normalising experiences: frontline healthcare work is intrinsically stressful, and being affected by difficult or traumatic cases is a normal response; this should be acknowledged and regularly discussed by peers and leaders. Being able to distinguish between 'normal' reactions and the emergence of more substantial difficulties is also key; with time, normal distress begins to dissipate, rather than intensify or impact daily functioning. Psychological impact of recurrent traumatic incidents on staff should be openly discussed, with particular focus on de-stigmatising views about mental health within the medical workforce.
Basic information regarding warning signs of deteriorating mental health in self and others should be offered to all staff (including clinical leaders), promoting shared responsibility for colleague wellbeing. Signs might include heightened emotional responses, absenteeism, withdrawal, and sleep disruption. Raising awareness of mental health issues should take place within medical training and routinely at a local level through practical 'welcome packs', which communicate trust ethos and attitudes towards mental health, pathways of support, and information regarding local lines of reporting. Local Trusts may wish to recommend specific resources such as eModules on trauma awareness and information on Trust-wide staff wellbeing teams, which could guide discussion.
Signposting availability of resources and what to access is useful even in the absence of psychological difficulties. Information relating to sources of support should be displayed and regularly refreshed in clinical areas, provided within standard operating procedures and as part of local guidance (e.g., return to work documentation). 'Warm handovers' should be used to facilitate transition to psychological care where possible, promoting likelihood of uptake.

(3) Embedded support

Face-to-face or video call clinical 'reflective spaces' between peers/senior staff should be offered and embedded within clinical teams. This may be ad-hoc or organised reflective spaces such as Schwartz rounds. More formal peer-to-peer interventions for structured support should be available; this may be in the form of Trauma Risk Management (TRiM) or 'StartWell > EndWell' procedures. These can be particularly helpful in time-poor contexts and should be encouraged and facilitated by clinical leads or trained health professionals.
'Psychologically safe' spaces which foster constructive reflection on own/others practice and on the moral dilemmas and challenges of health care delivery should be made available to all. These conversations should be dealt with confidentially and sensitively, including follow-up options to discuss with external peers or mentors; informal support seeking must be encouraged by clinical leaders to facilitate this.

(4) Psychological interventions

Pathways to appropriate level care are imperative: a stepped pathway of psychological care responsive to the presenting need of the individual should be offered. This might include provision to 'step up' from self-help/self-management approaches (such as use of apps, meditation, or bibliotherapy), to formal peer support and, at the highest level referral to high-intensity interventions, should this be required (e.g., CBT for PTSD). Referral outside the immediate team/serice to occupational health to address workplace issues, 'well-being' hubs or mental health services should also be part of a complete local pathway, which should outline route from peer or embedded support to mental health interventions and services.
Psychological interventions: should be evidence-based and tailored according to presenting difficulties. Support should be:

- embedded within services (in reach) where possible, offering access to hard to reach groups;
- suitable for ongoing/repeated traumatic events;
- sensitive to mental health stigma known in this population;
- tailored to individual need but considering the wider context of the team wellbeing;
- available in different formats e.g., group, individual, online;
- provided on a regular and reliable basis reflecting best practice;
- accessible to shift workers e.g., by release to attend during work hours;
- able to account for the unique characteristics of working on the frontline, such as moral distress, dealing with uncertainty, fear of harm and concerns over person wellbeing;

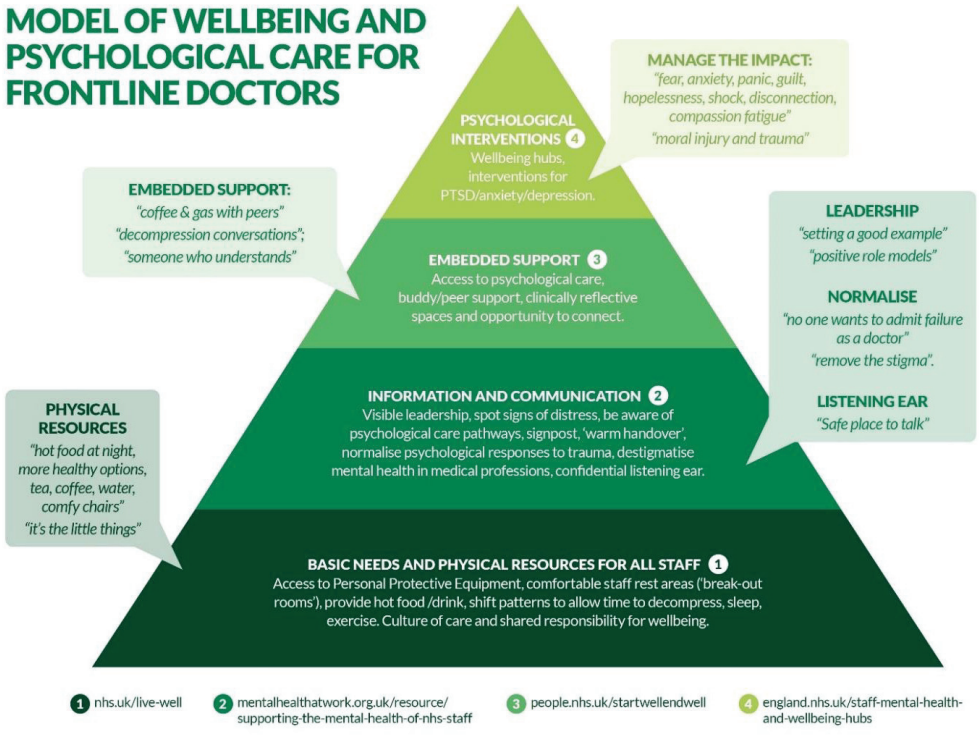

Figure 1. Model of wellbeing and psychological care for frontline doctors.

5. Discussion

This study aimed to develop empirically grounded recommendations and a future facing model of psychological care for frontline doctors, derived from the experiences of those most psychological distressed in the EM, An, and ICU specialties. Findings identified four key themes, including the range of strategies used to cope with their psychological stress; who they found most useful in helping them; their love–hate relationship for concepts like 'wellbeing'; and how physical and psychological barriers to access must be reduced and leaders encouraged to model psychologically supportive behaviours. These themes were used to underpin the development of recommendations (see Box 1) and a model of psychological care (see Figure 1), shaped by PPI input and expert advice. Our findings offer further insight into the ongoing psychological impact of COVID-19 and principally, the unmet needs which resonate with longstanding unresolved issues, specifically workplace culture, mental health stigma, and neglect of basic physical needs such as adequate food, rest, and sleep. Frontline healthcare work is and always has been, both intrinsically stressful and rewarding [25]. However, the nature of the occupational climate plays a pivotal role in this; working on the frontline during COVID-19 has cast a 'spotlight' on working practices within the NHS, drawing attention to pre-existing problems. These problems now urgently need to be addressed and can no longer be ignored.

In relation to previous studies, findings from this study reflect similar themes drawn out elsewhere during the pandemic [15–22] suggesting 'commonality' in experiences of frontline workers [40]. This extends across specialties, gender and ethnicity within our sample—few discrepancies were identified between groups, despite recent quantitative studies reporting significant differences in psychological distress related to age, gender [2,3,33–35], ethnicity, and specialty [1,27,28]. Accounts of working through two waves of the pandemic reflected a sense of immense and prolonged pressure, the second

wave causing considerably higher stress. Those experiencing higher levels of distress reported finding it difficult to manage without their usual coping mechanisms, instead using alcohol and food; strategies associated with poorer psychological outcomes during the pandemic [41,42]. Most commonly raised issues were concerned with basic sustenance and comfortable spaces to 'decompress'. The need for adequate access to hot food and time to reflect and process feelings are issues that predate COVID-19 [43] but have been reported repeatedly throughout the pandemic [8–11,23]. Despite calls to address this issue, it remains unresolved—getting the basics right is an essential foundation to wellbeing and necessary psychological care.

Consistent with current research [16,44] and guidance [8–12], 'peer support' in the workplace was valued, yet time pressure and organisational processes prohibited this being accessed fully. This suggests problems in organisational and local provision (e.g., insufficient staff/capacity) to facilitate the need to 'rest and digest', use appropriate clinical reflective spaces [45], or similar ad-hoc/organised sessions. Top-down organisational support and formal operationalising of local support structures are needed; working contracts enable this yet cultural expectations appear to prohibit it. The introduction of more formal peer to peer support is routinely facilitated, such as Schwartz Round [46], Trauma Risk Management (TRiM) [39], and StartWell > EndWell' [47] psychologically informed procedures; however, this must form part of a coherent care pathway, which enables doctors to access the help they need at the time and in the form they need, honouring contractual breaks in work shifts and signposting that involves a 'warm handover', i.e., direct facilitation of access to care [48].

Due to the complex and unique occupational demands of doctors, adaptations are required to promote and enable appropriate access to psychological care [25]. This is particularly related to mental health stigma reported in the profession acting as a barrier to engaging with services [25,49], but also relates to accessibility of services due to shift work and time pressure. This issue has again been further exacerbated by COVID-19 and the perceived absence of support to access care, such as the expectation that mental health related appointments should be attended during 'time off', as reflected in our findings and elsewhere [22]. Although participants were aware and positively regarded psychological support embedded in hospital settings, few accessed or engaged with the services available to them. Standard mental health services in their current form are unlikely to be sufficiently tailored to the specific challenges faced by frontline workers; however, there is a strong evidence base for structured psychological interventions [50,51] with work ongoing to adapt and refine for this group [52].

This study produced empirically grounded recommendations specifically focused on psychological care beyond the pandemic. The recommendations are drawn from the needs and preferences of frontline doctors in this study, and identify structures, processes, and procedures that facilitate delivery of care at each level. One key barrier identified has been the absence of a clear pathway or coherent framework within which to mobilise or deliver interventions, despite an abundance of research-based recommendations and professional body guidance [8–12]; few COVID-19 mental health guidance documents propose how recommendations fit together to produce a pathway of care.

It is further suggested that these recommendations and model of psychological care are implemented for use with frontline workers and in the recently developed 'wellbeing hubs'.

5.1. Strengths and Limitations

This study derived specific, practical recommendations for care from interviews with doctors following two waves of the COVID-19 pandemic. In response to calls to action [24], this study sought to draw on both the experience of those on the frontline but also a PPI group to assess salience, validity, and relevance of recommendations. A panel of field experts were also consulted to ensure recommendations were relevant and feasible. A purposive sample based on ethnicity, gender, specialty, and seniority were used in this study, increasing confidence in our findings and their relevance to these groups.

This study focuses solely on doctors rather than healthcare workers (HCW) more broadly: it is erroneous to assume that doctors, nurses, and other HCW are a homogenous group. Different professional groups are likely to have unique experiences working on the frontline and have been found to differ in their preferred coping mechanisms [44]. Finally, this study sampled only those experiencing clinical levels of psychological distress; while the rationale supports this, we are not able to offer insight into the needs of those who have not been psychologically impacted, and indeed, why that might be.

5.2. Future Research Directions

Interventions such as trauma-focused Cognitive Behavioural Therapy (CBT) and Eye Movement Desensitisation Reprocessing (EMDR) are effective for treating traumatic stress from exposure to a past trauma and are relevant to doctors, with research ongoing to support this. However, psychological interventions suitable for exposure to repeated or ongoing trauma, as experienced by healthcare staff, are lacking [50]. There is a need for effective interventions that are brief, repeatable, and low-intensity; that can be easily used each time a new trauma occurs; or that provide primary prevention (e.g., pre-emptive training to manage the impact of traumatic events when they occur).

6. Conclusions

Empirically grounded recommendations and an incremental model of psychological care were derived from psychologically distressed doctors' accounts of frontline working during COVID-19. Encompassing both basic needs such as lack of physical resources and access to specialist psychological care for those most in need, these recommendations and model of care must be implemented at an organisational level and led by clinical leaders who are well-supported, confident, and competent in delivering the necessary changes to address psychological wellbeing of doctors.

Author Contributions: The initial concept of the idea was developed by J.D. and E.C., and further developed in relation to the study design and methodology by J.I., J.D. and E.C. Clinical expertise on trauma was provided by L.I. Access to the participant pool was provided by T.R. The topic guide was devised by J.D., E.C. and J.I. and further refined by all listed authors. Interviews were conducted by A.P., J.I., E.W., J.D. and L.I. (majority conducted by A.P.). Planned analysis was led by A.P. and J.I. with K.B. and E.W. S.H. assisted with the set-up and delivery of the project. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Qualitative data from the CoCCo study is available on request by contacting J.D. on jd494@bath.ac.uk; due to the distressing nature of the data and accounts of experiences on the frontline, this is not currently being made publicly available.

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Article

A One-Year Prospective Study of Work-Related Mental Health in the Intensivists of a COVID-19 Hub Hospital

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Abstract: The COVID-19 pandemic has severely tested the physical and mental health of health care workers (HCWs). The various stages of the epidemic have posed different problems; consequently, only a prospective study can effectively describe the changes in the workers' health. This repeated cross-sectional study is based on a one-year investigation (spring 2020 to spring 2021) of intensive care physicians in one of the two COVID-19 hub hospitals in Central Italy and aims to study the evolution of the mental health status of intensivists during the pandemic. Changes in their work activity due to the pandemic were studied anonymously together with their perception of organisational justice, occupational stress, sleep quality, anxiety, depression, burnout, job satisfaction, happiness, and intention to quit. In May–June 2021, one year after the baseline, doctors reported an increased workload, isolation at work and in their social life, a lack of time for physical activity and meditation, and compassion fatigue. Stress was inversely associated with the perception of justice in safety procedures and directly correlated with work isolation. Occupational stress was significantly associated with anxiety, depression, burnout, dissatisfaction, and their intention to quit. Procedural justice was significantly associated with happiness. Doctors believed vaccinations would help control the problem; however, this positive attitude had not yet resulted in improved mental health. Doctors reported high levels of distress (73%), sleep problems (28%), anxiety (25%), and depression (64%). Interventions to correct the situation are urgently needed.

Keywords: longitudinal study; emergency; infectious disease; organisational justice; stress; loneliness; compassion fatigue; meditation; prayer; insomnia; mental health; anaesthetists; occupational health

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1. Introduction

Worldwide, the physical and mental health of health care workers (HCWs) has been put at risk by the pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). During the first phase of the pandemic, HCWs who came into contact with patients and were not adequately protected developed the disease and in turn frequently became carriers of infection [1]. A systematic review of studies published before 8 July 2020 indicated that frontline HCWs frequently developed SARS-CoV-2 (the estimated cumulated prevalence of a positive reverse transcription-polymerase chain reaction on a mucosal swab was 11%, 95% confidence interval (CI): 7, 15) [2]. In that initial period, HCWs who were COVID-19-positive accounted for a significant proportion of all COVID-19 patients. Although the severity and mortality of the disease were lower among HCWs [3], several were affected by long COVID or had permanent outcomes.

In addition to experiencing physical consequences, HCWs also underwent dramatic psychological pressure that manifested itself in various ways during the different phases of the pandemic. An impressive number of scientific publications (to date, over two thousand studies and more than a hundred systematic reviews and meta-analyses) have helped us to understand what happened. Each of the many cross-sectional studies focused on a specific phase in the pandemic during which emerging problems were added to the usual stressors of medical activities, thus resulting in a high level of disorders such as post-traumatic stress, sleep problems, anxiety, depression, and burnout [4]. HCWs were exposed to a wide range of emotions and environmental conditions that varied over time. In the very early stages, HCWs were mainly concerned with defining strategies to treat an unknown disease and minimise the possibility of transmission (e.g., via air conditioning systems [5] inside hospitals) or finding new safety procedures to assist patients [6] as well as addressing the ethical dilemmas that emerged from the imbalance between care needs and resources during the COVID-19 pandemic [7] whereas in the subsequent recurring waves of the epidemic, the main stressors were prolonged periods of work in isolation, high workloads, compassion fatigue, and a lack of time for physical activity, meditation, or relaxation.

Clearly, a cross-sectional study is not able to report this complex series of varying emotional reactions that resulted in evident repercussions on the health of HCWs and consequently on the quality of care. A few research groups have carried out short prospective studies by repeatedly consulting HCWs anonymously to evaluate, for example, a possible reduction in stress levels between the initial phase of the pandemic and the following period [8,9] or adaptation to new safety measures [10,11]. Studies that had a longer duration witnessed a steep drop in participation: out of the thousands contacted, only a few dozen HCWs responded during the follow-up [12]. In the very extensive mental health literature concerning HCWs struggling with the pandemic, we have not been able to find long-term prospective studies that measure different aspects of mental health simultaneously.

This study, which began during the first phase of the pandemic, was designed to follow a group of workers who were continuously and exclusively engaged in the treatment of patients with COVID-19 in one of the two COVID-19 hub hospitals in Central Italy. Our aim was to measure the perception of organisational justice and occupational stress and how these varied in relation to external factors. To do this, we investigated their association with possible causal factors and the resulting consequences on sleep, anxiety, depression, burnout, happiness, job satisfaction, and the intention to quit.

2. Materials and Methods

2.1. Participants

All the anaesthetists working in the COVID-19 department of the "A. Gemelli" University hospital in Rome were invited to participate by completing an anonymous questionnaire on the SurveyMonkey online platform. The baseline collection was carried out in April–May 2020 during the first wave; a second collection was conducted in December 2020 during the second wave and the current collection was conducted in April–May 2021 during the third wave, exactly one year after the first. No incentives were provided for participation. The workers were informed by email of the results of the previous surveys and asked to participate. The survey was conducted in accordance with the Helsinki Declaration. The Catholic University Ethics Committee approved the study (ID 3292).

Of the 198 eligible workers who were in service on 1 April 2021, 120 completed the present survey (participation rate = 60.6%). The cohort varied because many workers who had participated in the baseline left the hospital in the course of the year. The percentage of trainees in the cohort increased significantly during our survey because the hospital hired them under fixed-term contracts, moving them from the general hospital where they served at the COVID-19 centre to meet the care needs posed by the pandemic. However, the age distribution of the cohort did not change during the survey. In the current survey, participants were mainly young (70% under 35 years of age), female (62, 51.7%) workers.

Just over half of the participants (65, 54.2%) had been employed in the hospital for more than three years and 15 (12.5%) had been working there for less than a year.

The proportion of workers who reported unprotected exposure to COVID-19 patients increased significantly during the periods of observation (Table 1). At the time of the third survey, 59.2% reported at least one unprotected exposure. Of these, 4.2% occurred in a non-work environment and 16.9% both in the workplace and outside the workplace but, in most cases (78.9%), exposures were exclusively of a professional nature. A total of 23 HCWs (19.2%) had contracted COVID-19 and an additional 8 (6.7%) reported having had a false-positive antigen test at the periodic screening that all hospital workers undergo. A non-significant increase was observed in the prevalence of unprotected exposures and infections between the second and third survey. Most of the workers who had contracted the infection were completely asymptomatic (10, 38.5%) or had mild symptoms that did not require treatment (14, 53.8%); only 2 had mild symptoms that required home treatment. However, a significant proportion of the subjects who had contracted the disease reported protracted symptoms after the end of the infectious phase (long COVID, 38.5%) or permanent outcomes (post-COVID, 3.7%)

Table 1. Characteristics of the population.

Variables	Baseline		2nd Survey		3rd Survey		X^2
	n	%	*n*	%	*n*	%	*p*
Participant	154		105		120		
Resident	58	37.7	55	52.4	68	56.7	0.004
Gender, male	75	48.7	51	48.6	58	48.3	0.998
Age, < 35 years	94	61.0	76	72.4	84	70.0	0.115
Reporting unprotected exposure to COVID-19 patients	38	24.7	59	56.2	71	59.2	0.000
Reporting a false-positive swab test	-	-	2	1.9	8	6.7	-
Reporting COVID-19 disease	-	-	16	15.2	23	19.2	0.437
Asymptomatic COVID-19 case	-	-	6	37.5	10	38.5	0.709
Mild COVID-19 case	-	-	9	56.3	14	53.8	0.773
Moderate COVID-19 case	-	-	1	6.3	2	7.7	-
Reporting long COVID	-	-	-	-	10	38.5	-
Reporting post-COVID	-	-	-	-	1	3.7	-

2.2. Questionnaire

The questionnaire used in the survey was composed of a series of ad hoc questions, mainly related to the phase of the pandemic, and a few standardised tools for measuring perceived organisational justice, stress, and effects on mental health. To facilitate the interpretation of the results, all the scales obtained from the questionnaire were standardised by dividing by the maximum value of the scale and multiplying by 100.

Organisational justice was measured with the Italian version [13] of the Colquitt questionnaire [14–16]. The workers were invited to assess the correctness of the safety procedures by means of 3-item questions (e.g., "Are these procedures error-free?"). Each question was answered according to a 5-point Likert scale, from 1 = "I totally disagree" to 5 = "I strongly agree", thus producing a scale ranging from 3 to 15. In this study, the reliability of the questionnaire, measured by Cronbach's alpha, was 0.749 (good). The raw score was standardised.

Stress was measured using the Italian version [17,18] of the Siegrist effort/reward imbalance model [19,20]. The questionnaire contained three graded questions on a 4-point Likert scale for effort and seven for the reward scale, thus constituting two scales graded from 3 to 12 and 7 to 28, respectively. The raw scores were standardised. The weighted ratio between effort and reward (effort reward imbalance, ERI), if greater than unity, indicated a state of distress. In this study, the reliability of the scales, measured by Cronbach's alpha, was 0.726 for effort (good) and 0.820 for reward (very good).

Sleep quality was measured with the 2-item version of the "Sleep Condition Indicator" (SCI-02) [21,22], which aims to assess insomnia according to the Diagnostic Statistic Manual 5 (DSM5). Each question was graded on a 5-point Likert scale ranging from 4 to 0. The final score ranged between 0 and 8, with higher values indicating a better sleep quality. A score of $\leq$4 revealed a possible insomnia disorder. Cronbach's alpha in this study was 0.746 (good). The raw scores were standardised.

Mental health was measured using Goldberg's anxiety and depression scales (GADS) [23,24], each of which consisted of 9 binary questions. A score of 5 or more affirmative answers to the questions on the anxiety scale and two or more to the questions on the depression scale indicated a probable diagnosis of anxiety and depression. In this study, the reliability of the GADS questionnaire, measured by Cronbach's alpha, was 0.788 (good).

Job satisfaction was measured by a single question expressed on a 7-point Likert scale ranging from extremely dissatisfied to extremely satisfied, according to Warr et al. [25,26]. Happiness was measured by the 10-point scale of Ab-del-Khalek [27]. The frequency of burnout feelings was measured on a 6-point scale, according to West et al. [28]. The intention to quit the hospital was measured with a single item (yes/no).

2.3. Statistics

The variables were analysed in descriptive terms of mean and standard deviation for continuous variables and frequency for categorical variables. The variables measured at the baseline during the first pandemic wave (T_0), the second wave (T_1), and the third wave (T_2) were compared by an analysis of variance and a post-hoc comparison using the Bonferroni test if continuous or by means of the chi-squared and Fischer test if categorical.

A stepwise linear regression was used to determine which of the possible stressors had a greater effect on occupational stress. Perceived stress was the dependent variable (effort-reward imbalance). The independent variables included in the model were gender, age range, physical activity, meditation, procedural justice, workload, monotony, compassion fatigue, isolation at work, and social loneliness. In the stepwise selection method, the model started by entering the variable with the smallest p-value (PIN $p < 0.05$); after each step in which a variable was added, all candidate variables in the model were checked to see if their significance had fallen below the specified tolerance level (POUT $p > 0.1$).

To study the association of perceived justice and stress with mental health indicators, we constructed multiple linear regression models to assess the effect on sleep quality, anxiety, and depression and adjusted the result for age and gender.

Finally, we assessed the extent to which working conditions determined possible cases of anxiety, depression, burnout, dissatisfaction, and the intention to leave the workplace by constructing multiple logistic regression models adjusted for gender and age. In this way, we calculated the odds ratio (OR). For each OR, we calculated the 95% confidence interval (CI95%).

The analyses were performed using IBM/SPSS 26.0 (IBM Corporation, Armonk, NY, USA).

3. Results

In the third survey, the subjective perception of workload tended to grow progressively. The workers confirmed that their workload was greater/much greater than before the pandemic. For many of them, the type of medical activity had also become progressively more repetitive and monotonous because of the need to continually apply the same diagnostic and therapeutic procedures in COVID-19 patients. For safety reasons, contact with their patients' families was limited and there was an increasingly frequent need to inform patients of the unfavourable outcome of treatment, all of which contributed to determining compassion fatigue (Table 2). All these unfavourable occupational changes were reported more frequently in this survey than at the baseline. Moreover, 40% of workers complained of having to work in isolation and about 70% suffered from a reduction in social contacts.

However, between the second and third surveys, we observed a significantly lower frequency of workers who complained of isolation in their social life. Factors that contribute to increasing resilience such as the time devoted to physical activity, meditation, prayer, or spiritual activities were reduced or greatly reduced in most workers, as in previous surveys (Table 2).

Table 2. Changes reported during the COVID-19 outbreak and prevalence of high stress, insomnia, anxiety, and depression during the 1st and 2nd waves.

Reported Effect	Baseline		2nd Survey		3rd Survey		
	n	%	*n*	%	*n*	%	*p*
Increased/greatly increased workload	77	50.0	83	83.0	98	84.5	0.000
The work became more repetitive and monotonous	51	33.1	36	36.0	53	45.7	0.162
More frequent need to inform of the death of a relative	61	39.6	65	65.0	81	69.8	0.000
Isolation at work			42	42.0	47	40.5	0.669
Isolation in life			81	81.0	78	67.2	0.008
Time for physical exercise was shorter/much shorter	117	76.0	80	80.0	92	79.3	0.742
Time for meditation was shorter/much shorter	72	46.8	65	65.0	74	63.8	0.006
Distressed (effort/reward weighted ratio > 1)	117	76.0	80	80.0	83	72.8	0.468
Insomniac (SCI08 score $\leq$ 16; SCI02 score $\leq$ 4)	58	43.3	33	33.0	32	28.1	0.037
Anxious (GADS anxiety score $\geq$ 5)	40	26.0	31	31.0	29	25.4	0.599
Depressed (GADS depression score $\geq$ 2)	75	48.7	63	63.0	73	64.0	0.017

SCI08 = Sleep Condition Indicator used in the baseline survey; SCI02 = Sleep Condition Indicator short form with two items used in the 2nd and 3rd survey; GADS = Goldberg's anxiety and depression scales.

All workers were vaccinated between the second and third surveys. Most of them were moderately or strongly in agreement (71.0%) with the following statement: "With vaccinations it will be possible to control the pandemic".

The perception of procedural justice, i.e., the degree of trust in safety measures, was not high, exactly as in the previous surveys (Table 3).

Table 3. Mental health indicators (perceived justice, occupational stress, sleep quality, anxiety, depression) in anaesthesiologists during the three waves of the COVID-19 outbreak.

Variable	1st Wave	2nd Wave	3rd Wave	ANOVA	Bonferroni	
	Mean $\pm$ s.d.	Mean $\pm$ s.d.	Mean $\pm$ s.d.	*p*	*p*	
Procedural Justice	49.91 $\pm$ 13.64	53.60 $\pm$ 15.60	53.33 $\pm$ 15.67	0.079		
Effort	71.48 $\pm$ 16.59	77.91 $\pm$ 14.03	77.34 $\pm$ 14.52	0.001	1 vs. 2 0.003	1 vs. 3 0.006
Reward	58.88 $\pm$ 13.13	59.36 $\pm$ 13.95	61.40 $\pm$ 13.97	0.304		
Job stress	1.30 $\pm$ 0.51	1.42 $\pm$ 0.56	1.37 $\pm$ 0.57	0.228		
Sleep quality	59.64 $\pm$ 25.11	65.13 $\pm$ 28.50	67.43 $\pm$ 27.31	0.051		
Anxiety	3.04 $\pm$ 2.32	3.34 $\pm$ 2.33	3.02 $\pm$ 1.93	0.487		
Depression	1.97 $\pm$ 1.87	2.71 $\pm$ 1.95	2.49 $\pm$ 1.91	0.007	1 vs. 2 0.008	1 vs. 3 n.s.

On average, the efforts made by workers to respond to job demands remained very high (77% of the maximum value), confirming the level recorded in the second survey, which was significantly higher than at the baseline. The rewards earned from work showed a modest, non-significant increase. Occupational stress levels were on average much higher than the equivalence level between efforts and rewards, indicating a widespread state of distress in the sample. The share of distressed workers remained constant in the three surveys: at least three out of four workers were in a state of distress throughout the year.

The average score of the GADS anxiety scale did not register significant changes in the third survey and therefore it was confirmed that more than one in four workers had a score corresponding with a diagnosis of anxiety made by a specialist. Conversely, the mean

score of the depression scale showed a significant increase in the second survey compared with the baseline; in the present survey, it remained constant. Three out of five workers manifested depressive symptoms.

The quality of sleep, although remaining rather low (scores on average at two thirds of the maximum) showed a slight, non-significant improvement in the third survey compared with the baseline. The number of workers affected by insomnia was significantly lower in this survey than during the first wave.

A stepwise linear regression analysis was conducted to evaluate which of the variations in work activity associated with COVID-19 was most closely related to occupational stress. The prediction model, which explained 39.4% of the variance of stress, included isolation at work and a reduced perception of organisational justice in addition to the age group > 35 years (Table 4).

Table 4. Third wave stepwise linear regression analysis: the relationship between job changes and perceived work-related stress (ERI).

Variable	ERI	
	Standardised Beta	*p*
Isolation at work	0.383	0.000
Procedural justice	−0.335	0.000
Age class.	0.293	0.000
Determination coefficient of the model (R^2)		0.394

Variables excluded from the model: gender, monotony, compassion fatigue, social loneliness, physical activity, workload, and meditation.

The perception of organisational justice and the occupational stress variables were significantly associated with poor sleep quality, anxiety, and depression. In particular, the effort made to work was significantly associated with a reduced quality of sleep and with an increased anxiety and depression score in a multiple linear regression model adjusted for demographic variables (Table 5).

Table 5. Third wave health outcomes associated with procedural justice and occupational stress: a linear regression analysis adjusted for age and gender.

Variable	Sleep Quality		Anxiety		Depression	
	Standardised Beta	*p*	Standardised Beta	*p*	Standardised Beta	*p*
Procedural justice	0.062	0.628	−0.022	0.845	0.027	0.810
Effort	−0.333	0.013	0.541	0.000	0.578	0.000
Reward	0.066	0.613	−0.084	0.473	−0.057	0.622

A total of 21% of workers said they were dissatisfied with their job and 41.2% said they intended to quit. The average happiness score was 6.55 ± 1.92 on a scale of 1 to 10. Nearly half the workers (46.5%) reported experiencing burnout several times a month or more frequently.

The relationship between stress and the perception of justice and mental health was studied using a logistic regression analysis. The risk of being anxious and depressed or suffering from burnout was significantly associated with effort whereas the intangible rewards derived from work (reward) were protective towards burnout, job dissatisfaction and the intention to quit. Dissatisfaction with one's job and the intention to leave the job were significantly associated with high effort and low reward. Happiness was significantly associated with organisational justice (Table 6).

Table 6. Third wave health outcomes associated with procedural justice and occupational stress: a multivariate logistic regression model adjusted for age and gender.

Predictor	Dependent Variable OR (CI95%)					
	Anxious [1]	Depressed [2]	Burned Out [3]	Dissatisfied [4]	Happy [3]	Intention to Quit
Procedural justice	1.063 (0.843–1.340)	0.905 (0.729–1.124)	1.062 (0.840–1.344)	0.970 (0.765–1.230)	1.252 * (1.000–1.568)	0.870 (0.675–1.121)
Effort	1.721 (1.199–2.468) **	1.515 (1.095–2.096) *	2.151 (1.435–3.224) ***	1.459 (1.027–2.071) *	0.765 (0.560–1.044)	1.871 (1.230–2.847) **
Reward	0.947 (0.825–1.087)	0.926 (0.812–1.057)	0.848 (0.737–0.975) *	0.766 (0.655–0.894) ***	1.049 (0.916–1.201)	0.762 (0.650–0.892) ***

[1] = GADS anxiety score ≥ 5; [2] = GADS depression score ≥ 2; [3] = dichotomised at the median; [4] = moderately, very, or extremely dissatisfied. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

4. Discussion

This study, which, to the best of our knowledge, is the only prospective research on intensive care HCWs caring exclusively for COVID-19 cases conducted over a period of one year starting from the beginning of the pandemic, has shown that the mental health status of these workers is not excellent. Occupational stress, which remained high throughout the observation period, was associated with an elevated frequency of anxiety and an increasing prevalence of depression. Nearly half of the workers often felt burnout, and levels of job satisfaction and happiness in life were not satisfactory. A considerable number of intensivists planned to leave the hospital.

During epidemics, frontline anaesthetists are among the most vulnerable HCWs on account of infections and mental health problems [29–32]. All the effects observed in our sample have been reported by other cross-sectional studies on HCWs engaged on the frontline during the pandemic. Insomnia, anxiety, and depression were observed in the early phases of the pandemic in Chinese workers [33]. Fear and lack of confidence in safety measures were associated with reduced job satisfaction and the intention to leave the job [34]. Later on, these negative emotions occasionally led to post-traumatic stress disorder [35,36] or burnout [37,38]. The psychological picture naturally varied over time; a few months after the acute phase of the epidemic, both recurring involuntary memories and happiness were described [39]. The type of occupational problems to which workers were exposed changed over the course of the pandemic: in the early stages, a lack of readiness, a shortage of PPE, separation from families, stigma [40], and an increased workload [41,42] prevailed among professionals whereas in later stages other stressors, such as the death of patients and colleagues inducing moral injury and distress [43,44] and isolation or lack of support at work [45,46], attracted the attention of researchers. Moreover, a lack of physical activity has been associated with a poor quality of life in frontline HCWs [47], and a number of studies has underlined the importance of meditation and spirituality in improving psychological resilience in HCWs during the pandemic [48–51].

The repeated cross-sectional nature of our epidemiological design enabled us to follow variations over time in the response of HCWs to the pressure posed by the pandemic. Our setting—one of the two hub hospitals for COVID-19 in Central Italy—was typical of the conditions observed throughout the country. During the first wave of the pandemic in Italy in the spring of 2020 [52], the shortage of personal protective equipment (PPE), the fear of infection, and uncertainty about new safety measures were the main stressors [53] especially for younger workers and residents [54]. Before widespread screening measures were introduced [55], the oligosymptomatic carriers of SARS-CoV-2 represented a particularly threatening occupational risk that was difficult to predict [56]. HCWs who experienced unprotected exposure to patients with Covid-19 and, to a greater extent, those who tested positive for PCR manifested elevated levels of anxiety, depression, and sleep disturbances [57]. Our prospective observation of a highly selected sample of workers

continuously engaged in caring for COVID-19 patients demonstrated that in the first phase of the pandemic, the main stressors were the need to adhere to new safety procedures and uncertainty about their effectiveness [58]. The younger and less experienced residents complained of a significantly lower level of informational justice than the specialists although they had all undergone the same training [54]. Confidence in the correctness of safety procedures immediately proved to be an important factor in protecting against occupational stress. The widespread state of alarm and fear for their own health and that of their family members strongly influenced the quality of sleep [58].

During the second wave, in the autumn of 2020 [59], when the question of protective devices had been solved and new safety procedures were in place, other problems became evident. Difficulties in relations between doctors and patients' relatives led to a sharp deterioration in public opinion towards doctors, as witnessed by a surge in complaints of malpractice [60]. The availability of effective and rapid screening tests made possible a better control of infections; however, this continued to affect HCWs and thus reduced the workforce even in sectors where the workload was already excessive. The isolation of patients from their relatives and the isolation of HCWs from their colleagues proved to be a major stressor. Frontline HCWs were strongly isolated in their social life and registered a strong change in the orientation of public opinion towards them, which passed in a few months from very favourable to critical [60]. In our sample, the high workload and lack of time for meditation and activities that allow for mental recovery have been, in the opinion of doctors, increasingly important stressors. Their work was always carried out in solitude. The relationships with the patients' relatives became less but paradoxically the need to inform them of the unfavourable outcome of the therapies increased. This has certainly contributed to changing opinion towards doctors and has increased their social isolation. The prolongation of the epidemic—with workload levels that were higher than at the baseline without time to devote to family, sports, or meditation and persistent uncertainty about the correctness and effectiveness of safety procedure—has led to a significant increase in symptoms of depression [61].

In early 2021, the availability of vaccines made it possible to vaccinate all HCWs who consequently perceived the possibility of controlling the pandemic. Immunised workers probably felt able to resume social activities. In fact, the third survey reported a reduced prevalence of those who complained of isolation in life. However, at the time of our investigation, these positive changes had still not had a significant impact on mental health conditions. Only sleep quality showed a modest improvement from the baseline whereas distress, anxiety, and depression remained unacceptably high. Nevertheless, the trend towards improved sleep is worth highlighting because sleep has been shown to be a moderator of the relationship between stress and mental health [57] and could therefore be a positive indication of possible future health improvements. The factors that weigh most heavily on the perception of stress at this moment are isolation at work and the perception of a lack of correctness in the organisation of work. A year after the outbreak of the coronavirus epidemic, older workers such as specialists with permanent contracts are shouldering the greatest burden, probably because during the current stable phase of the epidemic, they are responsible for organisation and training.

Clearly, the situation illustrated in our study calls for preventive and supportive action. Unfortunately, it is far from easy to implement this kind of intervention. Excessive workload could be remedied by increasing staff but adequately trained personnel are not available and, as we have seen, the hiring of young physicians leads to training problems [54]. Preventive social distancing hinders clinical training and relationships with patients' relatives, thus increasing the clinical risk and the danger of a reduction in the quality of care. The lack of time to devote to physical activity or meditation and intellectual activities reduces resilience and hinders the application of individual psychological support treatments. The high percentage of workers reporting unprotected exposures and the fact that one in five has contracted COVID-19 indicate the need to improve safety procedures and their enforcement. The pandemic has compelled hospital authorities to introduce safety

measures with a "top-down" approach. The low degree of confidence in these procedures, which still persists a year after their implementation, should encourage the authorities to obtain greater worker participation in the planning and control of these measures. A "bottom-up" approach involving participatory ergonomics groups [62] could increase the collaboration of workers, the effectiveness of the measures, and the perception of organisational justice, thus reducing occupational stress. Another administrative measure that could reduce the perception of stress (if not effort) would be to increase material and immaterial rewards that doctors receive for their work. Furthermore, given the importance of sleep in the relationship between stress and pathologies [63,64], the utmost attention should be given to scheduling work shifts and respecting recovery times. Workers should be informed about the importance of proper sleep hygiene and trained to prevent sleep disturbances. This simple measure has proved effective in preventing stress damage in other categories of workers [65].

This study has several limitations. Although it was conducted over a one-year period on a high-risk population simultaneously investigating numerous variables that make up the complex relationships between work, stress, and health, our study was limited by being able to observe only one setting and therefore a numerically modest sample. The chosen setting, one of the two COVID-19 hospitals in Central Italy, and the representativeness of the response, which in each phase of the longitudinal study involved a qualified majority of those eligible, authorise us to believe that the results realistically describe the situation of workers continuously and exclusively dedicated to treating COVID-19 patients from the beginning of the pandemic to today. However, we cannot assume that the findings can be applied to all HCWs.

Another limitation is related to the epidemiological model. As participants were guaranteed anonymity, we were unable to evaluate the incidence of the reported pathologies; however, the prospective nature of the observations, which were repeated in correspondence with the three pandemic waves, made it possible to describe the evolution of the psychological state of frontline physicians during COVID-19 with greater effectiveness than in the numerous cross-sectional investigations conducted around the world.

5. Conclusions

In conclusion, our study documented the complexity and relevance of the psychological response of physicians at the forefront of the COVID-19 pandemic. Workers responded to the uncertainties and unpreparedness of the first wave with anxiety and sleep problems. The protracted work in isolation, the lack of time for meditation, and growing compassion fatigue resulted in a significant increase in depression in the second phase. In the third phase, the availability of vaccines allowed a partial resumption of social contacts but workers still reported concerns about safety measures, excessive workload, responsibility, high occupational stress, anxiety and depression, low satisfaction, burnout, and the intention to quit. The picture that emerged from one year of observations calls for the adoption of support measures. Participatory involvement in safety procedures, increased intangible rewards, and increased attention to meditation and sleep are recommended.

If the photo symbolising healthcare in Italy in the spring of 2020 was that of a nurse falling asleep in the workplace [66]—thus illustrating both the self-denial of the individual and the inadequacy of the work organisation—today, it is fair to ask that doctors who provide intensive care for COVID-19 patients have full occupational well-being.

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Mental Health Symptoms and Workplace Challenges among Australian Paramedics during the COVID-19 Pandemic

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Abstract: Background: Paramedics are vital to the health system response to the COVID-19 pandemic; however, the pressures on this workforce have been intense and challenging. This study reports on mental health symptoms and the working environment among Australian paramedics during the COVID-19 pandemic and explores their experiences of work and wellbeing during this time. Methods: An anonymous, online survey of frontline healthcare workers examined work environment, psychological wellbeing, and contained four open-ended qualitative items. Using a mixed method approach, quantitative data were analysed descriptively and qualitative data were analysed using content analysis. Results: This paper reports findings from 95 paramedics who provided complete quantitative data and 85 paramedics who provided free-text responses to at least one qualitative item. Objectively measured mental health symptoms were common among paramedics, and almost two thirds of paramedics self-reported experiencing burnout. Qualitative analysis highlighted key issues of safety and risk in the workplace, uncertainty and upheaval at work and at home, and lack of crisis preparedness. Qualitative analysis revealed four themes; 'the pervasiveness of COVID-19 disruptions across all life domains'; 'the challenges of widespread disruption at work'; 'risk, uncertainty and feeling unsafe at work', and 'the challenges of pandemic (un)preparedness across the health system'. Conclusions: The COVID-19 pandemic resulted in considerable occupational disruption for paramedics and was associated with significant negative impacts on mental health. Findings emphasise the need for more adaptive working conditions, mental health support for paramedics, and enhanced crisis preparedness across the health system for future crises.

Keywords: paramedics; pandemic; COVID-19; mental health; occupational stress; workplace; mixed methods

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1. Introduction

Public health crises such as the COVID-19 pandemic represent a major threat to the wellbeing of frontline healthcare workers (HCW), including paramedics. Frontline HCWs working in the community are particularly affected by such events, which intensify existing stressors and create additional challenges, such as increased uncertainty in the workplace [1,2]. Paramedics are a vital and fundamental part of this frontline healthcare response to COVID-19 and have faced increased risk and workplace stress during the pandemic [3]. Paramedics have had to adapt quickly to multiple challenges, including fear of contracting the virus, increased workloads, insufficient resources and large amounts of new and constantly changing information. The work of paramedics is also impacted by changes to healthcare delivery in both primary and secondary care as well as community perceptions about accessing healthcare services generally. Despite an initial reduction in callouts during the pandemic, lockdown restrictions are implicated in increased callouts

for psychiatric, behavioural and social reasons. Paramedics also bear the brunt of hospital protocol changes that may lengthen wait times for admission, and even the shift from face to face to telehealth in general practice may affect the type of call outs to which paramedics must respond [4]. Together, these conditions and changes pose significant threats to the wellbeing of paramedics, with potential for adverse effects on their mental health.

Even outside of public health crises, evidence suggests that paramedics may be at increased risk of mental health problems. Whilst elevated rates of mental health disorders, particularly post-traumatic stress disorder (PTSD), have been identified among emergency service workers [5], a 2012 review suggested that ambulance personnel may be at particularly high risk for PTSD compared to other emergency services [6]. A systematic review and meta-analysis of common mental disorders estimated pooled prevalence rates of 27% for general psychological distress, 15% for depression, 15% for anxiety and 11% for PTSD amongst ambulance personnel worldwide [7].

There is evidence from previous crises, such as the severe acute respiratory syndrome (SARS) pandemic, that working during a pandemic can have long-term adverse mental health effects [8–10]. Meta-analyses of studies undertaken with HCWs early in the COVID-19 pandemic indicated that between 20 and 25% of HCWs reported high levels of anxiety, depression and post-traumatic stress symptoms [11,12]. International evidence has continued to emerge showing high rates of anxiety, depression, PTSD [13,14] and burnout [15,16] among HCWs working during the COVID-19 pandemic. Recent data from Australia have also demonstrated the substantial mental health burden of being a HCW during the pandemic [17,18]. However, paramedics are under-represented in research on the impacts of COVID-19, as well as in the literature on the mental health of HCWs more broadly [6,7], with Australian research particularly lacking.

This study reports a subset of findings from the Australian Frontline Health Worker Study, which investigated the severity and prevalence of mental health problems and assessed the workplace, social and financial disruptions and challenges experienced by Australian HCWs during the COVID-19 pandemic [17]. A mixed methods sub-study was designed to focus on paramedics and had three objectives: (i) to assess the rates and severity of mental health problems and describe the occupational, social and financial disruptions experienced since the pandemic began; (ii) to identify the challenges and working conditions reported by paramedics during the pandemic; and (iii) to explore the experience and impact of these workplace factors on paramedics' wellbeing and life.

2. Materials and Methods

2.1. Study Setting, Design, Recruitment and Procedure

The full study methodology has been published elsewhere [17]. In summary, a nationwide, voluntary, cross-sectional, online, anonymous survey was conducted between 27 August and 23 October 2020. At this time, Australia was experiencing a second wave of the pandemic and in the state of Victoria, tough lockdown restrictions were imposed, restricting movement outside of the home, limiting the radius of travel, and requiring the use of masks in settings outside the home. While the situation has changed since then with lockdown restrictions eased and the Omicron variant of the virus spreading rapidly throughout most parts of Australia, in mid-2020, Victoria experienced far higher community transmission of the virus than other states, with active cases peaking at 6776 in early August [4], and these stringent lockdown restrictions were aimed at suppressing the spread of the virus.

Self-identified frontline HCWs from all health roles working in primary or secondary care across Australia were invited to participate using multiple recruitment and advertisement strategies. The study was promoted through health service organisations, and advertised widely via newspaper, television and radio news items, and social media sites. Strategies to recruit paramedics included contacting key ambulance personnel and asking them to promote the study to paramedics.

Data were collected at a single time point and each participant completed the survey once. Online consent was obtained prior to commencing the survey. The survey comprised:

demographics, work environment, self-reported mental health issues and five objective validated mental health measures (the Generalised Anxiety Disorder (GAD-7) for anxiety [18], Patient Health Questionnaire (PHQ-9) for depression [19], abbreviated Impact of Event Scale (IES-6) for post-traumatic stress disorder (PTSD) [20], abbreviated Maslach Burnout Inventory (MBI) for burnout, and abbreviated 2-item CD-RISC-2 scale for resilience [21]). Four optional open-ended free-text qualitative items were included asking participants about (a) what would help them to deal with stress and anxiety; (b) the main challenges of the pandemic; (c) the strategies they thought that would be useful in the future; and (d) if there was anything else they wished to add. Participants could write as much or as little as they wished in their responses.

2.2. Ethics Approval

The study received ethics approval from the Melbourne Health Human Research Ethics Committee (HREC/67074/MH-2020 approved 20 August 2020). All participants provided consent online. Information for participants was provided on the survey website, indicating that data would be stored securely, that no identifiable data were being collected, and that care would be taken to ensure that data remained anonymous in reporting. As the survey was about the psychosocial impact of COVID-19, links to mental health resources were also provided on the survey website.

2.3. Sub-Study Participants and Data Analysis

As paramedics were the focus of this sub-study, the current study reports only on participants who self-identified as paramedics. Quantitative data analysis was performed by two authors (KP and AP) and checked by NS, using SPSS statistical software version 26.0 (IBM Corp., Armonk, NY, USA). Demographic and work characteristics, mental health symptoms and workplace changes during the pandemic are reported descriptively, with Chi-square tests of independence (categorical data) and independent *t*-tests (continuous data) performed to compare paramedics with all other HCWs. Statistical significance was set at $p < 0.05$.

A qualitative descriptive approach [22,23] using content analysis was used to analyse the free-text responses. Data were exported into Excel, and an inductive approach was taken to elicit the key ideas in the responses. All responses were coded initially by one author (KP), with up to three codes applied per response, and a codebook was developed, with coding and codebook reviewed weekly by KW. As coding proceeded, additions were made to the codebook with the emergence of new ideas, and some coding categories were condensed or removed as coding progressed. Codes with similar or related underlying ideas were grouped together into key themes [24,25]. Weekly review meetings between KW and KP focused on achieving consensus on themes and sub-themes, with NS providing critical feedback on coherence between codes and themes at two time points.

3. Results

From 9518 participants, complete data were received from 7845 (82.4%), of whom 95 (1.2%) were paramedics. Half of all paramedics were female (50.5%, $n = 48$) and most were aged between 31 and 50 years (57.9%, $n = 55$) (Table 1). While the study was promoted nationally, most participants were from the Australian state of Victoria, partially explained by the fact that this was where there was the highest number of community transmissions and the most severe lockdown restrictions during the period of the survey.

Most paramedics were working full-time, and the majority reported working with individuals infected with COVID-19 (81.1%, $n = 77$). Concern about possible transmission of COVID-19 to their family was high (82.8%, $n = 77$) (Table 2). Almost half of paramedics reported working increased hours (49.4%, $n = 47$). Almost half of participants indicated a need for more training regarding personal protective equipment (PPE) or managing people infected with COVID-19 (45.3%, $n = 43$).

Table 1. Participants' characteristics (n = 7845).

Characteristic	Paramedics (n = 95)		All Other Professions (n = 7750)	
	Frequency (n)	**%**	**Frequency (n)**	**%**
Age (years)				
20–30	22	23.2	1838	23.7
31–40	32	33.7	2218	28.6
41–50	23	24.2	1715	22.1
>50	18	18.9	1979	25.5
Gender				
Male	45	47.4	1413	18.2
Female	48	50.5	6295	81.2
Non-binary	1	1.1	18	0.2
Prefer not to say	1	1.1	24	0.3
Living arrangements				
Lives alone	15	15.8	1072	13.8
Children <16 years at home	37	38.9	2707	34.9
Persons aged >65 years at home	9	9.5	688	8.9

Table 2. Workplace environment (n = 7845).

Characteristic	Paramedics (n = 95)		All Other Professions (n = 7750)		
	Frequency (n)	**%**	**Frequency (n)**	**%**	***p***
Location of practice					<0.001
Metropolitan	47	49.5	6325	81.6	
Regional/remote	48	50.5	1425	18.4	
Current employment status					<0.001
Full time	81	85.3	3736	48.2	
Part time	9	9.5	3633	46.9	
Casual/other	5	5.3	381	4.9	
Any change in working hours since the pandemic commenced **					
Increased paid hours	31	32.6	1603	20.7	0.004
Increased unpaid hours	16	16.8	1670	21.5	0.27
Decreased paid or unpaid hours	4	4.2	862	11.4	0.03
No change	52	54.7	3986	51.4	0.52
Currently working with people infected with COVID-19	77	81.1	2986	38.5	<0.001
Received training on PPE during the pandemic	88	92.6	5049	65.1	<0.001
Confidence in using PPE (mean score) *	5.30 (n = 93)	SD = 1.79	5.38 (n = 5860)	SD =1.60	0.65
Received training to care for patients with COVID-19	48	50.5	2744	35.4	<0.01
Confidence in caring for people with COVID-19 (mean score) *	5.12 (n = 91)	SD = 1.63	4.89 (n = 5786)	SD = 1.58	0.16
Desires more training regarding PPE or managing people with COVID-19	43	45.3	2957	50.5	0.42

Table 2. *Cont.*

Characteristic	Paramedics (n = 95)		All Other Professions (n = 7750)		
	Frequency (n)	**%**	**Frequency (n)**	**%**	***p***
Worried their role will lead to them transmitting COVID-19 to family					0.18
Not worried	11	11.8	718	12.3	
Neutral	5	5.4	669	11.4	
Worried or very worried	77	82.8	4473	76.3	
Worried about being blamed by colleagues if they contract COVID-19					0.28
Strongly or somewhat agree	62	65.3	4886	63.0	
Neither agree/disagree	19	20.0	1256	16.2	
Strongly or somewhat disagree	14	14.7	1608	20.7	
Communication received from the workplace during the pandemic has been useful and timely					0.79
Strongly or somewhat agree	69	72.6	5763	74.4	
Neither agree/disagree	9	9.5	792	10.2	
Strongly or somewhat disagree	17	17.9	1195	15.4	
Believed their workplace actively supported their wellbeing and mental health during the pandemic					0.77
Strongly or somewhat agree	63	66.3	5288	68.2	
Neither agree/disagree	14	14.7	1205	15.5	
Strongly or somewhat disagree	18	18.9	1257	16.2	

* Confidence was scored on a 7-point Likert scale: 1 = very unconfident, 7 = very confident. ** Multiple responses could be selected.

One third of participants reported having a diagnosed mental health condition before the pandemic (33.7%, n = 32) (Table 3). Many participants self-reported experiencing subjectively determined mental health issues since the onset of the pandemic, most commonly symptoms of burnout (61.1%, n = 58) and anxiety (53.7%, n = 51). Paramedics' responses to objective mental health symptom scales indicated moderate to severe symptoms of: emotional exhaustion (burnout subscale) (72.6%; n = 69), post-traumatic stress (42.1%; n = 70), anxiety (30.5%; n = 29) and depression (26.3%; n = 25). Paramedics reported significantly higher rates of self-reported PTSD (14.7%) compared to other HCWs (5.3%) ($p < 0.001$) and significantly higher rates of moderate to severe depersonalisation symptoms on the burnout scale compared to other HCWs (54.7% vs. 37.2%, respectively) ($p < 0.001$).

Table 3. Mental health symptoms (n = 7845).

Characteristic	Paramedics (n = 95)		All Other Professions (n = 7750)		
	Frequency (n)	**%**	**Frequency (n)**	**%**	***p***
Pre-existing mental health condition	32	33.7	2357	30.4	0.49
Self-reported mental health issues experienced since COVID *					
Anxiety	51	53.7	4824	62.2	0.09
Burnout	58	61.1	4517	58.3	0.59
Depression	33	34.7	2142	27.6	0.13
PTSD	14	14.7	413	5.3	<0.001
Other mental health problems	8	8.4	320	4.1	0.04
No mental health issues	17	17.9	1413	18.2	0.93

Table 3. *Cont.*

Characteristic	Paramedics (n = 95)		All Other Professions (n = 7750)		
	Frequency (n)	**%**	**Frequency (n)**	**%**	***p***
Mental health issues assessed by validated scales					
Burnout—Depersonalisation (DP)					<0.001
Low	43	45.3	4767	62.8	
Moderate/High	52	54.7	2825	37.2	
Burnout—Emotional Exhaustion (EE)					0.71
Low	26	27.4	2216	29.1	
Moderate/High	69	72.6	5389	70.9	
Burnout—Personal Accomplishment (PA)					0.39
Low	33	34.7	2325	30.6	
Moderate/High	62	65.3	5268	69.4	
Anxiety—GAD7					0.62
None to Mild	66	69.5	5559	71.8	
Moderate to Severe	29	30.5	2188	28.2	
Depression—PHQ9					0.97
None to Mild	73	76.8	5919	76.7	
Moderate to Severe	22	23.2	1801	23.3	
Impact of events/trauma—IES6					0.75
None to Mild	55	57.9	4585	59.5	
Moderate to Severe	40	42.1	3115	40.5	
Resilience—CD-RISC-2 (mean score)	3.18 (n = 94)	SD = 0.64	3.22 (n = 7746)	SD = 0.66	t-test 0.65

* Multiple options could be chosen. Anxiety (GAD-7): 0–4 = none/minimal, 5–9 = mild, 10–14 = moderate, 15–21 = severe anxiety; Depression (PHQ-9): 0–4 = none/minimal, 5–9 = mild, 10–14 = moderate, 15–19 = moderately severe, 20–27 = severe depression (Kroenke et al., 2001); PTSD (IES-6): 0–9: none-mild, >9 moderate-severe (Thoresen et al., 2009); Burnout on the MBI is indicated by higher scores on the EE and DP, and lower scores on the scale of PA. Burnout subdomains (MBI): depersonalisation DP: 0–3 = low, 4–6 = moderate, 7–18 = high; emotional exhaustion EE: 0–6 = low, 7–10 = moderate, 11–18 = high; personal accomplishment PA: 0–13 = low, 13–14 = moderate, 15–18 = high (Rikey et al., 2018).

3.1. Qualitative Findings

Of 95 participants, 84 paramedics provided valid free-text responses to at least one of the four qualitative items (88.4% of sample in quantitative analysis). Gender and work location (see Table 4 below) generally approximated the distribution in the sample overall; and the breakdown of responses to individual questions was the same as the sample overall, with Question 2 being the most frequently answered and Question 4 being the least frequently answered. Over half of participants provided responses to three or four of the free-text questions (n = 51); 26 participants responded to two questions; and 7 participants answered one question only.

Responses varied considerably, with some writing a single word, but most participants wrote a paragraph or more about their experience, and many covering multiple points within a single answer. Less than 10 responses per question were 1–2 words only; but these still provided rich data. Brief responses such as 'wearing PPE', 'burnout', and 'management caring' indicating challenges of the pandemic; and 'rest breaks', 'more compassion', 'more resources' and 'better plan' indicating the strategies useful to assist healthcare workers in future crises, were all covered by other participants in longer, more detailed responses. The data also varied according to whether participants wrote about the same issue (e.g., the

need for more time off) across multiple questions or noted quite different issues in their responses to different questions.

Table 4. Responses to free-text questions.

Question	Gender *		Work Location	
	Female	Male	Metropolitan	Regional
1. What do you think would help you most in dealing with stress, anxieties, and other mental health issues (including burnout) related to the COVID-19 pandemic? (n = 61)	37	24	29	32
2. What did you find to be the main challenges that you faced during the COVID-19 pandemic? (n = 81)	46	34	42	39
3. What strategies might be helpful to assist frontline healthcare workers during future crisis events like pandemics, disasters, etc.? (n = 69)	37	31	38	31
4. Is there anything else you would like to tell us about the impact of the COVID-19 pandemic or regarding supports that you feel are useful for well-being? (n = 26)	14	12	8	18

* Questions 2 and 3 also include response from one participant who indicated 'prefer not to say'.

From these rich and diverse approaches to the free-text questions, four themes related to paramedics' experiences of working and living during the early COVID-19 pandemic were identified. These were: the pervasiveness of COVID across all life domains; the challenges of widespread disruption at work; risk, uncertainty and feeling unsafe at work; and the challenges of pandemic (un)preparedness across the health system. Illustrative quotes are presented for each theme (Tables 5–8) to exemplify the key ideas in the data.

Table 5. Theme 1: The pervasiveness of COVID across all life domains.

Work–life imbalance challenges	Not being able to spend time with family as I was working. (male, age 31–40) Balancing work/home life. (female, age 31–40) Unrealistic expectation to be available to my staff 24/7 whilst having a young family. (female, age 31–40)
Pervasiveness of COVID stress in everyday life	[I could never] "get away" from the pandemic stressors. Affected at work then again at home due to isolation and restrictions. (male, age 31–40).
Physical and emotional symptoms	[Main challenge was] fatigue, physical effects of PPE e.g., dehydration, headaches. (female, age 50–64) [Main challenge was] exhaustion from cleaning, difficulties with eye allergies from chemicals used, heat exhaustion from full PPE. (female, age 41–50) [I have] worsening mental health and increased burn out. (female, age 31–40)
Changes to coping strategies and lack of social support	Social isolation, not being able to travel, as travel was my time away and a de-stressor. Unable to connect with other people other than who I work with. (female, age 31–40) [Feeling] over worked, burn out, no avenues for stress relief. (female, age 20–30)
Strategies needed to support mental health	Access to health facilities, i.e., pools/gyms, etc. (male, age 41–50) Allow persons of single households to connect with another household much earlier on. Being able to access psychology appointments straight away (female, age 31–40).

Table 6. Theme 2: The challenges of widespread disruption at work.

Disrupted, difficult working conditions	Added complexity and the volume of work and change in a short time is exhausting to keep up with. (female, age 50–64) [Main challenge was] Cleaning ambulances and equipment in trucks post COVID cases! (female, age 31–40)
Working with inconsistencies	Biggest issues are inconsistent approaches between hospitals and having to follow different protocols depending on where patients are transported. Hard to know what we are doing at times as it changes so often, generally mid shift with no notification. (female, age 41–50) [Main challenge was] Keeping up with organisational changes in relation to PPE, workplace procedures and changes to practice. (female, age 20–30)
Communication work challenges	[My service] have relied heavily upon "Workplace" which is a Facebook style social media platform that not all staff access. (male, age 20–30) Information has been given over multiple platforms, e.g., [we] must be using Workplace and checking emails and intranet as not all information was provided on both. Information being passed on mid shift about changes was inadequate, we were reliant on colleagues to see the information. There was also use of terms early on which we had never heard and weren't explained, e.g., told to consider social distancing mid shift but no direction of what that meant. (female, age 31–40) Getting consistent information from management has been tough. (female, age 20–30)
Supportive management	[We need] Less management demands at work regarding KPIs [key performance indicators] and [better] PPE management and constant updates about changes and policy alterations. it's a stressful time and I feel management are adding to our stress more when not needed. (male, age 41–50) [We need] More information and support from management. (female, age 31–40)
Abandoned and disillusioned	I feel totally abandoned by my employer and I'm on my own to manage my own mental health. I have seen so many front line worker collapse emotionally and be treated that bad they leave or kill themselves. Lift your game. (male, age 41–50) [Main challenge was] lack of support. Lack of respect. Lack of listening skills for staff to get their grievance out. Staff identify [name of service] as best care for the lowest price. They concentrate on compliance to appropriate documentation and KPI. Forget about mental health, emotional support, wellbeing, physical health and family with female staff on FWA [Flexible Working Arrangements], parental concerns. (male, age 50–64)
Workplace support for mental health	[We need] manager support, proactive support from psychologist or peer support services. (female, age 20–30) Provide us with sufficient leave that doesn't come out of sick leave when we try to do the right thing. More one on one support (female, age 41–50). Shorter shifts, calling and checking in on staff. (female, age 20–30).

Table 7. Theme 3: Risk, uncertainty and feeling unsafe at work.

Feeling unsafe at work	[I have] constant fear of becoming infected and passing on to family (female, age 20–30) [Main challenge was] face to face contact with an unknown risk on a day to day basis. (male, age 41–50)
The need for PPE	Anxiety in the workforce was in direct response to concern over appropriate/changing and supply of PPE. (female, age 50–64)
The challenges of balancing safety and patient care in high-risk workplace situations	Upper management [need to] take on suggestions that still provide best evidence based care for the patient and keep them safe BUT do not necessarily expose health care workers to risk. (female, age 41–50) During a pandemic health care workers need to be able to make decisions that are outside of the norm. For example—refusing to transport a person in confined space showing signs and symptoms of Coronavirus that are otherwise well enough to manage themselves at home with phone consultation and monitored health care checks, etc. (female, age 41–50)
Unpredictability of day-to-day work	[Main challenge was] Not knowing what we would be walking into on a job (female, age 20–30)

Table 8. Theme 4: The challenges of pandemic (un)preparedness across the health system.

Lack of resourcing and training at work	Consider extra training and resources prior to peak staff isolating and employ additional staff well before the requirement. (female, age 20–30)
Inadequate resourcing and training in the health system	[We need] Earlier identification and risk management planning. Better to go hard on risk management early such as PPE and training than have to play catch up later when people are already facing exposures. (male, age 31–40)
Reactive versus proactive approach across the organisation and the health system	[We need] the PPE to be highest level first then reduce if evidence supports. We went from lower to higher levels of PPE as evidence changed. Also case definition for suspected COVID-19 went from conservative to almost anyone. These two issues in combination could have been disastrous and never made sense so this was most stressful stage to work. (male, age 31–40) Better forward planning from healthcare organisations. A lot of making it up as they went along was happening as they didn't have systems in place for quarantine, cleaning, what to do in case of a breach (female, age 20–30) Knowing the government has a strategic plan in place to best deal with future incidents. I felt the government were ill prepared and were required to chase their tail the whole time. I lost faith in the government's ability. (male, age 31–40)

3.2. Theme 1: The Pervasiveness of COVID across All Life Domains

Paramedics described how the COVID pandemic had generated widespread disruption and a sense of fear that permeated all domains of their life, including work, home, personal and social contexts, particularly when usual supports and resources, such as childcare, were unavailable (Table 4). This was evident in four ways. First, they described the struggles to meet increased demands of both work and their personal life (such as caring responsibilities), meaning they were no longer able to achieve a work/life balance. Second, they described the pervasiveness of pandemic stress in their everyday life, being impossible to escape the pandemic at work or at home, resulting in an inability to 'switch off' from the pandemic. Third, the physical and mental effects of the pandemic were described and paramedics reported feelings of increased stress and burnout, commonly using words such as "exhaustion", "burnout" and "fatigue" to describe their experience. Finally, paramedics struggled to draw on their usual coping strategies, including social support, in order to self-care. Many reported that being unable to engage in their usual self-care strategies was the main challenge to their mental health and prevented them from effectively managing the emotional and physical challenges of working and living through a pandemic. The loss of social support from family and friends as a result of lockdown restrictions was frequently mentioned as a major loss that negatively affected their wellbeing. In particular, for those living alone, the challenges of isolation and lack of social connection were particularly pronounced and associated with considerable concern and fear around how they would cope by themselves should they be forced to quarantine. As one paramedic reflected, all of this meant that "normal will never be normal again" (male, age 41–50).

3.3. Theme 2: The Challenges of Widespread Disruption at Work

Paramedics wrote extensively about the impact of highly disrupted working conditions and described a number of major challenges in an unpredictable workplace with working conditions that were more physically and emotionally demanding (Table 6). They described increased workloads, more complex duties, longer working hours in uncomfortable, hot PPE, and undertaking additional time-consuming tasks such as ambulance cleaning that often resulted in unwanted overtime.

Constantly changing procedures and information was described as a major source of stress as paramedics struggled to keep up with rapid changes in their day-to-day role and guidelines, which occurred "daily", "hourly" and/or "mid-shift". They described

working in an environment where they frequently encountered inconsistencies, including in the information employees were receiving from their workplace, and in the approach and protocols followed by different health services.

Throughout their responses, paramedics described issues with communication. Examples included the use of multiple channels of communication, none of which were universally used by all employees, nor by management, and none of which held all the necessary information paramedics required. Some described overload of information, with lots of unnecessary and non-essential information. Others described a lack of communication, with insufficient or incomplete information that was often contradictory. Paramedics wrote about a sense of confusion at work as a result of this inconsistency in communication, some describing a fear of being left behind, and others describing how each employee had different interpretations of the guidelines. They called for streamlined centralised communication of selective, clear and consistent information from the organisation, with regular (but not too regular) updates. This needed to be accessible to all employees with clear outlines of rules, procedures and standards.

Paramedics described wanting a more proactive, responsive and accountable leadership approach from management. Some desired greater dialogue with management, where leaders were available and accessible to staff, and listened to and addressed paramedics' needs and suggestions. Paramedics wrote about feeling unsupported at work. Some felt that they were not listened to or respected by management, which contributed to a perceived "reality gap" between management and the frontline worker. Some reported a lack of direct contact from management to check in or to listen to employees, whilst others described feeling unsupported in terms of not being adequately recognised for the increased and intensified workload they had taken on or for placing themselves in high-risk situations daily. Many paramedics described feeling that their mental health needs were not supported by the organisation. They recommended that workplaces should provide proactive and timely support to address mental health needs. Suggested strategies included appointments with mental health professionals through work, online counselling, increased number of Medicare-funded sessions with psychologists, peer support and manager support programs. They wanted management to check in on staff wellbeing, and work conditions that included additional paid pandemic sick leave and gestures of appreciation, such as provision of food and drinks at work. Paramedics discussed the value of informal mental health supports at work, mostly through debriefing with colleagues and team members.

3.4. Theme 3: Risk, Uncertainty and Feeling Unsafe at Work

The third theme focused on risk, uncertainty and feeling unsafe at work (Table 7). Feelings of being unsafe and unprotected at work were raised most frequently in relation to access to appropriate, quality PPE, including masks, Tyvek suits, and hair nets. Feeling unsafe at work was also heightened by having to work in spaces or facilities where social distancing was impossible, such as in enclosed ambulances, often for long periods of time. Lack of PPE exacerbated fear and worry regarding the risk of infection, both to themselves and their loved ones. Inadequate PPE left paramedics feeling physically exposed and unprotected. They felt that their safety was not prioritised, and this was exemplified by inadequate or lack of PPE. Some paramedics felt that inflexible procedures and work demands left them feeling unnecessarily exposed to risk. Some described feeling unsafe due to being unable to make day-to-day decisions that ensured their right as an employee to be safe at work and that were appropriate to the context of working in a highly infectious viral pandemic. These issues were all connected to the broader difficulty of balancing risk of exposure and their own safety with their professional duty to provide quality patient care, a challenge most often raised in relation to high-risk clinical situations. Many paramedics described a sense of uncertainty and unpredictability at work, particularly in relation to the 'unknown' risk and unprecedented situations they faced in the pandemic.

3.5. Theme 4: The Challenges of (Un)Preparedness across the Health System

For many paramedics, the issues they identified in the workplace were emblematic of, and often compounded by, similar problems in the health system (Table 8). Paramedics described a lack of pre or forward planning for a crisis at work and in other services, and widespread unpreparedness for a public health crisis across the health system. They described how an already understaffed health system now needed to accommodate extra duties such as cleaning and COVID-19 testing, or to off-set staff losses due to quarantine. This lack of preparedness and resources in their immediate workplace, and in the hospitals they were sent to, and exacerbated the stress and pressure for paramedics as they struggled to manage increased workloads with inadequate resources. They described how working in an unprepared public health system exacerbated their sense of feeling unsafe and unprotected at work.

Paramedics also wrote about the reactive and slow responses to new knowledge, rather than a proactive response, often in relation to how knowledge about the transmission of the virus (e.g., airborne) improved, but was not reflected in their PPE. For example, they were concerned that only base levels of PPE were first recommended, and these were then only upgraded as evidence changed, rather than implementing universal high-tier protection and the precautionary principle to exposure from the pandemic outset first. Some described a lack of faith in the government or in ambulance management to keep them safe and to keep abreast of the latest scientific evidence.

4. Discussion

The experiences of working and living in the COVID-19 pandemic exacerbated work-based challenges and posed additional adverse impacts on paramedics' mental health. The majority of paramedics reported mental health issues, most commonly symptoms of burnout and anxiety. Whilst there is limited evidence assessing mental health outcomes in paramedic-only samples during public health crises, our findings are consistent with evidence from reviews [11,26], and overseas and Australian studies [12,17,27–30] showing the negative mental health impacts of working as a HCW during the COVID-19 and SARS pandemics [31,32].

Despite this psychological burden, paramedics described a general lack of support from their workplaces for their mental health needs, and a culture of disregarding their needs. In the absence of support from management, paramedics described turning to their team members for support, as observed in other HCW groups such as nurses [33]. The importance of workplace support as a protective factor for mental health and a buffer for workplace stress is now well-recognised [24,34], and emerging evidence has identified this pattern in ambulance personnel [35]. Evidence from past [36] and current pandemics [2,37,38] suggests organisational and collegial support may serve a protective role for HCW mental health. Efforts to enhance support at work for paramedics warrant further investigation.

A salient finding was that paramedics reported significantly higher rates of self-reported PTSD, and of moderate to severe depersonalisation symptoms on the burnout scale, compared to other HCWs. Figures are in excess of estimated PTSD rates among ambulance personnel reported in a meta-analysis of studies conducted in non-crisis times [7], suggesting that the pandemic was associated with this symptom burden. A review of work-related factors for PTSS and PTSD among HCWs during past pandemics and COVID-19 [39] identified key risk factors that were also recounted by paramedics in our study, including high exposure to the virus, high perceived threat to health or life, and social isolation. Protective factors included supervisor and colleague support, perceived adequacy of training and positive work aspects including communication—factors that were described as lacking by many paramedics. Additionally, systemic workplace issues such as increased workloads, frequently changing protocols and inadequate PPE have been directly associated with burnout and distress in HCWs [40,41]. Together, this indicates that

addressing organisational and systemic factors during a pandemic may be a promising strategy to improve mental health outcomes in paramedics and other HCWs [42].

Paramedics described major occupational uncertainty and upheaval during the pandemic, feeling unsafe at work, felt unsupported by management, and working within organisations and a health system that was unprepared for a crisis. Disruption, uncertainty and stress negatively impacted on emotional, social and physical wellbeing for most paramedics. They recounted widespread occupational disruptions including unpredictability in the workplace, inconsistent information, and rapid changes to the workplace, and cited adverse working conditions—occupational challenges also reported in qualitative studies with other HCWs during COVID-19 and past pandemics [28,43–45].

The most common workplace challenges for paramedics were problems with communication, and inadequate support from management. For some, this working environment exacerbated feelings of being unsafe and unprotected at work and created difficulties in balancing patient and personal safety in high-risk clinical situations. A lack of pandemic preparedness at work and in the health system was a major challenge, and paramedics recommended a proactive, evidence-based, coordinated and consistent approach be implemented across the health system in future crises.

Based on our findings, other studies [28] and commentary [46], strategies to enhance pandemic preparedness and supports for paramedics in future crises should include improvements to working conditions, training, PPE supply, consistent communication, more effective leadership and additional mental health support at work. Better health system preparedness through consistent implementation of guidelines, and additional training and resourcing of equipment and staff are needed to manage increased demand during a crisis. Further research with paramedics is warranted to understand the long-term impact of working in a pandemic on their wellbeing and working conditions and to develop targeted strategies to enhance occupational safety and support.

The small sample size, cross-sectional survey design and potential for self-selection and response bias are limitations of this study. Nevertheless, the sample size achieved is similar to other similar studies [47,48]. The findings may not be representative of the experiences and views of all Australian paramedics; however, there is congruence between our findings and that of other Australians studies drawn from different geographic areas [28]. Anonymous online surveys may have a sample selection bias, as they provide an avenue for participants to disclose mental health distress, particularly when distress is stigmatised. Conversely, the strength of this approach is that it provides a safe environment for the disclosure of such feelings. The strengths of the study include its mixed methods approach to understand the experience of paramedics, comprising the use of standardised validated mental health questionnaires and specific COVID-19-related items, along with free-text questions where paramedics could describe their experiences.

5. Conclusions

This study describes the experiences and challenges faced by paramedics working in the COVID-19 pandemic in Australia, particularly within the state of Victoria. The prevailing message conveyed by paramedics was the need for a safe, consistent, prepared, adaptive workplace where they felt supported to stay mentally healthy and to provide high-quality patient care during the pandemic.

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Article

A US National Study of Barriers to Science Training Experienced by Undergraduate Students during COVID-19

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Abstract: Undergraduate research is a high-impact practice on college campuses. How the COVID-19 pandemic has affected undergraduate researchers' progress is poorly understood. We examine how demographics, academic characteristics, research disruptions and faculty mentorship are associated with four barriers to research progress. Data are drawn from a survey of over 1000 undergraduate student researchers across the US. We examine students who actively continued to conduct faculty-mentored research during mid-March/April 2020 (n = 485). Using generalized estimating equations that control clustering by institution, we found economic hardship, discomfort teleconferencing, lower quality mentors, sexual minority status and higher grade point averages were associated with motivation problems. Economic hardship, serious illness, Internet connection issues, a lack of face-to-face meetings and lower a frequency of mentor–mentee communication were associated with a time crunch with regard to conducting research. Discomfort teleconferencing, Internet connection issues, a lack of face-to-face meetings and decrease in research workload were associated with task uncertainty. Economic hardship, serious illness and being an engineering major were associated with lacking needed tools for the research. In sum, economic hardship was an important correlate of research barriers, as were communication challenges and sexual minority status. Results can inform practical actions by research program directors and faculty undergraduate research mentors.

Keywords: COVID-19; undergraduate research experiences; motivation; sexual minority status; faculty-mentored research

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1. Introduction

As COVID-19 rapidly became a pandemic in spring 2020, college education was immediately and fundamentally altered. Universities transformed their operations. Classes moved online, science lab sessions were cancelled and graduation ceremonies were postponed [1]. Researchers are examining how these changes have impacted student well-being [2–5], learning and academic engagement [6–8], relationships with peers [9] and longer-term outcomes, such as retention and delayed graduation [10,11]. Few studies have examined how COVID-19 has impacted undergraduate research training [12–14], and few have focused on initial experiences during the early months of the pandemic [15].

Alongside service learning, learning communities, internships and study abroad programs, faculty-mentored undergraduate research experiences are high-impact practices [16] and critical to a well-rounded college education. Participation in research prepares students for graduate education and careers in research [17–24], while complementing the research workforce composed of graduate students, postdoctoral and faculty researchers. In 2019, 22% of United States (US) college seniors had participated in faculty-mentored research. In some majors, that percentage was substantially higher: 36% of physical science seniors and 46% of biological science seniors had engaged in research [25].

Students accrue many benefits due to participation in faculty-mentored undergraduate research, including improved critical thinking and communication skills, increased interactions with faculty, more extracurricular engagement, enhanced academic achievement and retention and greater persistence to STEM (science, technology, engineering and math) degree completion [26–30]. While majority group students are more likely to participate [25], undergraduate research opportunities are particularly important to the retention and success of students from groups traditionally underrepresented in higher education [17,31,32]. The importance of undergraduate research for student training [16] and its widespread implementation across US universities [25] makes it essential to examine it in the context of COVID-19, especially as undergraduate research training program directors and faculty mentors are planning for future potential disruptions to student research experiences.

How the COVID-19 pandemic has affected undergraduate researchers is poorly understood [13,14,33,34]. To advance knowledge, we developed and administered a survey to over 1000 undergraduate students across the country who were doing or planning to do research in spring and/or summer 2020. Here, we examine the subset of student respondents who were still actively conducting research under the direction of a faculty mentor in mid-March and April 2020. This paper examines how social demographics, academic characteristics, research disruptions and faculty mentorship are associated with four barriers to research progress: experiencing a lack of motivation for conducting research, experiencing a time crunch with regard to conducting research, uncertainty about the next steps in the research project and a lack of access to the tools needed to conduct research. Although research has not established the specific barriers that undergraduate researchers faced during the early months of the COVID-19 pandemic, there is an emerging literature on college students and their transition to online learning, which provides some insight for comprehending the challenges faced by undergraduate researchers. In what follows, we present our conceptual model, which is an input–environment–output (IEO) model [35]. We then review literature relevant to our input and the environment independent variables as well as our dependent variables (outputs).

1.1. Conceptual Model

To orient the study, we utilized an input–environment–output (IEO) model [35]. IEO models are used by education researchers to inform the design of statistical analyses in a manner that reduces bias. Specifically, IEO models adjust for the effects of differences in initial student attributes (e.g., sexual minority status) in order to isolate the effects of exposure to specific educational environments (e.g., undergraduate research experiences) while in college on student outcomes. This minimizes the chances of arriving at invalid inferences regarding the influence of an educational environment on student outcomes. The aim of an IEO model is to adjust for potentially biasing covariates in order to accomplish what random assignment enables in controlled experiments by statistical means [36]. "Inputs" is the term used to identify attributes that students bring to the specific educational environment under study. "Environment" represents students' experiences in the educational environment [35]. "Outputs" refers to the educational outcomes of interest. Figure 1 presents an overview of inputs, environment variables and outputs used in this study.

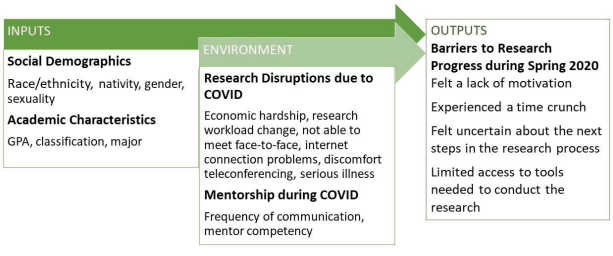

Figure 1. Input–environment–output (IEO) model.

1.1.1. Inputs: Social Demographic and Academic Characteristics

Studies of undergraduate research have shown inequalities in experiences and outcomes for students from historically marginalized backgrounds, which we define here to include minority race/ethnicity, foreign-born nativity, woman and non-binary gender identities and sexual minority status. Studies have demonstrated that racial/ethnic minority students tend to gain more from undergraduate research programs than their White peers [23,37–39]. However, a few studies find the opposite [30,40]. Only a few studies of undergraduate research have examined the nativity (US-born vs. foreign-born) of the participant [41]. While not a salient factor in the literature on undergraduate research, student nativity is an important input to consider during this pandemic, which the sitting US President blamed on international travelers and immigrants. The pandemic also occurred during a restrictive migration regime, symbolized by border walls, travel bans and hire American policies, which created challenges for foreign-born students [42]. Given these dynamics, it is possible that foreign-born undergraduate researchers might experience greater barriers to research progress during COVID-19 than their US-born counterparts.

In terms of gender identity, differences between women and men have been noted among summer research program participants [37,40]. While sexuality is often less examined in the context of undergraduate research, a national and longitudinal study found that sexual minority STEM students were significantly more likely to participate in undergraduate research than non-sexual minority students [43]. Despite this, sexual minority STEM majors who were similarly positioned to succeed in STEM as their non-sexual minority counterparts were 8% less likely to be retained to the fourth year. This suggests that the retention gap would be even larger if not for disproportionate participation in undergraduate research. How race/ethnicity, nativity, gender and sexuality relate to experiencing barriers to research progress during COVID-19 is not yet known.

Academic characteristics, such as classification, grade point average (GPA) and major, are also influences on undergraduate research participation and experiences. Research experiences are more common in the senior and junior year than they are in the first two years [21]. Limited research has examined how GPA relates to student intentions to persist in their undergraduate research experiences. In one study, students with lower GPAs were more likely to persist in their research experiences because they were worried that they might not have other research opportunities in the future [44]. This may stem from their recognition that students with higher GPAs are more likely to be invited by faculty to engage in research [18].

While faculty-mentored undergraduate research has been associated with an increase in GPA [45], nationally, in all majors, less than 8% of first-year students have conducted research with faculty. These percentages grow dramatically by the senior year, with 15% of education majors, 19% of health profession majors, 30% of engineering majors, 30% of social science majors, 36% of physical science/math/computer science majors and 46% of life sciences students having conducted research with faculty [25]. Given the differences in research experience and context, classification, major and GPA are important to consider when studying undergraduate research in COVID-19. We anticipate that first/second year students and those from bench research majors (in which wet laboratory-based work is the norm) will face greater odds of encountering barriers to research progress during COVID-19. We anticipate that those with lower GPAs might face greater odds of encountering research barriers during COVID-19 since they may be struggling with more competing demands in their lives.

1.1.2. Environment in Spring 2020: Research Disruptions and Faculty Mentorship

In addition to the well-established inputs reviewed above, COVID-19 changed the landscape of undergraduate researchers' lives, their education and their research context. Many college students began to struggle financially due to the pandemic. National data collected in early summer 2020 showed that over 75% of US college students reported some financial hardship [46]. As the spring semester progressed, increasing numbers of

undergraduate researchers were unable to meet face to face with their mentors, something that, in pre-COVID-19 times, has been shown to increase the odds of undergraduate students publishing their research [36].

In the midst of COVID-19, while nearly all US college students had access to Internet at home (95%), Internet connectivity issues were serious enough to interfere with students' abilities to attend or participate in their online courses at least "occasionally" for 44% of students, with 16% of students experiencing such problems "often" or "very often" [7]. Internet connectivity problems would also have interrupted remote research activities. Feeling disconnected from others was common in the early weeks and months of COVID-19. While many college students found videoconferencing platforms helpful [47], a minority (8%) lacked familiarity with the technical tools needed for online learning [48]. It is also the case that some students felt uncomfortable videoconferencing in online classes due to embarrassment over their living circumstances or the need to care for dependents during class [49]. Differences in what students see in the backgrounds of their peers' living spaces via Zoom or other videoconferencing software provide stark reminders of the inequalities between themselves and their classmates that were less obvious in campus classroom environs [50].

Getting sick and taking care of ill family members was relatively common during the early weeks of COVID-19 and could have influenced students' research experiences. One-third of college students had experienced at least one COVID-19-related symptom between February and April 2020, although less than 5% of them were tested [51]. Another national survey of college students documented that 45% of students reported having felt too unwell to participate in online classes at least once [7]. However, it is currently unknown how these potential COVID-19-associated research disruptions (e.g., financial struggles or getting sick) shaped students' undergraduate research experiences.

Faculty mentorship is a well-known correlate of successful student experiences in undergraduate research [52]. Higher-quality mentorship from faculty improves student gains [39,41]. Communication is another important element of faculty mentorship of undergraduate researchers. A qualitative analysis of both mentor and mentee perspectives reported that failed mentoring relationships were characterized by poor communication [53]. Working with more competent mentors and communicating with the mentors more frequently may buffer undergraduate researchers from research barriers associated with COVID-19.

1.1.3. Outputs: Barriers to Research Progress

We examined four barriers to research progress: lacking motivation, experiencing a time crunch, lacking necessary tools for research and feeling uncertain about next steps. We selected these four as they were the most commonly reported barriers among those we asked about (which also included concern about losing future opportunities, not receiving a requested letter of reference, and lost opportunity to present at a conference). Motivation is important to examine because it is critical to continued engagement in undergraduate research [54]. Initial research showed that college students struggled with motivation during spring 2020 when their courses switched to online learning [7,48], and that decreases in motivation were associated with lower cognitive engagement in their coursework [6]. Students explained that their motivation suffered as they lacked the structure of regular class routines, were subject to many kinds of distractions and were affected by the chaos of the pandemic [7].

We examine time management challenges as our second research barrier as it is well-established that college students struggled with time management during the pandemic. Even in pre-pandemic times, time management challenges increased student stress [55] and reduced GPAs [56]. COVID-19 has heightened time management challenges for college students [7,57]. Among college students interviewed about their experiences with online learning during the pandemic, time management was one of the key challenges mentioned [58].

Our third research barrier is task uncertainty. It is well-known that uncertainty is ubiquitous in the research context. Undergraduate students who are able to navigate the uncertainty inherent in the sciences are more likely to feel that they belong in science and to be retained in their science major [59–61]. While uncertainty is integral to the research process, students may abandon research altogether when the uncertainty is too great for them to manage [62]. Thus, uncertainty is an important element to examine in terms of student outcomes during the COVID-19 pandemic.

We examine lacking access to the tools needed to conduct research as the final barrier because research carried out remotely requires access to specific tools and resources unique to each research project, such as statistical packages and datasets. When courses shifted from in-person courses to remote learning, the success of that transition depended upon student access to computer hardware and software, in addition to Internet connectivity. Research has shown that students without that access struggled with their coursework [48]. One-quarter of college students experienced hardware or software problems severe enough to impact their ability to attend or participate in their online course at least "occasionally" during spring 2020 [7].

1.2. Statement of Contribution

Most previous studies have focused on the benefits of undergraduate research experiences [23,26], and fewer studies have examined undergraduates' challenges while doing research. This is especially relevant during a global health crisis such as the COVID-19 pandemic. The retention of undergraduate students in research now is critical to the development of the future research workforce [21]. Learning more about the correlates of barriers to research progress during COVID-19 will allow undergraduate research program directors and faculty mentors to better support students as this pandemic continues and when similar disruptions happen in the future. This is important because undergraduate research experiences have been shown to be an impactful and successful education model [17–23], although we do not know how robust this model is in the context of societal disruption. COVID-19 provides an opportunity for those involved to reflect upon and refine undergraduate research training programs to promote resilience moving forward. It is also important to document the challenges undergraduate students have faced during the COVID-19 pandemic in their own right. The pandemic is an important part of the history of higher education and it is critical to understand and document its effects.

2. Materials and Methods

2.1. Data Collection and Participants

We conducted a survey of undergraduate researchers that asked them about their college experiences, past, current and planned research experiences, mentorship and COVID-19-specific experiences, among other domains. The survey took approximately 30 min to complete. The survey was approved by the Institutional Review Board at the University of Utah. We recruited students through undergraduate research programs at 18 different US universities. We requested program participation through two channels: by emailing program directors affiliated with BUILDing SCHOLARS, which is a National Institutes of Health-funded multi-institutional consortium; and by posting a call for their participation through the Council on Undergraduate Research Listserv.

The survey was open for 4 weeks during the month of July 2020 and all students received the same invitation and set reminders. We obtained written consent (in a digital format) from participants. All participants received an Amazon gift card as an incentive. Figure 2 displays the data collection process and inclusion criteria for the analyses presented in this paper. Students included in this study were conducting research during mid-March and April 2020 (i.e., during the first months of the COVID-19 pandemic) under the direction of a faculty mentor (n = 485).

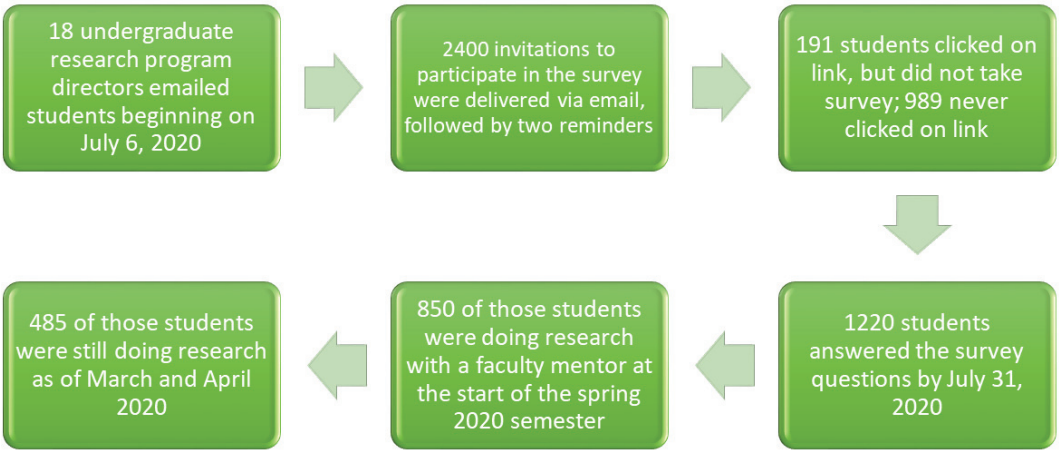

Figure 2. Diagram of the data collection process, including inclusion criteria for this analysis.

An additional group of students was conducting research under a faculty mentor at the start of the spring 2020 semester but had stopped conducting research in mid-March, presumably due to the pandemic. They were excluded from these analyses as they were no longer engaged in research during the pandemic. The two groups of students (those who continued doing research and are included in this paper vs. those who stopped doing research and are excluded from these analyses) were quite similar. As per an independent samples t-test, there were no significant differences in terms of GPA, non-White vs. White racial/ethnic status, gender, sexuality or nativity. There were significant differences in terms of several majors. Life sciences majors are overrepresented in the group that stopped doing research (31% of those who continued vs. 54% of those who did not were life sciences majors). "Other major" students are overrepresented in the group that continued doing research (11% vs. 6%) as are social and behavioral sciences majors (15% vs. 7%). Seniors also comprise a larger share of the group that continued to carry out research (51% of those who continued vs. 43% of those who did not).

2.2. Independent Variables: Inputs and Environment

Inputs include social demographic (i.e., race/ethnicity, nativity, gender and sexuality) and academic characteristics (i.e., GPA, major and classification). Environment variables in this analysis are students' COVID-19-specific research disruptions and faculty mentorship variables. Research disruptions include if the student experienced an economic hardship that affected their ability to carry out research, a change in research workload, challenges with not being able to have face-to-face meetings with mentors, Internet connection problems that affected their ability to carry out research, discomfort teleconferencing with mentors and serious illness that affected their ability to carry out research. The environment also includes faculty mentorship variables, i.e., the frequency of communication with the faculty mentor and the student-assessed faculty mentor competency. Table 1 provides more information on these input and environment variables, including the survey question used and how the variable is coded in our statistical models.

Table 2 presents descriptive statistics. Over half of the students were non-White (65.0%), women (58.1%) and seniors (50.7%). Just under one-fifth were sexual minority (18.8%). The average major GPA of the participants was 3.74. One-quarter were engineering majors (24.5%), 14.8% were social/behavioral sciences majors, 12.7% were math/computer science/physical science majors and 6.3% were in a health professional major. They rated their faculty mentor 4.07, on average, on a five-point scale. In terms of research disruptions, 28.7% reported that economic hardships disrupted their research experience, 42.6%

reported the same for internet connection issues. Approximately one-fifth (17.5%) were uncomfortable teleconferencing and 12.0% were disrupted by serious illness.

Table 1. Descriptions of input and environment variables used in the analysis.

Variable Name	Survey Question	Coding
INPUTS		
Social Demographic Characteristics		
Non-White	What is your race/ethnicity? (Pick just one)	1 = non-White (combines Hispanic, Black non-Hispanic, Asian non-Hispanic and other, which included Native American, Native Hawaiian, Pacific Islander, Multiracial and Other), 0 = White and non-Hispanic
Non-US nativity	Were you born in the US?	1 = Other country, 0 = US
Gender	What is your gender/gender identity?	3 categories: each coded 1 = yes, 0 = no. Beyond binary (i.e., trans man, trans woman, genderqueer/gender non-conforming, Other); woman; man (reference)
Sexual minority status	What is your sexual orientation?	1 = Yes (gay, bisexual, lesbian, pansexual, asexual or other); 0 = no (non-sexual minority)
Academic Characteristics		
Major GPA	Based on the 4-point scale, what was your GPA in spring 2020 in your major?	Continuous
Classification	Based on the credit hours you have taken, what was your class level in spring 2020?	3 categories, each coded 1 = yes, 0 = no. Senior; junior; first or second year (reference)
Major	Please select your major from the list below. The list includes 90 majors taken from the Higher Education Research Institute's Freshman Survey.	6 categories, each coded 1 = yes, 0 = no. Engineering; health professions; social and behavioral sciences; math/computer science/physical sciences; other majors; life sciences (reference)
ENVIRONMENT		
Research Disruptions		
Economic hardship	Did the student experience economic hardships caused by COVID-19 that affected their ability to conduct research during the time period of mid-March-April 2020?	1 = yes, 0 = no
Research workload change	How much did your spring 2020 research workload change as a result of COVID-19?	1 (working much less) to 7 (working much more)
Could not meet face to face	Did the student experience the following challenge, caused by COVID-19 that affected their ability to conduct research during the time period of mid-March-April 2020?	1 = yes, 0 = no
Internet connection problems	Did the student experience the following challenge, caused by COVID-19 that affected their ability to conduct research during the time period of mid-March-April 2020?	1 = yes, 0 = no
Felt uncomfortable teleconferencing	Did the student experience the following challenge, caused by COVID-19 that affected their ability to conduct research during the time period of mid-March-April 2020?	1 = yes, 0 = no
Student or family member got seriously ill in spring 2020	Did the student experience the following challenge, caused by COVID-19 that affected their ability to conduct research during the time period of mid-March-April 2020?	1 = yes, 0 = no
Mentorship		
Frequency of communication with mentor during-COVID-10	How often did you usually communicate with your primary faculty mentor during COVID-19?	1 = daily to 6 = less than once a month
Faculty mentor competency	The student answered 26 Likert items about their mentor's competency, which are averaged to create the score [63].	1 (low competency) to 5 (high competency)

Table 2. Descriptive statistics.

	N	Min.	Max.	Mean	Std. Dev.	Yes	No	% Missing
INPUTS								
Non-White	429					279	150	11.55%
Non-US Nativity	431							11.13%
Woman (ref: man)	430					250	180	11.34%
Beyond binary (ref: man)	430					9	421	11.34%
Sexual minority status	421					79	342	13.20%
Major GPA	462	2.00	4.00	3.74	0.36			4.74%
Senior (ref: first/second year)	473					240	233	2.47%
Junior (ref: first/second year)	473					164	309	2.47%
ENVIRONMENT								
Economic hardship	474					136	338	2.27%
Research workload changed due to COVID-19	474	1	7	2.98	1.76			2.27%
Could not meet face to face	474					426	48	2.27%
Internet connection problems	474					202	272	2.27%
Felt uncomfortable teleconferencing	474					83	391	2.27%
Student or family member got seriously ill in spring 2020	474					57	417	2.27%
Frequency of communication with mentor during COVID-19	455	1	6	3.32	1.241			6.19%
Faculty mentor competency	441	1.27	5.00	4.07	0.75			9.07%
Engineering (ref: life sci)	474					116	358	2.27%
Health prof. (ref: life sci)	474					30	444	2.27%
Soc/Behav. sci. (ref: life sci)	474					70	404	2.27%
Math/CS/Phys (ref: life sci)	474					60	414	2.27%
Other major (ref: life sci)	474					51	423	2.27%
OUTPUTS								
Felt a lack of motivation	474					324	150	2.27%
Experienced time crunch	474					268	206	2.27%
Felt uncertain about next steps	474					302	172	2.27%
Limited access to tools	474					279	195	2.27%

2.3. Dependent Variables: Outputs

Our dependent variables represent four common barriers to research progress that students experienced during spring 2020 (see "outputs" in Table 2). We asked students to indicate whether or not they had experienced "feeling a lack of motivation", "a time crunch", "feeling uncertain about the next steps in the research process" and "limited access to the tools needed to conduct the research" caused by COVID-19 that could have affected their ability to conduct research during the time period of mid-March–April 2020. Each of these variables is coded 1 = Yes and 0 = No and analyzed without transformation. Among our sample, as shown in Table 2, 68.4% "felt a lack of motivation", 56.5% reported "experiencing a time crunch", 63.7% "felt uncertain about the next steps" and 58.9% had "limited access to the tools needed".

2.4. Statistical Methods

We began the analysis by conducting multiple imputation (MI). Multiple imputation is a well-established practice for dealing with missing data. When researchers only include cases without any missing data, this can introduce bias into the results. When using multiple variables in a model, missing values across all the variables can substantially reduce the sample size, and therefore statistical power and precision (even if the complete case analysis does not introduce bias) [64].

Our MI approach consisted of creating multiple sets of values for missing observations using a regression-based approach [65]. This enabled us to avoid the bias that can occur when missing values are not missing completely at random [65]. The imputation procedure fully accounts for uncertainty in predicting the missing values by injecting appropriate variability into the multiple imputed values [64]. In IBM SPSS Statistics 25, we created 20 multiply imputed datasets, each separated by 200 iterations, with the imputed values at each 200th iteration saved as an imputed dataset [65]. When analyzing multiply imputed data in statistical models, the standard errors are calculated to take into account the variability in results across the imputed datasets and thus the uncertainty associated with the missing values [66]. Because the models average over the distribution of the missing data given the observed data, valid inferences are obtained [64].

We analyzed the multiply imputed data using multivariable generalized estimating equations (GEEs) predicting each of our four dichotomous dependent variables. GEEs build from the generalized linear model and provide a general method for the analyses of clustered continuous, ordinal, dichotomous, polychotomous and event-count response variables. GEEs relax several assumptions of traditional regression models [67]. GEEs assume that observations from within a cluster are correlated, whereas observations from different clusters are independent [67]. GEE models utilize an intracluster dependency correlation matrix that we specified as exchangeable, which assumes constant intracluster dependency [68]. GEEs are able to estimate unbiased population-averaged (i.e., marginal) regression coefficients, even with misspecification of the correlation structure when using a robust variance estimator [69,70], as we do here.

We used the student's home institution to define clusters (n = 49). While we recruited students through 18 research programs, some of these programs serve students from across the US during the summer. This led to the inclusion of students from 49 different home universities in the analyses. The number of students in each cluster ranged from 1 to 98 students. By defining home institution as the cluster variable, we are able to control home institutional effects as a nuisance parameter. Because our dependent variables are dichotomous, we employed GEEs which use a binomial distribution with a logarithmic link function. Model results are not affected by multicollinearity.

The quasi-likelihood estimating equations have the general form

$$\sum_i (\partial \mu_i / \partial \beta)' v(\mu_i)^{-1} [y_i - \mu_i(\beta)] = 0$$

where $\mu_i = g^{-1}(X'\beta)$ is the link function with g = *logarithmic*, the distribution of y_i is negative binomial and the GEE estimator ($\hat{\beta}$) is the solution to these equations. The resulting covariance of the GEE is given by

$$V_{G,n} = n \left[\sum_i D_i' V_i^{-1} D_i \right]^{-1} \left[\sum_i D_i' V_i^{-1} cov(Y_i) V_i^{-1} D_i \right] \left[\sum_i D_i' V_i^{-1} D_i \right]^{-1}$$

and is assumed to be compound symmetric. For more information about GEEs, see Zorn [71].

3. Results

Table 3A depicts results from the GEEs predicting the odds of students' lacking motivation to complete their research due to COVID-19. In terms of the inputs, sexual minority students were twice as likely to lack motivation than non-sexual minority students ($p < 0.05$), and a one-point increase in GPA was associated with 1.95 times greater likelihood of lacking motivation ($p < 0.05$). Several environment variables were statistically significant. Students who were experiencing economic hardship were 1.6 times more likely to lack motivation ($p < 0.05$). Those who felt uncomfortable teleconferencing were 2.3 times more likely to lack motivation ($p < 0.01$). Rating their mentor one point higher on the mentor

competency scale was associated with a 27% reduction in the odds of a student lacking motivation ($p < 0.05$).

Table 3. GEE models predicting the odds of undergraduate researchers (A) lacking motivation for research and (B) experiencing a time crunch.

	A				B			
	Exp(B)	**Lower 95% CI**	**Upper 95% CI**	***p***	**Exp(B)**	**Lower 95% CI**	**Upper 95% CI**	***p***
Intercept	0.227	0.017	3.105	0.267	0.179	0.007	4.393	0.292
INPUTS								
Non-White	0.935	0.610	1.435	0.758	1.531	0.972	2.411	0.066
Non-US Nativity	1.316	0.814	2.128	0.262	1.055	0.651	1.713	0.827
Man (ref)								
Woman	1.394	0.964	2.016	0.078	1.124	0.755	1.672	0.566
Sexual minority status	**1.965**	**1.065**	**3.626**	**0.031**	1.25	0.747	2.092	0.395
Beyond binary	0.795	0.242	2.609	0.702	1.359	0.414	4.459	0.611
Major GPA	**1.951**	**1.051**	**3.622**	**0.034**	0.874	0.365	2.092	0.762
First/second year (ref)								
Senior	1.071	0.589	1.948	0.822	1.144	0.742	1.765	0.541
Junior	1.212	0.616	2.385	0.578	0.953	0.511	1.779	0.881
Life sciences major (ref)								
Engineering	1.205	0.642	2.261	0.561	1.311	0.806	2.134	0.276
Health prof.	0.7	0.341	1.433	0.329	1.051	0.469	2.356	0.905
Soc/Behav. sci.	1.18	0.658	2.117	0.578	1.686	0.611	4.651	0.313
Math/CS/Phys. sci.	1.299	0.733	2.303	0.37	1.366	0.654	2.852	0.406
Other major	0.942	0.523	1.697	0.842	0.805	0.426	1.520	0.503
ENVIRONMENT								
Economic hardship	**1.583**	**1.033**	**2.425**	**0.035**	**2.172**	**1.323**	**3.564**	**0.002**
Research workload	1.029	0.940	1.127	0.536	1.087	0.963	1.228	0.18
Could not meet face to face in spring 2020	1.694	0.850	3.374	0.134	**2.088**	**1.121**	**3.892**	**0.02**
Internet connection problems in 2020	1.039	0.682	1.582	0.859	**1.5**	**1.106**	**2.034**	**0.009**
Felt uncomfortable teleconferencing	**2.227**	**1.349**	**3.680**	**0.002**	1.611	0.804	3.228	0.179
Student or family member got seriously ill in spring 2020	1.14	0.662	1.964	0.637	2.188	1.105	4.332	**0.025**
Frequency of communication with mentor during COVID-19	0.933	0.754	1.154	0.523	**1.173**	**1.055**	**1.305**	**0.003**
Faculty mentor competency	**0.727**	**0.548**	**0.966**	**0.028**	0.972	0.77	1.228	0.813

Note: Models use a binomial distribution with log link function and an exchangeable correlation matrix. They adjust for clustering by home university. There are 49 clusters, with 1–98 students/cluster. Bold font denotes findings that are significant at $p < 0.05$.

Table 3B shows results from the model predicting the odds of students experiencing a time crunch with their research due to COVID-19. None of the input variables were statistically significant. Four environment variables were significantly associated with a time crunch. The challenge of not meeting face to face was associated with a 2.1 times increase in the odds of a time crunch ($p < 0.05$). Struggling with Internet access was associated with 1.5 times greater odds of a time crunch ($p < 0.01$). If the student or the student's family got seriously ill in spring 2020, the student was 1.2 times more likely to report a time crunch ($p < 0.05$). A one unit increase in the communication frequency variable (scaled such that an increase corresponds to less frequent communication with the faculty mentor was associated with a 1.2 times increase in the odds of a time crunch ($p < 0.01$).

Results for the model predicting the odds of students' feeling uncertain about the next steps in their research projects (i.e., task uncertainty) due to COVID-19 are shown in Table 4C. In terms of inputs, no findings were significant. In terms of environment variables, an increase in research workload was associated with a 21% decrease in the odds of task uncertainty ($p < 0.001$). The challenges of not meeting face to face and Internet problems increased the odds of task uncertainty by 1.7 and 1.6 times, respectively ($p < 0.05$). Feeling uncomfortable with teleconferencing was associated with a 3.0 times increase in the odds of task uncertainty ($p < 0.001$).

Table 4. GEE models predicting the odds of undergraduate researchers (C) experiencing research task uncertainty and (D) lacking the tools needed to do research.

	C				D			
	Exp(B)	**Lower 95% CI**	**Upper 95% CI**	***p***	**Exp(B)**	**Lower 95% CI**	**Upper 95% CI**	***p***
Intercept	0.355	0.024	5.270	0.452	1.064	0.112	10.095	0.957
INPUTS								
Non-White	1.198	0.675	2.125	0.537	1.273	0.785	2.063	0.327
Non-US Nativity	0.92	0.626	1.351	0.669	0.741	0.512	1.073	0.112
Man (ref)								
Woman	1.364	0.777	2.394	0.279	1.055	0.607	1.835	0.849
Beyond binary	1.349	0.440	4.137	0.598	0.77	0.264	2.246	0.631
Sexual minority status	1.014	0.533	1.929	0.967	1.288	0.788	2.106	0.311
Major GPA	1.858	0.984	3.508	0.056	1.362	0.830	2.234	0.221
First/second year (ref)								
Senior	0.55	0.282	1.073	0.079	0.683	0.376	1.241	0.211
Junior	0.775	0.393	1.530	0.462	0.622	0.297	1.305	0.209
Life sciences major (ref)								
Engineering	0.873	0.573	1.327	0.524	2.099	1.058	4.166	**0.034**
Health prof.	0.907	0.425	1.937	0.802	0.575	0.268	1.234	0.155
Soc/Behav. sci.	1.313	0.804	2.145	0.276	0.426	0.258	0.702	**0.001**
Math/CS/Phys. sci.	0.741	0.467	1.175	0.203	0.751	0.453	1.246	0.268
Other major	1.339	0.713	2.514	0.364	0.573	0.268	1.221	0.149
ENVIRONMENT								
Economic hardship	1.316	0.687	2.519	0.408	2.081	1.344	3.219	**0.001**
Research workload	0.791	0.692	0.904	**0.001**	0.941	0.807	1.096	0.433
Could not meet face to face in spring 2020	1.718	1.005	2.936	**0.048**	1.188	0.598	2.363	0.623
Internet connection problems in 2020	1.625	1.113	2.373	**0.012**	1.061	0.658	1.709	0.808
Felt uncomfortable teleconferencing	3.013	1.726	5.259	**<0.001**	1.127	0.652	1.946	0.669
Student or family member got seriously ill in spring 2020	1.28	0.638	2.568	0.488	1.807	1.096	2.980	**0.02**
Frequency of communication with mentor during COVID-19	1.06	0.929	1.209	0.388	0.989	0.835	1.171	0.899
Faculty mentor competency	0.783	0.593	1.034	0.084	0.822	0.610	1.107	0.197

Note: Models use a binomial distribution with log link function and an exchangeable correlation matrix. They adjust for clustering by home university. There are 49 clusters, with 1–98 students/cluster. Bold font denotes findings that are significant at $p < 0.05$.

Table 4D presents results from the GEE predicting the odds of a student lacking the tools they needed to do research due to COVID-19. In terms of inputs, engineering majors were 2.1 times more likely to lack tools compared to life sciences majors ($p < 0.05$) and social and behavioral sciences majors were 57% less likely than life sciences majors to lack tools ($p < 0.001$). Among the environment variables, experiencing economic hardship increased the odds of lacking tools by 2.1 times ($p < 0.001$). Reporting serious illness (on behalf of the student or their family) increased the odds of lacking tools by 1.8 times ($p < 0.05$). In sum, Table 5 reviews the significant predictors ($p < 0.05$) for each barrier to research progress.

Table 5. Summary of significant findings for input and environment variables (from Tables 4 and 5).

	Research Barriers			
	Lacking Motivation	**Time Crunch**	**Task Uncertainty**	**Lacking Tools**
Inputs ($p < 0.05$)	○ Sexual minority ○ Higher GPA	○ None	○ None	○ Engineering major ○ Not social/behavioral major
Environment Variables ($p < 0.05$)	○ Economic hardship ○ Discomfort teleconferencing ○ More competent mentor	○ Economic hardship ○ Serious illness ○ Internet problems ○ No face-to-face meetings	○ Internet problems ○ Discomfort teleconferencing ○ No face-to-face meetings ○ Workload increase	○ Economic hardship ○ Serious illness

We explored some sensitivity analyses as part of the modeling. We ran the models with the racial/ethnic groups disaggregated into four groups (i.e., Black, Asian, Latinx and other) with non-Hispanic White as the reference; there were no significant differences, so we grouped them together to increase statistical power. We also tried including first-generation student status in the model, but that covariate did not approach statistical significance in any of the models, so we did not include it in the final models. We also explored international student status in place of foreign-birth, but the results for that variable were not statistically significant and were therefore not included.

4. Discussion

Overall, economic hardship was an important correlate of research barriers, as were communication issues (e.g., teleconferencing, Internet problems, no face-to-face meetings). Faculty mentorship was less related to the barriers, although working with high-quality mentors reduced students' motivation challenges. There were disciplinary differences regarding which students lacked tools.

Input variables were less closely related to the barriers than the environment variables, suggesting that the barriers were more closely related to changes in COVID-19-associated research environments than students' social demographic and academic characteristic inputs. Specifically, there were no racial/ethnic, nativity or gender differences in the experience of any of the barriers to research progress during COVID-19 (Tables 3 and 4). Sexual minority students were twice as likely to lack motivation as compared to their non-sexual minority counterparts (Table 3A), but they were not significantly more likely to experience a time crunch, be uncertain about next steps or to lack tools (Tables 3B and 4). The motivation disparity with regard to sexual minority status is concerning for several reasons. Sexual minorities are already underrepresented in STEM [72,73]. They are less likely to declare a STEM major [73] and less likely to be retained in a STEM major [72], even though they participate in undergraduate research at higher levels than non-sexual minority students [43]. This suggests there are likely barriers related to the mentoring of sexual minority students in their research training environments [43]. Other research on sexual minority students during COVID-19 has reported that, while they might be "out" among their college campus community, they may not be "out" at home or they may have returned home to hostile or unsupportive families or communities [74]. We believe that this may be linked to research motivation as other research has identified social support as an important correlate of academic motivation [75].

With regard to academic characteristics, we found that students with higher GPAs were more likely to lack motivation (Table 3A). Interestingly, pre-COVID-19, students with higher GPAs were more likely to have quit their research placement than those with lower GPAs, primarily because they did not enjoy their everyday research tasks [44]. Assuming those results are generalizable, they imply that our students with higher GPAs may have been more likely to dislike their research tasks before COVID-19, suggesting that they might have been less motivated with the onset of COVID-19 to continue those tasks. While speculative, conversations between the authors and several research program directors also suggested that high achieving students had higher expectations for their research experiences, which were not well-met with online research, resulting in lower levels of motivation during the pandemic.

While few disciplinary variables were significant, we did find that engineering students lacked tools, while social sciences students did not, relative to life sciences students (Table 4D). It is important to note that the comparison group of life sciences students was overrepresented among the students who had discontinued research by mid-March 2020, suggesting that they too may have faced this barrier (although this was not tested directly). It is likely that it was difficult or impossible to replace the technology needed to conduct engineering research (and potentially life sciences research as well) in an online framework without considerable lead-time for planning.

Research disruptions (environment variables) were strongly linked to the barriers, controlling for the inputs. Experiencing research-disrupting economic hardships increased the odds of lacking motivation (Table 3A) and lacking tools (Table 4D). Students without economic hardship likely already had, or could purchase, a sufficiently powerful computer to conduct analyses, and they could also have more easily purchased any needed software packages to conduct their research. Students who got seriously ill and/or had a family member become ill in the early days of the pandemic were more likely to face the barriers of a time crunch (Table 3B) and a lack of tools (Table 4D). While only 12% of students suffered from this experience, when they did, it appears as if it reduced the time that they could devote to research. Illness also contributed to students lacking access to the tools needed to conduct research (Table 4D). In the authors' cases, we know that the process of setting undergraduates up to work remotely through an online server was time-consuming and involved substantial troubleshooting, which may have been nearly impossible if a student was seriously ill or busy caring for ill family members.

Interestingly, an increase in research workload during COVID-19 was associated with a significant decrease in task uncertainty (Table 4C). The average student reported a slight decrease in workload relative to the pre-COVID-19 baseline. The average student in our sample was working approximately 10 h per week on research as of April 2020, yet 25% were still working over 15 h/week. While research workload is a rarely examined factor in the undergraduate research literature, feeling overworked/undervalued was not a reason given frequently by undergraduate researchers who had quit their research experience pre-COVID-19 [44]. We probed this finding by adding a quadratic term (i.e., workload*workload, b = 0.097, $p < 0.004$) to the GEE. The graphed result (not shown) showed that the protective (negative) effect of workload on task uncertainty was initially steep (i.e., when workload values were between 1 and 3 meaning that the student was working less than usual), then the negative effect tapered off at mid-levels of increased workload (i.e., when workload values were between 4 and 5 meaning the student was working the same or only slightly more) and the effect became positive (i.e., a risk factor for uncertainty) at the highest level of workload (i.e., when workload values were between 6 and 7 meaning that the student was working moderately more or much more). The finding shows that task uncertainty was at its lowest when students were spending similar amounts of time on their research during COVID-19 as they did pre-pandemic.

The challenges of not meeting face to face and unreliable Internet access were linked to increased odds of task uncertainty (Table 4C) and of a time crunch (Table 3B). Interestingly, these variables were not associated with lack of motivation (Table 3A). In terms of face-to-face meetings, students who could not meet face to face with their mentors or research teams struggled with finding time for research (time crunch, Table 3B) and with knowing what to do (task uncertainty, Table 4C). In-person communication is an important part of the mentor–mentee relationship, which the pandemic fundamentally disrupted (e.g., 89.9% of students in this sample reported this problem). After research mentoring became virtual due to COVID-19 at one US university, undergraduates reported feeling lost and missing opportunities for informal communication [15]. Internet problems contributed to these two barriers as well. Research on 23 remote 2020 summer research programs identified technology issues as one of the challenges that limited participants' experiences. Some students did not have suitable Internet connections, access to computers with sufficient computing capacity or credentialing to allow access to essential software [13]. One can imagine students struggling with the time pressures it takes to troubleshoot Internet issues or set up new services. Problems with Internet service could also leave them uncertain about next steps, as they likely missed out on timely communications from their mentors or research team (via email or video chat).

Feeling uncomfortable with teleconferencing was also associated with task uncertainty (Table 4C) in addition to lacking motivation (Table 3A). While discomfort teleconferencing affected just under 20% of our sample, the effect sizes in the GEEs for this variable are notable. Discomfort with teleconferencing increased the odds of task uncertainty and

lacking motivation by 3.0 and 2.3 times, respectively. Discomfort with teleconferencing could stem from a variety of sources, including technical difficulties due to Internet, hardware or software issues, competing caretaking demands and/or embarrassment about one's surroundings [49,50]. In our dataset, disadvantaged students were more likely to report feeling uncomfortable teleconferencing. For example (table not shown), 21% of sexual minority students reported feeling uncomfortable while 16% of non-sexual minority students reported the same. The percentages were 20% vs. 15% for women vs. men and 18% vs. 15% for non-White vs. White students.

Mentorship was a significant correlate of two barriers. More frequent communication was protective against students reporting a time crunch (Table 3B). Students who communicated frequently were likely to have opportunities to ask questions and receive instructions, making their research time more efficient. In terms of how much communication students were engaging in, the average student reported a communication frequency score of 3.3 on a scale of 1 to 6, with 3 corresponding to "once per week" and 4 to "several times per month." Indeed, this was less than what was typical before the pandemic. Pre-COVID-19, 81.5% of students communicated with their mentor at least once per week with 55.7% communicating at least several times per week (table not shown). During COVID-19, only 47.5% reported communicating with their mentor at least once per week and 19.1% communicated at least several times per week. At the other end of the spectrum, 28.9% reported speaking to their mentor once per month or less during the COVID-19 (table not shown). Pre-COVID-19, only 6.4% reported speaking with their mentor once per month or less.

It was notable that more competent mentors were a significant factor in relieving motivation problems (Table 3A). Identifying factors that improved student motivation under COVID-19 conditions is important since motivation was the first-ranked problem affecting college students in spring 2020 [7,48] and it affected 68% of undergraduate researchers here. More competent mentors have been linked to other important outcomes such as greater gains in science identity, research skills and personal skills [39]. During COVID-19, faculty mentor competency has been linked to graduate school intentions. Specifically, undergraduate researchers who had less competent faculty mentors (vs. more competent mentors) were 3.6% less motivated by COVID-19 to pursue a graduate degree in science [14].

Limitations

Selection bias could have impacted our findings. We do not know if students with more severe research challenges were more or less likely to participate. It may have been that students who were struggling the most were less likely to click on the link to take the survey due to competing demands on their time. Or, the survey may have attracted those students, as they may have felt they had much to contribute to the study. Overall, students whose research experiences were cancelled may have been less likely to participate in the survey. However, that would not influence this analysis since we only examined students who were conducting research through the entire spring 2020 semester. We are limited by only having dichotomous measures of the four barriers, which means we do not know the degree to which students may have struggled in each area. We also do not have more information about *why* they felt (un)comfortable teleconferencing, which would have furthered our ability to interpret that finding.

We asked students to recall their experiences during March–April 2020 in July 2020, which could introduce recall bias, although we conducted the survey as soon as possible. It is also the case that many students had already stopped doing research by mid-March 2020, possibly due to overwhelming challenges which are not captured in this study. For example, we saw that life sciences students were overrepresented among students who had stopped doing research by mid-March, potentially because it was too challenging to conduct life sciences research online without time to prepare. However, we could not include those students in our GEEs since the barrier items pertained only to students with active research experiences during mid-March/April 2020. Additionally, this paper

is focused on COVID-19-related barriers to research progress, but there are likely ways in which COVID-19 was beneficial to students' research progress, e.g., increasing their motivation to conduct real world research or their desire to go to medical school [76]. While those outcomes are important, they are beyond the scope of this paper.

5. Conclusions

Our study findings have practical implications that are relevant to research program directors as well as faculty mentors to undergraduate researchers. These are summarized in Table 6. These implications may also be relevant to anyone working with college students during COVID-19, since challenges affecting undergraduate researchers seem to reflect broader challenges on college campuses.

Table 6. Summary of practical implications by each barrier to research progress.

	Research Barriers			
	Lacking Motivation	**Time Crunch**	**Task Uncertainty**	**Lacking Tools**
Practical Implications	○ Guided reflection on the importance of research ○ Encouraging emails ○ Faculty mentor training ○ Modelling ally behaviors	○ Teaching research time management, including frequent due dates	○ Open lines of communication ○ Conversations about teleconferencing	○ Financial assistance ○ Creative remote options for engineers

While motivation is complex and influenced by a variety of factors, faculty mentors and research program directors can influence student motivation. Others engaged in studying emergency online learning during COVID-19 have recommended that professors prompt students to write out reasons why school is important for them or send out small announcements of encouragement, as two simple ways to boost student motivation. These approaches can easily be adapted to a research context, wherein trainees can be prompted to reflect on why they are involved in research to begin with and the value of their research projects. Mentors can also send encouraging emails to their student mentees regularly. As mentor training has been shown to improve mentor competency [77] and more competent mentors relieved COVID-19-related motivation issues here, mentor training, e.g., the Entering Mentoring curriculum, see [78], should continue to become an important part of faculty development among scholars working with undergraduate researchers.

We found sexual minority students to be affected to a greater degree by motivational barriers, which raises the concern that COVID-19 might push even more sexual minority students away from STEM. This implies that program directors and faculty mentors should implement strategies to retain these students now. To support sexual minority students, faculty and research program directors can use their own position of privilege to be allies [79]. They can engage in behaviors that outwardly support diversity by openly expressing their ally identities and by role modeling their support for all diverse groups. Mentors can emphatically state out loud their genuine support for minority groups and diversity-supportive causes and share information about diversity-related events on campus with their research team. Upon returning to campus post-COVID-19, they can post-ally/diversity-supportive stickers in their offices. Faculty who express their ally identities in these ways convey their desire to create safe spaces for students [79]. When faculty engage in and promote inclusive behaviors, they encourage students with hidden differences to feel comfortable disclosing their identities within the research team, which can engender positive changes including an improved commitment to the research team [80].

In terms of accessing tools needed to conduct research remotely, economic and disciplinary factors were the most salient correlates in our analysis. This suggests that students might need financial assistance to acquire the tools needed to do remote research, and that research programs serving engineering students must be sensitive to their particular

research training circumstances. Many engineering faculty mentors and program directors have creatively sought ways to facilitate authentic remote research experiences for their undergraduate trainees. Some have sent lab kits home with students and others have designed virtual reality experiments. Access to these sorts of "research at home" opportunities will need to expand as long as students are unable to fully return to campus life. Even after COVID-19, the growth in remote research opportunities spurred by the pandemic might create new participation opportunities for students who had previously been excluded from research (e.g., part-time students that also work full-time, home-bound students, students that care for dependents). Program directors and mentors should be attuned to these opportunities.

To address the barrier of task uncertainty, interventions are needed to address mentor–mentee communication challenges, since those are at the root of task uncertainty based on our model results. Opening lines of communication regarding teleconferencing is an important first step here. This might help mentors assess if this is a problem for their mentees and how they might address it, given that it is strongly linked to task uncertainty (as well as motivation).

To address the barrier of students feeling a time crunch with their research, both economic and communication challenges must be addressed. On the communication side, there are techniques that mentors can use to help mentees manage their time. Ho [81] reviewed literature on time management and suggests that mentors and mentees can devise a week-by-week schedule of activities for the project, with due dates, and then follow it. Mentors can build 'catching up time' into the schedule to allow for slight delays; divide the project up into small manageable units, which can make the project feel more attainable to the student; and finally, ask for regular submission of written work, as opposed to waiting until the end of the project [81]. Despite being written about years before COVID-19, these strategies are easily adaptable to the pandemic context.

In sum, the barriers to research progress identified in this study were more closely related to the changing circumstances induced by the pandemic than to student social demographics or academic characteristics. This provides opportunities for interventions to change the context so that students are less likely to experience these barriers moving forward under COVID-19 conditions and in the future.

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Article

Students' Views towards Sars-Cov-2 Mass Asymptomatic Testing, Social Distancing and Self-Isolation in a University Setting during the COVID-19 Pandemic: A Qualitative Study

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Abstract: We aimed to explore university students' perceptions and experiences of SARS-CoV-2 mass asymptomatic testing, social distancing and self-isolation, during the COVID-19 pandemic. This qualitative study comprised of four rapid online focus groups conducted at a higher education institution in England, during high alert (tier 2) national COVID-19 restrictions. Participants were purposively sampled university students (n = 25) representing a range of gender, age, living circumstances (on/off campus), and SARS-CoV-2 testing/self-isolation experiences. Data were analysed using an inductive thematic approach. Six themes with 16 sub-themes emerged from the analysis of the qualitative data: 'Term-time Experiences', 'Risk Perception and Worry', 'Engagement in Protective Behaviours', 'Openness to Testing', 'Barriers to Testing' and 'General Wellbeing'. Students described feeling safe on campus, believed most of their peers are adherent to protective behaviours and were positive towards asymptomatic testing in university settings. University communications about COVID-19 testing and social behaviours need to be timely and presented in a more inclusive way to reach groups of students who currently feel marginalised. Barriers to engagement with SARS-CoV-2 testing, social distancing and self-isolation were primarily associated with fear of the mental health impacts of self-isolation, including worry about how they will cope, high anxiety, low mood, guilt relating to impact on others and loneliness. Loneliness in students could be mitigated through increased intra-university communications and a focus on establishment of low COVID-risk social activities to help students build and enhance their social support networks. These findings are particularly pertinent in the context of mass asymptomatic testing programmes being implemented in educational settings and high numbers of students being required to self-isolate. Universities need to determine the support needs of students during self-isolation and prepare for the long-term impacts of the pandemic on student mental health and welfare support services.

Keywords: COVID-19; SARS-CoV-2; coronavirus; mass testing; social isolation; social distancing; mental health; students; focus groups; qualitative

1. Introduction

Coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The World Health Organization declared the outbreak of coronavirus disease (COVID-19) a pandemic in March 2020. During this time, restrictions on movement were put into place worldwide, to flatten the curve of infection through social distancing. The functioning of colleges and universities during the pandemic presents a challenge. Globally, strategies to manage the situation have included containment and mitigation, such as access control with contact tracing and quarantine, hygiene, sanitation, ventilation, and social distancing. In the United Kingdom (UK), this required rapid development of local organisational COVID-19 policies in universities, requiring regular adaptation in line with evolving updates from the UK Higher Education Taskforce, and rapid changes in government policy and guidance, as the national situation changes. In the UK, universities rapidly transitioned to online teaching and learning during the first surge of COVID-19 in March 2020, followed by large-scale reopening of campuses for the new academic year in September/October 2020. This mass movement of students from across the UK and overseas aligned with a second surge of COVID-19 across the UK [1] and the establishment of a national tiered system of restrictions to address local outbreaks of COVID-19 (Supplementary File S1).

The proportion of asymptomatic infection among COVID-19 positive persons is found to be high, with a substantial transmission potential [2]. A systematic review found that in two general population studies, the proportion of asymptomatic COVID-19 infection at time of testing was 20% and 75%, respectively, and among three studies in contacts it was 8.2% to 50% [2]. In the absence of a national strategy or policy, some universities developed local capability for frequent and regular mass asymptomatic SARS-CoV-2 testing programmes [3,4] in effort to reduce the risks [5] of viral transmission between asymptomatic students. This approach aimed to maximise the safety of staff, students, and local communities, and aligned with recommendations made by the UK's Independent SAGE Behavioural Advisory Group [6]. Without national guidance, there was hesitancy around asymptomatic testing, as the implications for students' social behaviours and wellbeing were unknown.

The success of mass testing approaches relies on high levels of testing and social isolation [7,8] to reduce viral transmission. Further, a combination of moderate physical distancing measures, self-isolation, and contact tracing is more likely to achieve control of severe virus transmission [7]. However, we know little about students' views towards these approaches to mitigation and containment. Although adherence to COVID-19 social regulations was generally high in the UK population (>90%), less than half of the population adhered to full self-isolation (duration adjusted adherence to full self-isolation was 42.5%) [9]. Additionally, 46% of 'resisters' to the lockdown rules were from younger age groups (16–24 years) [10]. Since 1 in 3 people aged 18 to 24 years were in full time education [11] it is possible that education settings host a high proportion of individuals who are less likely to adhere to social isolation. There is a high prevalence of younger age groups in universities; in 2019/20 there were 2.46 million students at UK higher education institutions [12], with 18–19 year-olds making the largest contribution to the Higher Education Initial Participation (HEIP) measure (the sum of the initial entry percentages in each of the age groups from 17 to 30 years, in a given academic year) [13].

This study was conducted at a university in England, in October 2020, at the beginning of the Autumn term, at the time of a second surge of COVID-19 in the UK. Earlier in the year (April–October 2020), a pilot asymptomatic testing programme was implemented at the same institution with a high reported acceptability of SARS-CoV-2 asymptomatic test-

ing and logistics (virus—swab and saliva; antibody—finger prick), and a high willingness to engage in future testing (94.9%) [4]. Self-reported adherence to weekly virus testing in this pilot delivery was high (92.4% completed ≥6 tests; 70.8% submitted all 10 swabs; 89.2% completed ≥1 saliva sample) and 76.9% submitted ≥3 blood samples [4]. Although there was a paucity of evaluations, high uptake of asymptomatic testing was also demonstrated at another UK institution [3,14].

However, at our institution, at the start of the Autumn term, there was a wide-scale deployment of local asymptomatic testing in residential student halls with much lower uptake than was found in the pilot service. Uptake amongst students first offered an asymptomatic test in residence-based deployments was 13% up to the end of October. During October there was a marked decrease in testing uptake, beginning at 58% in the first deployment in early October and decreasing to as low as 5% in a late-October deployment. Concurrently during this time there were around 2000 self-reports of positive SARS-CoV-2 tests in students, the majority of which were associated with symptomatic infection. A significant minority of these reports were associated with students following advice to seek confirmatory UK National Health Service (NHS) community testing, in response to a positive test identified through the University's asymptomatic testing service. The institution had one of the highest reported rates of COVID-19 in the country at that time [15], although it was anticipated that the asymptomatic testing programme would identify cases earlier and more quickly as it rolled out through the term and detected positive cases that might have otherwise remained undetected. The testing service was intended to reduce asymptomatic transmission and the number of future cases. Nevertheless, the impact of COVID-19 on social isolation at our institution was dramatic during this time, with many more students reporting entering isolation than reporting positive tests. Despite publication of isolation numbers being uncommon, the total number of people self-isolating across 45 universities with positive cases reported to be above 3540 within just 9 weeks [16], suggesting that this was a common experience across UK universities. The overall aim of the study was therefore to explore university students' perceptions and experiences of SARS-CoV-2 asymptomatic testing and strategies for mitigation (social distancing) and containment (self-isolation) in a higher education setting. The findings provide insight into students' barriers to testing uptake and adherence to social restrictions, contribute to a wider debate around mass testing approaches in a pandemic [17–20], and the impact of mitigation and containment strategies on young people's social behaviours and wellbeing.

2. Methods

2.1. Study Design

This was a qualitative focus group study involving four online focus groups with a total of 25 participants undertaken in a two-week period, during October 2020. The study design adhered to the consolidated criteria for reporting qualitative studies (COREQ) guidelines [21] (Supplementary File S2). The research protocol was approved by the University of Nottingham Faculty of Medicine and Health Sciences Research Ethics Committee (Ref: FMHS 76-0920).

2.2. Study Context

During this time, England was subject to national coronavirus restrictions. The participating university was in a region categorised as 'tier 2 high alert', during which government restrictions prevented people from meeting indoors with individuals or groups from outside of their household or support bubble. At this time, people were advised that no households should mix indoors or in groups of more than 6 outdoors with social distancing, remote working (and studying), other restrictions on travel, facilities, and services (Supplementary File S1). Students had to contend with abrupt changes in the way that education was delivered, the risks of COVID-19 more broadly, significant reductions in social contact, and separation from friends and family due to social distancing measures. Large numbers of students had to adapt to confinement strategies in residential education

settings, including shared student accommodation and houses in multiple occupation. Due to increasing numbers of positive cases locally and nationally, many students were required to self-isolate during this time, which meant staying in their home or place of residence and not going outside for any reason, including not travelling to a different place of residence. At the time of data collection, a mass asymptomatic SARS-CoV-2 testing programme was underway at the participating university [4], with testing deployments taking place in a small number of university halls of residence, with plans for a rapid roll out of testing to all university staff and students being developed.

2.3. Participants, Sampling, and Recruitment

Participants were university students recruited from a single higher education institution via an established cohort study of students living on and off campus [22]. Purposive sampling was used to provide a diverse range of ages, genders, living circumstances (on/off campus), SARS-CoV-2 testing, and self-isolation experiences (Table 1 and Supplementary File S3). Students required to self-isolate were those that tested positive for SARS-CoV-2, lived with someone who had symptoms or had tested positive, or were identified as a contact of someone who had tested positive by the NHS 'Test and Trace'. Of the 25 students in the sample, 12 were tested, of which 11 were symptomatic and one was asymptomatic. All participants were currently residing in the UK and gave informed consent online to be approached for interview via Jisc Online Surveys, and additional verbal consent was provided and audio-recorded prior to the start of the focus group. Recruitment continued until achievement of maximum variation sampling, in terms of the pre-specified interviewee characteristics. The 2-week data collection period allowed for rapid data analysis so that findings of the study could feed into university COVID-19 strategy around mass testing and student support. Students were not compensated for their participation. Online data collection was necessary due to social isolation policy. However, online focus groups are commonly used in health research to capitalise on group interaction in diverse and geographically dispersed participants, to collect rich responses to questions posed in a cost saving and convenient way [23].

Table 1. Characteristics of participants.

		Sample *n* = 25
Age (median, range)		23 (18–51)
Gender		
	Male *n* (%)	9 (36)
	Female *n* (%)	16 (64)
Student status †		
	Home students *n* (%)	19 (76)
	International students *n* (%)	6 (24)
Accommodation type		
	On-campus *n* (%)	8 (32)
	Off-campus *n* (%)	17 (68)
Testing status [a]		
	Not tested *n* (%)	13 (52)
	Symptomatic testing *n* (%)	11 (44)
	Asymptomatic testing *n* (%)	1 (4)
Previously self-isolated [b]		
	Yes *n* (%)	18 (72)
	No *n* (%)	7 (28)

Note: † International student; [a] Not tested for SARS-CoV-2, Tested Asymptomatic (University Asymptomatic Testing Service), Tested Symptomatic (NHS Symptomatic Community Testing); [b] Self-isolated for any reason.

2.4. Online Focus Groups

Students took part in one of four focus groups (n = 3–11 in each group) held online using video-conferencing facilities. The focus groups lasted for 58 to 70 min (mean = 64 min). Two psychologists (H.B./H.K.) generated the question guide, moderated the focus groups and analysed the data. We used a semi-structured question guide focused on the research outcomes of several studies [4,22,24], to cover the main topics related to the outcomes of the study. A draft topic guide was developed by the same two psychologists (H.B./H.K.). To judge the relevance of the topics and the possible emotional impact on students, the topic guide was discussed with experts who had expertise in mass SARS-CoV-2 testing (n = 2), psychology (n = 2), university operations (n = 2), student wellbeing (n = 3) and student members of a Patient and Public Involvement and Engagement (PPIE) group (n = 2). Following feedback, the draft topic guide was pilot tested for comprehensibility and level of burden with two students who were not participants in the study, which resulted in minor amendments to question wording. Both moderators were trained in qualitative research and interview skills and were not involved in delivery of the asymptomatic SARS-CoV-2 testing programme. Focus groups were conducted according to recommendations from NHS England's focus group guide [25]. A funnel approach was used with broader, generic questions at the outset (e.g., introductions), leading to more directed questioning (e.g., views on specific issues). The purpose was to build rapport within the group and ensure there was enough 'lead-in' time for participants to feel comfortable about contributing to the discussion. Due to the nature of the discussion, and the timing of data collection amidst a surge in the pandemic, it was not deemed appropriate to require all students to respond to every question, although every effort was made to encourage participation within the group. All focus groups followed the same questioning route (Supplementary File S4), were audio-recorded and transcribed verbatim. Participants are referred to as new students (first year students beginning their studies in the Autumn term) and returning students (those resuming their studies in the Autumn term following a summer break).

2.5. Data Analysis

The audio recordings were professionally transcribed. Two experienced researchers independently familiarised themselves with the data (H.K./H.B.). We performed inductive thematic analysis [26]. Data were examined for patterns and recurrent instances, which were then systematically identified across the dataset. Due to the rapidity of the study, one researcher (H.K.) coded all focus groups transcripts using open coding [27] into codes and subcodes. To ensure reliability of data interpretations, two researchers (H.K./H.B.) then independently read the emerging codes and supporting quotations to enhance the accountability of the analysis [26]. Codes were individually and critically examined by both researchers, and the overlapping codes and subcodes were further refined and grouped together. Codes and subcodes with similar characteristics were then grouped into meaningful overarching themes that emerged organically from the data. Themes, codes and subcodes were confirmed by two student participants. Given the aim of the study, the sample specificity, the rich dataset, in-depth insights into the phenomena of interest and the analysis approach adopted, the qualitative sample was deemed to have sufficient information power [28].

3. Results

Six themes emerged from the analysis of the qualitative data from the focus groups—'Term-time Experiences', 'Risk Perception and Worry', 'Engagement in Protective Behaviours', 'Openness to Testing', 'Barriers to Testing', and 'General Wellbeing'. A thematic map illustrating the relationships between the key themes and subthemes is provided in Supplementary File S5. Table 2 shows the list of all key themes and subthemes and the representative quotes, together with the frequency (and %) of students contributing independent statements of agreement within each subtheme.

Table 2. Examples of key themes, subthemes, frequency and their representative quotes.

Themes	Subthemes	Frequency *n* (%) *	Representative Quotes
Term-time experiences	Logistical difficulties	7 (28)	*'For me, it was very much a case I was supposed to be going abroad this year for like a study year abroad and that was cancelled quite late notice with the Covid stuff, it was cancelled in about June/July. And so I didn't really have much time to think about it before I had to start thinking about, you know, planning for next year and getting the practicalities sorted. So it was kind of almost a rush because I had in my head that I was going to go abroad and sorting my accommodation out there and everything like that, transport—and then suddenly everything changed and I knew I only had a couple of months to get everything together'*; Participant 12 *'A lot of the flats that have been in quarantine, the students have actually been forced to come out of quarantine just to get their food, because we don't get meals or anything with our accommodation'*; Participant 15 *'As an international student we wouldn't have to isolate in a usual time but during this time when we arrived at the UK we needed to isolate for two weeks first from certain countries and that happened with everyone. It's very difficult because when you just move into a new country and you cannot do anything and you're wondering 'how am I going to get groceries?'*; Participant 1
	Adjustment to online learning	11 (44)	*'All our limited lectures can be done online and it's quite nice to be able to relax and get myself into a rhythm. It isn't as pre-determined as it used to be'*; Participant 8 *'I think the university's done well to kind of quickly get it all online actually because, you know, it's still running and that's the most important thing and there's nothing—I can't think of anything more that they could be doing'*; Participant 23 *'I thought that I would have really interesting experiences and networking opportunities and potentially job opportunities at the end of my matriculation and I feel very frustrated by the fact that I don't have those opportunities anymore'*; Participant 2 *'I'm a new student, an international student in my Master's degree and for me it was quite difficult to get used to all the different platforms that we use for online teaching'*; Participant 11
	Safeguarding	10 (40)	*'On campus I actually feel relatively safe because of the social distancing. I don't know about in halls but like in teaching, especially when we have like our labs and in-person teaching, people are actually sat away from each other and we wipe down our area'*; Participant 22 *'Because we all have to wear masks and visors in the labs anyway, we're quite—and we have to social distance, 1 metre plus is the closest we're allowed to get in the labs, so in terms of actual risk of transmission we're lower risk than halls and social areas basically'*; Participant 13 *'I'm primarily lab-based and my lab was shut for 5 months due to Covid, so that's affected my studies quite a lot'*; Participant 4 *'Because of the fact that my hall has a courtyard and there was a security guard watching us, it felt a bit prison-y'*; Participant 19
	Connectedness through communication	4 (16)	*'I was actually really humbled to have an email from [my School] just to check up on me as they heard I was isolating, and that was really nice. It made me feel less forgotten'*; Participant 18 *'Also as a postgrad I also feel a bit forgotten about because like we were here the whole time when our labs were closed and just like a lot of the emphasis—I know we're like a minority obviously and you can't sort out everything at once, but it felt like a lot of the emphasis was on like majority groups that were probably less affected'*; Participant 4 *'I feel like they need to be in constant contact with people that are isolating or even just anyone that could make themselves known to the uni. Or just something to, I dunno, I think the uni needs to be really, really proactive in offering lots and lots of online things, constantly like daily or every evening, because I think the main thing is making sure people don't feel alone at all'*; Participant 6
Risk perception and worry	Previous experience with COVID-19	14 (56)	*'A guy who lives, who I share a bathroom with, tested positive but he didn't have any symptoms so it's been like something happening but not really anything to do with me'*; Participant 19 *'My mum was super bedbound for the whole ten days, but we were both very lucky, we didn't have to go to hospital or anything. So at the beginning I wasn't very worried about it until I kind of got it'*; Participant 6
	Perception of health	9 (36)	*'I had no real worry for myself because, I mean, I've had it now so hopefully it means I've got some sort of immunity. I'm more worried for my older relatives'*; Participant 14 *'Covid terrifies me—Until recently I was considered vulnerable to the virus because of previous serious illness. So being in a shared house, still going to work in order to pay rent and also having to go onto campus for some lessons has made my anxiety go crazy'*; Participant 18 *'I was actually pretty excited to come back to uni, just because I know young people at the moment are having loads of cases and everything, but it kind of separates me from my parents. I know I wouldn't put them at risk because I wouldn't be living with them so even if I contracted the virus on campus or whether in the city of Nottingham, I would just self-isolate by myself or with my friends. I wouldn't be putting my parents at risk. So in that sense I was kind of excited to come back and like kind of separate myself from parents'*; Participant 22
Engagement in protective behaviours	Format of communication and guidance	12 (48)	*'I know we've been receiving lots of emails about what the rules are, what we need to do—but they are very text heavy—and I wouldn't have thought of this if it weren't for my housemates—but they're all international students and they struggle with the large blocks of text because there are a lot of words in there that are just unfamiliar to them'*; Participant 15 *'There was no guidance from the government or the university that we could find about what to do when someone did test positive, so we didn't know if we should make them stay in their room or wear a mask. We weren't really sure'*; Participant 9 *'We didn't get told that we weren't allowed to use our communal space until after we finished self-isolating so, for us, there was no communication and then they emailed us to say 'oh, even if you've all tested positive, you're not allowed to use your communal space, or you are but one at a time'—we didn't realise this—so that seems like really weird because, to be fair, if you've tested positive it's probably too late and you've probably given it to all your flatmates anyway'*; Participant 14 *'And the only place it said what the mealtimes were initially for the first couple of weeks was on this email that we got and there's now a poster once you're at the food counter telling you what times you should be there. I think at that point it's a bit too late if you've turned up at the wrong time'*; Participant 5

Table 2. *Cont.*

Themes	Subthemes	Frequency *n* (%) *	Representative Quotes
	Environmental and structural factors	9 (36)	*'There were just like large crowds of them in the corridor over both sides of the system and then we would all get like stuck in crowds of students'*; Participant 4 *'I feel like the majority of people are self-isolating, at least here, and it got a lot better now they've got the categories in, because before they were trying to deliver to everyone who was isolating, which there were way too many people for that to work, so now that if you don't have symptoms but are isolating you're allowed to go to the dining room, it works so much better. And also you get to actually see people, which makes it feel a bit better, even if you're in different households you're not allowed to sit near them, you still get out your room'*; Participant 16
	Desire for social contact	12 (48)	*'It's the fact that people want to socialise more than they're worried about the rules'*; Participant 19 *'I think also people will social distance with strangers or people they don't know, but they feel it's fine with friends, even if they're not in the same household, which can be hard because literally some people, like the only friends they have are not in their household and now it's dark, it's getting cold and it's like sit in your room alone or, like, break the rules, and especially now you're not allowed people in your household even if you're social distancing with them, I reckon lots of people are going to not follow that'*; Participant 16
Openness to testing	Control of the virus	6 (24)	*'There clearly are people who are asymptomatic but carrying the virus and being able to get on top of that is going to play a massive role in being able to control the virus'*; Participant 13 *'I think it's a good idea in terms of—because obviously the whole point of wider testing means you've got a better ability to potentially control the virus and that's, like, in all other countries that have done good control and lots of testing is seen as a good thing'*; Participant 25 *'I fully agree with halls being prioritised because you're kind of mixing without PPE and stuff—but I know from the amount of work that's going in to trying to get postgrad researcher back in labs, I can imagine the asymptomatic screening would be really useful if there were capacity to do it'*; Participant 13 *'My only sort of slight issue with the asymptomatic testing is it does—it kind of puts, like, it makes [City] seem a lot worse than potentially it actually is in comparison to other areas of the country and other universities'*; Participant 5
	Access and experience	8 (32)	*'I think it's quite a good thing because otherwise you can't really have a test unless you've got symptoms'*; Participant 19 *'I think it's pretty much impossible to get an NHS test unless you've got really loads of symptoms and even if you do it's still really a long wait and you have to like drive somewhere. Like we see it on BBC news every single day how they're all backed up. So I think in a way it's quite nice to see. I know it's not everyone that gets the best but at least some halls and like quite a lot of people are getting tested, which is quite good, that otherwise wouldn't have been tested'*; Participant 22 *'Like it's not terrible but it's just a bit uncomfortable but it was quite easy to do, just like setting up that appointment online and then just going to the walk-in and it was a bit weird because it was that big white tent and it felt very much like a big Hollywood film or something. It wasn't too bad because everyone was really friendly and really helpful. I found it quite—even though it wasn't a massively fun experience, it was kind of a positive experience'*; Participant 6 *'I was impressed, I had my NHS results back within 2 days. The test was easy and quick'*; Participant 18
	Perceived immunity	6 (24)	*'I've had a few friends who've mentioned that they do want to get tested positive because they're quite confident on their immunity and so they're just like 'I want to get tested positive so that I can feel free about social distancing and not really have to feel so restricted'*; Participant 11 *'I'd be quite wary around some of the people that I know. I sort of fear that once they've got it they're going to feel like they're immune and they can do whatever now. I've certainly seen like parties of households as soon as they come out of isolation, they sort of celebrate and go a bit mad'*; Participant 10
Barriers to testing	Guilt about impact of test result on others	6 (24)	*'I feel people feel guilty if they have it and then that means everyone in the household has to isolate and then, like, the prospect of having to isolate in a pretty small room for like two weeks is quite daunting as well'*; Participant 16 *'I think once you're living in a bigger household, the guilt of knowing you're going to make everyone have to isolate with you, would be a very strong detractor'*; Participant 10 *'In our house—we're kind of getting it sorted now—but unfortunately we had some tensions over, like, to what extent the regulations hold specifically—and I've asked a few people their opinions of this—it's like there's one person that tests positive, should they be, like, literally allowed to leave their room'*; Participant 24
	Mental health impact of testing	8 (32)	*'Some of my friends don't want to get tested because if they are positive they have to isolate and they're really scared of the loneliness, kind of thing'*; Participant 4 *'I think it's that point about lockdown that really got me because, again, over the summer, especially that sort of first half of the summer, my mental health just completely deteriorated and went like really, really badly and I'm in the position now and sort of getting a positive test is I don't want to go back to what that was like, being locked down'*; Participant 24
General wellbeing	Social impact of the pandemic	10 (40)	*'I think that's going to be the tough thing for students, is that sort of emotional wellness boost that we all get from being around other people'*; Participant 15 *'I'd say I feel very strongly about the first years and sort of hearing, like, about, like, where they get like a positive test in a hall, they've got security guards on the door and they're sort of, like, breaking the law because they want to go and see their mates and I remember how difficult it was in first year, like, to meet people, to make friends—and when you don't have those obvious, like, big social weeks to meet people and the university is, like, encouraging them to not go out and meet people—I can't imagine how difficult that is for some people'*; Participant 25 *'I would say as a fresher starting, it's been really hard to actually meet people and I think what a lot of people are worried about is the fact that, you know, in the next couple of months we're going to have to choose who we want to live with next year and maybe even for like the rest of our course and we've really not had an opportunity to meet people outside of an academic setting'*; Participant 5

Table 2. *Cont.*

Themes	Subthemes	Frequency *n* (%) *	Representative Quotes
	Mental health impact of the pandemic	8 (32)	*'I'm getting quite down about it, because it's literally your work's on your screen, like, and then all you can do is like looking at your screen, like, if you socialise you have to do it over on your screen and it's just really, just making me a bit down really, because I can't even eat lunch with people'*; Participant 16 *'Nationally if we went into another lockdown I would be scared about how I coped because I coped pretty badly in the last one with my mental health and stuff and I'd just be scared I'd go straight back into that again if that were to happen'*; Participant 23

* Number of participants who contributed independent statements towards each theme. These figures do not reflect contextual or behavioural factors, such as nodding in agreement or participant agreement with the statements provided by others. PPE = personal protective equipment; and NHS = UK National Health Service.

4. Discussion

This study explored university students' perceptions and experiences of university life during COVID-19, SARS-CoV-2 mass testing, and strategies for mitigation (social distancing) and containment (self-isolation) of the virus, during the second surge of the COVID-19 pandemic in the UK, with six emerging themes. Theme 1 ('Term-time Experiences') highlights the impacts of COVID-19 on practical issues surrounding students' daily life and academic studies, alongside university approaches to protect and safeguard. Themes 2 and 3 ('Risk Perception and Worry'; 'Engagement in Protective Behaviours') demonstrate the individual and structural drivers of students' engagement with social behaviours that protect against virus transmission. Themes 4 and 5 ('Openness to Testing', 'Barriers to Testing') highlight students' openness to mass asymptomatic testing alongside the barriers and enablers of testing and its consequences. Theme 6 ('General Wellbeing') highlights the broader impacts of the pandemic on social and mental wellbeing, which are core concepts interwoven within Themes 1–6.

4.1. Impacts on University Life during a Pandemic

We found that COVID-19 impacted significantly on student experience of university life. It is clear that students in university-managed accommodation experienced some practical complications in accessing basic supplies at the start of the term, and although these issues likely contributed to student anxiety, they were temporary and quickly resolved at a local level. Nevertheless, there were students for whom access to food and basic supplies was likely to be more challenging during this time (e.g., students living off-campus in privately owned accommodation, particularly international students arriving to the UK for the first time). These groups might be at particular risk since food insecurity (worry about how, and where, to access food) was identified in 35% of students during COVID-19 lockdown, and students' living arrangements during the pandemic was found to be the strongest predictor of food insecurity [29].

The University's approach to safeguarding students while managing the continuation of studies was well received, although the pandemic had dramatically impacted the social aspects of learning and university life. Many students reported that the university had provided sufficient cleaning equipment and safety measures to make students feel comfortable on campus. This applied across different campus settings, including accommodation, libraries, lecture halls and gym facilities. Although perceptions of safety on campus were high, some felt that the safe-guarding measures negatively impacted the broader student experience. In particular, individuals undertaking laboratory-based research reported that their studies were heavily impacted by university-wide safe-guarding building closures. To some, the safe-guarding processes surrounding self-isolation in halls of residence were viewed to be particularly restrictive. However, this was mitigated by regular communications from university staff that improved students' experience of university life, and appeared to enhance students' feelings of connectedness, particularly during periods of social isolation.

The crisis-response migration of universities to online education early in the pandemic was essential and enabled the continuation of education in universities at that time [30] but the transition was not without its impacts. Impacts on studies were particularly notable at

the start of the Autumn term alongside efforts to shift to online teaching and learning, and to mobilize mitigation and containment strategies in a short period. Students endorsed varying levels of adjustment to learning online. Many students described adapting well to online functioning, noting that the course conveners had also adapted well to this shift, and consequently, their education did not suffer. Some students enjoyed the novelty of self-guided learning. However, multiple students found this format to be disorganized at the outset, with classes cancelled or rescheduled at the last minute at the start of the Autumn term. The transition to unfamiliar online learning environments was particularly challenging for new students who had not yet established their friendship groups and international students for whom English was not their native language. It was also noted that the move to online learning resulted in the loss of potential networking opportunities that might have arisen through the course if it were delivered face-to-face. The immediate challenges for higher education institutions were apparent, with regards to access to technical infrastructure, pedagogies for distance learning, competences (of students and staff), and managing the requirements of specific fields of study (e.g., hands-on learning requirements, field work, assessments) [31]. This rapid transition to online teaching and learning might precipitate enhanced teaching and learning opportunities in the future [32], by increasing opportunities for flexible learning approaches [31]. However, the requirement to adapt at speed to unfamiliar online e-learning approaches in the context of the pandemic is challenging for some.

For students in our study, many had adapted well to online learning, despite the early hitches of the transition period. While students generally felt that the university had appropriately managed safeguarding, the combined impact of safeguarding and the transition to online learning had limited opportunities for important social contact. Students who seemed to fare better were those who had received more regular contacts from university staff during the pandemic, and particularly through periods of self-isolation. As a result, universities should act on generating opportunities for social support and networking, which could be delivered through academic departments, sports, wellbeing facilities, clubs and societies.

4.2. Risk Perceptions, Adherence and Social Behaviours

With regards COVID-19 mitigation, students in our study were highly conscious of the risks of COVID-19, although many who considered themselves to be in good health were more concerned with the asymptomatic spread of COVID-19 to others than the risk of contracting the virus themselves. Previous experience with COVID-19 also heightened students' fears about the impact of the virus on others, particularly those in vulnerable groups (e.g., older relatives). However, those with a pre-existing health condition they felt put them at increased risk, conveyed a strong concern about the potential impact of contracting COVID-19 themselves. Students with pre-existing health conditions described concern about going into public settings for fear that others might put them at risk.

In our sample, there were two factors that were perceived to reduce compliance with social distancing in a minority of students and this did not seem to be related to risk perception, but more to the environment and desire for social contact. First, some of the residences and educational buildings had narrow corridors and 'bottlenecks', preventing the 2-m distancing between people that is required by UK government restrictions, which was seen to present an environmental constraint. Second, some students had an overwhelming desire to socialize that meant they were non-compliant with peers, despite adhering to social distancing in other contexts (with strangers). However, students perceived that only a small minority of the general student body were non-adherent to social distancing.

Although some improvement occurred over time, levels of adherence to test, trace, and isolate are low in the UK [10]. Our participants suggested that adherence to self-isolation might be more likely in students who experienced COVID-19 symptoms than in those who were self-isolating for other reasons. This might be due to greater perceptions of risk and disease severity in those who had personal experience of COVID-19 (e.g., [22]), and

that people with high risk perception around infectious diseases tend to take preventive behaviour [33]. However, risk perceptions can only partially explain this, since adherence to self-isolation in young people is strongly related to structural vulnerabilities and availability of resources (e.g., social support with food access and caregiving responsibilities, financial hardship, and space in living accommodation) [34].

Students' concerns about passing on COVID-19 to vulnerable loved ones indicates that adherence of university students to COVID-19 protective behaviours might be associated with a sense of social responsibility, and this was also identified in other populations of young people [35,36]. Although adherence to social distancing and protective behaviours was found to be lower in younger adults than other age groups [37], students in our study reported adhering to protective behaviours and observing compliance across the university more broadly. Nonetheless, they reported seeing or hearing that a minority of students were non-compliant with social distancing behaviours or self-isolation. This echoes data from the UK Office for National Statistics (ONS) Student Covid Insights Survey (SCIS) [38], which found that that 9 out of 10 university students reported complying with social distancing around the time of the study and were more likely to avoid leaving their accommodation completely than the general public, although the non-adherent minority were more likely to be from younger age groups [11].

Some studies indicated that non-compliance with public health advice during COVID-19 is associated with weaker feelings of moral obligation, low trust in authorities and individual characteristics related to antisocial potential [39]. Alternatively, it might be that non-compliant students simply perceive being around their peers, particularly in a campus environment and shared living accommodation, to be low risk, due to their familiarity with each other, and so the concept of social responsibility might feel less relevant to some individuals in this context. This could partially explain the high prevalence of COVID-19 outbreaks on university campuses across the UK.

Higher education providers are encouraged by the government to consider incentives for compliance, and disincentives for non-compliance including, in serious cases, the use of disciplinary measures [40]. For those willingly or repeatedly breaching University or Government guidance, policies, or laws in relation to COVID-19, there might, for example, be disciplinary investigations, fines, temporary or permanent withdrawal of students from university activities or a course of study, or referral to Police, Public Health, or Border Agencies. Nevertheless, a deeper understanding of the structural, psychological and social barriers to adherence might help reduce the occurrence of regulation breaches and non-compliance. Overall, social interaction is an integral part of students' lives. Universities and colleges should consider the social impact of protective behaviours and offer social outlets for students when appropriate (e.g., providing opportunity for monitored socializing outdoors when it is safe to do so). Given the highlighted structural difficulties some students experienced with their accommodation providers, the university should set out clear guidance for both students and providers on practical, social, and emotional supports for students, on return to campus following national lockdown and during periods of self-isolation. These strategies might improve adherence to self-isolation and reduce fear of self-isolation, which might equally enhance uptake of testing.

4.2.1. Communications and Social Behaviours

Our study suggests that students on the whole are predominantly adherent to protective behaviours, but reduced compliance with social distancing and self-isolation guidance was also associated with perceived inadequacies in university communications at the time of the study, which were not always seen to be timely. Students reported that they were most likely to comply with guidance if it was presented in a simple format, supported by elucidation of the reasons behind the guidance. Students noted that communications from both the government and university were text heavy, and difficult to read and comprehend, particularly for international students. Students thought communications could be improved through the use of infographics rather than text. Multiple students reported that

university communications were also relatively slow, meaning that students had already engaged in activities that could have caused spread of virus (e.g., use of communal space). Some students also reported finding it difficult to follow guidance, as a result of gaps in the government and university information pertinent to them.

However, students in this study recognized the challenges associated with communicating with large numbers of people in frequently changing national and global circumstances. Similarly, previous research conducted at the same institution found that most student participants were largely satisfied with university communications, with dissatisfaction expressed by a minority that was specifically related to an early approach to communicating negative test results at this institution, which was subsequently changed in response to student preference [4].

Government guidance emphasized that higher education providers should ensure that the rationale for protective behaviours is understood via clear and consistent messaging, while not assuming that everyone understands official guidelines [40]. We propose that institutional communications around COVID-19 might need to be more accessible and inclusive, since messaging at the time of the study was not universally understood amongst students, and the needs of certain groups (e.g., postgraduate students, international students, off-campus students) were not being met. It is important to consider these findings in the context of a fast moving and uncertain crisis situation, during which institutional COVID-19 strategies had to be developed and operationalized at speed. This required high responsivity to changes in local and national guidelines and procedures, with rapid communication of changes to university staff and students. It was advocated that organisational communications during the COVID-19 crisis should be succinct, to be read and understood [41]. Our findings might highlight a tension between the need for simplicity and readability of communications by the target audience, particularly students for whom English was not their first language. Additionally, the importance of communications (e.g., clarity, inclusion, and timeliness) in maximizing adherence to protective behaviours should not be underestimated. Given the identified link between desire for social contact and adherence to protective behaviours, messaging should emphasize the desirability of adhering to public health protocols, and signpost activities that minimize the boredom of self-isolation and maximize opportunities for social contact and activity engagement (e.g., virtual social interactions, exercise classes) [42].

4.2.2. Communication Approaches

Given the high proportion of young people in universities, COVID-19 information provided to young people should be clear, delivered by a trusted source, should avoid giving visibility to non-adherence, and should promote positive behaviours to enact, rather than avoid negative behaviours [34]. Ideally, messages for students would be co-created with students [43], since it is well-established that young people are often more heavily influenced by their peers than by other age groups and are more likely to heed advice from those in similar age groups. Thus, 'using the young person's voice' to deliver messaging would be helpful to reach higher education students in younger age groups. As 'social influence agents' who support or undermine health-related behaviours [44], peers both model, and influence, healthy and unhealthy behaviours [45]. Therefore, communications could emphasize social norms related to adherence to protective behaviours (e.g., what peers think, what peers do) [34]. Since young people in particular are generally more oriented towards short-term rewards rather than long-term consequences [46], messaging could emphasize the immediate impacts of COVID-19 such as the risks to loved ones, and young people should be thanked for their contribution to reduction of virus transmission. Communications should not just instruct young people on what to do but should include clear guidelines on how to enact protective behaviours (e.g., how to socialize in a COVID-safe way, how to socially distance in specific situations, and how to engage with peers who are non-adherent) [34].

4.3. Students and COVID Testing

Our study suggests that students at this institution remained positive towards the availability of local asymptomatic testing for SARS-CoV-2 and generally felt safe on the university campus at the time of the study (high alert, UK second surge) with mass testing in place, and during a time when the national situation had dramatically changed, and cases were rising [1]. With regards to the practicalities of testing, no particular problems were raised relating to any of the testing processes or procedures (NHS symptomatic community test—throat swab; University asymptomatic test—saliva). Some students reported that the throat swab test was uncomfortable, yet prior work suggests that students did not raise this as a barrier to the uptake of testing [4]. Studies in other populations suggest that discomfort was relatively low in both throat and nasal swabs, although nasal swabs were less likely to induce nausea or vomiting [47]. There is little published evidence in this area, although unpublished work suggests that saliva tests are a less intrusive approach with university students as compared to nasal swabs [48]. Testing uptake and self-isolation adherence could be low in education settings (e.g., [36]). Greater student adherence to SARS-CoV-2 asymptomatic testing is associated with their level of satisfaction with university communications [4]. Intrusiveness and convenience of testing procedures should also be considered and balanced alongside test sensitivity, to maximize testing uptake. Overall, our study showed that the availability of testing was seen by students to be an important approach to 'getting control' of the virus, although engagement with testing was more likely to be related to the emotional impacts of self-isolation and its consequences. To maximize uptake of asymptomatic testing, there needs to be significant support in place to manage the impacts of self-isolation on students' social relationships and mental wellbeing. Further, the risk of unintended behavioural consequences of mass testing could not be dismissed, since our findings suggest that for a minority, a negative test result might instill a sense of false security and perceived immunity to COVID-19.

4.4. General Wellbeing and Mental Health

Overall, the long-lasting pandemic situation and associated restrictions have had psychological consequences in the general population [49], with young adults being particularly at risk for mental ill-health [22,24]. Specifically, in university students, mental health concerns were identified globally during the pandemic, with high rates of stress, anxiety, depression, and evidence of clinically relevant post-traumatic stress disorder [4,22,50–52].

Confinement strategies associated with COVID-19 were unavoidable during the COVID-19 pandemic but were shown to impact mental health and exacerbate social inequalities in university students [53]. Our study suggests that mental health plays a key role in students' behavioural decision-making about engagement in protective behaviours, not least as a negative impact of self-isolating (e.g., avoidance of self-isolation to avoid emotional impact). For example, we found that students worried about how they would cope if they had to self-isolate, and experience high anxiety, low mood, and loneliness when self-isolating, coupled with a fear of re-experiencing these negative emotions if they were asked to self-isolate again. They also exhibited a strong sense of guilt if household members had to self-isolate because of them and fear the interpersonal conflict this situation might bring. Participants in our study believed that this might be a factor for young adults in decision-making related to COVID-19 testing, particularly for those who are asymptomatic. Students' emotions seem to override their willingness to engage in COVID-19 testing when they are asymptomatic, due to the risk of self-isolation for themselves and others, despite viewing onsite testing as convenient, and seeing testing as an important national and local strategy for controlling the virus. The same pattern occurs with other protective behaviours, since people socialize to avoid feeling lonely, and loneliness is a barrier to social distancing adherence in adult populations [54]. Further, young adults are more likely to report loneliness during COVID-19 restrictive measures than other age groups [55].

Overall, our findings are consistent with others suggesting that mental health is a key driver in both testing behaviour [4], and adherence to COVID-19 protective behaviours [34]. Further exploration of students' mental health impacts and support needs is warranted.

4.5. Diversity and Inclusion

Our participants proposed that the mental health impacts of social distancing and self-isolation differed between student groups. These were most notable for newly arriving students who registered at the University in October 2020, during the second surge of COVID-19 in the UK and were living in University accommodation. This was likely to be associated with a lack of social networks; these (primarily) young people had not yet established local support networks, yet social support predicts mental health and quality of life in university students [56].

The disproportionate impact of COVID-19 on young people [10,24], not only highlights a need for targeted communications to younger populations more broadly, but demonstrates the significance of structural barriers in adherence to public health messages, and the potential value of segmenting audiences for messaging to avoid making generalizations about behaviours and circumstances of particular groups [34] (such as university students). For communications in a higher education context, 'one-size-does-not-fit-all' and as we observed, some groups of students might feel forgotten. For example, working students (e.g., often international students, self-funded students, students with caregiving responsibilities) might have experienced a loss of income as a result of the COVID-19 related lockdown restrictions, leading to further worry, spiraling debt, uncertainty about the future, and risk of 'falling through the cracks in the system', all impacting on mental health [57]. The UK government 'COVID-19 Mental Health and Wellbeing Surveillance Report' shows that marginalised or disadvantaged groups might be disproportionally affected by the wider implications of the pandemic [58]. COVID-19 had an impact on equity and inclusion in educational settings, with young people from diverse backgrounds being at greater risk of increased vulnerability and less likely to receive the support and extra services they need [59]. Further research might be needed to explore the experiences and support needs of particular groups known to be at risk for mental health concerns, such as students with financial hardship, LGBTQI+ students, and students with special educational needs.

4.6. Study Strengths

Whilst vaccination levels at the time of the study were still insufficient to control population-level transmission, mass asymptomatic testing remained a prominent candidate for controlling transmission in educational settings, against the background of significant community prevalence of SARS-CoV-2 infection. Given the discovery of new variants that might be more transmissible [60], and therefore require more efficient control measures (including B.1.1.7), understanding experiences of testing and protective social behaviours in young people in schools, colleges, and universities is particularly relevant. This study sits in the context of a national debate around the implementation of mass asymptomatic testing programmes in schools and universities, which is divisive [18,19,61–65]. England's Department for Education advocates weekly testing in educational settings from January 2021 [66], and despite the potential for transmission from students to other members of the community, there is little evidence of how students interpret and respond to these approaches, and the impacts of mass testing on social behaviour and wellbeing. This study therefore contributes [67] to the wider debate around mass testing and informs mitigation and containment strategies for COVID-19 in educational settings.

Remotely conducted focus group interviews were a suitable approach for exploring commonality and differences in attitudes and experiences of university students, in the context of rapidly changing national policy. Due to the crisis situation, this rapid approach allowed for early sharing of qualitative findings, which was identified as important during complex health emergencies (e.g., Ebola [68]). Early study findings were provided to the

Department for Education in England and used in real-time to support institutional efforts to engage students, public health, and behavioural experts in COVID-19 messaging content and approaches to communication with students and staff. Finally, the sample included students who lived in university residences, and those who had tested for SARS-CoV-2, either at the university or via local government public health services.

4.7. Study Limitations and Considerations

Due to the timescale, we were unable to triangulate findings with all participants, although we confirmed themes with two participants. Students who had taken a test as part of the participating university deployment of asymptomatic testing in university residences were under-represented. Further research is needed to fully ascertain the views and experiences of marginalised groups to ensure supportive services are equitable. While students in our study were willing to express concerns in this focus group setting and talk about other students' behaviour or compliance to COVID-19 restrictions, there might be some reservations about openly discussing any personal breaches of COVID-19 guidelines, especially given that the focus group moderators were University employees. These data relate to the views of students in a higher education setting, which might vary from that of the general public in terms of personal and attitudinal variables [69]. The frequencies presented in Table 2 do not reflect the contextual or behavioural factors that were considered during analysis, such as nonverbal cues (i.e., nodding) or participant agreement with the statements provided by others. Therefore, the number of students agreeing with the statement contributing towards each theme is likely to be underestimated. Finally, it should be noted that data were collected when the participating institution had one of the highest rates of COVID-19 in the country, although by December 2020, this had dropped below the national average for cases per 100,000 population.

4.8. Summary and Future Recommendations

The key findings and recommendations for practice and policy that emerged from our data are presented in Table 3.

Table 3. Key points and policy recommendations.

Practical impacts during Autumn return to campus
• Last minute changes to accommodation, travel plans and academic timetabling. • Challenges of accessing basic supplies and help with everyday living. • Shift to online learning modality. • Pandemic impacts on academic studies (e.g., halted laboratory work and research). • Greater impacts for those without social supports and social networks.
Emotional impacts during Autumn return to campus
• Fear, worry, anxiety, guilt, low mood are widespread. • Some reports of food insecurity. • However, students do not feel unsafe being at university during the pandemic.
Risk perceptions
• Those with prior experience of COVID-19 (virus/self-isolation) feel more at risk. • Vulnerable groups (pre-existing conditions) feel more at risk. • Most students worry more about risks to others than themselves.
Engagement in protective behaviours (social distancing, self-isolation)
• Timeliness of communications will influence behaviour. • Presentation of communications is important—'one-size-does-not-fit-all'. • Environmental and structural factors play a role in social distancing on campus. • Desire for social contact is strong and can override perceived risk and regulations. • Primary reason for seeking social contact/breaking self-isolation is to avoid or mitigate the emotional impacts of social isolation.

Table 3. *Cont.*

Mass asymptomatic testing on campus
• Students are receptive to mass asymptomatic testing. • Testing is seen as a mechanism for getting control over the virus. • Availability of testing on campus enhances students' perceptions of safety. • Reports of convenience, accessibility and positive experience around testing. • Most students would adhere to social behaviour guidelines whether the test result is +ve or –ve. • Risk of 'perceived immunity' and breaking self-isolation rules but only in a minority. • Barriers to testing are primarily emotional factors associated with self-isolation (e.g., guilt about the impact of self-isolation on others, and fear of the mental health impact of self-isolation).
Broader and longer-term impacts of COVID-19
• This pandemic will have long-term impacts on student experience and satisfaction. • Coping with social isolation is harder for students without established social networks. • Social contact is intrinsically tied to students' emotional wellbeing. • Some students fear for the future, and many have sustained mental health concerns that will need to be addressed.
Recommendations
• Practical and emotional impacts of a pandemic are significant and need to be accounted for when assessing student engagement in studies and academic progress. • Action plans are needed to ensure equitable mobilisation of basic supplies for students living on and off campus, in the face of another pandemic. • Clear statements are required on expectations of student behaviour. • Guidance on pandemic-related social behaviour and testing needs to be regular, rapid and inclusive—'one size does not fit all' for messaging. • Providers should consider incentives for compliance, and disincentives for non-compliance such as the use of disciplinary measures in serious cases. • Implementation of mass testing programmes requires significant support in place for students who might be required to self-isolate to minimise the risk of virus transmission. • Practical, social and emotional support needs of self-isolating students should therefore be identified and should take into account the needs of marginalised groups. • Supportive services should seek to enhance social connectedness, inclusion and positive mental wellbeing. • Universities need to prepare for the longer-term impact of pandemic-related mental ill-health on support and welfare services.

5. Conclusions

Mental health of students is significantly impacted by the COVID-19 pandemic, and social isolation is a key factor in this. Fear of self-isolation is likely to influence uptake of asymptomatic testing and adherence to social restrictions, due to anxiety, guilt and low mood experienced during self-isolation. The adequacy of practical, social and emotional support for students will be paramount to encourage adherence to self-isolation, and ultimately reduce virus transmission in pandemics. Loneliness in students could be mitigated through increased intra-university communications and a focus on establishment of low transmission-risk social activities to help students build and enhance their social support networks. University communications around outbreaks and mental health support need to be timely and inclusive to reach groups of students that currently feel marginalised and are at risk of 'falling through the cracks' in the system. The practical and emotional support needs of students who have to self-isolate during a pandemic need to be determined, and this has relevance for other educational settings globally, particularly those in which mass testing might be implemented. Worldwide, universities need to prepare for the long-term impacts of the pandemic on student mental health and support services.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/ijerph18084182/s1. File S1: Tier 2 High Risk Alert National Restrictions; File S2: Consolidated

criteria for reporting qualitative studies (COREQ): 32-item checklist, File S3: Individual characteristics of participants; File S4: Focus Group Question Guide; and File S5: Thematic map illustrating the relationships between the key themes and subthemes.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to risk of participant identification.

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Article

"We're Not Going to Be as Prepared": A Qualitative Study of Healthcare Trainees' Experiences after One Year of the COVID-19 Pandemic

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Abstract: The COVID-19 pandemic had significant impacts on the mental health and academic experiences of healthcare trainees. Building on findings from earlier in the pandemic, we explore the impacts on healthcare trainees after a sustained pandemic period of 12–14 months, involving multiple lockdowns, changes in government COVID-19 regulations and the delivery of health education. A qualitative study was conducted between March–May 2021. Participants were 12 healthcare trainees (10 women, 2 men) of medicine, nursing, and midwifery, registered at one of three higher education institutions in the United Kingdom. Interviews were fully transcribed, and data were thematically analysed using a combination of deductive and inductive approaches. We identified three key themes with eight subthemes: (i) academic experiences (adjustment to online learning, loss of clinical experience, confidence in the university), (ii) impacts on wellbeing (psychosocial impacts, physical impacts, pandemic duration and multiple lockdowns), and (iii) support frameworks (university preparedness for increased student support needs, importance of relationship with academic tutors). Findings shed light on the long-lasting and emerging impacts of the pandemic over time. We identify support needs for trainees both during their academic studies, and as they move forwards into professional roles within the healthcare workforce. Recommendations are made for higher education institutions and healthcare employers.

Keywords: COVID-19; higher education; healthcare; students; mental health; qualitative

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1. Introduction

The coronavirus (COVID-19) pandemic has negatively impacted the mental wellbeing of the general population worldwide [1–4]. Globally, there has been high rates of anxiety, depression, post-traumatic stress disorder, psychological distress and stress [1,2]. In 2020, anxiety and depression were found to be highest in people living with pre-existing conditions and those infected with COVID-19 [3]. Common risk factors associated with mental distress during the COVID-19 pandemic in the general population include female gender, younger age group (≤40 years), presence of chronic/psychiatric illnesses, unemployment, student status, and frequent exposure to social media/news concerning COVID-19 [2]. Healthcare workers (HCWs) are at the forefront of the pandemic response and have experienced significant psychological impacts of COVID-19 [5–8]. The ICON study explored the impacts of COVID-19 on the UK nursing and midwifery workforce across three time points in 2020 and found that nurses and midwives experienced a high prevalence of negative psychological effects, including severe stress, severe anxiety, and signs of post-traumatic stress disorder [5]. Similarly, a systematic review and meta-analysis focused on doctors, nurses and allied health professionals found that post-traumatic stress disorder was the most common mental health disorder associated with the COVID-19 pandemic among

health care workers, followed by anxiety, depression, and distress [7]. There has been a high prevalence of insomnia and burnout in HCWs during the pandemic [6]. Increased psychological distress in HCWs has been associated with personal factors, such as younger age and caring responsibilities, and workplace factors such as a lack of personal protective equipment (PPE) and lack of access to, or confidence in, essential training [5]. It has been suggested that the mental health impacts of the pandemic on HCWs may be higher in certain occupational groups (e.g., health technicians, medical students, and frontline health workers) [8] and, overall, may be underestimated [6].

As the future healthcare workforce, trainees are capable and willing to be involved in global health emergencies [9], although the mental health of healthcare trainees has also been impacted during the COVID-19 pandemic [10–16]. Systematic reviews and meta-analyses found that student nurses reported suffering from fear, stress, anxiety, depression, and sleep disturbance [10,12]. Similarly, rates of stress, anxiety and depression are high in medical trainees [13–16], and some studies identified evidence of suicidal ideation and burnout [17]. The mental health impacts of the pandemic have influenced healthcare trainees' intentions to leave their training [11]. This is not unexpected since systematic reviews show that students and younger age groups are particularly at risk for pandemic-related distress [2,17], and college/university students more broadly have experienced high rates of anxiety and depression during the pandemic [18–22], often associated with social restrictions and periods of self-isolation [23–25]. However, the prevalence of depression and anxiety during COVID-19 is relatively higher among healthcare trainees than both the general population and healthcare workers (e.g., [8,13]).

A study conducted in the first few months of the outbreak of COVID-19 in the UK, highlighted the impacts of the pandemic experienced by healthcare trainees studying medicine, nursing, midwifery and other healthcare disciplines [26]. Among myriad challenges were the disruption to academic studies, rapid transition to online learning, social isolation, mental health impacts and challenges to accessing mental health support. Importantly, trainees in this study raised concerns about the future in terms of the negative impact of the pandemic on their education, and whether resulting gaps in their knowledge would leave them unprepared for their future clinical practice. These were early experiences, 4–5 months after the pandemic outbreak in 2020, in the context of high fear associated with a new and rapidly escalating virus, and higher education institutions operating in 'crisis mode' [27], rapidly implementing virus containment and mitigation strategies, and overhauling systems and processes for the delivery of teaching and learning. Many of the reported reviews also draw on evidence from earlier in the pandemic. Therefore, in the current study, we build on early findings to explore the impact of the COVID-19 pandemic on healthcare trainees after a sustained pandemic period of 12–14 months. Findings will shed light on any long-lasting or emerging impacts of the pandemic and identify support needs for trainees going forwards.

2. Methods

2.1. Study Design

This was a qualitative interview study, conducted as part of the larger PoWerS research programme [26] which had explored the impacts of COVID-19 on healthcare students six months after a pandemic was declared in the UK. Here, we explore the impact of the COVID-19 pandemic on healthcare students in the UK after a sustained pandemic period, specifically 12–14 months on. This follows multiple lockdowns and changes in government regulations relating to COVID-19 and social restrictions, alongside an extended period for higher education institutions to adjust approaches to the delivery of healthcare education and student support for learning. The consolidated criteria for reporting qualitative research (COREQ-32) checklist [28] was used to ensure the quality of reporting this study (Supplementary File S1). Ethical approval for the study was obtained from the University of Nottingham Faculty of Medicine and Health Sciences Research Ethics Committee in March 2021 (FMHS REC ref 39-0620).

2.2. Participants and Setting

Participants were medicine, nursing and midwifery trainees registered at higher education institutions in the United Kingdom (UK). Trainees from other disciplines and those who were not registered for study during this period were excluded. Participants were recruited via social media and email promotion of a study advertisement via student society circulation lists.

2.3. Procedure

Qualitative data were collected over a 7-week period between March and May 2021. In response to the study promotion, potential participants were asked to contact the researcher by email to express interest in taking part. They were emailed a participant information sheet that explained the purpose of the study, the research processes and an invitation to take part in a single interview to share their views. All participants provided written informed consent before the interview took place. To optimise recruitment during a challenging pandemic period, trainees were given the option of entering a prize draw to win a 25GBP shopping voucher which has been shown to increase response rates in research [29]. No trainees refused to participate after expressing interest or dropped out after consenting to take part. Recruitment continued until the dataset was deemed to hold sufficient information power [30]. Semi-structured interviews were conducted online using Microsoft Teams and were audio-recorded with consent. Interviews were fully transcribed using an online transcription software and then checked by the researcher to ensure their accuracy. Due to time constraints, the transcripts were not returned to the participants for comment and/or correction. An interview topic guide (Supplementary File S2) was generated to provide a foundation for the interviews. The topic guide was informed by the PoWerS study [26] and was finalised through discussion between the research team and a healthcare trainee who was not a participant in the study to agree on the relevance of the questioning. Our approach and interpretation were informed by published recommendations for virtual qualitative health research conducted during a pandemic [31].

2.4. Data Analysis

The data analysis process used in the current study employed thematic analysis [32] using a combination of deductive and inductive approaches. Initially, a coding framework was developed based on key areas identified in a previous study [26]. The key areas of discussion were as follows: impacts on wellbeing, impacts on academic studies and learning, and support for healthcare students. Under each overarching category, codes were generated that were grounded in the interview data. One researcher (AB) coded the data, and a second researcher (NC) checked and verified the codes. We did not code data that did not fall under these categories and was not relevant to our research questions. The initial overarching framework was then refined based on the data and generated codes. In accordance with the process of thematic analysis, a process of abstraction then took place whereby codes were grouped together into subthemes and then into main, overarching themes.

3. Results

In total, 12 participants provided informed consent and were interviewed (10 women, 2 men) registered at one of three universities in the UK (site 1: $n = 9$; site 2: $n = 2$, site 3, $n = 1$). Interviews lasted between 20 and 37 min, with an average time of 33 min. Participant age ranged from 19–42 years. Nine had worked in the UK health or social care environments in areas considered high-risk for COVID-19 during the pandemic (e.g., as defined in [26]; this included dedicated COVID + ve ward, intensive care unit, emergency department or ambulance services, ward with COVID + ve patients, entrance meet and greet, staff or regular visitor to care or residential home, or other self–defined high–risk area). Participants were trainees of medicine ($n = 7$), nursing ($n = 2$) and midwifery ($n = 3$). Table 1 shows participant characteristics.

Table 1. Participant characteristics.

Participant	Age	Gender	Discipline	Year of Study	COVID-19 High-Risk
1	19	Woman	Medicine	1	No
2	22	Woman	Medicine	4	Yes
3	20	Woman	Medicine	3	Yes
4	20	Woman	Medicine	2	Yes
5	19	Man	Medicine	1	No
6	26	Woman	Medicine	3	Yes
7	42	Woman	Midwifery	3	No
8	21	Man	Medicine	3	Yes
9	21	Woman	Nursing	2	Yes
10	34	Woman	Midwifery	3	Yes
11	18	Woman	Midwifery	1	Yes
12	22	Woman	Nursing	3	Yes

Drawing on the results of the thematic analysis of the qualitative data, three main themes and eight sub-themes were generated (Figure 1).

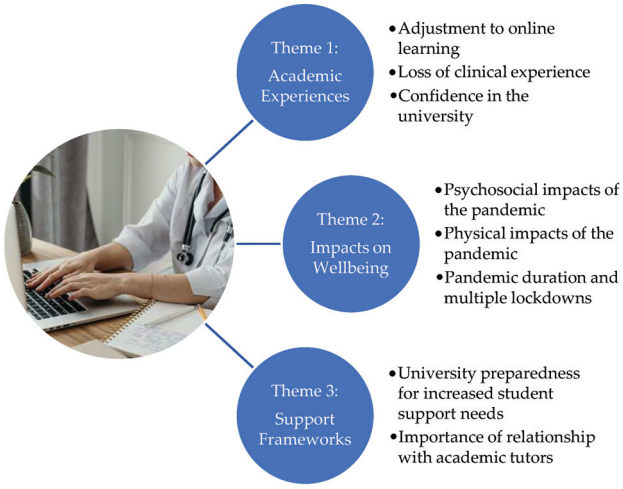

Figure 1. Summary of themes and sub-themes.

3.1. Theme 1: Academic Experiences

3.1.1. Adjustment to Online Learning

Trainees had diverse experiences and opinions relating to the sudden transition to online learning due to social restrictions during the early stages of the pandemic. The lack of social interaction with online learning was challenging for some who had: *"gone from everyday being in-person and being really interactive to just sitting in your room"* (P5). Some trainees raised concerns about the increased use of pre-recorded lecture materials, particularly in the early pandemic days, referring to: *"very poor-quality recordings of lectures from previous years, some of which were completely incomprehensible"* (P2). For others, pre-recorded sessions provided an opportunity for study without interruption and offered greater flexibility for trainees, which was valued. Live online lectures were viewed more positively than pre-recorded materials as they allowed trainees the opportunity for interaction and conversation, either verbally or via chat functions within the video-conferencing platform. Despite the challenges experienced by trainees over the course of a year, there was a clear recognition of the workload and challenges involved for educators in diverting traditional approaches to teaching and learning to online platforms at pace and scale. Trainees spoke

positively of the immense efforts and achievements of academic staff in continuing to deliver higher education through such unprecedented circumstances: " . . . *apart from the odd technical blip at the beginning, it's been pretty seamless. I mean, from, from people that have not done this before to pull off what they pulled off has been amazing. I can't fault them at all."* (P7).

3.1.2. Loss of Clinical Experience

Many trainees felt they had lost essential clinical experience during the pandemic: "*It felt like taking a step backwards. Having all the course moved online . . . that's what we were doing in pre-clinical years . . . suddenly, we're back in front of the computer and it was quite demoralising*" (P2). The impact on clinical experience varied according to the level of study and degree programme. Those in their earlier stages of study were less concerned about the impact of the pandemic on their clinical learning. Due to the strong emphasis on theory and less time in clinical practice in year one, students lost little or no practice experience and were confident they would have the necessary experience by the time they graduated. For those in the later stages of study, the pandemic had a greater impact on clinical learning as they were more likely to have missed clinical placement time due to lockdowns or social restrictions. A second-year medical student reported they "*haven't really had clinical placements this year*" (P4); a fourth-year medical trainee reported having "*missed a good six months of placement*" at the start of the pandemic (P2). This led to worry about the impact of missed or altered clinical exposure on academic learning and performance: " . . . *our clinical opportunities are greatly reduced because of the pandemic...we've definitely had a huge impact on our education*" (P2). Since the pandemic was long-lasting, this worry continued even after social restrictions were relaxed and placements had been reintroduced. Some trainees reported that clinical experiences during the pandemic were not of the same quality, whereas others felt well supported on placements (by clinical mentors and placement coordinators) and valued the learning experiences these opportunities provided. Views towards clinical learning on placements varied according to where trainees were placed (e.g., depending on the hospital or department, or level of mentor support). Some trainees had signed up to aid healthcare organisations in various roles (e.g., healthcare assistant, logistics) in which they gained further exposure to clinical environments and felt a sense of contribution to the pandemic response.

Trainees expressed concerns about preparedness for future clinical job roles, with some speaking of "*imposter syndrome*" (P2) as they felt they may not graduate at the same professional standard as others and would be unworthy of their professional title: *"something we've had to come to terms with that we're not going to be as prepared"* (P6). Trainees highlighted a need for clinical mentors to recognise the impact of the pandemic on clinical learning when students transition to professional posts (e.g., lost opportunities to practice clinical skills in clinical environments; associated loss of confidence), and a desire for future supervisors to recognise that they may need more support than their predecessors: *"hope that our seniors are understanding and . . . are able to guide us when we get to that stage"* (P6). Although there were concerns about preparedness for future practice, and an impact on confidence levels, trainees did not equate this with an impact on their future employability. Irrespective of their perceived amount of (and confidence in) clinical experience, it was perceived that: *"doctors are going to be needed anyway"* (P4).

3.1.3. Confidence in the University

Participants had mixed views relating to their confidence in the university's approach during the pandemic to the conduct of assessments and preparing trainees for clinical practice. Due to COVID-19 restrictions, several participants had some, or all, of their practical assessments changed to online format. Some alluded to inequity in the experience of online assessments; one trainee referred to the challenges of finding an appropriate environment in which to undertake online examinations: *"[I] didn't have a quiet place in my house to do the exam . . . family was going in and out of the house and being somewhat noisy"* (P3). Some participants raised concerns about the lack of standardisation in the university's

approach to conducting and monitoring take-home examinations and the potential for cheating, particularly among medical students: *"I heard a lot of rumours that people were doing the exams together . . . and some of my friends had suspiciously high marks compared to what they usually get relative to me. So, I think that was very upsetting."* (P3); *"there wasn't any sort of system put in place to stop people cheating"* (P6). Other trainees offered a more positive perspective on their university's approach, both to the assessment of learning and preparation for future clinical practice. They believed that the challenges of the pandemic would be taken into consideration in grading. In relation to clinical examinations, one medical trainee reported: "*I haven't had much clinical experience, but then again, I think the uni did tell the examiners to take it into account. And I do think everyone's in the same boat so, you know, the marks will naturally shift."* (P8). Some trainees suggested that the university was likely to generate opportunities to recoup any lost clinical learning time.

3.2. Impacts on Wellbeing

3.2.1. Psychosocial Impacts of the Pandemic

Most of the trainees commented on the negative impacts of the pandemic on their mental wellbeing. After more than a year of lockdowns, social restrictions (e.g., social distancing, self-isolation), and studying from home, several students felt this had impacted on their ability to live and study as they had done previously. Some trainees spoke of having to take time away from studies or placements due to the impacts of COVID-19 on their mental wellbeing: *" . . . some time off placement to make up at the end of the course"* (P10).

Several of the trainees experienced anxiety that was directly associated with the pandemic; for some, this was related to concerns about catching and transmitting the virus (e.g., to peers, colleagues, or vulnerable patients). This was discussed either in relation to their potential for contact with COVID-19 patients on placements or in the context of social mixing. In terms of socialising, for some, the virus transmission risk outweighed the desire to socialise. For others, their anxiety centred around a perceived loss of social skills and the return to interacting with others after long periods of isolation. One midwifery trainee referred to feeling *"slightly agoraphobic . . . it's just got worse the longer it's gone on"* (P7). For this trainee, the negative impact of the pandemic on their mental wellbeing was profound and led to them considering terminating their studies: "*(the pandemic) has made me feel incredibly low . . . at times not knowing if I can carry on my course"* (P7). Not all students were impacted to the same extent. Those who considered themselves to be less outgoing and sociable by nature, reported being less impacted by remote working and social restrictions during the pandemic than those who would usually socially interact to a greater extent: *"I'm quite introverted anyway, so it (isolation) has not had a massive psychological impact on me"* (P1). Other trainees proposed that their mental health during the pandemic could be improved through increased opportunities to socialise, even if this needed to be online (e.g., "pen pals" or evening social events).

Some trainees experienced a drop in their motivation for study during the pandemic, which worsened as the pandemic went on, with trainees: "*starting to struggle to maintain any kind of momentum, finding the will to do it"* (P7). Low motivation was associated with poor mental wellbeing, a loss of social interaction with peers and removal of in-person contact with academics during lockdowns: "*no-one's really keeping you accountable"* (P3).

3.2.2. Physical Impacts of the Pandemic

Although participants spoke more frequently about the psychosocial impacts of the pandemic, several of the trainees discussed the impacts of COVID-19 on their physical health. Impacts could be positive or negative depending on the individual, their circumstances and prior lifestyle behaviours. With the increased time spent at home to study, some trainees were consuming more unhealthy foods, whereas others reported they had less access to 'junk food' and their diet had improved: " . . . *when you're going about doing everything, you just have a pack of crisps here, a cake there, whatever. But when you're just sat about the house, you can feel it clogging up your arteries"* (P9). Similarly, some had exercised

more, and others less, compared with pre-pandemic behaviours. The closure of gyms and running tracks had impacted those who had previously been very physically active. Two participants reported experiencing sleep issues during periods of pandemic-related lockdown or social restrictions, and this was associated with working either in environments that were not fit for study or balancing work and home life: *"very hard . . . sleeping and doing everything in the same environment"* (P4).

3.2.3. Pandemic Duration and Multiple Lockdowns

At the point of interviews, the COVID-19 pandemic had continued for over a year, with key lockdowns and social restrictions introduced between March 2020 and May 2021. Several participants commented on how the impact of these restrictions varied across time. This was attributed to the progression of the pandemic, the weather, the timing (whether lockdowns occurred within or outside of academic term-time) and the presence (or lack) of social support through the year from peers, friends, and family. The wellbeing impact of the first lockdown had been less significant for some, as it occurred during a period of warm weather (spring/summer), and trainees had returned to family homes and were therefore accessing social support: *" . . . because I've got a lot of siblings the house it was still quite busy and it kind of felt like normal life to be honest"* (P3); *" . . . just being home for the lockdown was just nice because they're my support system and they're always there when I need them."* (P4). Some trainees raised that returning to family homes during lockdowns was a protective factor, providing a sense of safety and security in a rapidly changing global context. However, for those with young families, balancing childcare alongside studies was a particular challenge, especially during lockdowns and periods of self-isolation. With exceptions, as time went on, the pandemic took a heavy toll and wellbeing declined over time for most: *"the duration of the lockdowns has definitely affected my mental wellbeing."* (P12); *" . . . the thought of working from home and actually the pace being slower was actually quite nice because the course moves at a hundred miles an hour . . . but it quickly became apparent actually that it wasn't a gift"* (P7).

3.3. Support Frameworks

3.3.1. University Preparedness for Increased Student Support Needs

There was a consensus that structured mental health support services offered by universities during the pandemic were poorly communicated (i.e., in terms of what was available and how it could be accessed) and inadequate. Perceived problems with structured services seemed to be associated with access rather than the quality of provision. A minority of those raising psychological impacts of the pandemic did not know where or how to access help and support. A few trainees experiencing difficulties had reached out to counselling services. While those who had accessed counselling generally reported a good experience, several indicated that support was often not timely due to long delays in accessing appointments. Some trainees referred to specific efforts being made to improve wellbeing within their academic faculties, for example, course leaders providing protected time-out from study, and advocating attendance at structured wellbeing sessions. However, it was viewed that there was a focus on quantity of wellbeing sessions, rather than quality. Some trainees felt that the impact of wellbeing provisions on trainees was not fully considered, as trainee workloads were not reduced to allow attendance at wellbeing sessions. Therefore, academic activity was compressed into a shorter timescale to compensate for this, resulting in an increased work intensity, and paradoxically, negatively impacting wellbeing. While experiences were broadly comparable across trainees from different institutions, disciplines and years of study, the lack of clarity around mental wellbeing support provisions seemed to be particularly notable for medical trainees: *"If I was going through something, I wouldn't know who to contact"* (P5).

3.3.2. Importance of Relationship with Academic Tutors

While structured support services and online mental health support were viewed more negatively, most trainees spoke about the value of regular contact with academics, particu-

larly personal tutors, in ensuring they had a positive learning experience and supporting their wellbeing throughout the pandemic. Student representatives augmented support from personal tutors, and trainees applauded their efforts to support the communication of information about course-related changes and welfare support at critical times during the pandemic. In contrast, some trainees had reached out to academics for support, but were dissatisfied with the response and felt that support needs were not being met: *" . . . when we've raised concerns as a cohort, about, you know, our deteriorating mental health as a group . . . A couple of the lecturers didn't seem to be quite so sensitive to that. It was very much "well we're all in the same boat, everybody's struggling", that was difficult to swallow."* (P7). Trainees' experiences varied depending on their relationship with their personal tutor and the level of support that individual was willing or able to provide. Trainees who reported a good relationship with their personal tutor highlighted the support they provided and the positive impact of this on their mental wellbeing, particularly during lockdowns. In general, trainees placed a high value on tutors who actively reached out to provide support, rather than waiting passively for trainees to contact them with issues: *"he just checks in, makes sure I'm okay . . . he'll ask if I have any concerns"* (P5); "*I've got an amazing personal tutor who's really supportive and really responsive"* (P3).

4. Discussion

This study explores the impact of the COVID-19 pandemic after a sustained pandemic period of 12–14 months. Three key themes were generated from the data: (i) academic experiences, (ii) impacts on wellbeing and (iii) support frameworks.

In terms of academic experience, as identified in prior research [26], the rapid transition to online learning had been a significant stressor for healthcare trainees, although this was primarily related to the loss of social interaction with peers and tutors and was more problematic earlier in the pandemic and during periods of lockdown. Healthcare students have needed to adapt to a rapid transition to the use of technology to deliver education remotely and enable the continuation of teaching through periods of lockdown and social restrictions [33]. According to trainees in our sample, there was a difference in the value attributed to online teaching according to the nature of its delivery; live online lectures were generally perceived more positively than pre-recorded materials (particularly low-quality recordings). Our trainees felt that live online delivery allows interactivity and active collaborative learning, which is known to enhance critical thinking [34] and active learning [35] in a higher education context. While virtual teaching is purported to be effective, work is needed to further enhance student engagement and interactivity [36] and as noted by Rudolph and colleagues, "technology should not be revered as a panacea" [37]. With online learning likely to constitute at least a proportion of higher education teaching in the future, it seems advisable to ensure adequate attention is paid to strategies that foster online social interactions between faculty staff, clinical mentors, and healthcare trainees.

There were some aspects of taught course delivery that were viewed to be better delivered in-person. Specifically, the experience of technology-delivered remote examinations was not positive, in our sample. Remote examinations exposed inequalities in student experience during this time, largely due to the differences in home environments as some trainees did not have access to suitable environments to sit examinations, which they felt affected their performance. Social and digital inequalities have been noted in other student samples. For example, Bashir and colleagues [38] found that 61% of biosciences students at a UK institution were able to study uninterruptedly during an online examination period, with students (particularly those from more deprived households) reporting inadequate home working space/environment and lacking necessary items such as a desk [38]. Moving forwards, higher education institutions should consider exploring whether all trainees have access to reliable and affordable physical devices (e.g., computers, laptops), Internet connectivity and quiet study spaces in which to take online assessments—and ensure available institutional facilities are well-promoted to all trainee cohorts. While some trainees adopted a "*we're all in the same boat"* attitude and believed the university would

take the uniqueness of the pandemic situation into consideration with regards grading, other trainees were concerned about quality standards during this time and the lack of fairness in remote assessment processes. These concerns impacted their confidence in the university to deliver and monitor online assessments fairly. This has been found in other higher education settings, and participants have raised concerns relating to security, validity and fairness in the implementation of online assessments [39]. To mitigate these challenges, Shraim [39] recommended that online assessments may be best utilised for formative rather than summative assessments. However, there may be times when online summative assessments are necessary for trainees' progression (e.g., for distance learning professional development courses or during future pandemics). Further work is therefore needed to ensure equity in implementation and quality standards, instill confidence in student cohorts relating to the fairness of the system.

Having had time to reflect on the year, trainees in our study highlighted the efforts made by academic staff to continue the delivery of teaching and learning during the COVID-19 pandemic. This is an important observation. COVID-19 has impacted higher education institutions around the world [40]. Adjusting to online learning has been as challenging for academic staff as for students [25,41]; academics have needed to overcome gaps in digital skills and reconfigure their pedagogical approaches to the online learning environment [41]. The challenges for academic staff have been immense, including unfamiliarity with the learning management systems, privacy concerns, issues with student engagement, increased preparation time and technological issues [42]. Over time, educators have made progress in transitioning from emergency measures to more pedagogically consistent approaches, albeit there remains a need for better integration of theoretical and practical learning [43]. Our study highlights that trainees are aware of the efforts made by academic staff to keep higher education functioning during this crisis. With a greater focus on students compared to academic staff in the published literature, we advocate that wellbeing and technological/pedagogical support would benefit staff engaged in the delivery of remote, online or hybrid education at all times (not least during a pandemic), coupled with monitoring of workload and stress levels as proposed elsewhere [25]. Supporting staff is an essential part of ensuring the provision of adequate and equitable support for healthcare trainees, and indeed, all students in higher education settings.

A key concern for healthcare trainees was the loss of clinical experience during the long-lasting pandemic, resulting in missed placements or lower-quality placement experiences. This was primarily an issue for those in later years of study, as found in previous research [26]. A lack of preparedness for future practice has been identified in other samples of nursing [44,45] and medical trainees [46]. Interestingly, trainees in our sample did not view this loss of clinical experience as a risk to their employability. However, trainees reported experiencing "imposter syndrome" due to a belief that their knowledge and skills would be lacking compared to predecessors. Imposter syndrome is not a new concept in healthcare and has previously been identified in both nursing [47] and medical [48] trainees. Since imposter syndrome is evident at every stage of the career [49] and is linked to burnout, anxiety, and depression [50], higher education organisations may consider addressing imposter syndrome as part of the preparation for the transition to professional practice, through workshops and training (e.g., [49]). Further, healthcare organisations and line managers should be mindful of the COVID-19 impacts on new recruits' confidence to practice and ensure additional mentoring and training is in place to build confidence and address any perceived gaps in knowledge or skills in the initial employment period.

The impact of the pandemic and the shift to remote learning impacted on engagement in physical health behaviours for some of the trainees, including dietary and/or exercise habits and sleep patterns. With some exceptions, our trainees reported primarily negative impacts, which aligns with other studies showing that the COVID-19 pandemic impacted negatively on university students' dietary intake, physical activity, sedentary behaviour, and sleep [51,52]. Advocating health behaviours is important for health status across the life course, since diet, physical activity and sleep are independently associated with health-risk

indicators and all-cause mortality [53,54] and negative lifestyle behaviours are associated with lower psychological wellbeing [55,56]. With direct relevance to healthcare trainees, the prior finding that poor lifestyle choices in healthcare professionals or trainees can influence the likelihood of them role modelling health behaviours to others (e.g., colleagues, students), their views and actions towards promoting health to patients, and the willingness of patients to heed their advice [57–60]. Promoting the value of healthy lifestyles to health trainees (and health professionals) themselves during and beyond the pandemic, remains an important priority for health educators and healthcare employers alike. This will support future engagement with health promotion in patient care, and importantly, establish a healthy future workforce for health and care organisations.

Most notable were the psychological impacts of the pandemic on healthcare trainees, with participants in our study experiencing anxiety, low motivation for study, and low mood. Additionally, our trainees felt a sense of social responsibility as the future healthcare workforce; they feared contracting and transmitting the virus to vulnerable others. Fear of contracting the virus is high among college/university students more generally, irrespective of their subject discipline [61,62]. Our findings align with other studies that identified mental health impacts of the COVID-19 pandemic in the general population [1–4], healthcare professional [5–8] and healthcare trainee samples [10–16]. For some, the negative impacts of the pandemic on mental wellbeing were mitigated by environmental factors (e.g., good weather lifting mood), social support (e.g., from family members at home), or personality traits (e.g., those who reported introversion traits perceived reduced social contact to be less problematic). Conversely, other participants experienced significant wellbeing impacts that involved time out from studies and were sustained or increased over the duration of the year.

Our study shows that mental health impacts are still evident 12–14 months after COVID-19 was declared a pandemic. Using a conceptual model (Supplementary File S3), a prior study presented relevant actions for mitigating the impacts of the pandemic on health and care workers; this showed to have relevance for healthcare trainees from diverse health and medical disciplines [26]. The main areas for action described within this model include proactive organisation approaches; psychologically supportive teams; communication strategies; managing emotions; social support and self-care. However, our study findings suggest that increased investment in mental health support may be required in the long term and not just as a short-term pandemic response. Mental health impacts of the pandemic were exacerbated by ongoing challenges in accessing supportive services. One year into the pandemic, some healthcare trainees still did not know where to access information about help and support for mental wellbeing, and others were struggling to access counselling services due to long waiting lists. Poor communication from their institutions relating to mental health support and inadequate capacity of student support services were issues identified by healthcare trainees in the first few months of the pandemic (e.g., [26]), but our study suggests this situation has not greatly improved. Given the continuation of the pandemic well beyond the current study data collection period, and the ongoing mental health impacts of COVID-19 for healthcare trainees, higher education organisations need to urgently invest additional resources into structured mental health support services. More attention is needed to raising awareness of mental health, and signposting to support, particularly in disciplines where mental ill-health can be considered taboo [63], and in student communities in which access to structured services for mental health is known to be low [23].

Outside of structured services, academics play a key role in student support. We observed that proactive approaches to trainee support were valued, particularly check-ins from academic tutors. We advocate that academic tutors are mindful of the sustained impacts of the pandemic on trainee cohorts and trainees' concerns for their future as clinical practitioners. Tutors should be aware of the importance of their role in providing support and signposting to trainees, who may have increased support needs due to the long-lasting pandemic and its aftermath. This may require additional training and support for academics

related to the role of the personal tutor. This would increase the parity of support that is provided across cohorts and subject disciplines and ensure that signposting to supportive services is both appropriate and timely. It has been argued that a combination of academic and mental health support is needed for healthcare trainees during a pandemic [64] and, of course, beyond. Recommendations for the study are summarised in Box 1.

Box 1. Ten recommendations for higher education institutions and healthcare employers.

1. Work is needed to further enhance student engagement and interactivity in online learning.
2. Adequate attention should be paid to strategies that foster online social interac-tions between faculty staff, clinical mentors, and healthcare trainees.
3. Higher education institutions should consider the impact of inequalities when remote assessments are conducted, e.g., ensuring access to quiet study spaces, reliable and affordable devices, and Internet connectivity.
4. Technological/pedagogical support may benefit staff engaged in the delivery of remote, online or hybrid education, coupled with workload and stress monitoring, and wellbeing support.
5. Promoting the value of healthy lifestyles to health trainees (and health profes-sionals) during and beyond the pandemic remains an important priority.
6. Higher education organisations need to urgently invest additional resources into structured mental health support services to widen access and reduce waiting times.
7. More attention is needed to raising awareness of mental health, and signposting to support, particularly in disciplines where mental ill-health can be considered taboo and in student communities in which access to structured services for mental health is known to be low.
8. Proactive support from academic tutors, such as regular check-ins, will be bene-ficial given the sustained impacts of the pandemic on trainee cohorts. This may require additional training and support for academics related to the role of the personal tutor.
9. Higher education organisations may consider addressing imposter syndrome as part of the preparation for the transition to professional practice through workshops and training.
10. Healthcare organisations and line managers should be mindful of the COVID-19 impacts on new recruits' confidence to practice, and ensure additional mentoring and training is in place to build confidence and address any perceived gaps in knowledge or skills in the initial employment period.

Study Strengths and Limitations

Our findings are based on the views of a small sample of healthcare trainees from three healthcare disciplines. Although we gained insights across subject disciplines, our data did not allow us to explore similarities or differences between participants registered at different academic institutions. There were more female than male participants in our study (no trainees identified as non-binary), and so the views of male and non-binary trainees warrant further exploration. However, the gender imbalance in our sample broadly reflects trends in student cohorts and professional registrants from the disciplines included. For example, there is a higher proportion of female than male entrants, both to higher education in the UK [65] and to medical schools [66]. Further, the UK Nursing and Midwifery Council data shows that 89.3% of all nursing and midwifery registrants are female [67]. Our findings align with gender-based research, as participants in our sample reported beliefs aligned with "imposter syndrome", which is more common in female than male healthcare trainees [68].

There may be a risk of selection bias in the study since trainees who were impacted more, or less, may have been more, or less, likely to take part in the research. For example, trainees who had experienced greater impacts from the pandemic may have been more likely to agree to take part in the study. Conversely, however, trainees struggling with mental health concerns may have felt less able to engage in research. Recruitment was challenging during the COVID-19 pandemic. This was not surprising given that our study highlights the impact of the pandemic on healthcare trainee mental wellbeing, which may have impacted on research engagement. In addition, the challenge of virtual recruitment into research studies during the COVID-19 pandemic has been recognised [69]. In our study, recruitment may have been facilitated by traditional, in-person recruitment efforts.

However, the pandemic shifted research recruitment approaches to fully remote online platforms. Here, we focused primarily on the use of social media, although this has been identified as a valuable strategy for online recruitment to qualitative research studies [70]. We added a prize-draw incentive to encourage participation, which has been identified as a useful mechanism to increase uptake in research studies [70] and in this instance, helped us to achieve sufficient information power [30].

Future research may benefit from exploring the impacts of the pandemic on other healthcare disciplines. Further, there is a paucity of longitudinal research in this area and future studies might seek to explore whether there are changes in support needs over time, and the experiences of healthcare trainees who studied during the pandemic, as they transition into employment within healthcare organisations.

5. Conclusions

Building on findings from earlier in the pandemic, we conducted qualitative interviews to explore the impacts on healthcare trainees after a sustained pandemic period, involving multiple lockdowns, changes in government COVID-19 regulations and the delivery of health education. The COVID-19 pandemic had significant impacts on the wellbeing and academic experiences of healthcare trainees. The long-lasting duration of the pandemic has taken its toll; trainees' mental wellbeing declined over time, and trainees fear the impacts of a loss of clinical learning on their future job roles in the healthcare workforce. Healthcare employers should be mindful of trainees' perceived gaps in knowledge and skills and risk for "imposter syndrome". Organisations should consider providing additional mentoring and support for new recruits to the healthcare workforce. This may help to increase their opportunities to discuss or practice clinical skills and build their confidence with relation to their clinical competencies. Despite challenges with new approaches to teaching delivery, trainees value the efforts made by academic and support staff in ensuring the continuation of theory, practice learning and assessments through a challenging time. Support from academic tutors is highly valued, but the quality of support varies. Over a year into the pandemic, there were evident deficiencies in structured support systems for student mental wellbeing, particularly around awareness of and access to services. Higher education institutions should consider further resource investment in structured support services to expand service capacity.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph20054255/s1. File S1: COREQ_Consolidated criteria for reporting qualitative studies; File S2: Interview Topic Guide; File S3: Conceptual Model.

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Article

Exploring the Psychological Impacts of COVID-19 Social Restrictions on International University Students: A Qualitative Study

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Abstract: The global COVID-19 pandemic has impacted on the mental well-being of university students, but little attention has been given to international students, who may have a unique experience and perspective. The aim of this study was to explore the views of international students and university staff towards COVID-19 restrictions, self-isolation, their well-being, and support needs, through eight online focus groups with international students (n = 29) and semi-structured interviews with university staff (n = 17) at a higher education institution in England. Data were analysed using an inductive thematic approach, revealing three key themes and six subthemes: (1) practical, academic, and psychological challenges faced during self-isolation and the COVID-19 pandemic; (2) coping strategies to self-isolation and life during the pandemic; and (3) views on further support needed for international students. International students faced practical, academic, and psychological challenges during the COVID-19 pandemic, particularly relating to the rapid transition to online learning and the impact of social restrictions on integration with peers and well-being. Online social connections with peers, family, or new acquaintances reduced feelings of isolation and encouraged involvement in university life. Despite raising mental health concerns, most international students did not access mental health support services. Staff related this to perceived stigma around mental health in certain cultural groups. In conclusion, international students experienced specific practical and emotional challenges during the pandemic, and are at risk of mental ill-health, but may not actively seek out support from university services. Proactive and personalised approaches to student support will be important for positive student experiences and the retention of students who are studying abroad in the UK higher education system.

Keywords: COVID-19; higher education; university; mental health; well-being; social isolation; students

1. Introduction

Since the outbreak of Coronavirus disease (COVID-19) in December 2019 in China, Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) has spread rapidly to almost all parts of the world, infecting over 219 million people and claiming nearly five million lives up until October 2021 [1]. In the United Kingdom (UK), in March 2020, the World Health Organization (WHO) declared the situation a global pandemic [2]. In response to the rising number of cases and deaths attributed to COVID-19, the UK government implemented necessary restrictive measures to contain the spread of the virus, including stay-at-home orders, self-isolation measures, social distancing, and various levels of lockdowns and border closures [3]. Following national guidelines, universities around the world locked down their campuses to reduce the spread of the virus, and shifted their operations to online learning [4].

Though the risk of serious health implications following infection is lower in younger populations [5], the mental health impacts of living through a pandemic are now established, both in the general population [6,7] and in younger populations [8,9], especially in university and college students [10,11]. Student populations have faced considerable disruption to their academic and social lives, including the rapid transition to remote working, new online assessment methods, changes to workloads and performance expectations, closed university facilities and residences, reduced social interaction, financial concerns related to lost part-time jobs, and worries about future education and careers [12].

Studies are rapidly emerging which explore the psychological impacts of the COVID-19 pandemic on university students [4,10,11,13]. Students have faced considerable emotional challenges following COVID-19 restrictions, such as feelings of loneliness, stress, low mood, anxiety, and depression [14,15]. Various COVID-19 social restrictions (e.g., periods of national lockdown or self-isolation, defined as a period of remaining apart from others to prevent the transmission or acquisition of an infectious disease, or social distancing of >2m apart) have led to lifestyle behaviour changes, with increases in sedentary behaviour and reduced sleep or sleep quality, which are known risk factors for decreased well-being [8–10]. Despite a plethora of studies exploring the impacts of the pandemic on higher education students, there has been little attention to the specific experiences of international students, which may differ to those of their non-international peers. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) definition, international (or internationally mobile) students are those who have crossed a national or territorial border for the purpose of education and are now enrolled outside their country of origin [16].

International students already face significant challenges when studying abroad, related to adapting to new cultures, dealing with language barriers, homesickness, and financial issues [17]. The COVID-19 social restrictions may have exacerbated these existing challenges for international students, potentially leaving them more vulnerable to inequalities or mental health concerns. Since the pandemic began, prospective international students have been more likely to make major changes to their education plans, such as postponing university enrolment, and enrolling in a home country institution, rather than travelling abroad for study [18]. Despite this, many international students were already enrolled in, or arrived at, university in the UK during the midst of the pandemic. International students constitute a high proportion of the domestic higher education market. In 2019/20, there were 538,615 international students studying in the UK (142,985 from the European Union (EU) and 395,630 non-EU) [19]. Yet, this figure is declining, with an estimated 47% decrease in international student enrolments in the next academic year, costing the sector £2.5 billion [20].

The retention of existing international students, and attraction of new students will be paramount for the future sustainability of global academic institutions. Further, research has identified a need to explore the concerns and experiences of international students during the COVID-19 outbreak [3,21,22]. According to the Student Covid Insights Survey (SCIS) conducted by the Office for National Statistics (ONS) in 2020, the COVID-19

pandemic has affected the mental health and well-being of over 50% of students in higher education in England [23]. The SCIS survey also shows that students showed lower levels of life satisfaction and happiness, and higher levels of anxiety during the pandemic than the general population. Similarly, a study that looked at the mental health impacts on international university students in both the UK and the United States of America (USA) found that almost 85% of all international students had moderate-to-high perceived stress from COVID-19-related stressors, such as lack of social support [24]. Furthermore, approximately 18% had moderate-to-severe symptoms of insomnia, and 12% had moderate-to-severe anxiety and depression symptoms [24]. These issues are exacerbated by multiple periods of self-isolation that many international students have experienced, which has ultimately been very challenging for their mental well-being [10]. Although knowledge in this field is emerging, there is limited published literature on the experiences of international students who are registered for study in the UK, with relation to social restrictions and well-being.

The University Mental Health Charter [25], created in 2019, provides guidance on making mental health a priority in universities. It advocates that universities should offer proactive interventions to improve the mental health of university students. The Charter suggests that targeted interventions are required for specific student groups, such as international students, as they may have particular needs, or may not access supportive services, such as counselling [26]. Consideration must also be given to the impact of wider academic determinants on students' mental health and well-being, such as the availability of practical and logistical supports. However, there are currently no evidence-based guidelines on how to best support international student well-being, particularly in the context of the COVID-19 pandemic.

The aim of this study was to explore international students' perceptions and experiences of the COVID-19 pandemic, social restrictions, and periods of self-isolation while registered for study at a UK university, and explore any potential impacts on their well-being and support needs. The findings of the study will inform policymakers and university authorities on how to best support international students during a pandemic.

2. Methods

2.1. Study Design, Participants, and Sampling

A qualitative study with focus groups and interviews was conducted with international students and employees at a university in central England. Participants included international students who were registered for study at the participating institution during the COVID-19 pandemic, and university employees (referred to herein as "staff") who were in contact with international students during this time. Staff members who had a student-facing role, with particular emphasis on supporting international students, were invited to take part to gain a holistic view of the challenges faced by students during the pandemic. Focus groups with international student participants were conducted to facilitate discussions of differing experiences and perspectives [27]. A total of eight online focus groups were conducted, comprising 29 international students, with group sizes varying between three to five students. Seventeen one-to-one interviews were held with university staff members. We aligned our recruitment strategies with prior research which indicates that small focus groups are preferred by students to individual interviews or larger groups [28], provide in-depth insights, and foster a deeper understanding of participants' experiences [29]. Individual semi-structured interviews were conducted with staff both for practical reasons of data collection during term-time, and to encourage open conversation around issues which may have been sensitive to discuss in a group setting [29].

A sampling guide was followed to maximise coherence, transparency, impact, and trustworthiness [30]. This included defining the inclusion/exclusion criteria (defining the sample universe); deciding on sample size; selecting sampling strategy and sample sourcing. Inclusion criteria were students studying abroad, who were registered for study at the participating organisation during the recruitment period. Home students were excluded from the study. We aimed to recruit a culturally heterogeneous sample. Purposive sampling

was used to provide views from international students, using mixed-gender minimum quota sampling to recruit students with different nationalities, living circumstances (on/off campus), and experiences of COVID-19 (i.e., those who had recently tested positive for COVID-19, or never tested positive), and specifically targeted students who had experienced at least one period of self-isolation. Total sample size was informed by practical considerations (e.g., a pre-determined recruitment window of four weeks), since this was a rapid study intended to inform higher education policy and practice during a pandemic. The sampling criteria were based on published evidence. Students of different nationalities may vary in their experiences, needs [17,18], and access to services [26]. Students living on-campus may have easier access to services and lower stress levels than those living off-campus [31]. Finally, experiences of COVID-19 (i.e., having tested positive or not, having self-isolated or not) appear to have differential effects on psychological well-being [28].

Students required to self-isolate were: i) those that came to study in the UK from abroad and left the UK to go back to their home country, ii) those who tested positive for COVID-19 (with or without symptoms), iii) those who lived with someone who had COVID-19 symptoms or had tested positive. University staff members were purposively sampled for individual interviews, to represent the diversity of occupational roles and natures of student contact. Specifically, staff were invited to participate if they held a role providing direct support for international students, provided accommodation support, mental health support or other student-facing services, or worked in another role with a responsibility for pastoral care (i.e., academic tutor or supervisor). The study design aligned with the consolidated criteria for reporting qualitative studies (COREQ-32) guidelines [32] (Supplementary File S1). The research protocol was approved by the University of Nottingham Faculty of Medicine and Health Sciences Research Ethics Committee (Ref: FMHS 96-0920).

2.2. Procedure

Data collection was carried out between January and February 2021, when stay-at-home restrictions and social distancing rules were in place in the UK, and students were arriving back to the university after a winter break. At this time, international students who had been away from the UK during the break were required to quarantine for 14 days upon arrival in the country. In this study, there was a mixture of international students who had recently travelled and experienced self-isolation, and those who had stayed in either the UK or in their home country. Recruitment occurred through two channels, firstly a subset of international students who had taken part in an established cohort study, involving a total pool of 897 students [33], and secondly, international students who had taken part in the university's COVID-19 Asymptomatic Testing Service and had consented to be contacted for future research, involving a total pool of 133 students. Students meeting the sampling criteria were identified by the cohort leads and service administrators, and were subsequently contacted via email by a study researcher.

Student focus group participants were given a £20 voucher to thank them for their time. Staff members were invited by emails to participate in online semi-structured interviews. Students and staff were given access to study information, and those who were interested provided their consent online through the Jisc online survey platform. For practical reasons, recruitment continued for four weeks, in line with project timescales.

The research team conducted all student focus groups and staff interviews online using video-conference facilities (Microsoft Teams). Topic guides (Supplementary File S2) were developed for both the focus groups and interviews by two psychologists (HB and HK), and were reviewed by five international students who were not part of the study team, to check understandability to those for whom English is not the first language. Key topics included in this guide were: exploring students' experiences of self-isolation during COVID-19; the challenges that they faced; fears and concerns; and identifying facilitators, support, and coping mechanisms. Items about views towards vaccination were included, which will be explored in more depth elsewhere. The interviews took place at a time

convenient to the participants. All interviews were conducted in the English language, and all participants were proficient in the English language as a criterion for study at the institution. Interviewees were encouraged to speak up if they did not understand the line of questioning; similarly, focus group moderators used prompts, and repeated or adapted questions if participants' answers indicated they had not understood the essence of the question. Three researchers moderated the focus groups and conducted the semi-structured interviews and analysed the data. All interviews were recorded and transcribed verbatim. The focus groups with international students were led by two researchers who had personal experience of studying abroad (at undergraduate and postgraduate level, in the UK). One of these researchers was Turkish, and the other was Jordanian. Focus groups were co-moderated, and staff interviews were conducted by an English researcher, who had experience as both a student (postgraduate) and staff member (researcher/project worker) at the participating organisation.

Data were analysed thematically following Braun and Clarke's six stages [34]. Three researchers read the transcripts multiple times to become immersed in the data until the data content was eventually known. Initially, focus groups and one-to-one interviews were reviewed separately. The initial coding for the staff transcripts was led by two researchers, and the students' transcripts by a single researcher. Then, roles were exchanged where each researcher independently examined the coding for the students' and staff transcripts to ensure reliability. This allowed the identification of commonalities and differences within the data sets. The potential themes were then generated by combining both data sets. This triangulation of the data provided a stronger understanding of self-isolation experiences, as the staff interviews enhanced the interpretation of the focus group data.

3. Results

3.1. Participant Characteristics

Eight focus groups, comprising between three to five students per group, were conducted with 29 international students in total (i.e., 16 were recruited from the university's COVID-19 Asymptomatic Testing Service, and 13 from those who had taken part in the cohort study [33]). Seventeen university staff members were interviewed. The length of focus groups ranged from 58 to 90 min (mean: 68.8 min), whereas staff interviews were 29 to 69 min (mean: 44.5 min). The mean age of the students was 22.8 years (range between 19–32 years). Characteristics of the student and staff participants are displayed in Tables 1 and 2, respectively.

Table 1. Characteristics of international students (n = 29).

		Participants *n* (%)
Gender	Male	8 (27.5)
	Female	21 (72.5)
Nationality *	Americas (Brazil, Chile, Mexico, other)	4 (13.8)
	Eastern Mediterranean (UEA)	1 (3.5)
	Europe (Belgium, Croatia, Turkey)	4 (13.8)
	South-East Asia (India, Indonesia, Thailand)	4 (13.8)
	Western Pacific (China, Malaysia, Singapore)	11 (37.9)
	Not specified	5 (17.2)
Degree level	Undergraduate	22 (75.8)
	Postgraduate	7 (24.2)

Table 1. *Cont.*

		Participants *n* (%)
Type of accommodation	On-campus	7 (24.2)
	Off-campus	22 (75.8)
COVID-19 positive **	Yes	3 (10.3)
	No	26 (89.7)
Currently self-isolating	Yes	3 (10.3)
	No	26 (89.7)
Isolated more than once	Yes	12 (41.3)
	No	17 (58.7)

* Regions defined by World Health Organization definition of the world's countries by continent [35]; ** Received a positive test result for Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) RNA as per voluntary self-report.

Table 2. Characteristics of university staff members (*n* = 17).

		Participants *n* (%)
Gender	Male	4 (23.8)
	Female	13 (76.2)
Role *	Health and well-being	5 (29.5)
	Accommodation support	1 (5.9)
	Teaching and academic support	7 (40.8)
	Student experience	4 (23.8)

* Health and well-being roles: mental health advisors and well-being managers; accommodation support roles: hall tutors; teaching and academic support role: academic staff and personal tutors; student experience support role: student services administrative staff members and careers staff.

3.2. Key Themes

Three key themes (Figure 1) were identified from the data analysis, with six subthemes: (1) practical, academic, and psychological challenges faced during self-isolation and the COVID-19 pandemic; (2) coping strategies to self-isolation and life during the pandemic; and 3) views on further support needed for international students. Themes and subthemes are presented below. A description of each theme and subtheme, including representative quotes, is presented in Supplementary File S3.

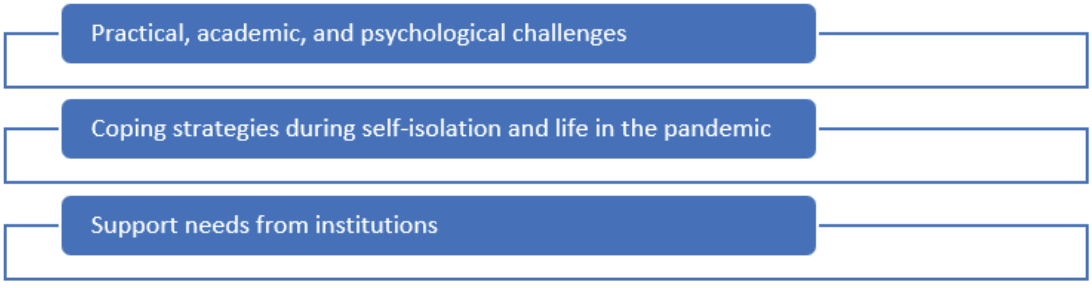

Figure 1. Key themes identified.

3.2.1. Theme 1: Practical, Academic, and Psychological Challenges Faced during Self-Isolation and the COVID-19 Pandemic

Sub-Theme 1: Logistics of Self-Isolation

In this study, there was a mixture of international students who were new to the UK, and those who had resided in the UK before. For those who were new, or returning to the UK, some described the challenges and fears associated with moving to a new country during the pandemic. Students travelling to the UK were required to self-isolate for two weeks, which led to difficulties setting up bank accounts, obtaining university cards, getting food, and other administrative tasks related to moving countries. The logistics of self-isolation posed unique challenges for many international students, particularly for those living alone or without existing social connections established in the community. Students spoke of difficulties getting essential supplies required for self-isolation, which led to a few students breaking self-isolation rules to meet their basic needs, highlighting the perceived lack of support for international students in self-isolation. For one student, the lack of practical support during self-isolation resulted in a negative impact on their physical health, as they could not obtain required medication.

> *"I tested positive-I myself can't go and I don't have anyone that can pick it up for me and they didn't find a way to send it to my house, so for those two weeks I could not—I didn't have my medication."* (Focus group 8, student 5)

> *"I think the food—we had a few students who were really worried about food, because they were all self-isolating."* (Staff member 11)

Sub-Theme 2: Transition to Online Learning

The transition to online learning following the pandemic was a cause for concern among international students. Students spoke of challenges related to adapting to using unfamiliar online platforms, with some reporting low knowledge of using such online platforms, and poor internet connectivity. Experiencing self-isolation left some students feeling unproductive, which, in turn, caused stress for some, as they felt behind in their academic studies. For those who had travelled to their home countries, connecting to live online lectures was a challenge due to differing time zones. A cause for concern for many was the uncertainties relating to the impact of the pandemic on their assignments for taught modules, or on field work, including laboratory sessions or placements. Some students reported frustration in the lack of clear communication from the university on COVID-19-related changes, stating it was a cause of stress and anxiety. For some, this stress and anxiety was further exacerbated by being signposted to mental health services when they perceived the problems to be related to other issues, such as a lack of clarity regarding academic processes and procedures, or a lack of clear communication from the university.

> *"There's just like no plans in place and no communication from the school. At the time we weren't sure whether I should go back to Malaysia or not just in case we would still have to go back to the UK for the June exams and everything. There was just no clear communication and that was really worrying."* (Focus group 3, student 3)

> *"I think there's no point in giving like a lot of mental health support if the main cause of our mental health worries are about missing placements or not being able to get the most out of the teaching."* (Focus group 3, student 2)

Though some students spoke of the practical challenges of the transition to online learning, others felt that online teaching was not as valuable as in-person teaching, as they perceived that some courses needed the "practical element" of learning, including healthcare, engineering, and architecture courses. Being taught solely online caused resentment for some individuals, related to the fact that international students were paying much higher fees than home students, and perceived lower value from online lessons or supervision.

> *"I'm paying double of what local students are paying, and not having lectures. Then on top of that, now I have to do everything online, I feel like the fees could have been reduced to lighten the burden."* (Focus group 2, student 2)

This view was mirrored by university staff, who advocated that online-based learning was not as effective as face-to-face lectures, particularly for international students where English is their second language, and that students may not know how to ask questions to lecturers through online platforms, potentially impacting their learning.

> *"With English as a second language, it's challenging enough to be writing essays, let alone thinking what is it that I'm actually asking? You can't just write it in email, 'I don't understand'. It's much easier to have those, just to verbalise things like that . . . for international students, I'm noticing that it's harder, it's just everything is harder."* (Staff member 9)

Furthermore, staff members suggested that online university courses undertaken in international institutions can be viewed less favourably than face-to-face teaching, which may impact on future employability. This was viewed by staff members as a cause for stress among international students, as it was perceived that students feared their degree would not be valued in their home country if it was conducted fully online, and that this was causing anxieties related to their future education and career prospects.

> *"Some of the students have talked to me about not wanting to study remotely because the perception overseas is that the degree is not worth the same. So, it's not worth coming to university because they don't receive an online degree to be of the same quality as face-to-face teaching. I just, I'm not sure whether tied into that there are cultural perceptions about reaching out, whether it should be, you know, whether it's still perceived to be a weakness, whether there's still some stigma about it."* (Staff member 14)

Sub-Theme 3: Social Isolation, Loneliness, and Impacted Well-Being

Most students believed that self-isolation was necessary to prevent the spread of the virus; however, and as agreed by university staff, around half experienced feelings of loneliness, anxiety, worry, sadness, and low mood when they learnt they had to self-isolate. During self-isolation, international students (as with all students) could not engage in activities that would normally help them to de-stress, such as exercise, and seeing friends and family; this significantly affected their well-being. In contrast, there were some international students who viewed self-isolation in a more positive light, as it allowed time to engage in new hobbies, talk to family and friends by phone or online, and fostered a sense of gratitude once self-isolation had ended.

Staff highlighted the importance of "student connectivity", in that international students need to immerse themselves in a new environment to fit in, which was not possible during this time, and the lack of social connections may have worsened feelings of loneliness and social isolation that are often experienced by the international community in more normal times.

> *"I think mental health was like my biggest challenge. It was very easy to just feel down and not wanting to do things, not feel motivated to either do work or just get out of bed."* (Focus group 8, student 5)

> *"I believe for our international community to arrive here into the UK and to find other people to talk to, to go to those societies . . . is part of university life. And that has been almost impossible for that to happen. So, you add the connection problems to the isolation problems that begins to impact on individual's health and mental health."* (Staff member 8)

> *"I think students often struggle because if you come to a foreign country where you don't know anyone, like you can't meet anyone. You know, like we had events for [students] in September or beginning of October for the global bodies, and I didn't expect that, but we had over 100 students, which was really good! But it was just like it was me and one*

hundred students on teams . . . like there was no like conversations that we could, or they could have." (Staff member 1)

Many international students highlighted a perceived lack of communication from the university during self-isolation periods and through the pandemic more generally, which left them feeling socially isolated from the rest of the university community. Some students reported little or no contact from university administrators, personal tutors, or lecturers. A perceived lack of contact from the university, compounded by the general reductions in social connection, led to feelings of disconnect from the university.

"I didn't exactly feel welcomed back when I came back after that. Compared to the first three years when I was at university, I thought it was great. The experience was great, staff was great. Now it just felt like it was deserted." (Focus group 4, student 3)

In marked contrast, other international students spoke of how university staff reached out to them during periods of self-isolation, and through the pandemic more generally, which helped them to feel supported during this difficult time. Some students found that the level of pastoral care provided by university staff helped them to manage increased workloads arising from the transition to online working, and to manage elevated stress levels experienced during the COVID-19 pandemic.

"My course has a course rep or 'representative', she would constantly send us survey forms on how we are doing mentally and how we are feeling with the changes. Like online schools, is there any improvements needed and how we feel, whether we feel stressed . . . . Applying for jobs is very intense and very stressful, so keeping up how we feel and letting us give feedback and suggestions anonymously really helped us." (Focus group 4, student 1)

3.2.2. Theme 2: Coping Strategies during Self-Isolation and Life in the Pandemic

Although periods of self-isolation posed some challenges, most international students used social and physical activities as coping strategies for self-isolating and living through the pandemic generally. Activities such as watching movies, chatting with family members and friends, reading, doing home exercises, and learning new hobbies were found to be helpful during the self-isolation period. These sorts of distractions were used as positive coping strategies for dealing with self-isolation and living under COVID-19 restrictions, and they made the isolation period feel shorter and were viewed to have a positive impact on mental well-being.

"I think distraction is one of the most important things, distractions such as just being excited about the things that you can do at home like cooking so many foods and baking and then watching movies or like having the time to study, to focus, things like that. So, distraction from the pressure of just being alone, those balance out and helps mood in the process." (Focus group 1, student 3)

"So for instance, there are some online yoga courses that we are supporting some other courses like they directly contact through the computers just online courses. It's kind of like social courses, they can join, and they can keep their life a little bit more active than just lying on the bed and then feeling they are sick and they're dying. And I think that could be the only things that we can support with these students." (Staff member 2)

Some staff highlighted that some students had not engaged in extra-curricular activities, and that a lack of distractions could be a source for stress and anxiety. Staff viewed international students to be highly driven to succeed in their studies, and witnessed students becoming more work-orientated during the pandemic, which served to intensify existing issues of stress and anxiety related to their academic studies.

"I mean even pre-pandemic, the students that I was meeting were quite often having issues with anxiety. Stress about work specifically, like academic prowess and how good they were doing, and it was very much work focused. Now I think that's been intensified, definitely because they have met so many less distractions." (Staff member 10)

In the absence of physical events, online activities were viewed positively by most of the students as a chance to learn something new, engage in fitness classes, or meet new people. In contrast, staff highlighted that meeting new people and establishing relationships can be daunting for international students, and with the current COVID-19 restrictions, meeting new people may be extremely challenging and impede the international student experience. In normal conditions, staff spoke of student communities that form within specific international student groups, as people tend to bond with others from similar cultures and places; they observed that this community bonding was reduced or lacking during the pandemic. However, both staff and students viewed online activities as a potential avenue to help facilitate networking among students, in the absence of face-to-face activities, and many staff and students advocated for online activities to be better utilised and advertised.

> *"Online social events could help students, they would not feel alone at this time, it would be very helpful. I know Students' Union event team has been organising some things, but it hasn't been well communicated and I don't think that many people are aware of them, so yeah, I think more some sort of community and event would be very helpful."* (Focus group 7, Student 5)

3.2.3. Theme 3: Support Needs from Institutions

Sub-Theme 1: Individual "Check-Ins" with Students

International students valued university staff reaching out to them, as it gave them a sense of being remembered and cared for, during periods when they felt particularly lonely. They specifically mentioned that individualised attention and personalised support was quite helpful during the self-isolation period. Staff views aligned with those of the students, and they reported that regular contact with students was beneficial to students' well-being, to reassure students that staff were present and available to provide support if needed.

> *"It really helps to have your personal tutor check in on you more frequently during this period, so my personal tutor he got in touch with me . . . ., asked me if I needed any support. He asked me when I would be self-isolating . . . as well to ask me how I was doing. So, I think just having that sort of individualised attention quite helped because I knew that I had someone to turn to if I needed any support."* (Focus group 2, student 3)

> *"I think it's just checking in with them would be just quite helpful, just to say you know how you are doing, how you getting on, that frequent outreach or checking in with them would be quite useful to them because I think it just makes them think that OK, I know people are there, you know, they care about me."* (Staff member 3)

Nevertheless, students' experiences appeared to have been highly variable, and some expressed disappointment and voiced dissatisfaction at the lack of support they received, particularly during self-isolation.

> *"I think they could check on people, like, more individually too, because there was like feeling really left aside, yeah, like the feedback and checking more individually, I think that would be amazing."* (Focus group 7, student 1)

Sub-Theme 2: Improved Academic Support and Communication

Overall, international students called for improved communication and practical support from the university during the pandemic. The transition to online learning resulted in feelings of anxiety and stress for all, and students wanted to feel reassured that their education and future careers would not be impacted by the pandemic. They called for "safety net" procedures, which would protect their current grades and give "peace of mind" regarding the integrity of their degree.

> *"I think for me it's more-it's just like more peace of mind about my education . . . there still wasn't anything to support us, like, education, academically sorry, in this pandemic. So that's one thing that would have eased me a lot, yeah."* (Focus group 7, student 2)

Timely information and decisions on how courses were being affected due to COVID-19 were seen as crucial by students in supporting their mental well-being during the pandemic, as this was a significant cause of anxiety, especially in times when some international students wanted to return home, but were unsure if they were able to during local and/or national restrictions. The lack of communication around COVID-19 impacts to courses led to confusion, and prevented many international students from returning home, which was viewed as crucial for well-being during the pandemic, since family and friends were key sources of support.

> *"Support that I think would be helpful, just communication from [my] school, just knowing how going into self-isolation would impact my course, like how I'm going to progress or things like that, how missing out in classes or maybe placements would impact how I graduate and things like that. I think that would have been really helpful."* (Focus group 3, student 4)

> *"Because for me, if they're going to move everything online there's not much of a need for me to stay here and especially with the current situation, there might not even be a graduation ceremony which I would stay for. It's putting me in a very awkward place where do I go back, do I not?"* (Focus Group 6, Student 1)

Staff recognised the importance of regular contact for international students, not only for them to feel connected to the university, but also for their English language to develop through daily communications and exposure to the language and culture.

> *"Maybe some online activities that specifically focus on English practice, like language practice. I've had a few students who would like that because if they are self-isolating and stuff as well, they're not having the opportunity to even go to the shop, and yeah, they can't go up to someone on the street and practice asking for directions and things like that. So they are missing out on the everyday small interactions that they would normally be having."* (Staff member 10)

> *" . . . I think, especially with PhD students or PGR students, one of the advice we give to our supervisors is do make it a weekly event that you're meeting them online, so that they can, and then if necessary do the smaller one to ones or individual analysis and things like that and do not forget them in all the other things you are doing."* (Staff member 5)

Sub-Theme 3: Inclusive Mental Health Support

Despite many international students experiencing negative emotions at some point during self-isolation or the pandemic more broadly, most students stated that they did not access mental health support services. Some of the students appeared to be aware of the university's services available to them; however, these international students described that, in situations where they were struggling with their mental health, they would talk to their friends about it, rather than seek formal support.

> *"I didn't really seek any support. Yeah, I did not feel like I needed the counselling services that the uni offers because I didn't feel like it was a specific problem, I just didn't feel motivated. I did try meditation, which is something that many people have suggested, and I think a support that really helps is just friendship, being able to talk to friends, facetime, or just chat."* (Focus group 7, student 5)

Although these student participants had not sought out mental health services, university staff stressed the importance of international students being aware of mental health services and using them if needed. Staff reported a perception that international students tended to load themselves with pressure to do well at university, often resulting from high family expectations. Staff highlighted that this self-imposed pressure may have been exacerbated during the pandemic, with the uncertainty around assignments causing more anxiety.

> *"Kind of with this whole weight of, I can't let my parents down, they're paying loads of money, they've saved up all their lives. Maybe grandad and uncle and other people are*

contributing towards it, and so they're kind of background of anxiety, like their resting level of anxiety is higher anyway, yeah, and then they've got to isolate and they're in a foreign country." (Staff member 9)

Staff believed that international students were less likely than domestic students to seek mental health services because of the stigma associated with it. University staff described mental health as a "real taboo" among international students, and had noticed that students were frequently hesitant to seek mental health assistance when it was needed.

"A lot of international students can have mental health is still kind of big taboo subjects. They don't necessarily, they're not used to maybe talking about it openly, which is one of the reasons they might not reach out to someone." (Staff member 15)

Interestingly, staff members spoke about the impact of the COVID-19 pandemic on their own workloads, which had challenged them emotionally, affected their own well-being, and, in turn, limited their ability to provide support to students.

"Staff members had a really tough time in this pandemic. They did everything online . . . don't know what's coming next. And the workload essentially quadrupled. So, the problem is when, and they're also human. We also go through all the emotional things students are going through. So, when you are not able to look after yourself, it becomes even harder to provide support for that many other students." (Staff member 6)

4. Discussion

This study provides a qualitative exploration of the impacts of COVID-19 and social restrictions on international students. Research has largely focused on domestic students, with little attention given to the well-being issues of students from abroad who are registered to study in the UK. We present the psychological, social, and academic challenges faced by international students, potential individual and institutional implications, and offer recommendations for enhanced student support.

Our findings align with previous research that explores the impact of COVID-19 social restrictions on university students in a UK higher education setting [10,11]. It has previously been suggested that the practical, social, and emotional support needs of self-isolating students should be identified and should consider the needs of marginalised groups [11]; although, to date, little is known about the experiences of international students as a unique population.

The rapid transition to online learning during the pandemic presented unique challenges for international students. Unfamiliar online learning environments led to difficulties articulating educational issues and queries in a second language, which may have limited access to previously received support. For those studying in their home countries, additional challenges included poor internet connections and studying in different time-zones. Available literature shows that the speed of adaptation to online leaning is highly dependent on the students' psychological and technological ability [36], and that difficulties adapting to online learning may trigger high academic distress, increased stress, anxiety, and depression [24,37]. Some students noted that these structural difficulties impacted their mental health to a greater extent than other pandemic factors.

Research suggests international students experience high degrees of perceived isolation, both academically and socially; however, students studying exclusively online may experience greater isolation than those completing traditional face-to-face programmes [37]. Students struggled to adapt to online learning due to language and technology barriers, and needed greater support from their institution in transiting to this learning platform, which may have heightened their stress and anxiety during this time. Universities need to ensure that international students have ongoing access to technical and logistical support for navigating remote learning environments, including (and in particular) those who continue their education remotely, accessing online learning platforms from their home country. As some UK institutions may choose to retain elements of online teaching and learning within their traditional teaching curricula, consideration should be given to supporting incoming

international students as they transition to using online platforms, for example, through introductory courses prior to, or immediately when starting, their course of study.

A common thread that emerged throughout the discussions was the need for greater communication from the university during the pandemic, including the provision of information about course alterations and regular check-ins by university staff. A perceived lack of communication resulted in increased anxiety amongst some of the international students in our sample, whereas increased pastoral communication improved connectedness. During the COVID-19 pandemic, communication was paramount to the uptake of COVID-19 testing and protective behaviours in students [38]. Delays in communication and a lack of messaging clarity caused confusion and impeded behavioural adherence [38]. For international students specifically, clarity and accessibility in both the frequency of and language used in university communications may reduce feelings of anxiety, particularly in individuals for whom English is not first language. Students within our sample described concerns that their overall performance, future career prospects, and quality of their degree would be impacted by the shift to online learning—many were concerned that this topic was not sufficiently covered within university communications. To attract and retain new students, information regarding the impact of online learning on course outcomes should be made readily available. The standards of online learning should be communicated clearly to international students (and their sponsors) to alleviate their concerns related to future career prospects of online study versus face-to-face modalities. Universities should provide timely communication to international students (and indeed, all students) about changes to courses, procedures, and service availability. This ideally would be available in alternative formats (e.g., online discussions) to avoid full reliance on lengthy, written, email communications, which can be challenging for students who are not native English speakers. Furthermore, to provide effective and focused educational support, universities must consider a holistic approach, through the assessment of international students' specific concerns and needs, including cultural, linguistic, and social factors.

Emerging evidence suggests that international student mobility has drastically decreased during the pandemic, with many international students advised not to travel abroad for study [38]. Beyond student enrolment, the impacts of the pandemic on student transition and integration may also have implications for academic attainment and cultural immersion. International student integration into a new culture significantly predicts second-language proficiency, in turn, predicting successful academic adaptation [39]. For international students, moving abroad and adjusting to a different country's culture and norms can pose significant challenges that affect mental health [40]. Additional evidence suggests that international students who returned to their home countries during the pandemic have been deprived of access to the cultural knowledge of the destination country, as well as of the insights typically arising from face-to-face teaching and social interactions [40]. Our findings suggest that simple mechanisms, such as pastoral communication, helped to improve student connectedness with their university courses, and may, in turn, foster cultural adaptation. Furthermore, the role of online social connections was also viewed as important for student well-being by both staff and students, including online exercise classes, conversations with family and friends, as well as events organised at a university level. The literature suggests that social connections are particularly important psychosocial resources for international students adapting to life in a new country [41]. International students share similar characteristics, regardless of their cultural and ethnic background, and are, therefore, more likely to form social connections with other international students [42]. Forming contacts with students from similar national groups allows for the exchange of experiences, and establishes a supportive network that improves well-being [43]. However, opportunities to make connections with home and international students have been limited due to COVID-19 restrictions. Despite the limited opportunities to establish supportive networks face-to-face, both international students and staff recognised the utility of online platforms to facilitate social activities during periods of self-isolation and COVID-19 restrictions, which was reported to be beneficial to students' psychological health and well-being.

International students were still motivated to attempt to build social networks through online platforms, suggesting that online social events may allow increased opportunities to form social connections.

Difficulties with adaptation were likely compounded by periods of self-isolation during the pandemic, with some students in our sample coping well, whereas others experienced loneliness and feelings of detachment from university life. In line with these findings, recent studies reported deteriorations in general student mental health, including feelings of isolation, loneliness, concerns about catching the virus, stress, anxiety, and depressive symptoms [44].

Addressing mental health concerns in university students is imperative, with potential impacts on physical health and academic progression. For example, mental health is associated with increased susceptibility to disease—there is emerging evidence to suggest that psychological factors may influence susceptibility to SARS-CoV-2 infection [45]. Regarding academic outcomes, students with mental health concerns are twice as likely to leave an institution without graduating; they have lower Grade Point Averages (GPAs), enrol and drop out in intervals, take longer to earn their credentials, or drop out completely [46].

International students already face stressors related to studying abroad, including educational difficulties, loneliness, and practical problems associated with changing environments [41]. Although international students are more likely to experience issues with mental health, they are less likely than home students to seek help from the university [47]. Within some cultures, counselling or other forms of formal support for mental health difficulties remain stigmatized [43]. Therefore, current services offered by British universities, which rely on individualistic Western models in which students proactively seek support, may not be fit for purpose for certain student groups. Our findings highlight that international students tend to seek informal support from friends and family, rather than formal university support systems. Psychological support received through social networks, such as family and friends, has been linked to reduced feelings of depression and lower levels of loneliness [48–50]. Further, peer support may also moderate the relationship between acculturative stress and anxiety symptoms [51], in addition to improving academic achievement [52] and self-efficacy [53]. The role of peers in mental health support may be multifaceted, ranging from signposting of services to the provision of support services themselves. Early data from an online peer support initiative demonstrated that 71% of students engaging with this platform experienced some improvement in pandemic-related stress [54]. Given that international students demonstrate higher rates of mental health conditions than those of their home student counterparts, it is imperative that further research focuses on delivery modalities that align with the needs of international students, for example, by incorporating peer support or peer advocacy for service signposting. Students in this study saw online social events as a route to engaging with the university community, which was crucial for positive well-being; therefore, universities should promote online events aimed at international students to protect well-being. Proactive approaches from university staff may provide a starting point to encourage international students to discuss mental health and well-being more openly; however, further initiatives should be focused on breaking the taboo on mental health in international students, to ensure access to services, particularly during the transition into post-pandemic academic life. As higher education institutions become increasingly culturally diverse, the need for inclusive mental health support is paramount—this means ensuring that mental health services are meaningful and accessible to all students with varying values, religions, beliefs, and cultural backgrounds. Offering various mechanisms for psychological intervention, such as proactive approaches ("reaching out" to student communities) and online peer support schemes, may benefit all students. Therefore, offering inclusive mental health services will likely improve access to psychological support across the university, and, in turn, serve a wider population of students [55].

University staff well-being was found to be impacted in this study. Student-facing staff had experienced significant pressures during the pandemic due to increased workloads

because of the transition to online working, leaving some staff experiencing work-related stress. Previous studies have found that university staff experienced stress during this time, as they adapted to home working and dealt with an increase in workload; re-gaining a sense of control seemed to be essential to reducing stress over time [56]. In this study, some staff highlighted feelings of guilt, as they believed their increased workloads prevented them from supporting students (i.e., being immediately available to them) to the best of their ability. Many university staff struggled with the increased and unique support needs of international students during the pandemic, alongside their usual workloads. Educational institutions should increase the availability and accessibility of centralised support for international students to improve the parity of support provided and reduce the burden on individual staff. Further mental health support for staff may also be warranted. A survey of 55 university staff found that 22–24% of participants reported clinical-level anxiety and depression scores, and 66.2% experienced high stress levels due to COVID-19 [45]. In this study, specific staff groups that required further support were highlighted, including staff members with care duties, and staff from minority ethnic backgrounds, who may be at increased risk with regards to the virus. University staff should have access to well-being and mental health support to avoid the risk of burnout during unprecedented circumstances such as a pandemic. If additional support is to be offered to students, this needs to be coupled with increased staff support and recruitment, to ensure staff workloads do not become excessive.

Implications for higher education policy and student support services are shown in Box 1.

Box 1. Recommendations and strategies to minimise psychological impacts of a pandemic for international students.

- Recognise the significant practical and emotional impacts of a pandemic on international students, and account for this when assessing student engagement in studies and academic progress.
- Ensure equitable mobilisation of basic supplies for students living on and off campus, in the face of another pandemic.
- Acknowledge the additional challenges faced by students who may work remotely during a pandemic—such as poor internet connections and studying in different time-zones.
- Provide ongoing access to technical and logistical support for navigating remote learning environments, including (and in particular) those who continue their education remotely, accessing online learning platforms from their home country.
- Provide additional services to support incoming international students as they transition to using online platforms, for example, through introductory courses prior to, or immediately when starting, their course of study.
- Ensure timely and regular communications relating to the provision of information about course alterations. Use alternative formats for the dissemination of key information.
- Involve international students in reviewing and developing the student-facing materials and messaging distributed during a pandemic.
- Provide an increased level of pastoral support for students, including regular check-ins by university staff. The impact on staff workloads and well-being should be considered, and there should be increased investment in centralised support services where appropriate.
- Seek to enhance social connectedness, inclusion, and positive mental well-being through supportive services delivered through various mechanisms (face-to-face, online, through local communities).
- Increase opportunities for international students to connect with others from their cultural and community groups.
- Endeavour to reduce perceived stigma among international students, related to accessing counselling services, or other forms of formal support for mental health difficulties.
- Encourage access to informal support (friends, family, community groups).
- Initiate service-led drop-in sessions for student queries and signposting.
- Provide peer mentoring or "buddy" programmes for international students—train and support peer mentors/buddies in signposting to supportive services.
- Invest in support and welfare services to prepare for the longer-term impact of pandemic-related mental ill-health on international (and all) students.

Study Strengths and Limitations

To date, there has been limited qualitative exploration into the impact of the COVID-19 pandemic on international university students. This study has demonstrated that international students' well-being has been impacted by the pandemic, and that individuals may face different challenges to domestic students. One of the key strengths of this study is looking at the perspectives of students from a range of ethnic and cultural groups, in conjunction with views from staff members, which broadened our understanding of international students' experiences with self-isolation, and highlighted the "hidden" challenges affecting their well-being. Our student sample was heterogeneous, which is of value in cross-cultural qualitative research, since any commonality found across a diverse group of cases is more likely to be a widely generalisable phenomenon than a commonality found in a homogenous group of cases (i.e., our findings are not confined to a particular cultural group, or stage of study) [30]. Online focus groups and interviews allowed us to reach students and staff both on- and off-campus without encountering logistical challenges or costs. However, the face-to-face approach may be valuable in recruiting hard-to-reach or vulnerable populations, as it builds trust [30]. Our sample included more women than men, which aligns with long-standing evidence that women are more likely to self-disclose than men [57]. Our findings are limited to the views and experiences of international students studying in the UK. It is recognised that the students who took part in the focus groups were likely to be proactive and engaged, and may not represent the views of those who felt more disconnected from the university or were less comfortable talking in this setting. We did not collect data on the type of degree that the students were registered for, and there may be differences in students' experiences during the pandemic. For example, prior research has suggested that students' willingness to discuss mental well-being (or other personal challenges), and the level of pastoral support they receive, can vary across disciplines [13]. Further, there may be differences in experiences of students registered on taught programmes, compared with those on research degree programmes. We did not collect information on socioeconomic status, which is a known risk factor for mental health; therefore, further research may be conducted to fully understand the impacts of the pandemic on international students from lower income backgrounds [58].

5. Conclusions

This study enhances our understanding of the experiences and vulnerabilities of international students enrolled in a UK university during the COVID-19 pandemic. Our findings provide insights into how higher education institutions can best support international student groups during this pandemic. Primarily, this may be achieved through clear communication strategies with alternative formats for the dissemination of key information, regular contact and support, and the provision of proactive and tailored mental health services (such as peer support programmes and drop-in sessions) accessible to international students. Universities should actively encourage the formation of online social communities and events for international students to encourage immersion into university environments, and provide additional practical, academic, and emotional support to international students adapting to online learning environments. International students enhance the overall student experience and students' personal development. The UK must respond to the impacts from the pandemic on international students, to retain and expand international student recruitment in the future.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19137631/s1, File S1: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist; File S2: Topic guides; File S3: Description of each theme and subtheme, including representative quotes.

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Would Organizational Climate and Job Stress Affect Wellness? An Empirical Study on the Hospitality Industry in Taiwan during COVID-19

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Abstract: During the COVID-19 pandemic, hospitality employees face a tremendous amount of job stress due to the decline in revenue and close contact with people. This study has three aims: first, to analyse the status quo of organizational-climate job stress on employee wellness in the hospitality industry during COVID-19; second, to discuss the correlation between organizational-climate job stress and employee wellness in the hospitality industry; and third, to analyze the associations between of personal background and organizational climate on job stress and wellness in the hospitality industry. This research uses a survey method to examine these issues. Participants were employees of franchise hotel branches in Taipei City, which yielded 295 effective sample sizes from five chain hotels. The personal background factor questionnaire, organizational climate questionnaire, job stress questionnaire, and wellness questionnaire served as the main research tools. In this study, Factor analysis, Pearson Correlation and Multiple Regression Analysis were used for sample analysis. The results revealed a significant relationship between organizational-climate job stress with wellness. Personal background factors, organizational climate, and job stress would affect the wellness of employees. As a result, the present research provides empirical evidence for the impact of organizational climate and job stress on employee wellness in the hospitality industry in Taiwan during COVID-19. The study's findings, as well as its theoretical and practical implications, are discussed. The main contribution of this study is that the results serve as a reference for hospitality business owners to design better organizational environments for their employees, plan human-resource-related strategies, and provide training for their employees during a pandemic.

Keywords: COVID-19; organizational climate; environmental job stress; wellness; hospitality industry

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1. Introduction

A working environment that attends more closely to the needs of employees would increase their willingness to spend more time and effort on their work tasks [1–3]. Organizational climate is an important concept that drives the aforementioned scenario. Organizational climate, an enduring quality of the internal environment of an organization, exerts impacts on the behaviours of organizational members [4]. Marinova and Park [5] found that organizational climate could predict employees' work attitudes and cognition, as well as allowing managers to make preparations and improve the workplace. Job stress refers to an individual's perceived feeling that they need to deviate from normal expectations when they have to handle important work-related opportunities, restrictions, or requirements. An individual may perceive an inappropriate level of stress or burden when their own adjustment capacity is constantly in conflict with the events that surround them [6,7].

In recent years, the hospitality industry in Taiwan has suffered a great decline in revenue due to the impact of COVID-19. Moreover, Taiwan began to restrict the entry of

foreign nationals in late March 2020 and completely banned indoor dining in early May 2021 due to the alarming epidemic. These measures drastically altered consumer behaviours and resulted in the sharp decline of revenue from catering and tour operators, as well as the negative growth of the hospitality industry in Taiwan [8]. Faced with unprecedented business challenges, hospitality workers constantly have job stress, and business owners even required them to achieve a decent business performance in order to overcome the COVID-19 crisis. As a result, job stress became concomitant with the pandemic [9–11].

According to the World Health Organization (WHO) in 1946, health is a state of complete physical, mental, and social wellness, and not merely the absence of disease or infirmity. This definition implies that health should cover physical, mental, and social aspects. Physiological diseases and psychological impacts may arise when individuals are unable to alleviate the tremendous level of stress that they perceive [12–14]. To prevent the negative impact of stress, the pursuit of wellness is seemingly the ultimate goal of hospitality employees.

The hospitality industry is essential in a modern country, as well as an important indicator that reflects the level of the country's development and the quality of life of its citizens [15]. Globalization developments during the COVID-19 pandemic have intensified the competition within the hospitality industry. Therefore, the approaches employed by Taiwanese hospitality business owners in response to the course of the epidemic are remarkably important, particularly because these approaches must be able to strengthen organizational structure, reduce job stress, and enhance the well-being of employees. On this basis, this research conducted further research and analysis on the impact of organizational climate and job stress on the wellness of Taiwanese hospitality employees.

According to the aforementioned discourse, the objectives of this study are as follows:

I. To analyse the current status of organizational climate, job stress and wellness in Taiwan's hospitality industry during the COVID-19 pandemic.
II. To explore the correlations between organizational climate, job stress, and wellness in the hospitality industry.
III. To analyze the associations between personal background and organizational climate on job stress and wellness in the hospitality industry.

2. Materials and Methods

2.1. Organisational Climate

Organizational climate is a general concept constituted by employees' subjective opinions about their organization, management, and other environmental factors. It represents a group of attributes that are used to describe an organization's behaviour. While the organizational climate of some organizations is open and harmonious, some instead are dour and depressing. These different organizational climates exert different impacts on the behavioural intentions and work ethic of members. Relevant studies also show that employee fringe benefits and a supportive work climate correlate positively with job satisfaction and enthusiasm, and also reduce job stress among employees [16,17]. Employee opinions toward the workplace may be representative of the organizational climate [18]. Shanker et al. [19] pointed out in his study that innovative organizational behaviours have emerged as a material topic, as innovative organizational climate has an indivisible impact on organizational performance. Ahmad et al. [20] maintained that organizational climate is among the factors that would impact an individual's understanding of their capabilities. In the service industry, organizational climate is perceived to be more important than work tasks [17,21]. Taken together, Litwin and Stringer's [22] theory serves as the theoretical basis of this study.

2.2. Job Stress

As defined by the American National Institute for Occupational Safety and Health in 1999, job stress is the harmful physical and emotional responses that occur when the requirements of a job do not meet the capabilities, resources, or needs of the worker.

There are many factors and sources that could lead to job stress, such as interpersonal relationships, organizational management approaches, work overload, long working hours, or repetitive work tasks, etc. which could gravitate towards job stress [23]. Hospitality employees often perceive more stress as they need to strike a balance between their job and family responsibilities [15,24,25].

Stress is neither good nor bad. Although the negative effects of stress are often visible, stress has positive effects, especially when it creates opportunities in potential fields of interest [26]. The perception of job stress is closely related to the traits of an individual. If an individual responds appropriately to stress, they would be able to mitigate the negative impacts of job stress on their life, mind, and body. Excessive stress, on the other hand, drags the individual down, which not only reduces their work efficiency and influences their interpersonal relationships but also decreases their wellness [27]. Koc and Bozkurt [28] pointed out in their study that job stress comes from a variety of complex sources, among which are mainly related to the external environment, jobs, and the individuals themselves. These factors are also influenced by various intricate and subtle factors that are subjective and objective. Based on the aforementioned elaborations, this study identifies the components of job stress as workload, job support stress, interpersonal stress, and professional knowledge stress.

2.3. The Hospitality Industry and Job Stress

In the hospitality industry, employees are required to serve customers in a kind and gracious manner. When employees fail to meet their own inner requirements, they must suppress their negativity and continue to present themselves externally as enthusiastic and dedicated. This emotional burden may result in burnout and fatigue [29]. Job stress is usually manifested as lethargy. Employees would feel exhausted and tired after work and slack off before starting work. Therefore, the sense of burnout at work weakens employees' motivation to pursue and achieve good performances, which in turn leads to physical and mental loss. Stress gives the feeling that one finds it difficult to complete their work tasks [15,30].

In the fiercely competitive hospitality industry, considerable importance is attached to service quality and the provision of high-quality products. In light of growing consumer expectations, workers must keep an enthusiastic and friendly attitude and take positive actions [31]. Indeed, hospitality employees often experience tremendous levels of job stress [32]. Comprehensive stress-related factors include perception of burnout and mental factors such as anxiety, frustration, hostility, and insecurity. The degree of impact of these factors depends on the intensity of stress and stressors [33].

These stressors are related to working conditions (shift work, extreme kitchen temperature), the roles and tasks performed (work overload, nonstandard work arrangements), as well as social and emotional job climate, such as workplace bullying and emotional dissonance [34]. These stressors influence an individual's physical (such as illness, symptoms, etc.) and mental (such as emotions) health due to temporal and expectation-related conflicts. Since service quality in the hospitality industry is correlated with customer loyalty and brand image, absence from duty without leave becomes more prevalent due to job stress, work-family conflicts, customer service, work shifts, and the lack of employment security. In particular, employees may sacrifice their physical and mental health for the sake of good service quality, and employees who are often in direct contact with customers are at a higher risk of spreading viral diseases [11,35].

The hospitality industry requires work shifts, which may increase the risk of short-term health impacts including work-related injuries and accidents. Additionally, prolonged work shifts may also affect the cardiovascular system, metabolism, digestive system, immune system, and hormone balance. Occupational injuries, such as mental disease, physical injury, medical malpractices, job stress, etc., would also lower job satisfaction [15,36]. However, providing excellent services is a prerequisite for hospitality employees, which means that their service value must be reflected through their professional competence and ability

to provide high-quality services. Therefore, the operations and developments of businesses in the hospitality industry rely on the professionalism, dedication, and meticulousness of employees. This study explores the associated of organizational climate and job stress on the physical and mental state of hospitality employees, with the expectation that more attention can be drawn to the work environments of hospitality employees and further precautions can be taken.

2.4. Wellness

Eisenberg [37] and Engel [38] argued that disease is a negative subjective experience while wellness is a positive subjective experience. In terms of health and perception, individuals can be healthy but feel uncomfortable, or feel good but are unhealthy. Therefore, the WHO has taken into account an individual's self-reported health status as the well-being perceived by staying healthy and taking more positive actions [39]. Moreover, good health, considered to be pain-free in the past, has been gradually re-interpreted by the concept of wellness. Additionally, the concept of wellness has received considerable attention and is interpreted as health, comfort, total fitness, holistic health, and happiness, etc., as well as covering physical, physiological, emotional, social, environmental, and occupational aspects.

Wellness is considered as an individual's life satisfaction or positive state of mind. The definition of health is also impacted by positive psychology. The criteria for measuring wellness include dedication, interpersonal relationships, significance of existence, and sense of personal achievement. On the positive level, wellness is a robust feeling of physical and mental health [40].

Russell [41] argued that health is an individual's state of complete physical, social, and physiological comfort, rather than merely being free from illness. The evaluation of personal wellness generally covers physical and mental aspects. In terms of physical health, health is the self-reported feeling of physical or physiological functioning. Objective evaluations are performed through diagnoses of chronic and acute diseases as well as declines and restrictions in physical functioning; while subjective evaluations are performed through self-reported perceptions and attitudes [42]. With regard to physiological health, individuals subjectively examine whether they are in a good mental state and have good social adaptability through feelings of anxiety, worry, interpersonal adaptation, depression, emotional anxiety, emotional tension, and life adjustment [43]. More specifically, healthiness not only refers to being in good health and free from illnesses, but also feeling comfortable in all aspects, including the physical, mental, and social aspects [44]. Therefore, besides the basic needs to survive, health also entails the pursuit of the value of life and wellness [45,46]. Based on Russell's [41] arguments, this research defines wellness as an individual's mental health and physical health.

According to the above literature, this research proposes the following hypotheses:

Hypothesis 1. *Organizational climate and job stress are associated with wellness.*

Hypothesis 2. *Personal background and organizational climate associated job stress and wellness.*

3. Materials and Methods

3.1. Study Design and Procedure

The present study follows a cross-sectional survey design, using questionnaires for data collection. The researchers contacted supervisors in five franchise hotels in Taipei City, Taiwan by e-mail. They explained the purpose and objectives of the research, and the supervisors agreed to distribute a questionnaire to the hotel's employees.

3.2. Ethical Statement

Because no therapeutic medication was involved in this study, it required no formal approval from the Institutional Review Board of the local Ethics Committee. Nonetheless,

all respondents were informed about the study's purpose and participation was voluntary. Participants were assured of the confidentiality and anonymity of all information associated with the surveys. The study was conducted according to the Declaration of Helsinki guidelines.

3.3. Sampling, and Recruitment

Using snowball sampling, this study recruited employees from five chain hotels in Taipei City. The researchers issued 330 questionnaires from January to June 2021, from which they received 295 valid completed questionnaires. Participants were recruited after the researchers posted explanatory posters in staff restaurants and provided a mailbox for the completed questionnaires. Participants filled out the anonymous questionnaire, and confidentiality was respected.

3.4. Measuring Tools

In this empirical study, a questionnaire was devised in this study to collect information about the associations between of organizational climate and job stress on wellness. This research applied four measuring tools, namely (1) a personal background questionnaire; (2) an organizational climate questionnaire; (3) a job content questionnaire; and (4) a well-being questionnaire. The scales in this research were revised by three hospitality management college professors and five hotel supervisors in human resource departments. The phrasing of the questionnaires complied with the titles of organizational climate, job stress, and wellness of hospitality employees during COVID-19 in Taiwan.

3.4.1. Organizational Climate Questionnaire

This research edited and revised the organizational climate questionnaire developed by Litwin and Stringer [22]. The questionnaire covers three dimensions, namely Reward and Promotion Incentive, Identification and Responsibility. Scores are measured on a five-point Likert scale, with the measures being strongly agree (5 points), agree (4 points), neutral (3 points), disagree (2 points), and strongly disagree (1 point). The higher the score, the stronger the participant's positive perception of the organizational climate, and vice versa. The internal consistency of the scale expressed as the Cronbach's alpha is 0.896, suggesting that the questionnaire has good reliability. This research uses the Kaiser-Meyer-Olkin (KMO) test to sample goodness of fit, Bartlett's sphericity test, and exploratory factor analysis to verify its construct validity (see Table 1).

Table 1. Summary table of factor analysis of organizational climate scale.

Number	Question Title	Factor 1 Reward and Promotion Incentive	Factor 2 Identification	Factor 3 Responsibility
1	During COVID-19, the company is often encouraging and supportive of personal judgements, as long as it helps the supervisor.	0.833		
2	During COVID-19, the rewards and encouragement that employees receive are more than accusations and criticisms.	0.786		
3	During COVID-19, the company rewards and praises good work performance.	0.781		
4	During COVID-19, production is positively affected by good planning.	0.777		
5	During COVID-19, employee rewards are proportional to work performance.	0.754		
6	During COVID-19, the company encourages employees to seek promotion.	0.767		
7	During COVID-19, employees are encouraged to seek solutions when they make mistakes.	0.729		
8	During COVID-19, if I think it is correct, I will go ahead with it and there is no need to ask for instructions	0.689		

Table 1. *Cont.*

Number	Question Title	Factor 1 Reward and Promotion Incentive	Factor 2 Identification	Factor 3 Responsibility
9	During COVID-19, I will contact co-workers and be supportive of the company's policies.		0.905	
10	During COVID-19, I am supportive and approve of new company regulations.		0.775	
11	During COVID-19, the company encourages us to be frank about our opinions, even if they differ from the supervisor's.		0.759	
12	During COVID-19, the duties of the supervisor are to set specific working goals and help achieve them.			0.856
13	During COVID-19, the company's policies and employee duties are clear.			0.721
Characteristic value		6.127	1.531	1.246
Explained variation (%)		47.115	11.769	9.582
Cumulative explained variance (%)		47.135	58.892	68.484
KMO Measure of Sampling Adequacy = 0.792				
Cronbach's Alpha value = 0.896				

3.4.2. Job Content Questionnaire (JCQ)

This study edited and revised the job content questionnaire developed by Karasek et al. [47]. The scale consists of four dimensions—namely Workload Stress, Interpersonal Stress, Supervisor Support Stress, and Professional Competence Stress. Scores are measured on a five-point Likert scale, with the measures being strongly agree (5 points), agree (4 points), neutral (3 points), disagree (2 points), and strongly disagree (1 point). The higher the score, the stronger the participants' perception of job stress, and vice versa. The internal consistency of the scale expressed as the Cronbach's alpha is 0.859, suggesting that the questionnaire has good reliability. This research uses the KMO test for goodness of fit, Bartlett's sphericity test, and exploratory factor analysis to verify construct validity (see Table 2).

Table 2. Summary table of factor analysis in job content scale.

Number	Question Titles	Factor 1 Workload Stress	Factor 2 Interpersonal Stress	Factor 3 Supervisor Support Stress	Factor 4 Professional Competence Stress
1	For the impact of COVID-19, I feel that workloads are currently too heavy.	0.884			
2	For the impact of COVID-19, the unclear division of powers and responsibilities in the company doubles my work and halves the results.	0.849			
3	For the impact of COVID-19, I have too much work to complete in the allotted time.	0.847			
4	For the impact of COVID-19, I feel a lot of pressure to reach company goals.	0.825			
5	For the impact of COVID-19, I feel a lot of pressure every time my performance fails to meet company goals.	0.798			
6	For the impact of COVID-19, my job is often hard to complete alone. Colleagues may need to help one another.	0.790			
7	For the impact of COVID-19, I am troubled by insufficient coordination among colleagues		0.745		
8	For the impact of COVID-19, I often remain silent to maintain the peace between colleagues.		0.743		

Table 2. *Cont.*

Number	Question Titles	Factor 1 Workload Stress	Factor 2 Interpersonal Stress	Factor 3 Supervisor Support Stress	Factor 4 Professional Competence Stress
9	For the impact of COVID-19, I worry about conflicts with colleagues due to miscommunication and poor coordination.		0.741		
10	For the impact of COVID-19, I feel work is busy, which makes it hard to maintain positive relationships with my colleagues.		0.707		
11	For the impact of COVID-19, I feel my supervisor believes I lack the required ability.			0.864	
12	For the impact of COVID-19, I feel the supervisor ignores or demeans my work performance.			0.853	
13	For the impact of COVID-19, I am unable to finish all of the tasks required by the supervisor.			0.836	
14	For the impact of COVID-19, I feel little sense of achievement in the job.			0.709	
15	During COVID-19, I feel I'm not always sufficiently professional.				0.855
16	For the impact of COVID-19, I am unable to show my competence.				0.798
17	For the impact of COVID-19, I am unable to show my professional competence in my job.				0.769
18	For the impact of COVID-19, I cannot convince my co-workers of what to do.				0.740
19	I feel my professional development is slower. than the speed of the spread of COVID-19.				0.729
20	For the impact of COVID-19, I feel helpless about finding the time for professional development.				0.665
Characteristic value		5.876	2.792	1.606	1.235
Explained variation (%)		39.171	18.612	10.705	9.682
Cumulative explained variance (%)		39.171	57.783	68.488	78.170
KMO Measure for sampling adequacy = 0.751					
Cronbach's Alpha value = 0.876					

3.4.3. Wellness Questionnaire

This study edited and revised the wellness questionnaire developed by Russell [41]. The questionnaire consists of two dimensions, namely Mental Health, Physical and Mental Harmony and Physical Health. Scores are measured on a five-point Likert scale, with the measures being strongly agree (5 points), agree (4 points), neutral (3 points), disagree (2 points), and strongly disagree (1 point). The higher the score, the stronger the participants' perception of good wellness, and vice versa. The internal consistency of the scale expressed as the Cronbach's alpha is 0.876, suggesting that the questionnaire has good reliability. This research uses the KMO test for goodness of fit, Bartlett's sphericity test, and exploratory factor analysis to verify construct validity (see Table 3).

Table 3. Summary table of factor analysis for wellness scale.

Number	Question Titles	Factor 1 Mental Health	Factor 2 Physical and Mental Harmony	Factor 3 Physical Health
1	During COVID-19, I am full of energy for facing work challenges.	0.805		

Table 3. *Cont.*

Number	Question Titles	Factor 1 Mental Health	Factor 2 Physical and Mental Harmony	Factor 3 Physical Health
2	During COVID-19, I have no doubts about my ability and judgment at work, and I will continue to improve myself.	0.804		
3	During COVID-19, I won't feel sad or depressed when encountering frustrations.	0.790		
4	During COVID-19, I seldom feel overwhelmed or worried.	0.777		
5	During COVID-19, if my colleagues and friends shun me, I will examine what I have done and try to maintain good relationships.	0.749		
6	During COVID-19, I won't stay in bed for job burnout.	0.727		
7	During COVID-19, I am seldom exhausted by heavy burdens.		0.850	
8	During COVID-19 in my usual work, I am often busy but rarely upset or feel ill at ease.		0.834	
9	During COVID-19, when stress from my job starts to rise, I have enough energy to overcome most challenges.		0.787	
10	During COVID-19, when I feel angry at work, I often remind myself that "It's good to be alive", which helps to adjust my emotions and lessen the stress.		0.515	
11	During COVID-19, I am healthy and free of most aches and pains (such as in my head, arms, shoulder, waist, and feet).			0.798
12	During COVID-19, I never feel short of breath or dizzy.			0.769
13	During COVID-19, I feel no muscle tremors (such as eyelid twitches).			0.740
14	During COVID-19, my weight is normal; it hasn't changed.			0.665
Characteristic value		5.529	2.180	1.591
Explained variation (%)		39.495	15.568	11.366
Cumulative explained variance (%)		39.495	55.063	66.429
KMO for sampling adequacy = 0.751				
Cronbach's Alpha value = 0.876				

3.5. Analysis Tools and Methods

The research applied SPSS 25.0 statistical software for data analysis. The data is analyzed in terms of frequency distribution, percentage, mean, Pearson correlation coefficient, and multiple regression.

4. Results

4.1. Description of Participants' Personal Background

The primary characteristics of the participants are as follows: in terms of gender, there were more women (150) than men; in terms of educational background, most of the participants (220) held an undergraduate degree or above; in terms of tenure, most of them (195) had worked for 15 years in the hospitality industry; in terms of position, most of the participants (180) were supervisors; and in terms of salary, most of the participants (150) earned between US$1000 and US$2000 per month.

4.2. Analysis of the Current State of Organisational Climate

The total mean of organizational climate was 3.48 (standard deviation (SD) = 0.64). Concerning its dimensions, responsibility was the highest (mean = 3.7; SD = 0.72), followed by identification (mean = 3.47; SD = 0.78), and reward and promotion incentive (mean = 3.42; SD = 0.71) All dimensions were higher than the theoretical midpoint (3 points), with responsibility having the highest mean. This part measures the current state

of organizational climate. Therefore, the standard deviation is small, which means that the questionnaire titles are suitable and homogeneous.

4.3. Analysis of the Current State of Job Stress

The total mean of job stress was 3.11 (SD = 0.47). Concerning its dimensions, interpersonal stress was the highest (mean = 3.34; SD = 0.65), followed by workload stress (mean = 3.23; SD = 0.55), and supervisor support stress (mean = 2.68; SD = 0.63). The last item is professional competence stress (mean = 2.58; SD = 0.63) Interpersonal stress had the highest mean, while supervisor support stress had the lowest mean. This part measures the current state of job stress. Therefore, the standard deviation is small, which means that the questionnaire titles are suitable and homogeneous.

4.4. Analysis of the Current State of Wellness

The total mean of wellness is 3.49 (SD = 0.43). Concerning its dimensions, mental health was the highest (mean = 3.59; SD = 0.50), followed by physical health (mean = 3.32; SD = 0.62), and physical and mental harmony (mean = 3.42; SD = 0.56). All dimensions were higher than the theoretical midpoint (3 points), with mental health having the highest mean. This part measures the current state of wellness. Therefore, the standard deviation is small, which means that the questionnaire titles are suitable and homogeneous.

4.5. Correlation Analysis of Organisational Climate, Job Stress and Wellbeing

According to the result of the Pearson correlation matrix in Table 4, most of the correlation coefficients of the dimensions of organizational climate, job stress, and wellness in the hospitality industry were at least moderate. Therefore, Hypothesis 1 is supported.

Table 4. Correlation analysis of wellness, organizational climate, and job stress in the hospitality industry.

	Reward and Promotion Incentive	Identification	Responsibility	Supervisor Support Stress	Professional Competence Stress	Workload Stress	Interpersonal Stress	Mental Health	Physical and Mental Harmony	Physical Health
Reward and promotion incentive	1									
Identification	0.71 **	1								
Responsibility	0.46 **	0.55 **	1							
Supervisor support stress	0.08	0.03	0.05	1						
Professional competence stress	0.09	0.04	0.05	0.08	1					
Workload stress	−0.17 **	−0.12 *	−0.09	0.42 **	0.41 **	1				
Interpersonal stress	−0.25 **	−0.32 **	−0.15 **	0.38 **	0.35 **	0.48 **	1			
Mental health	0.33 **	0.35 **	0.19 **	0.10	0.12	0.00	−0.11	1		
Physical and mental harmony	0.33 **	0.31 **	0.22 **	0.15 **	0.15 **	−0.09	−0.10	0.71 **	1	
Physical health	0.18 **	0.21 **	0.07	−0.05	−0.06	−0.19 **	−0.17 **	0.33 **	0.48 **	1

Note: * $p < 0.05$, ** $p < 0.01$.

4.6. Multiple Regression Analysis of Personal Background Factors, Organizational Climate, Job Stress and Wellness

According to the multiple regression analysis in Table 5, gender, educational background, seniority, position, salary, reward and promotion incentive, identification, responsibility, and other variables can associated with an employee's wellness. Therefore, Hypothesis 2 is supported.

Table 5. Multiple regression analysis of wellness, personal background factors, and organizational climate.

Personal Background	Mental Health		Physical and Mental Harmony		Physical Health	
	Beta	t	Beta	t	Beta	t
Gender	−0.07	−0.62	−0.03	−0.86	0.01	0.21
Educational background	0.04	0.82	0.04	0.77	0.11	1.75
Seniority	0.12	1.36	−0.03	−0.18	−0.02	−0.12
Position	−0.12	−2.10 *	−0.03	−0.56	0.06	1.16
Salary	0.02	0.18	0.03	0.33	0.06	0.84
Reward and promotion incentive	0.16	1.84	0.23	3.12 *	0.11	1.53
Identification	0.28	3.38 *	0.14	1.57	0.13	1.62
Responsibility	−0.07	−1.20	0.01	0.17	−0.03	−0.64
Constant	2.85		2.46		2.36	
R^2	0.16		0.13		0.07	
F	7.98 ***		5.95 ***		2.92 *	

Note: * $p < 0.05$, *** $p < 0.001$.

According to the multiple analysis result in Table 6, gender, educational background, seniority, position, salary, supervisor support stress, professional competence stress, workload stress, interpersonal stress, and other variables can associated with an employee's wellness. Therefore, Hypothesis 2 is supported.

Table 6. Multiple regression analysis of wellness, personal background factors, and job stress.

Personal Background	Mental Health		Physical and Mental Harmony		Physical Health	
	Beta	t	Beta	t	Beta	t
Gender	−0.03	−0.55	−0.06	−1.06	0.02	0.16
Educational background	0.02	0.24	0.02	0.33	0.08	1.38
Seniority	0.06	0.78	0.00	0.05	−0.04	−0.42
Position	−0.12	−1.88	−0.03	−0.36	0.04	0.58
Salary	0.13	1.51	0.11	1.17	0.13	1.63
Supervisor support stress	0.14	2.28 *	0.26	3.85 ***	0.07	1.29
Professional competence stress	0.11	2.39 *	0.28	3.38 ***	0.06	1.38
Workload stress	0.00	0.06	−0.15	−2.09 *	−0.14	−2.22 *
Interpersonal stress	−0.18	−2.95 **	−0.15	−1.92	−0.11	−2.03 *
Constant	3.68		3.57		3.73	
R^2	0.06		0.07		0.07	
F	3.53 *		3.18 **		2.83 **	

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

5. Discussion

According to the analysis results, there is a significant and negative correlation between the perception of organizational climate and job stress in all dimensions, indicating that the higher negative perception of organizational climate, the greater the perception of job stress. There is a significant and positive correlation between the perception of organizational climate and wellness in all dimensions, suggesting that the higher the perception of organizational climate, the greater the perception of wellness. Finally, there is a significant and negative correlation between the perception of job stress and wellness in all dimensions, indicating that the greater the perception of job stress, the lower the perception of wellness. These results are in line with those from previous studies [11,27,46].

It is worth noting that the mean value of the item "As long as I think it is correct, I would go ahead with it and there is no need to ask for instructions (M = 2.86)" in the Organizational Climate Questionnaire is smaller than the median, and the supervisor

support stress dimension in the job content questionnaire (M = 2.79) is also smaller than the median. In addition, the mean value of the second item in the Wellness Questionnaire, "I have no doubts about my ability and judgment at work, and I will continue to improve myself-confidence (M = 3.72)", is higher than the median. Based on these results, hospitality employees were rather confident of their professional attitudes and job competence, but they are seldom identified or favored by others. This suggests that, despite their confidence, they do not have much authority in their work tasks. Therefore, this study suggests that hospitality business owners should not only provide employees with complete education and training to empower their professional knowledge but should also provide them with sufficient authority, to jointly maximize interests and contributions to the hospitality industry.

Cumulative job stress associated with employee wellness. We find from the analysis of job stress that the construct of "interpersonal stress" has the highest score, which means that employees feel the greatest increase in stress due to poor coordination and communication with colleagues during COVID-19. "Workload stress" is also a major contributor, in which workloads generate additional stress due to vague divisions of powers/responsibilities and insufficient time for completing tasks. Previous studies show that organizational structures in the hospitality industry need to be revised effectively, and it is very important to effectively reduce the job stress of employees [48,49]. Organizational climate and job stress are key indicators of organizational operations [45]. Therefore, in light of the changes and globalized competition during the COVID-19 pandemic, the hospitality industry should take a more positive stance in making strategic plans to change the organizational structure climate, so that employees have a better perception of the overall organizational climate [25]. Meanwhile, employees should also cooperate with the adjustment of their organization and pay more attention to their wellness. Only through good wellness management can the quality of the industry be enhanced, and companies should constantly maintain sustainability in their organizational climate.

6. Conclusions

According to the regression analysis results, position, identification, and reward and promotion incentives in various organizational climates, were associated with the wellness of employees, indicating that the most effective way to improve organizational climate and wellness is to provide rewarding and promotional incentives in all dimensions of the organizational climate. Therefore, it is suggested that hospitality business owners can provide an effective remuneration and reward system, enhance organization identification, provide timely encouragement, and appropriately adjust the organizational environment to enhance their employees' perception of wellness.

The dimensions of job stress—i.e., supervisor support stress, professional competence stress, workload stress, and interpersonal stress—can obtain a correlation between physical and mental health. There was a negative correlation between supervisor support stress and professional competence stress, while workload stress and interpersonal stress had positive correlations with mental and physical health. This study concludes that supervisor support stress and professional competence stress arise from a poor understanding of job contents. When professional competence stress and supervisor support stress are lessened, this has associated effects on employee wellness. However, workload stress and interpersonal stress positively correlate with physical and mental health, demonstrating that the greater the workload stress, the poorer the perception of wellness.

7. Research Limitations

This research was mainly conducted on employees of five hotel branches in Taipei City, Taiwan. Therefore, the results could not be applied to the entire hospitality industry. Meanwhile, different companies have special cultural backgrounds, core values, and organisational structures, and this research can merely serve as a reference for human resource management and organisational adjustment. Further research is needed concerning the

organisational structure, cultural background, core values, and regional characteristics of other industries.

8. Practical and Managerial Implications

The topic of this study is the impact of organizational climate and job stress on the well-being of hospitality employees. This study belongs to the category of environmental psychology. In the past, most studies on organizational climate focused on innovative performance, organizational innovation, organizational leadership, work attitudes, and turnover intentions. There is a dearth of studies on the impact of organizational climate and job stress on hospitality employees' wellness in Taiwan during the COVID-19 pandemic. By centering on organizational climate, job stress, and wellness, this study sheds further light on how hospitality business owners create a suitable organizational climate and effectively reduce the job stress of employees during the COVID-19 pandemic, to improve their wellness and lead the way towards sustainability. As the research shows, the three variables are interrelated, so employers should try to improve organizational climate. Additionally, reducing job stress and safeguarding wellness during COVID-19 should be a priority. We recommend that hotel operators adopt measures to improve organizational climate, mitigate job stress, and maximize the wellness of their employees.

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Synergistic Interaction between Job Stressors and Psychological Distress during the COVID-19 Pandemic: A Cross-Sectional Study

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Abstract: Psychosocial job stressors increase the risk of mental health problems for the workers in health and social services (HSS). Although previous studies suggest that the accumulation of two or more stressors is detrimental to mental health, few studies have examined the synergistic interaction of accumulating job stressors. We examined survey responses from 9855 Finnish HSS workers in a cross-sectional study design from 2021. We conducted an interaction analysis of high job demands, low rewards and low workplace social capital on psychological distress, focusing on the relative excess risk due to interaction (RERI). Additionally, we analysed the interaction of job demands, low rewards and COVID-19 burden (extra workload and emotional load). Our analysis showed that the total RERI for the job stressors on psychological distress was considerable (6.27, 95% CI 3.14, 9.39). The total excess risk was caused by two-way interactions, especially between high demands and low rewards and by the three-way interaction of all stressors. The total RERI for job demands, low reward and COVID-19 burden (3.93, 95% CI 1.15, 6.72), however, was caused entirely by two-way interaction between high demands and low rewards. Mental health interventions tackling high demands, low rewards and low social capital are jointly needed.

Keywords: work stress; mental health; interaction; social capital; COVID-19

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1. Introduction

Psychosocial job stressors are a major risk for sickness absence and premature disability retirement due to mental disorders [1]. Work-related stress and sickness absences due to stress are prevalent among health and social service (HSS) workers, and the situation has worsened since the COVID-19 pandemic began [2,3]. During the pandemic, HSS workers have also faced considerable physical strain in their work, including fatigue, sleep problems, and COVID-19 infection, especially due to shift work [4–6]. High job demands and low rewards are among the key job stressors increasing the risk of job stress and more adverse health issues [7,8]. High workplace social capital is a potential protective factor for mental health; however, low workplace social capital is associated with self-reported depression and can thus increase worker strain [9].

Job stressors are comprehensively studied in epidemiological research; however, most previous studies primarily investigated one stress factor at a time [10]. In the everyday work environment, many stress factors, such as high workload, time pressure, violence, and harassment, coexist [11]. The situation calls for studies which investigate accumulating and interacting job stressors. Juvani and her colleagues [12] investigated how the clustering of several psychosocial stressors affects mental health among public sector workers. The study discovered that job strain, effort–reward imbalance, and organizational injustice cluster in the same individuals. Individuals who experience two or three stressors simultaneously had the highest risk of disability pension due to depression. Milner et al. [13] studied the association of several psychosocial job qualities and reporting attendance at a mental health

ward, finding in a fixed effects model no relationship between psychosocial job stressors and service use.

Essentially, Juvani et al. and Milner et al. studied the effect of cumulative adversities on mental health [14]. The syndemics literature, introduced by Singer [15], focuses instead on the synergistic interaction of adversities. In a syndemic situation, two or more epidemics interact synergistically, causing excess burden on the population [16]. In the work environment, a syndemic effect could produce a vicious circle, i.e., a super-additive interaction of job stressors, which affects HSS workers' mental health more than would be expected from the combination of coexisting job stressors. Revealing possible synergistic interactions between several stressors can facilitate more efficient interventions to promote mental health: if a synergistic interaction exists between exposures, a joint intervention addressing all the interacting exposures simultaneously is more efficient than interventions tackling single stressors [14].

Studying interaction as a departure from multiplicativity has been more common in epidemiological research [17] than studying interaction as a departure from additivity. The latter is, however, more important when studying public health: it indicates which subgroups of the study population are vulnerable to interacting exposures, and thus which subgroup would benefit most from an intervention or treatment [18]. Studying additive interaction is recommended also in the syndemics literature, being more relevant to the theory of synergistically interacting epidemics [19]. A few job stressor studies have analysed interaction as a departure from additivity [20–24]. Choi et al. [20], for example, discovered that workers with low job control and low social support at work were at excessive risk of psychological distress when job demands were high. These studies analysed, however, effect modification or interaction between two variables at a time. To our knowledge, no job stressor studies have been conducted on the synergistic interaction of more than two job stressors. In this paper we aim to fill this gap by expanding the analysis into a three-way interaction.

In addition to the more common job stressors, we include in our analysis the extra burden that the COVID-19 pandemic has placed on HSS workers. For example, in a Finnish cohort study, potentially traumatic COVID-19 pandemic-related events and front-line COVID-19 work were associated with personnel's psychological distress [2]. Ervasti et al. [25] also studied the impacts of COVID-19 on psychosocial stressors; however, to our knowledge, no previous study has included the excess burden of the COVID-19 pandemic in an analysis of interacting work stressors.

The present study aimed to discover whether synergistic interaction between several job stressors occurs among HSS workers. We first examined the interaction of high job demands, low rewards, and low workplace social capital. Focusing on the relative excess risk due to interaction (RERI), we analyzed whether this accumulation is associated with workers' psychological distress (PD). Second, we replaced social capital with COVID-19 burden—extra workload and fear for one's own health—in the interaction model and investigated whether it affects PD. Thus, we studied the following hypotheses:

Hypothesis 1 (H1). *High job demands, low rewards and low workplace social capital interact and cause excess risk for PD in HSS workers.*

Hypothesis 2 (H2). *High job demands, low rewards and COVID-19 burden interact and cause excess risk for PD for HSS workers.*

2. Methods

2.1. Study Design and Population

The present study examines data collected from a survey of Finnish HSS employees. The survey has been conducted annually since 2018 and measures the psychosocial strain factors and job resources in HSS work. The survey used in this cross-sectional study was undertaken 26.10.2021–28.11.2021 in six Finnish public health and social care organiza-

tions. 11,925 employees who were actively working in the organization during that time responded to the survey. Workers on parental, sick or study leave were excluded from the eligible population. The response rate was 62%. 90% gave their consent to use the data for research. After excluding employees without research consent, with missing values on any job stressor or covariate, the final data comprised 9855 respondents.

The study was approved by the ethical board of the Finnish Institute of Occupational Health. Participation in the survey was voluntary and consent to use the responses for scientific research was requested in the questionnaire.

2.2. Variables

2.2.1. Outcome

The main outcome, psychological distress (PD), was measured using a 4-item Patient Health Questionnaire (PHQ-4). We used it because it is brief and thus less burdensome for respondents, and yet is a validated screening instrument for psychological distress [26]. PHQ-4 comprises 2 items from the 9-item Patient Health Questionnaire (PHQ-9) and 7-item Generalized Anxiety Disorder (GAD-7). Responses were scored as 0 ("not at all"), 1 ("several days"), 2 ("more than half the days"), or 3 ("nearly every day"). The total score thus ranged from 0 to 12. The internal reliability of the scale was good, as the average inter-correlation among the items was high (Cronbach's alpha = 0.86). Following the rationale of Löwe et al. [27], individual survey responses with a PHQ-4 score of 6 or more were coded as psychologically distressed.

2.2.2. Exposure Variables

To measure psychosocial job stressors—job demands and job rewards—we chose the commonly used and validated instruments from Karasek [28] and Siegrist [29]. In our survey, to reduce response burden, job demands were measured with two items (Cronbach's alpha = 0.88) derived from the Job Content Questionnaire [28]: "An unreasonable amount of work is expected of me" and "I don't have enough time to get my work done". The response scale was five-level (1 = strongly agree to 5 = strongly disagree). We calculated a mean of the scores. Job rewards were measured with three items (Cronbach's alpha = 0.74) from the effort–reward imbalance model [29]: "How much do you feel you get in return for work in terms of income and job benefits?", "How much do you feel you get in return for work in terms of recognition and prestige?", and "How much do you feel you get in return for work in terms of personal satisfaction?". The response scale was five-level (1 = very much to 5 = not at all) and we calculated a mean of the scores. Workplace Social capital was measured using a validated and psychometrically tested self-assessment scale [9]. We calculated a mean from eight items (Cronbach's alpha = 0.87): "We have a 'we are together' attitude", "People feel understood and accepted by each other", "We can trust our supervisor", "People in the work unit cooperate in order to help develop and apply new ideas", "Our supervisor treats us with kindness and consideration", "Our supervisor shows concern for our rights as an employee", "People keep each other informed about work-related issues in the work unit" and "Do members of the work unit build on each other's ideas in order to achieve the best possible outcome?". The response scale had five points (1 = strongly disagree to 5 = strongly agree in the first seven items and 1 = to a very little extent to 5 = to a very great extent in the last item). To examine interaction effects in strained workers, we set the lowest quintile of job demands and of social capital, and the highest quintile of rewards to indicate exposure to each job stressor. The remaining four quintiles of each stressor were set as non-exposed.

COVID-19 burden was measured using two statements created by the authors in collaboration with the studied health and social care organizations: "I have been afraid for my health because of the COVID-19 situation", and "my workload has increased because of the COVID-19 situation", with a response scale of yes/no. Respondents who answered yes to both statements were classified as having COVID-19 burden.

2.3. Covariates

Employee age, gender, supervisory position (yes/no), and occupation were collected from organizational registers. We classified the respondents into three levels of socioeconomic status according to their occupation: Skilled labor included, for example, managers, physiotherapists, physicians, and nurses. Semi-skilled labor included, for example, practical nurses, social workers, and clerical workers. Unskilled labor included, for example, cleaning and kitchen staff. We also included self-reported health status as a possible confounding factor. It was measured with a question: "how is your health", with a 5-point scale: good, fairly good, average, fairly poor, and poor. We used this 5-point classification in our analyses.

2.4. Statistical Analysis

During statistical analysis, we calculated and compared relative excess risks due to the interaction (RERI) of the job stressors. First, using binary logistic regression, we calculated odds ratios (OR) for PD in relation to exposure variables alone and to their interaction terms. As advised by Knol et al. [30], we calculated the OR:s for the interaction terms by multiplying their OR:s by the interacting exposure variables. This approach works well when the outcome is rare, as $RERI_{OR}$ approximates the relative excess risk due to the interaction of risk ratios, $RERI_{RR}$. For example, in a case of two interacting exposure variables A and B,

$$\ln(\text{odds}) = \beta_0 + \beta_1 A + \beta_2 B + \beta_3 AB$$

the combined effect of A and B, compared with no effect of A and B, is [30]:

$$OR_{A+B+} = e^{\beta 1+\beta 2+\beta 3} = e^{\beta 1} \times e^{\beta 2} \times e^{\beta 3} = OR_A \times OR_B \times OR_{AB}$$

In a case of two interacting exposure variables A and B, relative excess risks due to interaction, $RERI_{OR}$, are calculated as follows [18]:

$$RERI_{OR2} = OR_{A+B+} - OR_{A+B-} - OR_{A\text{-}B+} + 1 = e^{\beta 1+\beta 2+\beta 3} - e^{\beta 1} - e^{\beta 2} + 1$$

With the analysis of three interacting variables, we followed the instructions by Katsoulis et al. [31]. In a case of three interacting exposure variables A, B, and C,

$$\ln(\text{odds}) = \beta_0 + \beta_1 A + \beta_2 B + \beta_3 C + \beta_4 AB + \beta_5 AC + \beta_6 BC + \beta_7 ABC$$

The total relative excess risk due to interaction ($TotRERI_{RR3}$, or $TotRERI_{OR3}$, when the outcome is rare) should be calculated by comparing the joint effect of the three risk factors to the situation when each one acts separately:

$$\begin{aligned} TotRERI_{OR3} &= OR_{A+B+C+} - OR_{A+B-C-} - OR_{A-B+C-} - OR_{A-B-C+} + 2 \\ &= e^{\beta 1+\beta 2+\beta 3+\beta 4+\beta 5+\beta 6+\beta 7} - e^{\beta 1} - e^{\beta 2} - e^{\beta 3} + 2 \end{aligned}$$

As the total RERI can be a result of either three- or two-way interactions, we need to calculate the effect of three-way interaction $RERI_{OR3}$ as follows:

$$\begin{aligned} RERI_{OR3} = OR_{A+B+C+} - OR_{A+B+C-} - OR_{A+B-C+} - OR_{A-B+C+} + OR_{A+B\text{-}C-} + OR_{A-B+C-} + OR_{A-B-C+} - \\ OR_{A-B-C-} = e^{\beta 1+\beta 2+\beta 3+\beta 4+\beta 5+\beta 6+\beta 7} - e^{\beta 1+\beta 2+\beta 4} - e^{\beta 1+\beta 3+\beta 5} - e^{\beta 2+\beta 3+\beta 6} + e^{\beta 1} + e^{\beta 2} + e^{\beta 3} - 1 \end{aligned}$$

The interaction of the three factors is positive or super-additive when $TotRERI_{OR3}$, $RERI_{OR3}$, or $RERI_{OR2}$ is above zero. Correspondingly, the interaction is negative or sub-additive when $TotRERI_{OR3}$, $RERI_{OR3}$, or $RERI_{OR2}$ is below zero [18].

Using the formula suggested by Katsoulis et al. [31], we created two interaction models. Model 1 investigates the interaction of high job demands, low rewards, and low social capital. We calculated first, using binary logistic regression, the main effects, and then multiplicative interaction effects of the stressors. We then calculated total RERI, two-way RERI:s, which we stratified by the third factor, and three-way RERI. In model 2, we replaced

low social capital with COVID-19 burden. Both models are adjusted for covariates. For the estimation of 95% confidence intervals, we used the delta method.

3. Results

Table 1 shows the characteristics of the respondents in the study population. Respondents were mostly women and had a socio-economic status of skilled labor. Most respondents also reported having good health. One tenth of the individual respondents reported intermediate or severe PD. 19.4% of the respondents reported having extra burden because of the COVID-19 situation.

Table 1. Characteristics of the study population (N = 9855).

	%
Sex	
Female	88.8
Male	11.2
Age	
Under 40	34.5
40–49	24.9
50–59	28.0
Over 59	12.6
Supervisors	5.8
Socio-economic status	
Skilled labour	62.2
Semi-skilled labour	34.1
Unskilled labour	3.7
Self-reported health good	74.8
Experiencing COVID-19 burden	19.4
Psychological distress	10.4

Table 2 shows the model 1 with OR:s of job stressors and of their interactions and the RERI:s for two- and three-way interactions on PD. Adjusting for age, gender, supervisory position, occupation and self-reported health status, all job stressors had alone a strong association with PD. In accordance with hypothesis 1, The total RERI was 6.27 (95% CI 3.14–9.39), suggesting a six-fold risk due to the joint presence of all stressors, compared to each stressor acting separately. The excess risk was caused by both two- and three-way interactions. The interaction between high demands and low rewards, whether in the stratum of low social capital (RERI 3.19, 95% CI 1.55–4.83) or intermediate or high social capital (RERI 3.26, 95% CI 1.13–5.39), produced a high RERI for PD. The interaction between low rewards and low social capital in the stratum of high demands was also associated with PD. Contrarily, the interaction between high demands and low social capital was significant when low rewards was absent (−1.37, 95% CI −2.69, −0.04). This indicates a sub-additive interaction, meaning that the risk of PD is lower when high demands and low social capital interact. Finally, the RERI for three-way interaction of the risk factors was 3.41 (95% CI −0.53, 7.36), indicating a strong joint effect also without the contribution of two-way interactions. The RERI for three-way interaction had, however, a relatively high *p*-value, 0.090, indicating relatively weak evidence of the effect.

Table 2. Odds ratios of high demands, low rewards, and low social capital and their production terms from a binary logistic regression analysis of psychological distress on an individual level, with indices of additive (relative excess risk due to interaction) and multiplicative interaction.

Risk Factors	N with PD/Total N	OR	95% CI	*p*-Value
high demands only	132/870	3.17	2.51, 4.00	0.000
low rewards only	117/830	2.37	1.86, 3.02	0.000
low social capital only	85/813	2.09	1.60, 2.73	0.000
Measure of interaction: multiplicative				
high demands × low rewards	113/330	1.04	0.70, 1.54	0.859
high demands × low social capital	41/273	0.44	0.27, 0.71	0.001
low rewards × low social capital	123/515	0.89	0.59, 1.33	0.579
high demands × low rewards × low social capital	140/324	1.87	0.96, 3.65	0.066
Measure of additive interaction: relative excess risk due to interaction (RERI)				
	RERI	**95% CI for RERI**		***p*-value**
$RERI_2$ (high demands × low rewards/intermediate or high social capital)	3.26	1.13, 5.39		0.003
$RERI_2$ (high demands × low social capital/intermediate or high rewards)	−1.37	−2.69, −0.04		0.043
$RERI_2$ (low rewards × low social capital/low or intermediate demands)	0.97	−0.23, 2.16		0.115
$RERI_2$ (high demands × low rewards/low social capital)	3.19	1.55, 4.83		0.000
$RERI_2$ (high demands × low social capital/low rewards)	0.86	−0.68, 2.40		0.274
$RERI_2$ (low rewards × low social capital/high demands)	1.38	0.22, 2.54		0.020
$RERI_3$ (high demands × low rewards × low social capital)	3.41	−0.53, 7.36		0.090
$TotRERI_3$ (high demands × low rewards × low social capital)	6.27	3.14, 9.39		0.000

PD = Psychological distress; OR = Odds ratio; CI = Confidence interval; RERI = Relative excess risk due to interaction; OR:s are adjusted for age, gender, supervisory position, occupation and self-reported health status.

In model 2 (Table 3), we replaced low social capital with COVID-19 burden to see whether high demands, low rewards and COVID-19 burden interact and increase the risk of PD. As in model 1, high demands and low rewards were alone strongly associated with PD, while COVID-19 burden was less so. The total RERI of the three stressors was 3.93 (95% CI 1.15, 6.72), suggesting a nearly four-fold risk due to joint presence of all stressors, compared to each stressor acting separately. However, contrary to model 1 and hypothesis 2, the excess risk was entirely caused by two-way interaction between high demands and low rewards.

Table 3. Odds ratios of high demands, low rewards, and COVID-19 burden and their production terms from a binary logistic regression analysis of psychological distress on an individual level, with indices of additive (relative excess risk due to interaction) interaction.

Risk Factors and Their Product Terms	N with PD/Total N	OR	95% CI	*p*-Value
high demands only	121/837	2.83	2.22, 3.60	0.000
low rewards only	186/1 035	2.97	2.40, 3.68	0.000
COVID-19 burden only	89/1 065	1.43	1.11, 1.85	0.006

Table 3. *Cont.*

Risk Factors and Their Product Terms	N with PD/Total N	OR	95% CI	*p*-Value
Measure of interaction: multiplicative				
high demands × low rewards	158/423	1.09	0.75, 1.57	0.689
high demands × COVID-19 burden	52/306	0.80	0.51, 1.26	0.334
low rewards × COVID-19 burden	54/310	0.66	0.43, 1.03	0.059
high demands × low rewards × COVID-19 burden	95/231	1.32	0.67, 2.60	0.397
Measure of additive interaction: relative excess risk due to interaction (RERI)				
	RERI	**95% CI for RERI**		***p*-value**
$RERI_2$ (high demands × low rewards/no COVID-19 burden)	4.34	2.15, 6.54		0.000
$RERI_2$ (high demands × COVID-19 burden/intermediate or high rewards)	−0.01	−1.24, 1.21		0.983
$RERI_2$ (low rewards × COVID-19 burden/low or intermediate demands)	−0.58	−1.66, 0.51		0.296
$RERI_2$ (high demands × low rewards/COVID-19 burden)	3.16	1.04, 5.29		0.004
$RERI_2$ (high demands × COVID-19 burden/low rewards)	0.06	−1.11, 1.22		0.924
$RERI_2$ (low rewards × COVID-19 burden/high demands)	−0.14	−1.39, 1.11		0.826
$RERI_3$ (high demands × low rewards × COVID-19 burden)	0.18	−3.50, 3.86		0.922
$TotRERI_3$ (high demands × low rewards × COVID-19 burden)	3.93	1.15, 6.72		0.006

PD = Psychological distress; OR = Odds ratio; CI = Confidence interval; RERI = Relative excess risk due to interaction; OR:s are adjusted for age, gender, supervisory position, occupation and self-reported health status.

4. Discussion

The present study examined the synergistic interaction between job stressors, finding out whether interaction is associated with psychological distress (PD) among health and social service (HSS) workers. Focusing on the additive interaction effect, we found support for our first hypothesis: the relative excess risk due to interaction (RERI) for high job demands, low rewards and low social capital was noticeable. Having the three stressors simultaneously raised the risk of having PD over six times compared to the stressors acting separately. The excess risk was caused by both two- and three-way interactions, with high job demands and low rewards producing a significant RERI regardless of workplace social capital. Adding low social capital to the interaction increased the risk: the three-way interaction produced a RERI of 3.41 (95% CI −0.53,7.36), although the evidence on the three-way interaction was rather weak (*p*-value 0.090), possibly due to limited data size.

To our knowledge, this is the first study that has examined the synergistic interaction effect of three job stressors on workers' health. Our results are in line with those of Juvani et al. [12], who found that the accumulation of several job stressors is detrimental to mental health, and Selander et al. [32], who discovered that the accumulation of several job stressors is associated with low work ability. The results of this study are also somewhat comparable to those of Choi et al. [20], who found a strong synergistic effect between job control and social support at work when job demands were low.

In the analysis of the interaction between high demands, low rewards and COVID-19 burden, we found that job demands and low rewards accounted for the total excess risk for PD. Refuting hypothesis 2 of this study, COVID-19 burden had no effect on the excess risk. The result indicates that HSS workers are under such a severe strain that COVID-19 burden poses no extra burden on them. Another possible explanation is our study measure: questions about fear for one's own health and extra workload may not have captured the essence of COVID-19 burden.

Evident limitations must be considered when generalising the results of this study. First, our data size was relatively small for examining three-way interactions. This is

a recognised challenge in interaction analyses [17]. More voluminous data would have enabled more reliable evidence on interaction effects, especially on the three-way interaction effect of high demands, low rewards, and low social capital on PD. The findings of this study should be confirmed with more data in the future. Second, the current study used cross-sectional data. We were able to analyse only the OR:s of interacting exposures and the prevalence of PD. Even though the outcome in our analysis was rare, OR:s only approximate risk ratios. Analysing the risk ratios of exposures and the incidence of PD in a longitudinal design would produce more reliable evidence of the synergistic interaction of several stressors. The unexpected sub-additive interaction effect (RERI −1.37, 95% CI −2.69, −0.04) between high demands and low social capital in the stratum of intermediate or high rewards should be examined with longitudinal analysis, for example. Third, both the exposure variables and the outcome in our study, PD, was measured with self-reported measurements, which may increase subjectivity and reporting bias [12]. However, as PD refers to symptoms of mental disorders, it identifies individuals who are under considerable stress but who can still be helped to avoid work disability due to mental disorders. Future studies are needed to investigate the effect of synergistic interaction on more severe outcomes, such as sickness absences.

Despite these limitations, this study has important implications. The results of the present study suggest that the synergistic interaction of several job stressors may increase the risk of having psychological distress, which can ultimately lead to sickness absences, more adverse mental disorders, and even work disability pension. Our results show, however, that not all stressors create a synergistic interaction. Future studies should, thus, examine which job stressors are most important in creating synergistic interaction and increasing the risk for PD. This information is needed to identify and monitor the most important psychosocial risk factors at HSS workplaces.

5. Conclusions

The results of this study emphasize the need for HSS workplaces to identify job stressors, for example, with annual well-being surveys and to support the health and work ability of individuals who are under risk of accumulating job stressors. Interventions that decrease the excess risk of interacting job stressors are also needed. Following the argument of Tsai and Venkataramani [14], the findings of this study suggest that interventions tackling high demands, low rewards, and low social capital could decrease PD in isolation. They would, however, have a greater preventive impact if the intervention would address all stressors jointly. Organizational workplace interventions which tackle job stressors and promote better workplace social capital are seldom studied; instead, intervention studies usually focus on the individual level, for example, through the use of stress coping skills and mental relaxation [33]. Organizational-level interventions are urgently needed in the future to maintain HSS workers' mental health and work ability, and to attract new personnel into HSS.

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Data Availability Statement: Data are available upon reasonable request. The deidentified data and statistical analysis code that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to legislative restrictions, as the data contains information that could compromise the privacy of the research participants.

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Systematic Review

Are Organizational Interventions Effective in Protecting Healthcare Worker Mental Health during Epidemics/Pandemics? A Systematic Literature Review

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Abstract: It is unclear how to effectively protect healthcare workers' mental health during infectious disease epidemics. Targeting the occupational determinants of stress may hold more promise than individual stress management, which has received more focus. Through a systematic review of the 2000–2021 English- and French-language scientific literature, we evaluated the effectiveness of organizational and psychosocial work environment interventions to protect healthcare workers' mental health in an epidemic/pandemic context. Evidence from medium- and high-quality studies was synthesized using GRADE. Among 1604 unique search results, 41 studies were deemed relevant, yielding 34 low-quality and seven medium-quality studies. The latter reported on promising multi-component prevention programs that combined staffing adjustments, work shift arrangements, enhanced infection prevention and control, recognition of workers' efforts, psychological and/or logistic support during lockdowns (e.g., accommodation). Our confidence in the effectiveness of reviewed interventions is low to very low, however, owing to methodological limitations. We highlight gaps in the reporting of intervention process and context elements and discuss theory and implementation failure as possible explanations for results. We conclude by urging authors of future studies to include and document detailed risk assessments of the work environment, involve workers in solution design and implementation and consider how this process can be adapted during an emergency.

Keywords: effectiveness evaluation; health and social services worker; infectious disease; pandemic; psychological health; psychosocial work environment; occupational determinants of stress

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1. Introduction

The healthcare workforce experiences a substantial burden of ill mental health, burnout and turnover [1–5] and an increased burden of mental health symptoms and problems during epidemic and pandemic health emergencies, such as the COVID-19 pandemic [6,7]. The exacerbation of already suboptimal working conditions, including high demands and inadequate staffing [1,3,5,8], compounded by specific workplace stressors associated with epidemics or pandemics, seem to contribute to this burden. These stressors include lack of personal protective equipment (PPE), involuntary deployment, reassignment to unfamiliar teams and tasks, increased work-family conflict related to school and daycare closures and the experience of moral dilemmas when caring for infected patients while risking one's own health and that of one's family and when having to decrease the quality of care due to resource constraints [6–13].

It has been suggested that 44% of hospital turnover could be prevented through hypothetical improvements in the psychosocial work environment [14]. In their meta-analysis, Panagioti and colleagues [15] showed that organization-directed compared to person-directed interventions were more effective in protecting physicians against burnout. Evidence on the effectiveness of work environment interventions in protecting healthcare workers' mental health in an epidemic or pandemic context is limited. As Muller et al. [16] stated in their COVID-19 rapid review, there is "a mismatch between the likely organizational sources of psychological distress [. . .] and how healthcare systems are attempting to relieve distress at an individual level." A mixed-methods review on interventions (not limited to organizational interventions) covering the period 2002 to 28 May 2020, identified only one study reporting on the effectiveness of workplace-delivered psychological first aid training to frontline healthcare staff to assist the Sierra Leone population after the Ebola outbreak (non-randomized studies were excluded from that review) [17]. Soklaridis et al. [18], covering studies on mental health interventions during epidemics published between 2003 and 31 July 2020, reported mainly on individual-level behavioral interventions (e.g., cognitive behavioral therapy (CBT), music therapy] and on a single organizational intervention among health professionals that has been captured in the present review [19]. The systematic review by Zace et al. [20] covering mental health intervention studies published up to 2 October 2020 included studies that either did not report on effectiveness with respect to a mental health outcome and/or were not directed at the work environment. It is also useful to search for relevant literature published since the aforementioned reviews.

Our goal was to conduct a systematic review of the scientific literature in order to answer the following research question: compared to usual work (i.e., no intervention), what is the effectiveness of organizational and psychosocial work environment interventions in protecting healthcare workers' mental health in an infectious disease epidemic/pandemic context? By work organization, we refer to the way in which work is designed and performed, including the nature and distribution of work tasks, production methods, work pace, management, scheduling, remuneration, and training practices and policies [21]. The psychosocial work environment results from the interplay between the working conditions, work organization, management practices and social relations at work. It refers to, among others, the intensity of physical, emotional and cognitive work demands (e.g., excessive workload, time constraints), the level of control over one's own work, the possibility for skill development and creativity at work, emotional and practical support from supervisors and colleagues, recognition of worker efforts (e.g., in the form of job security, respect, promotion prospects and salary), work-life balance and workplace harassment and violence [22–29]. In this review, we include workplace interventions targeting work organization or any of the aforementioned elements of the psychosocial work environment in order to protect mental health. We also include organizational interventions targeting the epidemic-causing biological hazard to protect mental health, for example through infection prevention and control (IPC) protocols and training. The fear of infection may be a risk factor for mental health problems in healthcare personnel during epidemics [6] and mitigating the biological risk could therefore be protective. Moreover, men and women may have different physical and psychosocial work exposures, thus different intervention needs (e.g., daycare closures during lockdowns may impact work-family balance differently for female compared to male healthcare staff). We therefore also examined whether such considerations were present in the analyzed studies, either in the study theoretical framework (e.g., introduction) or during data collection, analysis or interpretation.

2. Materials and Methods

This review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [30]. The review was not registered. The review protocol (in French) can be obtained upon request from the authors.

2.1. Literature Search

We searched for English- and French-language peer-reviewed scientific studies published between 1 January 2000, and 9 September 2021, in nine electronic databases: Medline, Excerpta Medica Database (Embase), EBM reviews/Cochrane Library, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, SocINDEX, Psychology and Behavioral Sciences Collection, Business Source Premier and Social Science Abstracts (access to the latter two databases was available to us until 22 December 2020). In addition, we manually searched the reference lists of eligible studies and reviews. The search strategy was developed with the help of a librarian and combined natural language and database-specific terms using Boolean logic and proximity operators. Terms referred to four broad concepts: (1) mental health problems, (2) organizational or psychosocial work environment interventions, (3) effectiveness evaluation and (4) epidemic/pandemic. A detailed search strategy for Medline is provided in Appendix A, Table A1.

2.2. Study Eligibility and Exclusion

Eligible studies were epidemiologic studies reporting on an organizational or psychosocial work environment intervention to protect the mental health of healthcare workers (including managers, team leaders, and heads of health and social services establishments) in an infectious disease epidemic or pandemic context (e.g., COVID-19, severe acute respiratory syndrome (SARS), middle east respiratory syndrome (MERS), influenza, H1N1 flu, Zika virus disease, Ebola virus disease), that reported on the effectiveness of the intervention on a mental health outcome or psychosocial work environment indicator. Most often, the effects of the solutions or measures generated by the intervention process are reported and quantified in epidemiological evaluation studies. We therefore also included studies that reported on associations between preventive measures and mental health or work exposure indicators, even if an intervention *per se* had not been described. We penalized such studies during methodologic quality assessment for insufficient information on contextual and implementation elements. Moreover, given the challenges associated with conducting and evaluating complex system-level interventions in dynamic work settings and the anticipated paucity of randomized trials in work environment research [31,32], especially in an epidemic context, we also included observational study designs, though these were penalized during quality assessment. We excluded studies focusing solely on individual-level stress management interventions that did not make changes to the work environment (e.g., CBT, mindfulness training, fitness programs).

Search results were exported to Zotero, and duplicates were removed. Two authors independently screened records against the selection criteria, first by reading the title and abstract, then the full text of records initially retained. Disagreements were resolved through discussion to reach consensus, and when necessary, through decision by a third author.

2.3. Methodologic Quality Assessment of Individual Studies

We evaluated the methodologic quality of selected studies with the 15-item instrument used by Stock et al. [33] and adapted to the current study. The instrument addresses various sources of bias related to study design, selection, attrition, measurement and confounding, and includes workplace intervention-specific items pertaining to implementation, co-interventions and contextual factors (Appendix A, Table A2). Scores range from 0 to 2 points at the item level for a maximum study score of 30 points. Total study scores were converted to percentages and study quality was categorized as low (0–50%), medium (51–79%) or high (80–100%). To promote inter-rater reliability, item interpretation was tested on two studies and discussed prior to independent critical appraisal of the remaining studies by two authors. Consensus was sought at the item and study level. Only studies of at least medium quality were retained for data extraction and analysis.

2.4. Data Extraction and Analysis

The following information was extracted by one author from studies of sufficient quality, and confirmed by a second author: country of research, study design, sample size, participant characteristics [sex (biological attribute) and/or gender (encompasses socio-culturally-shaped attitudes, behaviours and roles), occupation], participation and drop-out rate, intervention content, implementation, duration and timing of follow-up, mental health indicators, indicators of exposure to the epidemic-causing pathogen and to elements of the psychosocial work environment, confounding variables, co-interventions and contextual factors considered, statistical analysis and effect of the intervention on the mental health and/or work exposure indicators (e.g., the difference in prevalence or in mean score). We contacted the authors of three studies for clarifications (Supplementary Table S1). It was not possible to pool results for meta-analysis due to heterogeneous interventions (in content and duration) and outcomes across the few studies of sufficient quality that were retained for analysis.

2.5. Evidence Synthesis

For each outcome measure reported in the studies for a given intervention, the quality of the evidence on effectiveness was assessed as high, moderate, low or very low, reflecting our level of confidence in effect estimates, according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. Randomized trials provide initially high-quality evidence in GRADE that can be rated down by one or two levels if there is a risk or serious risk of bias (methodologic limitations), inconsistency, indirectness, imprecision or publication bias. Observational studies provide initially low-quality evidence, but in the absence of methodologic limitations, can be rated up if there are large effects across studies, for example [34–41].

3. Results

3.1. Identification and Selection of Studies

Figure 1 presents the number of identified and selected studies. The search produced 1604 unique records, of which 1530 were excluded based on their title and abstract, and 74 retained for further assessment of their full text. Of these, we excluded 33 not meeting selection criteria, leaving 41 studies that were assessed for methodologic quality.

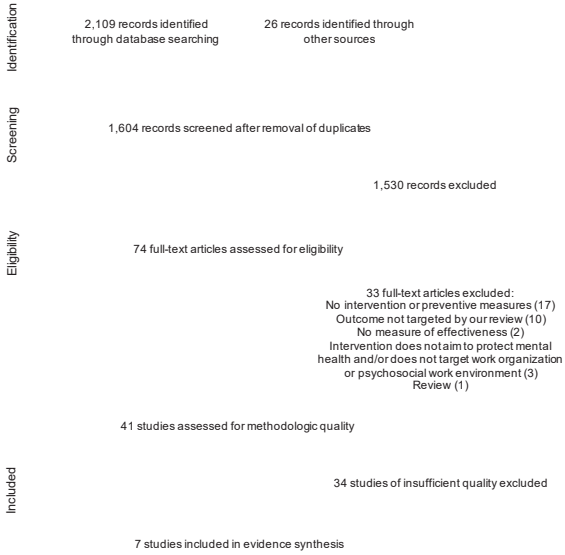

Figure 1. PRISMA flowchart detailing the identification and selection of studies.

3.2. Methodologic Quality of Individual Studies

The methodologic quality assessment gave rise to 34 low-quality and seven medium-quality studies (Table 1). Overall, studies performed poorly on item 2 (lack of a control group), items 4 and 5 (relevant work exposures not measured and inappropriate indicators), item 9 (undocumented or low participation rate at recruitment), items 10 and 11 (undocumented or important loss to follow-up without a comparison of study "completers" and "drop-outs"; these two items were also used to penalize for cross-sectional designs), item 12 (undocumented implementation of targeted changes or none/few changes implemented) and item 14 (co-interventions and contextual changes not documented or few were documented or considered in analysis or result interpretation).

3.3. Description of Analyzed Studies and Interventions

A description of the seven studies retained for data extraction and analysis is presented in Supplementary Table S1. Five studies were conducted during the COVID-19 pandemic [42–46], two in the context of SARS [19,47]. Studies were from Canada [47], the United Kingdom [43], Italy [44,45], Spain [42], China [46] and Taiwan [19]. Study designs included a controlled prospective cohort study [42], three before-after uncontrolled studies [19,44,45] and three cross-sectional studies [43,46,47]. Samples were predominantly female (at least 85% in five studies) and included mainly nursing professionals (>65% in four studies) in hospital settings. The seven studies collected information on sex or gender through online questionnaire, offering the categories male and female (though these were not defined), and one study reported an additional non-binary/gender fluid category [43]. One or more mental health outcomes were measured in the studies, including but not limited to anxiety, depression and post-traumatic stress, and related outcomes, such as sleep quality, intention to quit and presenteeism.

Table 1. Methodologic quality of individual studies.

Studies	Items [1]															Study Score		Study Quality [2]
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	/30	%	
Zaghini et al. 2021 [45]	2	0	2	2	1.5	2	1.5	2	2	2	2	1.5	1	0	1	22.5	75.0	M
Giordano et al. 2021 [44]	2	0	1.5	1.5	1.5	2	1	2	0	2	2	2	0.5	0	1	19.0	63.3	M
Chen et al. 2006 [19]	2	0	1.5	1	0	2	1.5	2	0	2	2	1	1.5	0	1	17.5	58.3	M
Maunder et al. 2006 [47]	2	1	2	1	1	1	2	2	1.5	0	0	0.5	1.5	0	2	17.5	58.3	M
Zhu et al. 2020 [46]	2	1	1.5	1	0.5	1	1.5	1	2	0	0	1.5	2	0.5	1.5	17.0	56.7	M
Beneria et al. 2020 [42]	2	1	1	1	1	1	1	2	1	0.5	0	2	1	0.5	0.5	15.5	51.7	M
Blake et al. 2020 [43]	2	1	1	1	0.5	1	1.5	2	0.5	0	0	2	1	1	1	15.5	51.7	M
Chen et al. 2021	2	0	1.5	1	1.5	1	1.5	0.5	0.5	0	0	0.5	2	1	2	15.0	50.0	L
Cyr et al. 2021	2	1	2	1	1	1	1.5	1	0	0	0	0.5	2	0.5	1.5	15.0	50.0	L
Smith et al. 2020	2	1	1.5	1	1	1	1.5	0.5	0.5	0	0	0.5	1.5	1	2	15.0	50.0	L
Arnetz et al. 2020	2	1	1	1	1	1	2	1	0.5	0	0	0.5	1.5	0	2	14.5	48.3	L
Lancee et al. 2008	2	0	1	1	1	1	2	2	1.5	0	0	0.5	1	0	1.5	14.5	48.3	L
Xu et al. 2021	2	0	1	0.5	0.5	2	1.5	1	1	1	0	2	0	0	1.5	14.0	46.7	L
Tam et al. 2004	2	1	1.5	1	0.5	1	1.5	2	0	0	0	0.5	1	0	2	14.0	46.7	L
Lasalvia et al. 2021	2	1	2	1	1	1	1.5	1.5	0	0	0	0.5	1	0	1	13.5	45.0	L
Castro-Sanchez et al. 2020	2	1	1	1	0.5	1	0	2	0	0	0	2	1	0.5	1.5	13.5	45.0	L
Zhan et al. 2020	2	1	1.5	1	1	1	1.5	0	0	0	0	0	1.5	1.5	1.5	13.5	45.0	L
Hennein et al. 2021	2	0	2	1	1	1	1.5	1	0	0	0	0.5	2	0	1	13.0	43.3	L
Sharma et al. 2021	2	1	1.5	1	1	2	2	0	0	0	0	0.5	1	0	1	13.0	43.3	L
Huang et al. 2020	2	1	1	1	1	1	1.5	1	0	0	0	0.5	2	0	1	13.0	43.3	L
Chan and Huak 2004	2	0	0.5	0.5	1	1	1.5	1.5	1	0	0	0	1	1	2	13.0	43.3	L
Matsuishi et al. 2012	2	0	1.5	1	0.5	1	1.5	2	0	0	0	0.5	1	0	2	13.0	43.3	L
Fiksenbaum et al. 2006	2	0	1	1	1	1	2	2	0	0	0	0	0.5	0	2	12.5	41.7	L
Marjanovic et al. 2007	2	0	1	1	1	1	2	2	0	0	0	0	0.5	0	2	12.5	41.7	L
Petrella et al. 2021	2	1	1	0	0	1	1.5	1	0	0	0	1.5	1.5	0	1.5	12.0	40.0	L
Esmaeilzadeh et al. 2021	2	0	1.5	1	1	1	1	1	1	0	0	0.5	1	0.5	0.5	12.0	40.0	L
Holton et al. 2020	2	0	1	1	0.5	1	2	0.5	0.5	0	0	0	1	1	1.5	12.0	40.0	L
Kim and Choi 2016	2	0	1.5	1	0.5	1	1.5	1.5	0	0	0	0	1	0	2	12.0	40.0	L
Kase et al. 2021	2	1	1	1	1	1	1.5	0	0	0	0	0.5	1.5	0	1	11.5	38.3	L
Young et al. 2021	2	1	1	0	0	1	1.5	1	0	0	0	0.5	1.5	0	2	11.5	38.3	L
Morgantini et al. 2020	2	1	1	1	1	1	1	0.5	0	0	0	0.5	1	0	1.5	11.5	38.3	L
Demirjian et al. 2020	2	1	1.5	1	0.5	1	1	1	0	0	0	0	1	0	1.5	11.5	38.3	L
Durmaz Engin et al. 2021	2	0	1	1	1	1	1.5	1	0	0	0	0.5	1	0	1	11.0	36.7	L
Buch et al. 2021	2	0	1	1	0	1	1	2	0.5	0	0	1.5	0	0	0.5	10.5	35.0	L
Shalhub et al. 2020	2	0	1	1	1	1	1.5	0	0	0	0	0.5	0.5	0	1.5	10.0	33.3	L
Martinez-Caballero et al. 2021	2	0	1	0	0	1	1.5	1	0	0	0	1	1	0	1	9.5	31.7	L
Temsah et al. 2021	2	1	0.5	0	0	1	1	0	0	0	0	0.5	1.5	0	2	9.5	31.7	L
Zhang et al. 2020	1.5	0	1.5	1	0	1	1.5	1	0	0	0	0	1	0	1	9.5	31.7	L
Cai et al. 2020	2	0	0.5	0.5	0	1	0	1	1	0	0	1	0	0.5	0.5	8.0	26.7	L
Huffman et al. 2020	2	0	0.5	1	0.5	1	0	0.5	0	0	0	0	1	1	0	7.5	25.0	L
Reidy et al. 2020	2	0	0.5	1	0	1	0	1	0	0	0	1	0.5	0	0.5	7.5	25.0	L

[1] The 15 quality assessment items refer to those presented in Table A2. [2] M: medium; L: low. The complete references for low-quality studies are available upon request to the authors.

Interventions were described in six studies. Authors of the seventh study [47] reported the association between perceived adequacy of training, protection and support measures and mental health outcomes, but did not describe an intervention *per se*. Intervention content and duration varied. Blake et al. [43] described the implementation and usage of wellbeing centers over approximately four months. The centers consisted of one purpose-built room and one converted hospital ward equipped with staff ('wellbeing buddies') trained to offer psychological first aid to personnel of an acute hospital trust (listening, comforting and directing towards services, as needed). Wellbeing buddies were employees with a reduced workload because of the pandemic, who volunteered for the role and received training and supervision by two clinical psychologists. Beneria et al. [42] described a 25-h simulation-based teamwork training program aimed at developing leadership and communication skills required in a crisis. The study by Giordano et al. [44] reported on the "R2 for Leaders" resilience training program consisting of 12 virtual two-hour weekly sessions over three months. It was intended to equip healthcare leaders to better lead their staff and their organization through the identification and implementation of individual-level as well as organizational prevention programs (details in Supplementary Table S1).

Three studies described multi-component programs combining slightly different preventive measures, lasting approximately two weeks [46], three months [19] and four months [45]. The two-week program reported by Zhu et al. [46] was initiated by hospital management at Wuhan's largest tertiary hospital designated for the treatment of severe COVID-19 patients. It included several measures targeting workplace recognition, such as additional allowances for frontline staff, verbal recognition and reassurance by hospital executives, nursing leaders and department chairs, and acknowledging staff's infections as work injuries. Measures to protect against nosocomial infection included the use of PPE in all departments, regardless of the presence of infected patients. The program also included what authors referred to as "reasonable" work shift arrangements, workplace meals and hydration, and the arrangement by hospital administrators of shuttle services, hotel rooms and dormitories when public transport was suspended by authorities, to reduce the staff's fear of infecting their family. A virtual support group led by the hospital psychiatry team was also organized, though used by only 5% of the staff, perhaps due to workers' concerns over confidentiality or stigmatization, as hypothesized by the authors.

In the study by Zaghini et al. [45], an Italian university hospital proactively started to prepare for the arrival of the pandemic in order to manage its impacts on the nursing staff. The hospital reorganized its wards (e.g., increasing intensive care beds), procedures (e.g., cleaning and disinfection) and internal paths to separate infected from uninfected patients. Nurse-to-patient ratios were increased, from 1:9 to 1:6 in COVID units of medium-intensity care and from 1:4 to 1:2 in high-intensity care units, maintaining these ratios over 24 h. Nurses were provided with training on the correct use of PPE and were monitored for infection through COVID-19 testing. A psychological help desk was established, available to staff every day on-site and remotely. The hospital promoted a participatory approach and autonomy, for example, through meetings where nurses could discuss the care of critical cases with other healthcare professionals. In focus groups, nurses expressed a greater sense of autonomy, with statements such as "doctors and managers had never asked us our opinion on how to perform a certain intervention on a patient, but in the SARS-CoV-2 context, they did!" and "suddenly we were autonomous professionals in a process that was unfamiliar to everyone; they asked us for opinions and gave us the opportunity to experiment with solutions that we found independently".

The three-month program described by Chen and colleagues [19] was initiated by a SARS-designated treatment hospital in Taiwan. It comprised limiting the workday to eight hours to prevent fatigue, adjusting staffing levels according to the number of admitted SARS patients, alternating the units that treated SARS patients on a weekly basis, daily information updates to workers, availability of immune-boosting supplements to nursing staff, availability of PPE, a variety of IPC measures, protocols and in-service

training (53 classes) for the handling of SARS patients and the correct use of PPE, and the availability of a multidisciplinary mental health team and clinic for workers.

The effects of the interventions were analyzed in combined samples of men and women in the seven studies. Three of the studies adjusted regression analyses for the sex variable [42,46,47]. One study additionally carried out stratified analyses in men and women separately [46], yielding slightly different intervention effects (details in Supplementary Table S1). Namely, in women, most measures seemed protective (recognition measures, satisfaction with reasonable work shift arrangements and with logistic support, i.e., workplace-provided meals, transportation and accommodations), whereas the only factor that appeared to be protective in men was satisfaction with IPC measures. These findings were reported as supplementary material, but not addressed in the main paper, besides the brief mention in the discussion of "entrenched traditional social roles in China" leading to dilemmas for women "between working and family care and between the family care and avoidance of contact with family members" [46]. Stratified analyses were not possible for most studies because of the small number of men in the samples. Sex and gender considerations were absent in the theoretical framework of the studies and absent [19,43–45,47] or minimal [42,46] in result interpretation.

3.4. Quality of the Evidence on Intervention Effectiveness

Table 2 summarizes the quality of the evidence on intervention effectiveness for each outcome measure reported in the studies. The aforementioned multi-component prevention programs appear to be protective, reducing, for example, the likelihood or level of anxiety and depression [19,46] or improving the quality of the psychosocial work environment or of some of its dimensions like job control, managerial and peer support and the quality of relationships at work [45]. However, our confidence in the effectiveness of these and other reviewed interventions is low to very low owing to the observational study designs and serious risks of selection and confounding bias. Notably, most studies failed to describe the intervention process and implementation as well as context elements that may influence intervention effectiveness [48] (Table 2 and Supplementary Table S1).

Table 2. Summary of intervention effects on mental health or psychosocial work exposure indicators and quality of the evidence on intervention effectiveness according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

Intervention [1]	Intervention Effect [1] on Mental Health or Psychosocial Work Exposure Indicators	Quality of the Evidence [2] on Intervention Effectiveness and Justification of Rating
Simulation-based teamwork training program (25 h) (Beneria et al. 2020) [42]	↑ **likelihood of anxiety and depression** (HADS > 12) post-program in workers having had contact with COVID-19 patients: AOR 2.56, 95% CI: 1.03–6.36; $p = 0.043$. AOR not reported for all workers who received the training program or for those who received it but had had no contact with COVID-19 patients.	**Very low** Observational design, serious risks of selection and confounding bias (48% participation rate for control group, important confounders omitted, i.e., history of mental illness, psychosocial work exposures)
Wellbeing centers supported by wellbeing buddies (4–5 months) (Blake et al. 2020) [43]	↑ **mental wellbeing** of 1.93 points on WEMWBS scale that ranges from 14 to 70 points: mean WEMWBS score (SD) is 47.04 (9.49) for center users and 45.11 (9.35) for non-users; $p = 0.02$ ↑ **work engagement** of 0.19 points on dedication subscale of UWES-9 ranging from 0 to 6 points: mean score (SD) is 5.02 (1.38) for center users and 4.83 (1.15) for non-users; $p = 0.08$ ≠ **% presenteeism past 12 months** among center users vs. non-users: no, never: 16.31 vs. 14.97 yes, once: 17.05 vs. 12.76 yes, 2 to 5 times: 16.92 vs. 12.64 yes, >5 times: 4.53 vs. 4.41 $p = 0.28$ ≠ **% with intention to quit** among center users (16.31%) and non-users (15.09%); $p = 0.25$	**Very low** Observational design, serious risks of selection and confounding bias (<5% participation rate, confounding factors not considered in analysis) **Very low** Observational design, serious risks of selection and confounding bias (<5% participation rate, confounding factors not considered in analysis) **Very low** Observational design, serious risks of selection and confounding bias (<5% participation rate, confounding factors not considered in analysis) **Very low** Observational design, serious risks of selection and confounding bias (<5% participation rate, confounding factors not considered in analysis)

Table 2. *Cont.*

Intervention [1]	Intervention Effect [1] on Mental Health or Psychosocial Work Exposure Indicators	Quality of the Evidence [2] on Intervention Effectiveness and Justification of Rating
Multi-component SARS prevention program: scheduling and staffing adjustments, IPC measures and protocols, latest PPE, daily information, training, mental health team and clinic for workers (3 months) (Chen et al. 2006) [19]	↓ **anxiety level** from moderate before SARS patient care (T0) to mild two weeks (T1) and one month (T2) under prevention program to no anxiety at final time point (T3), Zung's self-rating anxiety scale: Mean anxiety score (SD) • T0: 60 (9.28) • T1: 51 (10.32) • T2: 50 (9.84) • T3: 46 (7.48) Change (improvement) ○ T0 vs. T1: $Z = -2.68$; $p = 0.0075$ ○ T0 vs. T2: $Z = -4.45$; $p < 0.0001$ ○ T0 vs. T3: $Z = -6.58$; $p < 0.0001$	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, unclear if all measured covariables were included in models, other potential confounders not measured, i.e., program compliance, medication use for anxiety, work exposures, e.g., changing work schedules mentioned in discussion, other factors outside work)
	↓ **depression level** from moderate before SARS patient care (T0) to mild two weeks (T1) and one month (T2) under prevention program to no depression at final time point (T3), Zung's self-rating depression scale: Mean depression score (SD) • T0: 61 (12.62) • T1: 51 (11.94) • T2: 50 (10.60) • T3: 48 (10.76) Change (improvement) ○ T0 vs. T1: $Z = -4.58$; $p < 0.0001$ ○ T0 vs. T2: $Z = -4.80$; $p < 0.0001$ ○ T0 vs. T3: $Z = -6.37$; $p < 0.0001$	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, unclear if all measured covariables were included in models, other potential confounders not measured, i.e., program compliance, medication use for depression, work exposures, e.g., changing work schedules mentioned in discussion, other factors outside work)
	↑ **sleep quality** under prevention program, but sleep quality remains poor, i.e., PSQI > 5, at all time points Mean sleep quality score (SD) • T0: 12 (3.83) • T1: 10 (3.43) • T2: 10 (3.77) • T3: 8 (2.75) Change (improvement) ○ T0 vs. T1: $Z = -2.79$; $p = 0.0053$ ○ T0 vs. T2: $Z = -3.14$; $p = 0.0017$ ○ T0 vs. T3: $Z = -3.37$; $p = 0.0008$	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, unclear if all measured covariables were included in models, other potential confounders not measured, i.e., program compliance, work exposures, e.g., changing work schedules mentioned in discussion, other factors outside work)
Multi-component COVID-19 prevention program: recognition measures (2 weeks) (Zhu et al. 2020) [46]	Recognition measures are associated with **24%** ↓ **likelihood of anxiety** (GAD-7 $\geq$ 8) compared to not having received recognition measures: AOR (95% CI): 0.76 (0.60–0.97); $p = 0.03$	**Low** Observational design
	Recognition measures are associated with **31%** ↓ **likelihood of depression** (PHQ-9 $\geq$ 10) compared to not having received recognition measures: AOR (95% CI): 0.69 (0.52–0.90); $p = 0.007$	**Low** Observational design
	Recognition measures are associated with **24%** ↓ **likelihood of acute stress** in the past 7 days caused by a traumatic event, COVID-19 being the specific event (IES-R > 33), compared to not having received recognition measures: AOR (95% CI): 0.76 (0.60–0.97); $p = 0.024$	**Low** Observational design

Table 2. *Cont.*

Intervention [1]	Intervention Effect [1] on Mental Health or Psychosocial Work Exposure Indicators	Quality of the Evidence [2] on Intervention Effectiveness and Justification of Rating
Multi-component COVID-19 prevention program: satisfaction with IPC measures (2 weeks) (Zhu et al. 2020) [46]	Satisfaction with IPC measures is associated with **35% ↓ likelihood of anxiety** (GAD-7 ≥ 8) compared to not being satisfied: AOR (95% CI): 0.65 (0.50–0.85); $p = 0.002$	**Low** Observational design
	Satisfaction with IPC measures is associated with **30% ↓ likelihood of depression** (PHQ-9 ≥ 10) compared to not being satisfied: AOR (95% CI): 0.70 (0.51–0.95); $p = 0.02$	**Low** Observational design
	Satisfaction with IPC measures is associated with **31% ↓ likelihood of acute stress** in the past 7 days caused by a traumatic event, COVID-19 being the specific event (IES-R > 33) compared to not being satisfied: AOR (95% CI): 0.69 (0.53–0.89); $p = 0.004$	**Low** Observational design
Multi-component COVID-19 prevention program: satisfaction with logistic support (shuttle service, meals/hydration and accommodation) (2 weeks) (Zhu et al. 2020) [46]	Satisfaction with logistic support is associated with **31% ↓ likelihood of anxiety** (GAD-7 ≥ 8) compared to not being satisfied: AOR (95% CI): 0.69 (0.50–0.96); $p = 0.03$	**Low** Observational design
	Satisfaction with logistic support is associated with **33% ↓ likelihood of depression** (PHQ-9 ≥ 10) compared to not being satisfied: AOR (95% CI): 0.67 (0.47–0.97); $p = 0.03$	**Low** Observational design
	Effect of satisfaction with logistic support on likelihood of acute stress in the past 7 days caused by a traumatic event, COVID-19 being the specific event (IES-R > 33), **not reported** because not significant in univariate analysis	**Low** Observational design
Multi-component COVID-19 prevention program: satisfaction with work shift arrangements (2 weeks) (Zhu et al. 2020) [46]	Effect of satisfaction with work shift arrangements on likelihood of anxiety **not reported** because not significant in univariate analysis	**Low** Observational design
	Satisfaction with work shift arrangements is associated with **52% ↓ likelihood of depression** (PHQ-9 ≥ 10) compared to not being satisfied: AOR (95% CI): 0.48 (0.34–0.67); $p < 0.001$	**Low** Observational design
	Satisfaction with work shift arrangements is associated with **55% ↓ likelihood of acute stress** in the past 7 days caused by a traumatic event, COVID-19 being the specific event (IES-R > 33), compared to not being satisfied: AOR (95% CI): 0.45 (0.33–0.63); $p < 0.001$	**Low** Observational design
"R2 for Leaders" resilience training program intended to equip healthcare leaders to better lead their staff and organization by identifying and implementing individual resilience and organization-level prevention programs (12 virtual 2-h weekly sessions over 3 months) (Giordano et al. 2021) [44]	**↓ emotional exhaustion level in healthcare leaders** post-program: mean MBI-EE score (SD): T1: 6.31 (1.35) vs. T2: 5.37 (1.20); $p = 0.020$; Hedge's g (corrected Cohen's *d* for small samples < 50) = −0.30	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, potential confounders not considered in analyses), potentially inadequate power
	≠ emotional exhaustion level in staff post-program (no clinically or statistically significant difference): mean MBI-EE score (SD): T1: 4.70 (1.63) vs. T2: 4.35 (1.64); $p = 0.098$	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, potential confounders not considered in analyses), potentially inadequate power
	≠ quality of leaders' psychosocial work environment post-program: mean HSE-MSIT score (SD) on scale of 22 to 110: T1: 50.50 (15.33) vs. T2: 50.56 (15.17); $p = 0.966$	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, potential confounders not considered in analyses), potentially inadequate power
	↑ quality of staff's psychosocial work environment post-program: mean HSE-MSIT score (SD) on scale of 22 to 110: T1: 50.18 (10.56) vs. T2: 46.93 (10.75); $p = 0.028$; Cohen's d = −0.29	**Very low** Observational design, serious risks of selection and confounding bias (participation rate ND, potential confounders not considered in analyses), potentially inadequate power

Table 2. *Cont.*

Intervention [1]	Intervention Effect [1] on Mental Health or Psychosocial Work Exposure Indicators	Quality of the Evidence [2] on Intervention Effectiveness and Justification of Rating
Multi-component COVID-19 prevention program: reorganized wards (e.g., increased ICU beds), procedures (e.g., cleaning and disinfection) and internal paths, increased nurse-to-patient ratios in COVID units, PPE training, other training, promoted participatory approach, autonomy and conscientiousness through continuous clinical and organizational audits, lectures, workshops and meetings, psychological help desk for staff, staff COVID-19 testing (4 months) (Zaghini et al. 2021) [45]	≠ **quality of emotional life** post-program: mean score on emotional subscale of NQoL-SAT-P (SD) that ranges from 1 to 4: T0: 3.13 (.49) vs. T1: 3.16 (.52); $p = 0.334$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	↑ **quality of the psychosocial work environment** post-program: mean HSE-MSIT score (SD) on scale of 1 to 5: T0: 2.46 (0.40) vs. T1: 2.32 (0.50); $p < 0.001$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	≠ **work demands** (workload, time pressure) post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 2.81 (0.48) vs. T1: 2.79 (0.58); $p = 0.601$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	↑ **job control** post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 2.76 (0.67) vs. T1: 2.65 (0.65); $p = 0.020$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	↑ **managerial support** post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 2.34 (0.88) vs. T1: 2.17 (0.98); $p = 0.020$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	↑ **peer support** post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 2.12 (0.67) vs. T1: 1.93 (0.69); $p = 0.001$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	↑ **quality of relationships at work** (harassment, tension, bullying) post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 2.23 (0.88) vs. T1: 2.04 (0.68); $p = 0.001$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	≠ **role clarity at work** post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 1.71 (0.52) vs. T1: 1.69 (0.60); $p = 0.798$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
	Improvement in how organizational change is managed and communicated at work post-program: mean HSE-MSIT subscale score (SD) on scale of 1 to 5: T0: 2.98 (0.49) vs. T1: 2.46 (0.79); $p < 0.001$	**Low** Observational design, risk of confounding bias (several potential confounders ND (i.e., level of adherence to the intervention) or not integrated in analyses (i.e., age, having children))
Study reporting on the association between perception of adequate PPE, training and support and mental health indicators 13–25 months after SARS outbreak (no intervention described *per se*) (Maunder et al. 2006) [47]	**20% ↓ likelihood of post-traumatic stress** (IES-R $\geq$ 26) post-outbreak, multivariate logistic regression model: $\beta = -0.22$; $p = 0.01$	**Low** Observational design
	24% ↓ likelihood of emotional exhaustion (MBI-EE $\geq$ 27) post-outbreak, multivariate logistic regression model: $\beta = -0.27$; $p = 0.002$	**Low** Observational design
	Likelihood of psychological distress (K10 $\geq$ 16) **not reported** because the "Training, protection and support" indicator was not significant in univariate models	**Low** Observational design

[1] Detailed descriptions of intervention content and effectiveness are provided in Supplementary Table S1. [2] Low: our level of confidence in effect estimates is low, the true effect could be very different from that estimated in the studies; very low: our level of confidence in effect estimates is very low, the true effect is probably very different from that estimated in the studies. ↑ higher; ↓ lower; ≠ no change. AOR: adjusted odds ratio; CI: confidence interval; GAD: Generalized Anxiety Disorder; HADS: Hospital Anxiety and Depression Scale; HSE-MSIT: health and safety executive management standards indicator tool; ICU: intensive care unit; IES-R: impact of event scale-revised; IPC: infection prevention and control; K10: Kessler 10-item psychological distress scale; MBI-EE: Maslach burnout inventory—emotional exhaustion subscale; ND: not documented; NQoL-SAT-P: Nurses Quality of Life Scale—Satisfaction Profile; PHQ-9: Patient Health Questionnaire; PPE: personal protective equipment; PSQI: Pittsburgh sleep quality index; SARS: severe acute respiratory syndrome; SD: standard deviation; UWES-9: Utrecht Work Engagement scale; WEMWBS: Warwick—Edinburgh Mental Wellbeing Scale

4. Discussion

Based on a rather small number of studies, we found low- to very low-quality evidence on the effectiveness or ineffectiveness of the reviewed organizational or psychosocial work environment interventions on healthcare workers' mental health during an epidemic or pandemic context. Our level of confidence in effect estimates is therefore low to very low, and real intervention effects are likely very different from those estimated in the analyzed studies [41]. Nevertheless, promising solutions were evaluated in these studies that may warrant consideration in future research.

4.1. Theory or Implementation Failure?

An important question is whether the interventions reviewed in the current study are theoretically likely to protect mental health [31]. More specifically, were they designed to target the work exposures contributing to stress and psychological ill health and did they mitigate these harmful exposures? These questions remain largely unanswered, as intervention effects on working conditions and on indicators of the psychosocial work environment were often undocumented. Some of the barriers to the use of wellbeing centers [43] included that it was not possible to take a break or that breaks were too short. Although access to a space for respite and psychological support could be useful in the context of a broader prevention program, could work–rest schedules or staffing ratios [49] have been the necessary targets for intervention to reduce the prevalence of presenteeism and intention to quit? Staffing issues were alluded to as a potential reason for missed breaks by authors of the wellbeing centers study [43]. In Beneria et al. [42], simulation-based teamwork training failed to mitigate the likelihood of anxiety and depression. It is unclear if this is partly due to a failure to improve workplace communication, teamwork and leadership targeted by the intervention after a single 25-h course, or if the intervention missed the predominant causes of occupational stress.

Secondly, assuming that interventions correctly diagnosed the occupational determinants of stress, were interventions implemented as intended and were changes integrated by workers into their practices? Such details were rarely provided in the studies, and when they were, information was limited. For example, in the study evaluating a three-month SARS prevention program, no information was given regarding availability of PPE across units, adherence to IPC protocols, worker awareness and participation in training and awareness and use of the mental health clinic [19]. Regarding the COVID-19 prevention program reported by Zhu et al. [46], details were not provided on whether PPE availability varied across hospital departments, whether "reasonable" work shifts were negotiated or set by management, whether shuttle services were readily or intermittently available and whether the staff was aware that hospital-acquired infection could be recognized as a work injury and what this recognition process entailed (e.g., a complicated process could have had unintended negative effects). Such details could have shed light on divergent results between men and women reported by the authors in stratified analyses. They would help to determine if, for example, certain components of the program were integrated differently by male and female staff. This also highlights more generally the importance of conducting distinct analyses in men and women, where sample size permits, and the study by Zhu et al. [46] was one of the few to do so, of all studies we reviewed. Adjustment for the sex/gender variable, rather than stratification, was the norm in reviewed studies, a practice that may have concealed distinct associations in men and women [50–52]. Considering that men and women often vary in their personal [53] and professional exposures [54], as well as in their interactions with health and compensation systems [55–57], research will be enhanced by considering exposure-outcome relations and intervention effects in the male and female workforce [58]. This type of subgroup analysis is consistent with the recommendations for realist evaluation to determine for whom, when and in what context interventions produce intended effects [59].

Information on other initiatives (co-interventions) occurring alongside the main intervention was similarly lacking in most studies, as was information on workplace dynamics

and contextual changes that may have affected how preventive measures were applied and followed (e.g., labor disputes, staff turnover, changes in management, rapidly changing public health guidelines). Moreover, in nearly all studies reviewed, workplace actors appear not to have been involved in risk assessment or solution development or if they were, this was not documented. Workers are uniquely positioned to identify risks to their health and contribute to solutions that are compatible with their work and their wellbeing. Participatory intervention processes that include employees and managers at different levels within the organization can facilitate the implementation of changes and increase their uptake, thereby enhancing intervention effectiveness [60,61]. Several authors have argued for the involvement of key stakeholders and end-users in intervention design and implementation and for the consideration of context and process elements when evaluating outcome effects [48,60,62–66]. Innovative approaches for studying the mechanisms through which participatory organizational interventions exert their effects have been put forth and could help advance intervention evaluation research [67].

4.2. Strengths and Limitations

This is one of the few systematic reviews on the effectiveness of organizational and psychosocial work environment interventions to protect healthcare worker mental health in an epidemic or pandemic context. Outside of an infectious disease emergency context, such interventions are also relatively scarce [15,68]; a preponderance of mental health intervention studies have evaluated individual stress management like CBT. This study is therefore one of the relatively few to attempt to shift the focus from individual stress relief towards upstream workplace prevention targets that can produce broader and more durable effects. We used a systematic approach and author consensus in study identification, selection and evaluation, in an attempt to reduce bias. The search covered an extensive literature in English and French spanning 21 years across nine databases (and 20 years across 7 databases) in medicine, nursing, psychology, sociology and business. The sensitivity of the search strategy was tested, and the strategy was adapted with the help of a librarian. However, due to time constraints, non-peer-reviewed pre-publications and gray literature were not included and some intervention studies may have been missed. Some of our requests for clarifications to authors of original studies were not answered, therefore conclusions are based on an accurate interpretation of related findings.

5. Conclusions

We identified very few organizational or psychosocial work environment interventions to protect healthcare workers' mental health during epidemics/pandemics, and these provided low- to very-low quality evidence on (in)effectiveness. There was also a gap in the reporting of intervention process and context elements that could account for outcome effects. Nevertheless, several promising solutions in the studies reviewed herein may help orient future efforts and ultimately contribute to building more robust healthcare systems that can withstand the challenges of new health emergencies. Authors of future intervention studies should consider carrying out and reporting detailed risk assessments of the work environment, a participatory approach that mobilizes key workplace stakeholders, context and process evaluation to allow for adequate interpretation of intervention effects [48,60,63,65,67], as well as distinct analyses in men and women, where sample size permits. Unique challenges associated with a health emergency will need to be considered and will likely require adapting the intervention process. For example, virtual stakeholder consultations rather than in-person focus group meetings may be needed that meet physical distancing requirements while giving a voice to workers. High-impact solutions that can be implemented rapidly may need to be prioritized during an emergency. Ensuring that interventions are theoretically designed to address the occupational determinants of stress and that workers are involved in change processes should increase the likelihood of better health outcomes for the healthcare workforce during the COVID-19 pandemic and beyond.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19159653/s1, Supplementary Table S1. Description of the seven analyzed studies.

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Appendix A

Table A1. Medline search strategy combining concepts 1, 2, 3 and 4.

Concept *	Search Strategy
1	(depression or "depressive disorder" or anxiet* or anxious or "mental health" or "mental disorder*" or "adjustment disorder*" or (stress adj3 work*) or distress or ptsd or "post traumatic stress" or "post-traumatic stress" or "vicarious trauma*" or "secondary trauma*" or "compassion fatigue" or "compassion satisfaction" or traumatisation or traumatization or exhaustion or burnout or suicide or suicidal or fear).ti,ab,kw. OR anxiety disorders/ or depressive disorder/ or depressive disorder, major/ or "trauma and stressor related disorders"/ or stress disorders, traumatic/or stress disorders, post-traumatic/ OR emotions/ or bereavement/ or sadness/ or grief/ or guilt/ or loneliness/ or psychological distress/ or sadness/ OR exp adaptation, psychological/ or exp stress, psychological
2	((interven* or program* or initiative* or approach* or project* or strateg* or reorganis* or reorganiz* or "re-organis*" or "re-organiz*" or redesign or "re-design" or restructuring or re-structuring or policy or policies or regulation* or guidance or guideline or standard or solution or change) adj5 (workplace or worker* or "work-place" or "workplace based" or "work-place based" or workload or workflow* or staff or personnel or employee* or occupation* or industry or "public sector" or "private sector" or employer or organization* or organisation* or task* or colleague* or coworker* or co-worker* or supervisor* or manager* or corporate or corporation or "iso-strain" or ((quantitative or mental or emotional or psychological) adj1 (demand* or workload)) or (job adj1 (control or demands or strain)) or "psychological strain" or "stress at work" or "stressful working condition" or "emotionally demanding work" or (decision* adj1 (latitude or authority or autonomy)) or (skill adj (discretion or utili#ation)) or "effort-reward" or "((social or corporate or organizational or organisational or company) adj1 (justice or leadership or trust))" or "team spirit" or harassment or violence or bullying or ((colleague* or coworker* or co-worker* or supervisor* or superior* or manager* or management) adj1 support) or ((corporate or safety or psychosocial) adj1 (climate or culture or environment)) or "flexible working conditions" or "work-life balance" or "work life balance" or "work-life conflict" or "work life conflict" or (work adj2 family) or "moral dilemma" or "moral injury" or "ethical dilemma" or "management practice*" or "corporate management" or "workplace management" or "work place management" or communication or transparency or purposeful)).ti,ab,kw. OR ergonomics/ or man-machine systems/ or organizational innovation/ OR Organizational culture/

Table A1. *Cont.*

Concept *	Search Strategy
3	(efficien* or inefficien* or effective or efficacy or ineffective or evaluat* or assess*).ti,ab,kw. or ((intervention adj2 (trial* or study or studies)) or "Before and After Stud*" or "Before-After Stud*" or (pre adj5 post) or survey or surveys or questionnaire* or "focus group*" or interview*).ti,ab,kw. or comparative effectiveness research/ OR evaluation studies as topic/ OR program evaluation/ OR intervention studies/ OR Controlled Before-After Studies/ or ("Evaluation studies").pt.
4	(H1N1 OR "middle east respiratory syndrome*" OR MERS OR SARS* OR "severe acute respiratory syndrome*" OR "SARS-CoV-2" OR "SARS-CoV" OR "COVID" OR "COVID-19" OR coronavirus* or pandemic* or epidemic* or influenza or flu or outbreak* or ebola or ebolavirus or zika or quarantine or confinement or ((health or sanitar*) adj1 (crisis or crises or emergenc*))).ti,ab,kw. Or COVID-19/ or epidemics/ or pandemics/ or disease outbreaks/

* Concept 1: "mental health problems"; concept 2: "organizational or psychosocial work environment interventions"; concept 3: "effectiveness evaluation"; concept 4: "epidemic/pandemic". Natural language terms are the same for all databases. Database-specific terms, ending with an oblique symbol (/), can be provided for the other databases upon request to the authors.

Table A2. Methodologic quality assessment instrument: items and scoring.

Item	Scoring (Number of Points)
Was the research question or study objectives clear and explicitly stated?	
No research question or study objective was described	0
A research question or study objective was mentioned but was not clear	1
The research question and/or study objectives were clear and explicitly stated	2
Did the study include a control group?	
There was no control group	0
There was a control group, but it was not appropriate	1
There was an appropriate control group	2
Were study participants randomly assigned to the control or intervention group? If study participants were not randomly assigned, were workers' baseline sociodemographic, occupational exposure and mental health outcome characteristics measured?	
Study participants were not randomly assigned to the control or intervention group and their baseline characteristics were not measured	0
Study participants were not randomly assigned to the control or intervention group but some of their baseline characteristics were measured (however, important baseline sociodemographic, occupational exposure or health characteristics are missing)	1
Study participants were randomly assigned to the control or intervention group OR baseline sociodemographic, occupational exposure and health characteristics were measured	2
Were relevant occupational exposures measured before (at baseline) and after (at follow-up) the intervention?	
Relevant occupational exposures were not measured	0
Some very relevant occupational exposures were not measured	1
Relevant occupational exposures were measured either only at baseline or at follow-up, but not at both time points	1
Relevant occupational exposures were measured at baseline and at follow-up, but not in the same participants (unpaired data)	1
Relevant occupational exposures were measured at baseline and at follow-up in the same participants (paired data)	2
Were occupational exposure measures appropriate, valid, reliable and sensitive to change?	
Occupational exposure measures were not appropriate	0
Occupational exposure measures seem appropriate, but there was no confirmation that they were valid, reliable and/or sensitive to change	1
Occupational exposure measures were appropriate, valid, reliable and sensitive to change	2
Was the mental health outcome measured before (at baseline) and after (at follow-up) the intervention?	
A mental health outcome was not measured	0
The mental health outcome was measured either only at baseline or at follow-up, but not at both time points	1
The mental health outcome was measured at baseline and at follow-up, but not in the same participants (unpaired data)	1
The mental health outcome was measured at baseline and at follow-up in the same participants (paired data)	2
Not applicable: study objective is to measure the effect of the intervention on occupational exposures, not mental health	1

Table A2. *Cont.*

Item	Scoring (Number of Points)
Was the mental health outcome measure appropriate, valid, reliable and sensitive to change?	
The mental health outcome measure was not appropriate	0
The mental health outcome measure seems appropriate, but there was no confirmation that it was valid, reliable and/or sensitive to change	1
The mental health outcome measure was appropriate, valid, reliable and sensitive to change	2
Not applicable: study objective is to measure the effect of the intervention on occupational exposures, not mental health	1
Was the length of follow-up after the end of implementation of the intervention appropriate?	
The length of follow-up after the end of implementation of the intervention was not indicated	0
The follow-up was done before the end of intervention implementation or the length of follow-up was too short to allow for an effect on the health outcome (or on another measured outcome) to be demonstrated	1
The length of follow-up after the end of implementation of the intervention was appropriate	2
Was study participation rate after recruitment documented and adequate for the experimental and control groups?	
Study participation rate after recruitment was not documented or was <60%	0
Study participation rate after recruitment was between 60 and 79%	1
Study participation rate after recruitment was ≥80%	2
Was the loss of study participants to follow-up in the experimental and control groups acceptable?	
The loss to follow-up was not documented or was >30%	0
The loss to follow-up was between 21 and 30%	1
The loss to follow-up was ≤20%	2
Were the participants who dropped out of the study (drop-outs) comparable to those who completed the study (completers)?	
A comparison of the characteristics of drop-outs and completers was not documented	0
There were important differences in the characteristics of drop-outs and completers, but this was not considered in the analyses	1
There were no important differences in the characteristics of drop-outs and completers, and this was documented OR the loss to follow-up was ≤20%	2
Was the implementation of intended changes documented and were changes implemented as intended?	
The implementation of changes was not documented	0
The implementation of changes was documented but they were not implemented or only some intended changes were implemented	1
The implementation of changes was documented and the majority of intended changes were implemented	2
Were potential confounders of the effect of the intervention on the mental health outcome (ex. history of mental illness, intervention compliance) and on the work exposures measured considered and properly taken into account in the analysis (ex. adjustment, stratification) or interpretation of results?	
No potential confounders were measured	0
Important confounders were not measured or measured confounders were not properly taken into account in the analysis or were only considered in interpretation of results	1
Potential confounders were measured and properly taken into account in the analysis	2
Were contextual factors and co-interventions that could influence the results considered in the analysis or in the interpretation of the results?	
No contextual factors or co-interventions that could influence the results were documented	0
Only a few relevant contextual factors or co-interventions were documented or considered in the analysis or in the interpretation of the results	1
Relevant contextual factors and co-interventions were documented and considered, either in the analysis or in the interpretation of the results	2
Was the statistical analysis appropriate for measuring the effectiveness of the intervention?	
The analysis was inadequately described, precluding us from evaluating its appropriateness or the analysis was inappropriate	0
The statistical power of the study or at least one other important element of analysis was inappropriate	1
The analysis and power of the study were appropriate	2

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The Role of Off-Job Crafting in Burnout Prevention during COVID-19 Crisis: A Longitudinal Study

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Abstract: The COVID-19 pandemic and remote working challenge employees' possibilities to recover from work during their off-job time. We examined the relationship between off-job crafting and burnout across the COVID-19 crisis. We used a longitudinal research design, comprising one wave collected before the onset of the pandemic, in March 2019 (T1), and one wave collected during the first lockdown of the crisis in April 2020 (T2). We measured the six off-job crafting dimensions (Crafting for Detachment, Relaxation, Autonomy, Mastery, Meaning, and Affiliation) and burnout (fatigue/exhaustion) via a questionnaire among German and Swiss employees (N = 658; Age M = 47; 55% male). We found that both burnout levels and crafting for affiliation significantly decreased at T2 compared to T1. All off-job crafting dimensions and burnout correlated negatively cross-sectionally and longitudinally. Regression analyses showed that employees who crafted in their off-job time before and during the crisis experienced fewer burnout complaints during the crisis. Looking more closely at the subdimensions of off-job crafting, employees who crafted for detachment before and during, and for affiliation before the crisis, reported less burnout during the crisis. We conclude that off-job crafting may act as a buffer mechanism against burnout during the COVID-19 crisis.

Keywords: burnout; off-job crafting; COVID-19; longitudinal; employees; DRAMMA; prevention; Germany; Switzerland; pre-post COVID-19 study

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1. Introduction

The continuing global COVID-19 pandemic and the related control measures seriously challenge employees' ability to maintain their health while staying productive at work [1,2]. The pandemic affects employee health through direct pathways (e.g., via the fear of being affected by the virus in high-exposure occupations) and indirect pathways (e.g., via the fear of being economically affected by the measures to control the pandemic), resulting in mental health complaints and stress symptoms [3]. Moreover, a report published by Eurofound [4] showed that even employees who have experienced some improvements in their work situation after lifting the first lockdown (e.g., getting back to full working hours) still report high levels of work-related stress. In addition, research on teachers, a group frequently studied in burnout research, revealed that perceived threats due to work-related changes during the COVID-19 pandemic were related to higher burnout levels [5]. Besides its markedly adverse effects, the ongoing COVID-19 pandemic offers an excellent opportunity to increase our understanding of how employees recover from work stress in their non-working time before and during crisis situations, which may buffer the

effects of the crisis on burnout complaints—a key predictor of adverse workplace health and well-being outcomes [6–10].

Based on a longitudinal study design, comprising one wave collected before the onset of the pandemic and one wave collected during the crisis, the present study examines the role of off-job crafting for burnout prevention in times of the COVID-19 pandemic. Insights into the potential role of off-job crafting may support the work of health-promotion practitioners and policymakers in enabling the workforce to develop and maintain optimal levels of health and well-being during public health crises situations.

1.1. Off-Job Crafting for Better Recovery from Work

Adaptive strategies to cope with highly demanding work can be classified into three types [11,12]: (a) dealing with depleted resources (e.g., coping strategies, recovery); (b) altering job characteristics (e.g., job crafting); and (c) work and non-work boundary management (e.g., segmentation). Off-job crafting belongs to the first category as it enables restoration of depleted resources during non-working time and employees' capacity to cope with workplace stressors successfully, thereby preventing negative effects of job demands on employee burnout. Off-job crafting refers to employees' proactive and self-initiated changes in their non-working lives to satisfy their psychological needs [13,14]. According to the identity-based integrative needs model of crafting, the satisfaction of psychological needs is understood as the core driver and result of crafting [15]. The needs addressed in off-job crafting are defined by the DRAMMA model [14], an acronym that stands for the six needs (Detachment, Relaxation, Autonomy, Mastery, Meaning, and Affiliation). Engaging in activities that lead to the satisfaction of these needs during non-working time may also alleviate burnout complaints. Based on Kujanpää et al. [13] and the groundbreaking work by recovery researchers such as Sonnentag and Fritz [16], *detachment* is defined as "switching off" from one's thoughts related to work and tasks during off-job time. Aligning with the stressor–detachment model, crafting for psychological detachment such as purposefully "refraining from job-related activities and thoughts during non-work time" can reduce the effect of job stressors during non-work time [17]. Off-job crafting for *relaxation* encompasses proactively striving for feeling physically well and for reducing effortful activities. It has been found that strain, representing a lack of detachment and relaxation from work, predicted higher levels of burnout and lower life satisfaction [13,17]. Off-job crafting for *autonomy* reflects striving for a feeling of being in control over one's actions, life, and choices. Off-job crafting for *mastery* refers to behaviors aiming for feelings of proficiency and skillfulness in the task in which employees engage, such as taking up pleasant challenges and learning opportunities. Off-job crafting for *meaning* taps into striving for the experience of a sense of purpose and significance in one's life and activities. Finally, off-job crafting for affiliation refers to aiming for the experience of being closely related and emotionally connected to others.

Before the onset of the COVID-19 crisis, studies showed that the recovery experience of detachment, relaxation, and mastery were negatively associated with burnout [16]. More recently and related to the previous study, research indicated that all six DRAMMA dimensions had strong, negative associations with work-related stress [13]. Another study indicated negative associations of the general off-job crafting factor with burnout over a three-month time period [16,18]. These effects are indicative of spillover effects between life domains [19] when people craft during leisure time, and this can have an impact on well-being at work. Overall, earlier studies support the notion that off-job crafting could be a helpful and relevant proactive strategy for preventing burnout under changing living and working conditions such as the COVID-19 pandemic. Employees may proactively craft their off-job time when not demanded by work [20], and experience positive spillover in terms of better detachment and recovery, which prevents them from developing burnout symptoms in the long term. We therefore assume that off-job crafting can potentially reduce exhaustion and fatigue, as covered in the burnout concept.

1.2. Burnout

Following Kristensen et al. [21], we define burnout as the degree of physical and psychological fatigue and exhaustion that is perceived by the person concerning their work. In everyday working life, it is well established that burnout is closely associated with various work-related and non-work-related health and well-being outcomes [6–10]. For example, burnout leads to adverse physical (e.g., musculoskeletal pain, severe injuries, type 2 diabetes), psychological (e.g., insomnia, depressive feelings, anxiety), and occupational (e.g., high sick-leave costs, lower job performance, job dissatisfaction) consequences [22]. Burnout is often the result of high job demands, in particular role stress, stressful events, role ambiguity, role conflict, and work pressure [23,24]. These demands are particularly harmful when job and personal resources, such as social support, autonomy, and self-efficacy are lacking [25,26]. Consequently, employees become chronically exhausted and psychologically distance themselves from their work, thereby impairing feelings of meaningfulness and the fulfilment of inherent psychological needs [27]. Since the onset of the pandemic, the role of employees' non-working lives plays an important role in maintaining their (workplace) health and well-being. For example, a recent cross-sectional study conducted by Tusl et al. [2] showed that employees who experienced the changes after the pandemic hit as positive, such as having more leisure time, reported higher levels of mental well-being and self-related health than employees who experienced these changes as negative.

Besides the important role of reducing job demands and strengthening job resources in burnout prevention in general [28], employees are not passive agents undergoing a crisis. They can employ adaptive regulation strategies to prevent or diminish the onset of burnout complaints [29]. Although adaptive strategies for burnout prevention have received more attention recently within employees' working life [28], little research exists for such proactive strategies within non-working life [29]. Crafting the non-work life domains is a promising stream of research still in its infancy [29,30]. It is therefore important to explore the role of off-job crafting as a possible pathway for alleviating burnout complaints in crisis situations.

1.3. Study Aims and Research Questions

In an effort to expand prior studies, the present study aims to understand (1) the impact of the COVID-19 crisis on off-job crafting and burnout, and (2) to examine cross-sectional and longitudinal relationships between off-job crafting and burnout before and during the pandemic. Thereby, this study provides new insights into the extent to which people proactively craft their non-working life in a way that potentially protects against burnout. Since this study draws on longitudinal data collected before (T1) and during the crisis (T2), knowledge will be gained on how employees cope during and beyond crisis situations via off-job crafting, which is also little understood. Therefore, we focus on the following explorative research question:

Research Question 1: To what extent do both burnout and off-job crafting change during the COVID-19 crisis (T2) compared to before the crisis (T1)?

As the pandemic is unprecedented in modern working life and the impact of telework on a massive scale has neither been investigated with regard to burnout nor off-job crafting, this research question is explorative. Earlier research has shown that burnout levels can rise during a crisis due to, for example, increasing levels of job demands, lowering levels of job resources, and rising levels of job insecurity [31]. On the other hand, telework may also provide resources to people such as enhanced autonomy, social support and increased self-discipline [32]. In a drastically changing work and private life situation, crafting may be required in order to cope with these new challenges. However, people may also struggle and feel that they lack the personal resources to invest in crafting efforts, which may reduce actual crafting behaviors, similar to the recovery paradox [33]. The recovery paradox describes a situation in which workers find it particularly hard to recover during times of high job demands and work stress—a situation in which recovery is most needed.

Regarding the relationship between off-job crafting (i.e., crafting for DRAMMA) and burnout, based on the above literature review, we propose the following explorative research question:

Research Question 2: To what extent is off-job crafting (i.e., the total concept and the six subdimensions) related to burnout?

(2a) Cross-sectionally (i.e., How is off-job crafting at T1 and T2 associated with burnout at T1 and at T2, respectively?);

(2b) Longitudinally (i.e., How is off-job crafting at T1 associated with burnout at T2?)

Finally, we explore whether off-job crafting before and during the crisis can predict changes in burnout during the crisis and how off-job crafting during the crisis is related to burnout during the crisis:

Research Question 3a: To what extent is off-job crafting (i.e., the total concept and the six subdimensions) before the COVID-19 crisis (T1) related to a change in burnout during the crisis (burnout at T2 controlled for burnout and off-job crafting at T1)?

Research Question 3b: To what extent is off-job crafting (i.e., the total concept and the six subdimensions) during the COVID-19 crisis (T2) related to burnout during the crisis (burnout at T2 controlled for burnout at T1)?

Following earlier research on the beneficial effects of crafting and its importance for recovery, we expect that off-job crafting can act as a buffer that can prevent increasing burnout complaints during the COVID-19 crisis.

2. Methods

2.1. Participants and Procedures

A prospective longitudinal design was employed among employees in Germany and Switzerland, comprising two waves of measurements with a one-year time interval between the waves. As a baseline to compare the situation before the outbreak of COVID-19, we use a wave collected in March 2019, constituting the baseline measure (T1). The second wave was collected during the first lockdown in April 2020 to reflect the COVID-19 crisis (T2). Participants were recruited via Respondi (respondi.com), which is a high-quality panel provider based in Germany. Hence, the data allow us to follow the same participants throughout both waves, covering up to 12 months before the COVID-19 outbreak (T1) and the peak of the COVID-19 lockdown measures (T2). Only employees within the age range of 18 to 65 years who worked more than 20 h per week were included, excluding self-employed people. Participants were from a range of occupational sectors, including the health and social sector, public sector, sales, agriculture, production of goods, information and communication, finance, research, education, hospitality, transport, and construction.

The full sample collected in the first wave included $N = 1501$ participants, of which those who participated in the second wave $N = 658$ participants (44% participation). Men were more likely to participate in both waves, with 55% of those who participated in both waves being male compared to 51% of those who participated in the first wave only. However, the difference in proportions was not significant $\chi^2(1) = 2$, $p = 0.157$. Participants responding to both waves were significantly older with a mean of 47 years compared to a mean age of 44 years in the first wave, $t(1386) = -4.96$, $p < 0.001$. No significant differences were found in the study variable of burnout and off-job crafting between those who participated in both waves and those who participated in first wave only. The total paired sample was $N = 658$. The vast majority of the respondents were German (85%), whereas a minority of the sample was of Swiss nationality (15%). Most of the respondents finished their secondary school (63%), followed by tertiary (30%) and primary (7%) education. Concerning gender, about half of the sample were men (55%) and women (45%).

2.2. Measures

Work-Related Burnout. The seven-item measure from the original 19-item Copenhagen Burnout Inventory was used [25]. Items were answered on a five-point scale from 1 = "never/almost never" to 5 = "very often". All items captured the degree of physical and

psychological fatigue and exhaustion that is perceived by the person as related to their work; for example: "do you feel burnt out because of your work?". One item was recoded so that a higher score indicates higher levels of burnout. The scale showed good reliability before ($\alpha = 0.89$) and during ($\alpha = 0.87$) the crisis.

Off-Job Crafting. The 18-item version of the Needs-based Off-job Crafting Scale (NOCS) was used to measure off-job crafting over the past month, comprising the following six dimensions: detachment, relaxation, autonomy, mastery, meaning, and affiliation [13]. All items measured the extent to which people restore their psychological needs in their non-working life on a five-point scale from 1 = "never" to 5 = "very often". A sample item reads: "I have organized my free time in such a way that I switch off from professional duties". The scale and its subdimensions showed excellent reliability before ($\alpha = 0.91$) and during ($\alpha = 0.91$) the crisis. Concerning the off-job crafting subdimensions, the scales showed excellent reliabilities given the low number of items before and during the crisis (see Table 1).

Demographic and COVID-19 Specific Variables. We measured key demographic variables, including age, gender, education, and nationality.

2.3. Statistical Analysis

Data analyses were conducted using the statistical software R [34]. Although we did not identify any outliers in our sample, we still inspected the extreme values in overall mean scores (i.e., 1 and 5). In total, there were 50 participants with at least one such "extreme" score. A more detailed analysis showed that there were no extremes scores that would be suspicious (i.e., suggesting mindless responding). Moreover, we implemented attention checks in the survey (e.g., "Please choose option 4") to filter out random answers. Therefore, we did not exclude these values as these values were possible and they occurred only in a small number of cases.

Before conducting the analyses for the research questions, we first tested both concepts (i.e., burnout and off-job crafting) for configural, metric, and scalar invariance across the two time points using the full information maximum likelihood estimation procedure from the *lavaan* package [35]. To evaluate the models, we used comparative-fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) with the conventional cut-off values. The goodness-of-fit values for CFI surpassing 0.90 indicated an acceptable fit and exceeding 0.95 indicated a good fit [36]. A value under 0.08 for SRMR and RMSEA indicated a good fit [37]. The models were compared using chi-square difference tests. The configural fit for OJC was good (CFI = 0.983; RMSEA = 0.04, SRMR = 0.03), and we then tested for metric invariance in which the factor loadings were constrained to be equal across the two time points. The model fit was good and there were no significant differences between the two models: $\Delta\chi^2 = 9.9$, $\Delta df = 11$, $p = 0.54$. Finally, we tested for scalar invariance where the intercepts were also fixed to be equal across the two time points. The fit indices were good and the model did not significantly differ from the metric model: $\Delta\chi^2 = 18.7$, $\Delta df = 11$, $p = 0.07$. The configural fit for burnout was good (CFI = 0.968; RMSEA = 0.09, SRMR = 0.03), so we proceeded with metric invariance. The metric fit was good and there were no significant differences between the two models: $\Delta\chi^2 = 3.18$, $\Delta df = 5$, $p = 0.67$. Finally, we tested for scalar invariance. the fit indices were good and the model did not significantly differ from the metric model: $\Delta\chi^2 = 5.06$, $\Delta df = 5$, $p = 0.41$. We were therefore able to establish configural, metric, and scalar invariance for both studied variables, enabling us to conduct appropriate analyses for the three research questions.

To examine the impact of the pandemic on off-job crafting and burnout (Research Question 1), pre–post comparisons were conducted using paired sample t-tests. Correlation analyses were used to assess the cross-sectional associations between off-job crafting and burnout before and during the COVID-19 crisis, respectively (Research Question 2a), and the longitudinal associations between off-job crafting before the crisis and burnout during the pandemic (Research Question 2b). Multiple hierarchical linear regression analyses

were conducted to examine the predictive value of off-job crafting before the crisis on burnout during the crisis, controlling for burnout before the crisis (Research Question 3). By controlling for these variables in the second step, we were able to assess the predictive value of the off-job crafting dimensions before the crisis on a change in burnout levels during crisis, ruling out possible confounding effects of other variables affecting burnout at baseline. We conducted this regression analysis using both the total off-job crafting concept to test its explanatory power for burnout during the crisis as well as its six subdimensions to test which off-job crafting subdimensions predict the biggest change in burnout. Annotated R script with all the analysis is included as Supplementary Material (See Supplementary Material File S1).

2.4. Ethical Considerations

Informed consent was obtained from all participants. The study included adult participants (18+ years) only. Participants voluntarily completed the questionnaires, guaranteeing their anonymity. For anonymous surveys on working/living conditions and self-reported mental well-being and health, no ethical review was necessary under national (Swiss Human Research Act), university (Central Ethics Committee of the University of Zurich, https://www.research.uzh.ch/en/procedures/ethikkommissionen.html, accessed on 23 December 2021), or departmental rules (Department of Data Protection at the University of Zurich, www.dsd.uzh.ch/en/, accessed on 23 December 2021). The study was conducted under strict observation of ethical and professional guidelines.

3. Results

3.1. Changes and Associations between Off-Job Crafting and Burnout before and during the Crisis

Related to Research Question 1, Table 1 shows the means and the results of the bivariate correlation analyses between off-job crafting and burnout before the onset of the pandemic. The results of the paired-sample t-tests showed a significant decrease in burnout at T2 ($\Delta M = -0.10$) compared to T1, $t(657) = 3.91$, $p < 0.001$, and in the dimension of off-job crafting for affiliation ($\Delta M = -0.16$), $t(649) = 4.78$, $p < 0.001$; see Figures 1 and 2. The effect size was small in both cases ($d = 0.19$; $d = 0.15$, respectively). The other off-job crafting dimensions (i.e., crafting for detachment, relaxation, autonomy, mastery, and meaning) did not significantly change between T1 and T2.

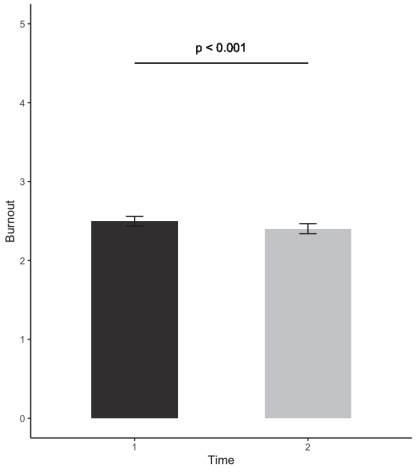

Figure 1. Pre-test (before the crisis) and post-test (during the crisis) changes in burnout.

Table 1. Means, Standard Deviations, Cronbach Alphas, and Bivariate Correlations between the Study Variables.

	M	*SD*	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Burnout T1	2.50	0.80	0.89	1															
2. Burnout T2	2.40	0.83	0.87	0.71	1														
3. OJC T1	3.74	0.61	0.91	−0.27	−0.29	1													
4. OJC T2	3.71	0.65	0.91	−0.29	−0.24	0.59	1												
3. OJC for Detachment T1	3.91	0.88	0.86	−0.19	−0.24	0.69	0.41	1											
4. OJC for Relaxation T1	3.79	0.83	0.83	−0.17	−0.17	0.73	0.43	0.66	1										
5. OJC for Autonomy T1	3.85	0.76	0.75	−0.23	−0.22	0.80	0.48	0.45	0.52	1									
6. OJC for Mastery T1	3.44	0.87	0.82	−0.18	−0.20	0.76	0.46	0.30	0.39	0.63	1								
7. OJC for Meaning T1	3.61	0.79	0.78	−0.21	−0.20	0.77	0.46	0.28	0.33	0.57	0.70	1							
8. OJC for Affiliation T1	3.80	0.86	0.89	−0.25	−0.28	0.71	0.40	0.33	0.33	0.45	0.44	0.62	1						
9. OJC for Detachment T2	3.93	0.89	0.85	0.08 *	−0.18	0.38	0.70	0.50	0.36	0.28	0.16	0.19	0.19	1					
10. OJC for Relaxation T2	3.82	0.82	0.80	−0.09 *	−0.15	0.42	0.73	0.34	0.47	0.37	0.25	0.25	0.21	0.62	1				
11. OJC for Autonomy T2	3.82	0.83	0.80	−0.11 **	−0.17	0.47	0.83	0.32	0.35	0.47	0.38	0.35	0.26	0.50	0.57	1			
12. OJC for Mastery T2	3.45	0.87	0.82	−0.14	−0.21	0.47	0.78	0.22	0.27	0.38	0.53	0.45	0.29	0.36	0.42	0.66	1		
13. OJC for Meaning T2	3.57	0.81	0.76	−0.13 **	−0.19	0.48	0.77	0.20	0.23	0.41	0.48	0.52	0.34	0.32	0.37	0.61	0.66	1	
14. OJC for Affiliation T2	3.64	0.93	0.89	−0.13 *	−0.19	0.44	0.70	0.24	0.24	0.30	0.30	0.37	0.51	0.32	0.33	0.43	0.48	0.58	1

Note. $N = 658$; all correlations are significant at $p < 0.001$, if not indicated otherwise; ** $p < 0.01$ * $p < 0.05$.

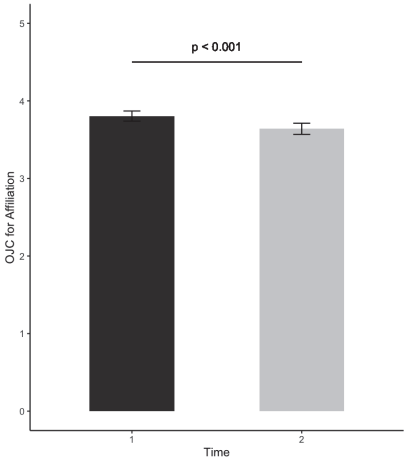

Figure 2. Pre-test (before the crisis) and post-test (during the crisis) changes in off-job crafting (OJC) for affiliation.

Concerning Research Question 2, the results showed that all subdimensions and the combined off-job crafting score (i.e., average across all dimensions) were cross-sectionally negatively associated with burnout before and during the COVID-19 crisis. These negative associations between off-job crafting and burnout were also present longitudinally, indicating that employees who off-job crafted for detachment, relaxation, autonomy, mastery, meaning, and affiliation before the crisis experienced fewer burnout complaints during the crisis. Off-job crafting for affiliation showed the strongest negative association with burnout, followed by off-job crafting for detachment, autonomy, mastery, meaning, and relaxation.

3.2. Predictive Values of Off-Job Crafting before the Crisis on Burnout during the Crisis

Table 2 shows the results of the multiple hierarchical regression analyses to address Research Question 3. The results of the regression analysis for Model 1 indicated that the model was a significant predictor of burnout during the crisis: $R^2 = 0.51$, $F(2, 655) = 341.4$, $p < 0.001$ explaining 51% of the variance. Burnout during the crisis was significantly predicted by the total concept of off-job crafting before the crisis, meaning that employees who crafted before the crisis experienced less burnout during the crisis.

When looking at the subdimensions of off-job crafting in Model 2, off-job crafting before the crisis was a significant predictor of burnout during the crisis: $R2 = 0.51$, $F(7, 650) = 100.3$, $p < 0.001$, explaining 51% of the variance. Burnout was most strongly predicted by detachment followed by affiliation. Relaxation, autonomy, mastery, and meaning were not significant predictors. This suggests that employees who crafted for detachment and affiliation before the crisis experienced less burnout during the crisis.

The results of the regression analysis for Model 3 showed that off-job crafting before the crisis was a significant predictor of burnout during the crisis: $R2 = 0.52$, $F(3, 650) = 233.4$, $p < 0.001$, explaining 52% of the variance. This indicates that, when controlling for burnout and off-job crafting before the crisis, burnout during the crisis was predicted by off-job crafting during the crisis. Therefore, people who crafted during the crisis experienced fewer changes in burnout during the crisis.

Looking at the subdimensions of off-job crafting in Model 4, the model showed that off-job crafting during the crisis was a significant predictor of burnout during the crisis: $R2 = 0.52$, $F(7, 630) = 99.2$, $p < 0.001$, explaining 52% of the variance. Burnout was significantly predicted by crafting for detachment, but none of the other subdimensions reached significance. This suggests that employees who crafted for detachment during the crisis experienced less burnout during the crisis.

Table 2. Multiple Linear Regression Analyses between Off-Job Crafting and Burnout during Crisis (T2).

Model	Predictor	Estimate	SE	95% CI		β	R^2	F(df)	ΔR^2	ΔF
				LL	UL					
	Model 1									
Step 1	Burnout T1	0.73	0.03	0.67	0.78	0.71 ***	0.498	653.5(1, 656)		
Step 2	Burnout T1	0.69	0.03	0.64	0.75	0.68 ***	0.508			
	OJC T1	0.14	0.04	−0.22	−0.07	−0.11 ***				
								341.4(2, 655)	0.010	312.1 ***
	Model 2									
Step 1	Burnout T1	0.73	0.03	0.67	0.78	0.71 ***	0.498	653.5(1, 656)		
Step 2	Burnout T1	0.69	0.03	0.63	0.75	0.67 ***				
	OJC for Detachment T1	−0.12	0.18	−0.19	−0.05	−0.13 ***				
	OJC for Relaxation T1	0.06	0.03	−0.02	0.13	0.06				
	OJC for Autonomy T1	0.01	0.04	−0.07	0.09	0.01				
	OJC for Mastery T1	−0.07	0.04	−0.15	0.01	−0.07				
	OJC for Meaning T1	0.04	0.04	−0.04	0.13	0.04				
	OJC for Affiliation T1	−0.07	0.03	−0.14	−0.01	−0.07 *				
							0.514	100.3(7, 650)	0.016	553.2 ***
	Model 3									
Step 1	Burnout T1	0.69	0.03	0.64	0.75	0.68 ***	0.508	341.4(2, 655)		
	OJC T1	−0.14	0.04	−0.22	−0.07	−0.11 ***				
Step 2	Burnout T1	0.69	0.03	0.64	0.75	0.68 ***				
	OJC T1	−0.05	0.05	−0.14	0.04	−0.04				
	OJC T2	−0.16	0.04	−0.24	−0.07	−0.12 ***				
							0.516	233.4(3, 650)	0.008	108 ***
	Model 4									
Step 1	Burnout T1	0.73	0.03	0.67	0.78	0.71 ***	0.498	653.5(1, 656)		
Step 2	Burnout T1	0.69	0.03	0.63	0.75	0.67 ***				
	OJC for Detachment T2	−0.09	0.03	−0.16	−0.03	−0.10 **				
	OJC for Relaxation T2	0.01	0.04	−0.07	0.08	0.01				
	OJC for Autonomy T2	0.02	0.04	−0.06	0.10	0.02				
	OJC for Mastery T2	−0.05	0.04	−0.12	0.03	−0.05				
	OJC for Meaning T2	−0.03	0.04	−0.11	0.05	−0.03				
	OJC for Affiliation T2	−0.03	0.03	−0.09	0.03	−0.04				
							0.519	99.2(7, 630)	0.021	554.3 ***

Note. $N = 658$; *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$.

4. Discussion

4.1. Theoretical Implications

The overarching aim of this study was to examine the role of off-job crafting in burnout prevention during the COVID-19 crisis. First, we synthesize the results of our longitudinal study, followed by practical implications, reflections on study limitations and strengths, and directions for future studies in this research area.

The results regarding Research Question 1 showed that both burnout and off-job crafting for affiliation decreased during the crisis compared to before the crisis. After the onset of the pandemic, employees experienced less physical and psychological fatigue and exhaustion related to their job. This is in line with Kimhi et al. [38], who showed that negative outcomes such as distress symptoms, decreased, while positive outcomes such as perceived well-being, increased during the crisis. Since burnout is a work-related phenomenon [20], the decrease in burnout levels may be attributed to the slowing down of the whole economy due to the crisis, which potentially reduced experienced job demands such as workload and increased job resources such as autonomy. Speculatively, the crisis may have 'forced' employees to also slow down their everyday pace of life, thereby supporting their recovery from work in their non-working context. Related to this, the decrease in off-job crafting for affiliation may be attributed to the lockdown, in particular the social distancing measures, which significantly reduced the opportunities for socializing with others.

The results concerning Research Questions 2a and 2b indicate that, even though burnout and off-job crafting decreased during the crisis, employees who crafted in relation to detachment and affiliation experienced less burnout before and during the crisis. Although previous studies have not yet focused on a differentiated perspective for the six off-job crafting dimensions for burnout prevention, the finding aligns with previous studies investigating the benefit of satisfaction of the six DRAMMA dimensions in relation to work-related stress [13,20]. The results also align with studies focusing on other coping resources, such as having a positive attitude, which has shown to mediate the relationship between perceived stress and life satisfaction during the pandemic [39]. The present study complements this research by showing that the overall off-job crafting concept and its subdimensions are all negatively associated with burnout both cross-sectionally and longitudinally in crisis situations. Moreover, the results related to Research Questions 3a and 3b showed that people who off-job crafted for specific crafting dimensions before and during the crisis reported less burnout during the crisis. In this regard, looking at the off-job crafting dimensions, employees who crafted for detachment before and during the crisis and for affiliation before the crisis reported fewer burnout complaints during the crisis. Our results indicate that detachment seems to be the most relevant dimension of off-job crafting in relation to burnout. This is in line with previous research that indicates the protective value of detachment against burnout [13]. Employees that crafted their off-job time according to this specific need might consequently be better able to detach from work during the crisis. Affiliation is also known to be a protective resource against burnout in the workplace [40], which indicates that even in times of a rigorous lockdown employees could still benefit from the experience of affiliating in terms of lower risk of burnout complaints. The other off-job crafting dimensions (i.e., relaxation, autonomy, mastery, and meaning) did not significantly predict burnout in any of the regression models, suggesting that these dimensions do not play a big role in burnout prevention during crisis.

4.2. Practical Implications

The present findings yield valuable insights for practice (e.g., interventions) to stimulate off-job crafting behaviors, which may in turn prevent the onset or alleviate burnout complaints. The results showed that crafting in relation to detachment and affiliation seems particularly important in burnout prevention in crisis situations. Both of these crafting dimensions can possibly be targeted through interventions on recovery in general [41] and by a recently designed hybrid off-job crafting intervention [42]. With regard to recovery

interventions in general, Hahn et al. [41] developed and evaluated a recovery training program comprising multiple training sessions targeting employees' control during off-job time, psychological detachment from work, transition rituals, mastery experiences, and relaxation and sleep. The effect evaluation of this intervention showed that the intervention decreased perceived stress, among other outcomes [41].

Concerning the above proposed hybrid off-job crafting intervention, Kosenkranius et al. [42] developed two on-site group training sessions in which employees learn about off-job crafting and how to achieve the satisfaction of needs. Additionally, a smartphone app (i.e., Everydaily) has been developed to support employee engagement in off-job crafting. Participants receive daily suggestions for three different activities to help them satisfy their psychological needs, such as engaging in nature walks, mindfulness, volunteer work, or scheduling an hour of "me-time" in the agenda. Although the intervention has not been evaluated yet regarding its effectiveness, it may inspire companies and provide them with ideas to stimulate off-job crafting behaviors. Implementing such interventions might also be relevant for public health policies during this COVID-19 pandemic.

4.3. Limitations and Strengths

This study has several limitations and strengths that should be taken into account when interpreting the results, which we translated into possible directions for future studies. It is a particular strength of this study that it refers to a broad and relatively large sample, offering a pre–post study design concerning the COVID-19 crisis. A first limitation is that all measures were self-reported, which may bring multiple, common methodological biases, such as socially desirable answers, aggravated by the length of the survey [43]. However, we used valid and reliable scales to enhance the internal validity of the study, as reflected in the good reliability of all scales. It is a strength of this study that it applied a longitudinal study design, using one wave before the crisis and one wave during the pandemic. This allowed us to comprehensively test for changes in burnout and off-job crafting during the crisis compared to before the crisis and to examine the extent to which off-job crafting before and during the crisis changed burnout levels during the crisis, covering one year and similar periods of the year (March 2019–April 2020). Future research may identify how off-job crafting across even shorter time intervals (e.g., daily or weekly) exerts its influence on the prevention of burnout [44] and how daily crafting can be promoted through interventions [42]. Second, it is of interest to examine the role of off-job crafting in relation to restoring employees' ability to regulate cognitive and emotional processes, as an impediment of these processes has recently been acknowledged as additional burnout symptoms [45]. Being physically and mentally exhausted still remain important core symptoms of burnout (i.e., "I can no longer do my job"). However, these symptoms intertwined with a reduced capacity to regulate cognitive and emotional functioning (i.e., "I do not want to do my job anymore"), and are often accompanied by a depressed mood and non-specific psychological and psychosomatic tension complaints [45,46]. The present study could not consider these recent developments in research, as we started collecting data long before the publication of these recent measures and manuals for burnout research. Future studies are hence encouraged to understand how employees' crafting styles in their non-working life can potentially also reduce burnout through enhancing or restoring cognitive and emotional functioning.

Third, although the findings of the present study show that off-job crafting contributes to fewer burnout complaints during the crisis, the explained variance and standardized beta coefficients were relatively small. This implies that other factors may play a role in burnout prevention in crisis situations, for instance, the role of job security, family relationships, proactive personality, and actually contracting the corona disease. Future studies are recommended to include such factors. Moreover, 85% of the participants in our study were German, which means that the results should be generalized with caution to the underrepresented Swiss population or other countries.

Finally, it could be that employees with low levels of burnout complaints are able to craft more proactively than those with high levels of burnout complaints (i.e., reverse causation). However, we controlled the regression analyses for burnout before the crisis and the results do suggest that employees who proactively crafted before the crisis experienced less burnout during the crisis—independent of their baseline level of burnout. Nevertheless, future studies are encouraged to test possible reverse causations between off-job crafting and burnout within and beyond crisis situations. We also tested whether burnout at T1 could predict changes in off-job crafting between T1 and T2 and did not find statistically significant relationships. This suggests that the relationship between off-job crafting and burnout is in the expected (causal) direction.

5. Conclusions

The present study shows that both burnout and off-job crafting for affiliation decreased during the COVID-19 crisis compared to before the crisis, while other off-job crafting dimensions remained stable across time. The findings also show that employees who crafted in their off-job time before the crisis experienced fewer burnout complaints during the crisis. Looking more closely at the subdimensions of off-job crafting, employees who crafted for detachment and affiliation before the crisis, and those crafting for detachment during the crisis, reported less burnout during the crisis. Overall, the present study offers unique insights into how employees can proactively craft during crisis situations and complements the existing body of knowledge on burnout prevention. We hope these findings will encourage future researchers to examine the role of off-job crafting in burnout prevention beyond crisis situations and help to develop interventions to increase employees' off-job crafting capacities.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19042146/s1.

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Coping Methods and Satisfaction with Working from Home in Academic Settings during the COVID-19 Pandemic

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Abstract: In this paper, we examined how university staff and students coped with challenges related to working or studying from home during the COVID-19 pandemic, and the level of satisfaction with working from home. An online survey was conducted among faculty, staff, and students at universities in 24 countries (n = 674). The results show that over 80% of the respondents used multiple coping methods. Three clusters of coping methods were generated through factor analysis: (1) social and health factor, with focus on personal health and the social surrounding, (2) activity factor, i.e., being busy with work or studies, finding up-to-date information about COVID-19, while thinking about what one could do rather than what one could not do, and (3) public health factor, which meant trusting health authorities while avoiding misinformation from sources such as social media. Furthermore, 56% of the respondents were very or somewhat satisfied with working from home. Differences in the methods of coping and satisfaction with working from home highlight the need for employers to prepare for working from home beyond the COVID-19 pandemic.

Keywords: coronavirus; enforced telework; higher education; home confinement; job satisfaction; coping strategies; workplace health; occupational health; telecommuting; remote work

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1. Introduction

The world was hit by the COVID-19 pandemic in 2020 resulting in subsequent lock-down in most countries. Other preventive strategies were implemented such as mask-wearing, social distancing, and frequent handwashing [1]. With the onset of the lock-down, employers encouraged working from home or other premises other than the usual workplace. University faculty/staff and students were among the groups affected by working from home. Working from home changed the working environment for many employees, presenting both challenges and opportunities for work life [2]. People in academic settings faced a new reality with the closure of campus-based in person activities, and the shift of teaching to different online platforms [3,4]. College and university faculty/staff and students practiced social distancing by working and studying from home.

Earlier research shows benefits of working from home, e.g., increased autonomy and flexibility [5], yet research among academics in the context of the COVID-19 pandemic is limited. Some empirical studies indicate that working from home during the COVID-19 pandemic has increased productivity for some academics, and many are positive about working from home in the future [6]. However, there is evidence from different contexts that associates working from home during the COVID-19 pandemic with negative consequences, e.g., reduced productivity [6], physical ill-health [7] and mental ill-health [3,7–10]. Therefore, we cannot ignore the negative consequences of the pandemic; a "mental health spill over" can be anticipated now and in the future [11].

Some recommendations were proposed to help the academic population during the COVID-19 pandemic, e.g., creating clear routines for home working, having work life

balance, simplifying communication, networking, and using available remote platforms and programs for teaching [12–14]. Personal, and technology-related factors, e.g., internet access and family-work conflict mediated the negative effects of working from home [15]. Therefore, academics' individual efforts seemed to play a big part in how they dealt with the challenges related to working from home during the COVID-19 pandemic.

Coping strategies can alleviate the psychological burden associated with stressful events [16,17]. In the context of COVID-19 and academics, research shows that several methods of coping have been useful. The role of social support during lockdown and working from home is important. Many studies show that academics have utilized contact with family and friends to deal with the stresses of the pandemic and working from home [18,19]. The importance of a support network, e.g., friends, family and work colleagues has also been highlighted in other occupational settings [20,21]. Additionally, meaning-making coping has had an important place in academics' effort to cope with COVID-19. Using nature as a coping resource and considering life as integrated to a greater whole are significant for coping with COVID-19 among the academics, and in other traumatic situations [2,21]. Additionally, religious coping methods have been used, especially in the context of Muslim academics [22,23]. Moreover, theory and research show that individuals who perceive stressors positively, e.g., as an opportunity for growth, seem better prepared to deal with life challenges [17,24]; this is true in the context of COVID-19 [25,26]. Additional coping strategies generally include having a positive attitude, self-reliance, and self-care [20], although these have not been studied in the context of academics.

Job satisfaction and coping methods used to deal with challenges at work can be understood through models that explain the interaction between job demands, and resources that employees have to meet the demands. One such model is the Demand-Control model by Karasek [27]; this model postulates that working with high demands and low control over job tasks leads to job strain. With more control, employees are often able to cope with the high job demands, thereby avoiding strain. Having control implies employees' ability to decide how job tasks are conducted and being able to use their skills in task execution [27,28]. Karasek and Theorell refer to this as the decision latitude [27,28]. Several studies demonstrate the applicability of the Demand-Control model [28–30].

Although modified to the Job-Demand Control-Support model through the addition of a social support dimension [31,32], the model is insufficient on its own to explain job satisfaction and health outcomes because it assumes centrality of work overload and lack of autonomy as a source of job strain [33]. A modified theoretical approach to understanding the relationship between job demands, satisfaction and employee wellbeing is the Job Demands-Resources Model [33,34]. The model divides job-related characteristics into two, (1) job demands, which many be physical, cognitive, or emotional and (2) job resources, e.g., physical, social, or organizational aspects that alleviate job demands and ensure attainment of work goals [33,34]. Thus, control/autonomy is just one of many aspects that buffer wellbeing and job satisfaction. However, we note that previous research and theoretical perspectives are used only in an indicative manner to provide inspiration in the context of discovery.

Research shows that working from home can increase control over the job, because employees decide how to apportion time between work and family [5]. However, there are contradicting results on how working from home translates into positive health outcomes. For example, Gonzáles Ramos and García-de-Diego [35] found that oscillating between domestic labor and paid work during the lock down led to poor well-being, because it was difficult to concentrate on work. Nevertheless, for women, increased control and work–life balance was positively related to general health much more than men. Therefore, some differences based on gender seem to exist. The "flexibility stigma", i.e., the desire not to work from home, seemed eradicated by the COVID-19 pandemic, because both female and males were more positive to working from home [24]. In the context of the COVID-19 pandemic, employees in academic setting have enhanced wellbeing and job satisfaction by being proactive and thinking about what they can do about the situation, rather than

focusing on what they cannot do [20,26,36]. Therefore, several coping methods must be considered when studying coping with the challenges of COVID-19 pandemic.

Whereas there is research on how academics are generally dealing with the COVID-19 pandemic, there are gaps in research specific to working from home. Moreover, most research is based on local country contexts. There is a paucity of research that addresses working from home and coping at an international level. In this paper, we examined the methods through which university staff and students coped with challenges related to working/studying from home during the COVID-19 pandemic. Additionally, we investigated the level of satisfaction with working from home during the pandemic.

Specifically, we addressed the following research questions:

Question 1: What coping methods do academics use to deal with the challenges of working from home during the COVID-19 pandemic?

Question 2: To what extent are academics satisfied with working from home during the COVID-19 pandemic?

2. Materials and Methods

A quantitative research design method was used for this study. The authors used an online survey to examine university faculty, staff, and students' methods of coping and job satisfaction with working from home during the COVID-19 pandemic. The study targeted university academics across different countries using convenient sampling (n = 674). The countries included Austria, Bangladesh, Denmark, Finland, France, Germany, India, Iran, Italy, Malaysia, Malta, Norway, Philippines, Portugal, Saudi Arabia, Singapore, South Korea, Sweden, Switzerland, The Netherlands, The UK, Tunisia and Turkey. Table 1 demonstrates the characteristics of the respondents.

Table 1. Sample characteristics (n = 674).

Variable	Variable Value	Percentage
Gender	Man	34%
	Woman	66%
Age group	Younger than 35 years	47%
	Between 35 and 49 years	31%
	50 years or older	22%
Education level	University or equivalent	96%
	High school or equivalent	4%
Occupation	Employed	64%
	Student	36%
Civil status	Married	46%
	Divorced	3%
	Engaged	6%
	Single	35%
	Other	9%
Children in family	Yes	64%
	No	36%
Area of residence	Capital city	22%
	Medium-large city (not capital)	51%
	Small town, close to large city	19%
	Small town, far from large city	8%

An online questionnaire was used for data collection. The link to the online survey was e-mailed to faculty members, students and university staff working at different universities across different countries in May 2020. The email and online survey contained an invitation letter explaining the research aim, procedure, and ethical considerations. The data were collected between June and December 2020.

No pre-existing questionnaire was used for measurement. The COVID-19 pandemic created new challenges and working arrangements for academics and other occupational groups. The challenges created an urgent need to study our research topic; thus, we constructed a questionnaire with items relevant to working from home during the COVID-19 pandemic. In the questionnaire, we asked four questions: (1) if the respondent worked more than contracted (responses *yes* or *no*); (2) how satisfied the respondent was with working from home (responses *very dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied,* and *very satisfied*); (3) how the respondent rated his/her general health (responses on a scale *poor, fair, good, very good* and *excellent*); and (4) how the respondent coped with challenges related to working from home (responses on a scale *never, seldom, sometimes, often* and *always* in relation to 12 methods of coping included in the questionnaire, see Figure 1) with a Cronbach's Alpha value of 0.726 (good level). For this paper, we used responses to question 1, 2 and 4.

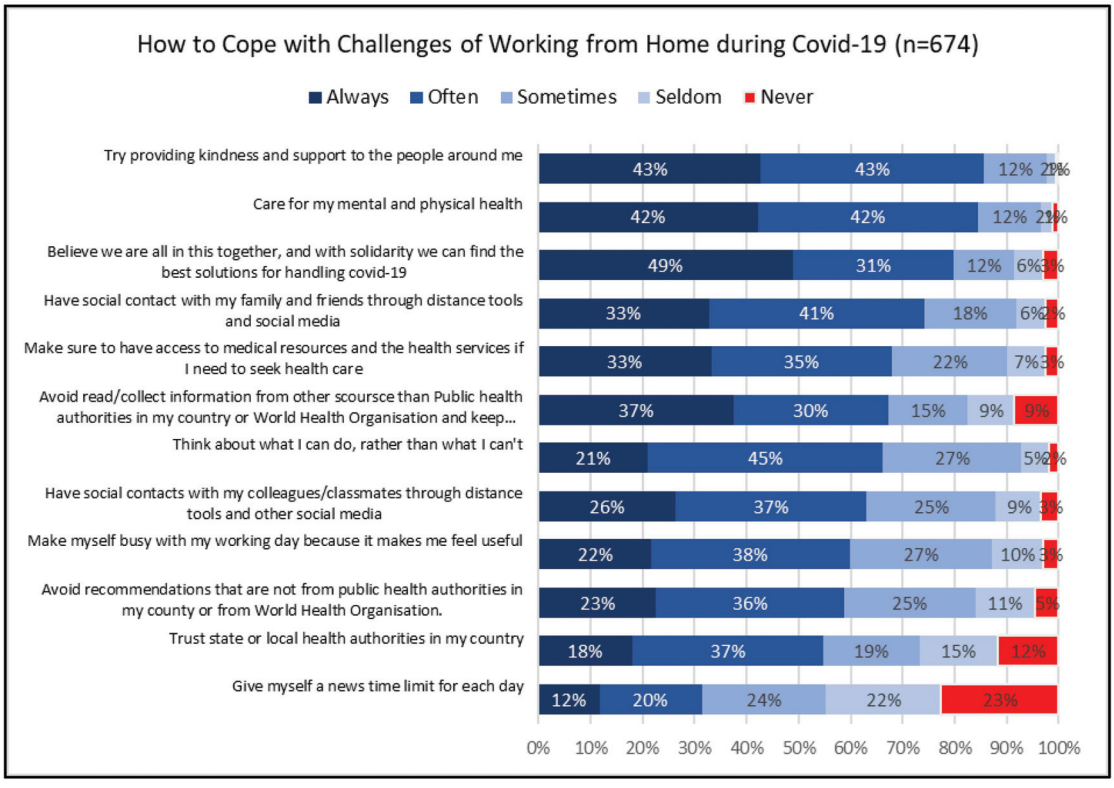

Figure 1. Methods of coping with challenges of working from home.

We used a single-item measure of job satisfaction to keep the questionnaire simple and short. Nevertheless, a single-item measure of job satisfaction can yield reliable and valid results [35]. The methods of coping included in the questionnaire were adapted from our extensive international research on coping in times of crisis [21,37–41], the revised Brief RCOPE questionnaire [40], and the budding research on COVID-19 that was available at the time. In addition, we borrowed from the Demand-Control model [27,28] and it's later versions, with focus on possible resources necessary to reduce work stress in the context of working from home.

It was not our intention to study differences in coping and satisfaction with working from home in different countries or socio-cultural settings. Rather, we intended to focus on

what the academics had in common as an occupational group. We did not translate the questionnaire based on the assumption that the respondents, being academics, had at least professional working proficiency in the English language.

Based on the sample of 674 respondents, the margin of error for this study is +/− 3.9 percentage units for results around 50%, as well as 2.3 percentage units for results around 10 or 90%. See Table 1 for the sample description.

Statistical analysis was conducted using IBM SPSS Statistics 27. The sample was not weighted to reflect the actual academic population of staff or students of which it was representative. We conducted exploratory factor analysis to identify the underlying coping methods, i.e., factors measured by the coping methods we studied. In this way, we could identify coping methods that belonged together, thereby condensing them into fewer latent variables (factors). Factor analysis identified interdependent coping methods, i.e., if one coping method x was normally mentioned together with another coping method y, then x and y were factored together. We used varimax rotation and all coping methods were included in the analysis. Varimax rotation takes the correlation between the coping methods and factors and maximizes the sum of their variance. We used varimax rotation because it can produce simpler and easy-to-interpret factor solutions. The 12 coping methods were originally not formulated to construct an explanatory model; thus, the intention was not to conduct a confirmatory factor analysis

The Declaration of Helsinki was considered when conducting the study. Respondents were informed about voluntary participation, anonymity, and data usage and storage. Ethical approval was granted by the Swedish Ethical Review Authority, for elements of the study linked to data collection, analysis, usage and storage in Sweden (Reg. no. 2020/02368 9).

3. Results

The results are presented in four sub-sections—coping with challenges of working from home, time input when working from home, satisfaction with working from home, relationship between coping methods and satisfaction with working from home.

3.1. Coping with Challenges of Working from Home

The four mostly used methods of coping included "providing kindness and support to the people around me", "caring for my mental and physical health", "believing that we are all in this together, and with solidarity we can find the best solutions for dealing with COVID-19" and "having social contact with my family and friends through distance tools and social media". More than 80% of the respondents used 9 of the 12 methods of coping studied. The three methods of coping that were least used included "giving myself a news time limit for each day", "trusting state or local health authorities in my country" and "avoiding recommendations that are not from public health authorities in my county or from World Health Organization (WHO)". Forty-five percent (45%) of the respondents seldom or never had a daily news time limit. Twenty-seven percent (27%) seldom or never coped through trusting the state or local authorities, while 18% seldom or never avoided reading/collecting information from sources other than national public health authorities or WHO (See Figure 1).

Based on factor analysis, three clusters of methods of coping emerged. The first cluster, labeled *social and health factor,* focused on personal physical and mental health, as well as the surrounding. Methods of coping in this cluster included taking care of one's physical and mental health, provide kindness and support to people around, making sure one had access to medical care when needed, believing that COVID-19 was a communal problem, showing solidarity, having social contact with work colleagues or classmates, and keeping social contact with family and friends. The second cluster was labeled *activity factor* and focused on being active while dealing with the COVID-19 pandemic. This included giving oneself a news time limit for each day, making oneself busy with the working day to feel useful, thinking about what one could do, rather than what one could not do, and reading/collecting information from public health authorities or WHO and keeping oneself

updated with public health news. The third cluster, named *public health trust factor*, included trusting local or state health authorities, or avoiding misinformation in social media and recommendations from sources other than public health authorities in the country" (See Table 2).

Table 2. Factor analysis of methods of coping with challenges of working from home.

	Coping Method	Social and Health Factor	Activity Factor	Public Health Trust Factor
Social and Health Factor	I try to provide kindness and support to people around me	0.719	0.154	0.086
	I care for my mental and physical health	0.678	0.117	0.116
	I make sure to have access to medical resources and health services if I need to seek health care	0.652	0.002	0.306
	I have social contact with my family and friends through different social media	0.594	0.231	−0.279
	I believe we are in this together, and with solidarity we can find the best solutions for handling COVID-19	0.5	0.18	0.436
	I have social contact with my colleagues/classmates through different social media	0.458	0.365	−0.452
Activity Factor	I give myself a news time limit for each day	−0.019	0.735	0.15
	I make myself busy with my working day because it makes me feel useful	0.213	0.693	−0.104
	I think about what I can do, rather than what I cannot do	0.393	0.473	0.055
	I read/collect information from public health authorities in my country or World Health Organization, and keep myself updated with public health news	0.176	0.525	0.412
Public Health Trust Factor	I trust state or local health authorities in my country	0.148	0.065	0.727
	I avoid recommendations that are not from public health authorities in my country, as well as misinformation in social media	0.038	0.067	0.546

3.2. How Much Academics Worked during the COVID-19 Pandemic

The majority of the respondents did not work more than contracted during the COVID-19 pandemic. However, about three in ten (34%) worked more than contracted each week during the COVID-19 pandemic. Respondents aged 50 years and above were overrepresented among those who worked more than contracted (See Figure 2). There were no noteworthy differences based on gender.

3.3. Satisfaction with Working from Home

Most respondents (56%) were satisfied or somewhat satisfied with working from home. Slightly more women than men were satisfied with working from home, although the observed difference was minimal. Respondents under 35 years of age were much less satisfied with working from home compared to other respondents. Respondents who did not work more than contracted were more satisfied with their work situation compared to those who worked more. University employees were much more satisfied (62%) compared to students (45%). Additionally, respondents with higher education were more satisfied with working from home (57%) as compared to their colleagues with a lower education level (37%) (See Figure 3).

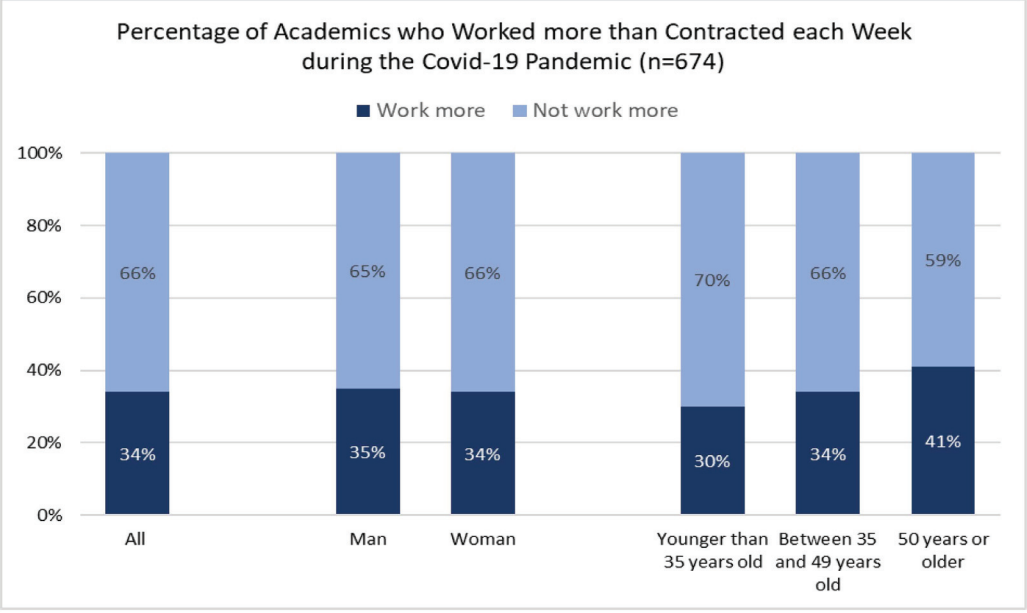

Figure 2. How much academics worked during the COVID-19 pandemic.

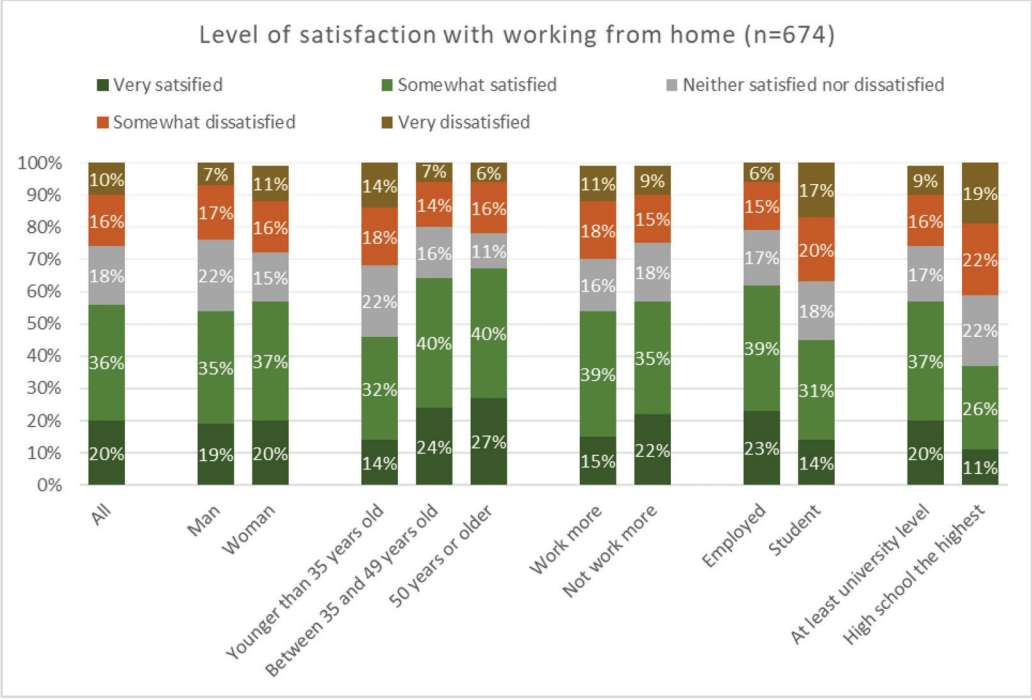

Figure 3. Level of satisfaction with working from home.

4. Discussion

This paper set out to examine the ways in which university staff and students coped with challenges related to working/studying from home during the COVID-19 pandemic. Additionally, the study investigated satisfaction with working from home during the pandemic. The results show that over 80% of the respondents used 9 of the 12 methods of coping studied. The mostly used methods of coping included providing care and support to other people, caring for personal mental and physical health, believing in solidarity and that COVID-19 was a matter of common concern, and using social media and communication tools to keep social contact with family and friends. Three clusters of coping were generated through factor analysis: (1) social and health factor, with focus on personal health and the social surrounding, (2) activity factor, i.e., being busy with work/studies, finding up-to-date information about COVID-19, while thinking about what one could do rather than what one could not do, and (3) public health factor, which meant trusting health authorities while avoiding misinformation from sources such as social media. The results further show that 56% of the respondents were very, or somewhat satisfied with working from home. Higher levels of satisfaction were observed among respondents aged 35 and above, university employees, and those with a higher level of education.

Our findings show that coping methods from the *health and social factor*, e.g., social interaction, feeling of solidarity and kindness and support to others, were among the most used methods to deal with the challenges of working from home. The COVID-19 pandemic and related restrictions were associated with loneliness and social isolation [41], yet social interaction has a positive effect on wellbeing. The academics adopted several socially oriented coping methods to compensate for the lost face-to-face in-person social contact. Research shows that perceived social support, more so from family, can protect against anxiety [20,42–44]. This could explain why efforts to keep in touch with family and friends were prominent among the academics' methods of coping. This is consistent with finding from other studies among students and university staff [18,45,46]. Most previous studies focus on students; thus, our findings help to illuminate the situation among university staff. However, keeping in touch with friends/family or work colleagues may not be highly prominent in individualistic countries, as shown by results from the Swedish academic setting [36].

Our findings further show that the academics extended their coping beyond mere social interaction, by providing kindness and support to others. This can be explained by research showing that being kind and helpful to others helps to improve the wellbeing of the kind person [47–49]. This is irrespective of whether the recipient of the kindness is a stranger or friend/family member [48]. Kindness can be further discussed in relation to altruism. Altruistic behavior, often motivated by empathic feelings, is a selfless act to help and support others often at some cost to oneself, such as time or effort [49]. These types of coping methods are generally used in times of crisis, illness, and loss [50]. Hartman and Morse [51] found that a crisis and trauma can cause solidarity which in turn can motivate empathy-driven altruism.

The COVID-19 pandemic negatively affected people in all walks of life, thus, having solidarity and the belief that "we are all in this together" was important for coping. Jenkins [52] asserts that solidarity, compassion, and empathy experienced via distance tools alleviated the challenges of working from home. Solidarity seemed an important aspect for academics since it was the third most used coping strategy. Solidarity in the context of COVID-19 is explained as "being bound together" and a method for fighting against the viral "enemy" [53]. It is not surprising therefore that altruism was a central part of the academics' coping methods during the COVID-19 pandemic. Supporting and reaching out to others was a recurring theme throughout the pandemic. Reaching out via social platforms and other distance tools aided individuals to cope with working from home [54,55]. Therefore, while the university staff and students used several methods of coping, the role of social contact, kindness and solidarity cannot be undermined.

Majority of the respondents in our study (56%) were very or somewhat satisfied with working from home. This could be explained by Karasek's demand-control model that postulates that workers are satisfied with their job when they experience balance between work demands and control over the job [27]. Apart from the obvious benefit of reducing new infections, working from home during the COVID-19 pandemic was associated with positive outcomes such as increased productivity [6,56] and work life balance [56,57]. Ahmadi et al., Arora and Vyas, and Baert et al. [47,58,59] found that employees during the COVID-19 pandemic were overall more satisfied with their jobs. These benefits came with flexibility associated with being able to work undisturbed, saved time due to reduced commuting, and a balance between work and family/private activities. Working from home gives individuals the opportunity to make their own schedule, working in smaller segments, taking breaks when needed and taking care of their household [60]. According to Harpaz [5], working from home can provide autonomy and flexibility. Lopez-Leon et al. [12] discusses that people working from home during the COVID-19 pandemic could combine household activities such as household chores, childcare and home-schooling which could improve the work–life balance. Work–life balance was an important factor for promoting wellbeing and consequent satisfaction with working from home during the COVID-19 pandemic [57].

However, negative effects of working from home are also noticeable. One study reported that 65% of respondents perceived that working from home had a negative effect on team spirit [61]. Moreover, working from home can lead to individuals working more than contracted. This can be due to factors such as increased workload, working more in the evening or weekends, changes in workplace routines and working instead of spending time traveling to and from work [62,63]. Working from home can cause strain within the family due to increased work-family conflicts [64]. Thus, it is not surprising that up to 20% of our respondents were not happy with working from home. In our study, 34% of our respondents reported that they worked more than contracted when working from home during the COVID-19 pandemic. Respondents who worked more than contracted were slightly less satisfied with working from home as compared to those who did not work more than contracted. Working more than contracted seemed therefore to have a negative effect on job satisfaction. This finding is in line with previous research. However, the observed difference in job satisfaction between the two groups was very small. Nevertheless, the finding seems contradictory because 50% of our respondents stated that they often or always kept themselves busy with work because it made them feel good. Put together, our findings seem to indicate that working more than contracted can have both a negative and positive effect on job satisfaction. Therefore, it is necessary to further examine the conditions under which working more than contracted affects job satisfaction. It could be that employees who voluntarily and actively choose to work more than contracted feel good about work as compared to those who feel forced to work more than contracted. Unfortunately, our data do not address the issue of voluntary and forced "working more than contracted".

The positives and negatives of working from home must not be generalized for all academics; there are differences depending on the characteristics and job demands on different sub-groups. Our findings show that respondents who were older than 35 years, and those with a higher education were more satisfied than the younger ones, students, and those with a lower education level. This may be due to the fact that early and mid-life career researchers, more than full professors and more experienced researchers experienced increased workload and stress during the COVID-19 pandemic [56]. Working from home may provide the opportunity to balance work and family life. However, the possibility that younger researchers have young families may increase the demands on balancing work and family/private life, especially with a shared work-family space. This may especially be the case for students, who often are younger, and must juggle between work, family, and studies. The additional stress of working from home reduces the extent to which they are satisfied with their situation.

5. Conclusions

This paper provides novel insight into coping and satisfaction with working from home among a multinational sample of academics during the COVID-19 pandemic. Whereas many studies have investigated coping and job satisfaction generally, this study's focus on academics and highlight issues that are specific for academics as an occupational group, despite the multicultural sample. Differences in methods of coping and satisfaction with working from home highlight the need for employers to prepare for working from home beyond the COVID-19 pandemic. Despite hesitation about working from home at the beginning of the COVID-19 pandemic, there is positivity about continuing to work from home. Many academics would want to continue working from home after the COVID-19 pandemic.

However, this paper has limitations, mainly due to the sample selection and correlational nature of the study. It is not possible to state with certainty that the observed differences in satisfaction with working from home are due to COVID-19 or specific coping methods. The pandemic has affected all people, albeit in different ways depending on available coping resources, leaving an unexplainable trail. Additionally, the sample is not evenly distributed; for example, men, families without under-aged children, and people with lower education level are under-represented in the sample. This makes it difficult to generalize the results of the study. Furthermore, we studied several counties, yet we were not able to provide analyses specific to the countries we investigated, partly due to the non-symmetrical representation of the countries in the study. Neither did we analyze the different coping methods based on the different sociodemographic variables.

This paper did not set out to investigate differences based on country and culture. However, further studies must consider contextual differences in different academic settings. Furthermore, pandemics and other potentially traumatic events may leave long lasting effects on individuals and communities. Therefore, a longitudinal study design is necessary to investigate the long-term effects of COVID-19, coping, and job satisfaction.

Author Contributions: Conceptualization, F.A.; methodology, F.A.; software, outsourced; formal analysis, F.A., J.S.M., S.Z., N.D. and S.A.; investigation/data collection, outsourced.; data curation, outsourced.; writing—original draft preparation, F.A., J.S.M., S.Z., N.D. and S.A.; writing—review and editing, F.A., J.S.M., S.Z., N.D. and S.A.; visualization, F.A., J.S.M., S.Z., N.D. and S.A.; supervision, F.A.; project administration, F.A.; funding acquisition, F.A. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: An online questionnaire was used for data collection. The link to the online survey was e-mailed to faculty members, students and university staff working at different universities across different countries in May 2020. The email and online survey contained an invitation letter explaining the research aim, procedure, and ethical considerations. Respondents were informed about voluntary participation, anonymity, and data usage and storage.

Data Availability Statement: The data supporting the reported results are available at the Faculty of Health and Occupational Studies, University of Gävle. The data are not publicly available to protect informants' personal information and secrecy.

Conflicts of Interest: The authors declare no conflict of interest.

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Return to Work during the COVID-19 Outbreak: A Study on the Role of Job Demands, Job Resources, and Personal Resources upon the Administrative Staff of Italian Public Universities

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Abstract: Background: Compared to healthcare workers and teleworkers, occupational wellbeing of employees who continued or suddenly returned to work during the COVID-19 pandemic have received less attention thus far. Using the Job Demand–Resource model as a framework, the present study aimed at evaluating the role of job demands and job and personal resources in affecting emotional exhaustion among university administrative staff. Methods: This cross-sectional study analyzed data collected through an online questionnaire completed by 364 administrative employees that continued working in presence (WP) and 1578 that continued working blended (WB), namely, partly remotely and partly in presence. Results: Among job demands, quantitative job demand overloads and perceived risk of being infected were positively associated with higher levels of emotional exhaustion. Among job resources, colleague support was significantly associated with lower emotional exhaustion for both WB and WP, whereas supervisor support and fatigue management were salient only for WB. Among personal resources, personal contribution in managing COVID-19-related risk at work emerged as a protective factor for emotional exhaustion. Conclusion: Insights for the development of targeted preventive measure for a more psychologically safe and productive return to work can be derived from these results.

Keywords: return to work; quantitative job demands; supervisor support; fatigue management; personal contribution in managing COVID-19; emotional exhaustion

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1. Introduction

The advent of the COVID-19 pandemic has radically changed the ways by which businesses have had to think about work processes and organization by putting health and safety management at the fore. From the earliest stages of the health emergency in March 2020, understanding the impact that the pandemic, as well as its occupational correlates, could have on workers' well-being and mental health has been the subject of many studies in the field of work and organizational psychology (e.g., [1,2]). On the one side, to counter the spread of contagion, many public and private organizations "re-considered" new ways of working, such as tele-working and smart working practices, and a huge number of studies have been developed to understand risks and potentialities for remote workers' productivity and wellbeing (e.g., [3–5]). On the other side, most of the focus has been placed on those occupational groups for which the degree of exposure to the risk of contagion and COVID-19-related challenges and demands turned the job conditions highly stressful, as is the case of the healthcare sector (e.g., [6–9]). However, as it has been pointed out by Rudolph and colleagues [10], focusing on health, safety, and wellbeing issues should be differentiated according to occupational groups. Despite this, less attention has been paid

to those sectors that have been classified, on the basis of the levels of exposure, proximity, and aggregation, at medium-high level of contagion, such as public administration [11].

In Italy, since the implementation of lockdown measures on 11 March 2020, the public administration has introduced, to counteract the spread of contagion, forms of working from home, such as teleworking and smart working practices, that were mandatory for at least the 50% of employees. Compared to pre-pandemic period, a considerable expansion of remote work has been implemented. It has been estimated that about 58% of the employees in the Italian public administration sector worked, and are still working now, remotely [12]. However, some critical issues, primarily linked to difficulties in expanding digitalization tools and the management of the often and rigid bureaucratic procedures that distinguish this sector from the private one, hindered the adoption of remote working practices for the entirety of the staff. Therefore, since the earliest stages of the pandemic, and then more substantially starting from the second phase in May 2020, a considerable amount of public administration employees continued working in presence or started working in a mixed way, i.e., partly in presence and partly remotely.

On the one hand, this situation required organizations to deploy resources to ensure the physical and psychological safety of people facing a higher work-related risk of being infected and states of mental fatigue. Relatedly, in addition to the application of "technical" guidelines pertaining to engineering, administration, and use of PPE preventive measures [13], the relevance of considering psychosocial safety and "non-technical skills" has been recently outlined [14], by which both the effective application of technical measures and the perceived psychological safety and wellbeing depend [15–17]. On the other hand, such changes involved new ways of working that may significantly impact on future policies and culture shifts. As was recently pointed out [18,19], although mixed, or hybrid, working abruptly emerged due to the COVID-19 pandemic, it is likely that these forms of work will characterize the reorganizational plans not only in the short-, but also in the medium- and long-term, even in the public sector. This implies that organizations must consider how to deal with challenges and resource provision distinctly for workers who continue to work in presence and for those who are starting to work partly in presence and partly remotely.

In the light of these premises, this study aimed to address the need to increase research on COVID-19-related wellbeing and psychosocial safety among a currently overlooked working population, namely, that of administration staff of Italian public universities that suddenly returned working in presence, or has started in a mixed form, during the pandemic. To the best of our knowledge there is a lack of studies that currently have dealt with such issues. This may represent a first step in the process of understanding the encountered challenges and providing public organizations first indications for targeted interventions.

To achieve this goal, the hypotheses of the present study were developed according to the Job Demands–Resources model (JD-R) [20] that suggests that work conditions, which can be categorized into job demands and job resources, may affect employees' health and wellbeing. Job demands refer to the physical, psychological, or socio-organizational aspects of the work, whose energy-depleting process induces people to experience energy loss and fatigue, leading to stress, burnout, and health impairment. Conversely, job resources refer to the physical, psychological, social, or organizational aspects of the job that reduce job demands and stress reactions while stimulating work motivation, personal growth, and development. In addition, personal resources have been introduced in the JD-R model defining them as "aspects of the self that are generally linked to resilience and refer to individuals' sense of their ability to control and impact upon their environment successfully" ([21] p. 123), thus stimulating optimal functioning and lessening stress. Moreover, according to the JD-R model [20], any occupation and work environment have their own specific job demands and job resources. Hence, the present study considered some job demands and job resources and one personal resource that can be relevant in reference to wellbeing and psychosocial safety at work among public universities' administration

staff by investigating their relationship with employees' stress reaction. Specifically, we consider the relationship with emotional exhaustion, as well as considering the distinction between those who continued to work in presence (WP) and those who started working in a blended way (WB).

Literature Review and Hypothesis Development

One of the most influential factors that have been investigated in relation to wellbeing and mental health outcomes during the COVID-19 pandemic is the perceived risk of being infected. Generally, it can be viewed as a cognitive process involved in various daily activities, fostering people's preventive and protective behavior when they must take decisions involving potential risks, such as with COVID-19 infection [22,23]. However, it can also have negative consequences on mental wellbeing by enhancing negative emotional responses and concerns. Referring to the occupational context, most of the research has primarily investigated front-line and healthcare workers by evidencing its association with psychological distress outcomes [24–27]. Studies have also highlighted that among workers of different productive and service jobs, perceiving return to work as a health risk was associated to higher levels of psychological distress [28,29]. Furthermore, it has been recently suggested that the perceived risk of being infected at work, while potentially increasing protective behaviors, may induce a psychological resources' depleting process, thus increasing levels of exhaustion [17]. Following these lines of research and according to the J D-R model [20], the perceived risk of being infected in the workplace can then be conceptualized as a salient new psychosocial risk even among those workers of the public administration sector who continued working in presence or returned to work partly in presence and partly remotely since the first phases of the pandemic. The following hypothesis was formulated:

Hypothesis 1 (H1). *The perceived risk of being infected is positively associated with emotional exhaustion.*

Furthermore, it can be hypothesized that for WPs, the perception of being infected is greater compared to WBs due to the longer time spent in presence and the increase in social interactions within the workplace. In this vein, we can sustain that, despite being relevant for both sub-samples, the relationship between the perceived risk of being infected and emotional exhaustion will be stronger among WPs.

According to Kniffin and colleagues [30], there is variation across and within occupational sectors with respect to how COVID-19 has affected the demands associated with various jobs; furthermore, there is evidence suggesting that working conditions have deteriorated for most employees [31]. Therefore, along with the perceived risk of being infected, another job demand that may affect public administrative employees' wellbeing can be represented by quantitative job demand overload. Quantitative, or psychological, demands are those relating to the "amount of work to be done" ([32] p. 308). A range of words that connotes high quantitative job demands includes work intensity, work pressure, or work overload; in turn, all of these expressions specifically imply sustained cognitive effort that, according to the JD-R model [20], are associated with higher levels of exhaustion. Although an increase in the workload has been recorded in both the healthcare sector and among those who shifted to remote working practices due to the pandemic emergency (e.g., [33–35]), this element can also be traced back to workers who, by returning to work, have had to readjust their job according to new procedures for managing the "new" or "next normal" [36] situation. Indeed, new routines and behaviors, such as wearing masks and social distancing, along with frequent messages about handwashing and cleaning, as well as new ways of working with physically distant colleagues, may have affected changes in work schedules; furthermore, these changes have been shown to increase stress, anxiety, and fatigue in general [31,37]. Thus, the following hypothesis was formulated:

Hypothesis 2 (H2). *Quantitative job demand overload is positively associated with emotional exhaustion.*

Despite no previous evidence being available, it is possible to hypothesize that, for WBs, the need to adapt to a mixed or hybrid work organization may involve a higher level of workload compared to WPs. In this vein, we can assume that despite being significant for both sub-samples, the relationship between quantitative job demand overload and emotional exhaustion will be stronger among WBs.

In relation to these circumstances, the centrality of being able to re-establish a balance through the use and deployment of specific resources was emphasized [30]. Through the employment of an integrated approach to safety, health, and wellbeing of workers who continued to work in presence during the pandemic, the centrality of work and organizational policies, programs, and practices that foster supportive conditions has been brought forth [16]. Among these, social support, which can be defined as the employee's belief that help can be available from others in demanding conditions [38], has been investigated as one of the most powerful sources of wellbeing and mental health able to reduce uncertainties during unpredictable time of crisis. Therefore, it should have a further critical role, especially during the COVID-19 pandemic, when employees are under additional and atypical stress and are even more socially isolated [39,40]. In line with these arguments, recent studies have contended that among smart workers, both supervisor and co-worker support helped employees reduce emotional exhaustion by lessening perceived uncertainties and organizational crisis communication during the COVID-19 lockdown [41–43]. According to this evidence, it can be hypothesized that experiencing workplace social support, functional to the best management of difficulties caused by the pandemic emergency, may represent a significant workplace resource, even for those workers who had suddenly returned to work in presence or started to work partly in presence and partly remotely during the first phases of the COVID-19 pandemic. Thus, the following hypotheses were formulated:

Hypothesis 3a (H3a). *Supervisor support is negatively associated with emotional exhaustion.*

Hypothesis 3b (H3b). *Co-worker support is negatively associated with emotional exhaustion.*

Concerning these aspects, it is also possible to hypothesize that, due to higher social isolation and greater communication difficulties that WBs may face when working from home, the perceived supervisor and co-worker support could be lower among WBs compared to WPs. In this vein, it is possible to assume that despite being relevant for both subsamples, these resources may be more salient for WBs in the relationship with emotional exhaustion.

Along with social support experienced in vertical and horizontal workplace relationships, organizations should also provide resources able to recognize states of fatigue related to the context of uncertainty and radical change brought forth by the pandemic transition [31]. Fatigue is generally considered as a state of feeling tired, weary, or sleepy, one that results from prolonged mental and physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep [44], potentially being a precursor of chronic stress consequences such as burnout [45]. According to guidelines inherent to mitigation strategies to cope with workplace fatigue in times of COVID-19 [31], the role of fatigue management practices has recently been gaining recognition. Fatigue management can be referred to the identification of antecedents and consequences of fatigue (mental and physical) related to COVID-19 at work, as well as to the implementation of coping strategies [15]. Following the JD-R model [20], fatigue management practices can therefore be considered as a job resource able to lessen levels of emotional exhaustion. Thus, the following hypothesis was formulated:

Hypothesis 4 (H4). *Fatigue management is negatively associated with emotional exhaustion.*

Specifically, we can assume that organizational resources able to counteract states of fatigue may be effective for both WPs and WBs, and it is possible to hypothesize that there are no significant differences between the two subsamples in the perception of this organizational resource. However, it could be hypothesized that, since WBs may probably face more challenging changes and social isolation, organizational resources such as fatigue management practices may be more salient in the relationship with emotional exhaustion for WBs.

Finally, in order for worker safety, health, and wellbeing to be supported during the COVID-19 pandemic, an integrated and participatory approach for the enforcement of the identified procedures has been emphasized [16]. The broader literature on workplace safety has outlined the role of employees' safety behaviors and safety participation, defined by acts such as helping co-workers, promoting the safety program, and suggesting changes [46] that help preventing accident and injuries as well as preserving health (e.g., [47,48]). These lines of research highlight the role of workers' personal contribution in managing the COVID-19 risk at work, i.e., how much employees feel able to adopt functional behaviors to facilitate and improve all measures to combat contagion [15]. Therefore, according to the JD-R model [20], the following hypothesis was formulated:

Hypothesis 5 (H5). *personal contribution in managing COVID-19-related risk at work can be considered as a relevant personal resource that may lessen levels of emotional exhaustion among employees who continued, or suddenly returned, to work during the pandemic.*

It is possible to hypothesize that such proactive behaviors to safety may be higher among the WPs who must manage daily work in presence and for which the responsibility for their behavior may be more salient in safeguarding their health, not only physical but also psychological, compared to WBs.

2. Materials and Methods

2.1. Procedure and Participants

The study is part of a wider research intervention project of the National Conference of Equality in Italian Universities; the conference brings together, in a network, the representatives of the university committees working on equal opportunities and wellbeing issues, in order to build systematic inter-university cooperation relations on the areas of gender equality, work–life balance, wellbeing, and inclusion.

The data used for the purposes of the present study were collected among the administrative sector of these organizations by means of an online questionnaire. The respondents participated to the survey during working hours and no incentives were offered for participation in the survey. The survey, approved by the Bioethics Committee of the University of Turin on 22 October 2020 (prot. no. 458997), was proposed to the member universities who were provided with documents and informative materials to support the presentation of the study. Prior to the start of the survey, each university informed their various stakeholders (governance, management, and trade unions) by their own accord and procedures. The voluntary participation and anonymity of the participants were ensured, and all the ethical guidelines were followed according to the Declaration of Helsinki (and following revisions) and Italian regulations on data protection and privacy (Law 196/2003). At the end of the survey, the results were shared with the member universities through a presentation and discussion workshop, which also aimed to identify needs and possible interventions to be implemented at a general level. Subsequently, the universities received a detailed report that covered every investigated area in depth, consistent with an intervention-oriented research approach.

2.2. Measures

Exhaustion was assessed with the 8-item scale of the Oldenburg Burnout Inventory [49] (e.g., "After my work, I regularly feel worn out and weary"). The scale ranged from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha = 0.84.

Quantitative job demands were measured using 4 items adapted from Bakker and colleagues ([50,51] (i.e., time pressure, working fast, concentration load, mental demands). Respondents chose their answer on a 5-point Likert scale ranging from 1 (never) to 5 (always). Cronbach's alpha = 0.80.

Perceived probability of being infected during daily work was assessed using 1 item ("What is the likelihood that you can be infected by COVID-19 in your work organization?"). Responses were measured on a 10-point Likert scale ranging from 1 (not at all) to 10 (completely).

Support from colleagues ("How much do you feel you can count on the support of your colleagues in this phase of the COVID-19 emergency?") and from the supervisor ("How much do you feel you can count on the support of your direct supervisor in this phase of the COVID-19 emergency?") were measured on a 10-point Likert scale ranging from 1 (not at all) to 10 (completely). These two questions were ad hoc measures developed for the present study.

Organizations' COVID-19 fatigue management (e.g., "In order to contain contagion risks by COVID-19, it is important that each employee adopts specific behaviors, i.e., using PPE, keeping interpersonal distance, practicing remote working. In your opinion, your employer organization is able to recognize the possible effects of such behaviors on physical fatigue") was assessed using the specific 4-item scales of the SAPH@work questionnaire [15]. Cronbach's alpha = 0.97.

Finally, personal contribution to healthy and safe practices in relation to COVID-19 was assessed using the specific 5-item scale of the SAPH@work questionnaire [15]. Cronbach's alpha = 0.86. SAPH@work scales used a 5-point Likert scale ranging from 1 (not at all) to 5 (completely). Reliability of the scales were satisfactory and above the threshold of 0.70.

2.3. Data Analysis

Data analyses were performed using SPSS (SPSS Statistics for Windows, Version 27.0., IBM Corp, Armonk, NY, USA), Version 27. Before proceeding with the analyses, as data were collected among 22 universities, the between-unit variability of individual perception of emotional exhaustion was calculated running mixed models with SPSS. Level 2 variance estimate ($\sigma^2\mu_{0j}$) was equal to 0.0027, and not significant ($p = 0.25$). Therefore, we decided to ignore the nested structure of the data due to the low between-unit variability.

For each scale of the questionnaire, we calculated synthetic indexes; we then carried out descriptive analyses (mean (M) and standard deviation (SD)). Analysis of variance (ANOVA) was performed to detect differences on the study variables between groups according to work arrangement (continuing to work in presence or just partly). Differences according to gender and frequency of contact with service users were also evaluated for both WPs and WBs to understand if they could be relevant control variables to insert within the regression models. Pearson's correlations were performed to detect relationship between variables, and hierarchical multiple regression models were established to evaluate the association between job demands, job and personal resources, and exhaustion.

3. Results

A total of 533 university administrative employees that continued working in presence (WP) and 2407 that continued working blended (WB), namely, partly remotely and partly in presence, agreed to participate in the survey. The present study was run on a sample of 364 WP and 1578 WB that correctly filled out the questionnaire. The WP sample was composed of a majority of females (65.4%) with a mean length of service of 20.5 years, and most of them had a permanent (93%) and full-time working hours (92.2%) contract. The majority (68.4%) had a master's degree, whereas 26.1% had a high school diploma and

4.1% had a middle school diploma. The majority of people were employed in the research services area (30.9%), followed by educational (28.3%) and administrative procedure (14.1%) services. The remaining part of the sample was employed in human resources (9.3%), ICT (8.2%), logistics and maintenance (5.2%), internationalization (1.9%), finance (1.9%), and legal affairs (0.4%).

Among WPs, 62.6% declared that working in presence was their actual optimal working condition, 36% declared that their optimal working condition would have been working partly remotely and partly in presence, and only 1.4% declared that the optimal working condition would be remote work only. In the WP sample, 37.9% of the employees declared they had sporadic contact with service users, and 31.3% reported having frequent contact with users, whereas another 30.5% declared having no contact with users but only with colleagues.

The WB sample was composed of a majority of females (70.4%) as well, with a mean length of service of 17.8 years, and most of them had a permanent (90.4%) and full-time working hours (87.7%) contract. The majority (70.2%) had a master's degree, whereas 26.8% had a high school diploma and 1.5% had a middle school diploma. The majority of people were employed in the educational services area (31.9%), followed by research (28.3%) and administrative procedure (19.2%) areas. The remaining part of the sample was employed in ICT (8.9%), human resources (6.5%), logistics and maintenance (4.8%), finance (5.1%), internationalization (2.9%), and legal affairs (0.6%).

Among WBs, 77.9% declared that working blended was the actual optimal working condition, whereas 10.8% declared that the optimal working condition would have been working completely in presence, and another smaller part (11.3%) stated that they wanted to work completely remotely. In the WB sample, 40.9% of the employees declared they had sporadic contact with users, and 26% reported having frequent contact with users, whereas the 33% declared having no contact with users but only with colleagues.

Tables 1 and 2 display means, standard deviations, and Pearson's correlations among the study variables for the WP and WB samples, respectively. All the variables correlated significantly and in the expected direction in relation with exhaustion. In both samples, age was significantly and negatively associated to colleague support: older workers experienced less colleague support in relation to COVID-19 management. In the WB sample, age was also significantly and negatively associated to fatigue management and personal contribution. No significant correlation emerged between age and exhaustion.

Table 1. Means, standard deviations, Cronbach's alphas, and correlations among the study variables in the sample of employees who continued working in presence.

	1	2	3	4	5	6	7	8
1. Age	1	0.099	−0.059	−0.05	−0.118 *	−0.062	0.047	−0.061
2. Exhaustion		1	0.282 **	0.195 **	−0.368 **	−0.253 **	−0.273 **	−0.232 **
3. Quantitative demands			1	0.112 *	−0.115 *	−0.082	−0.143 **	0.074
4. Work contagion				1	−0.193 **	−0.163 **	−0.055	−0.089
5. Co-worker support					1	0.569 **	0.405 **	0.267 **
6. Supervisor support						1	0.427 **	0.269 **
7. Fatigue management							1	0.248 **
8. Personal contribution								1

* $p < 0.05$; ** $p < 0.01$.

Furthermore, ANOVA analysis evidenced significant differences between the WP and WB levels of perceived probability of being infected by COVID-19 in daily work since WP reported lower levels compared to WB employees ($F = 9.52$, $p = 0.002$; $M_{WP} = 5.04$; $M_{WB} = 5.47$) (Table 3). This difference may be read in the light of the higher percentage of employees in the WB sample that stated that they wanted to work completely remotely (WB1) (11.3%). These employees indeed reported significant higher levels of perceived probability of being infected by COVID-19 in daily work compared to those who declared

that working blended was their actual optimal working condition (WB2), and those who declared that the optimal working condition would have been working completely in presence (WB3) (F = 37.17, $p < 0.001$; $M_{WB1} = 6.79$; $M_{WB2} = 5.36$; $M_{WB3} = 4.79$).

Table 2. Means, standard deviations, Cronbach's alphas, and correlations among the study variables in the sub-sample of smart workers.

	1	2	3	4	5	6	7	8
1. Age	1	0.034	0.006	−0.002	−0.064 *	−0.023	−0.056 *	−0.052 *
2. Exhaustion		1	0.351 **	0.108 **	−0.279 **	−0.267 **	−0.225 **	−0.269 **
3. Quantitative demands			1	0.126 **	−0.064 *	−0.074 **	−0.149 **	−0.014
4. Work contagion				1	−0.160 **	−0.148 **	−0.032	0.019
5. Co-worker support					1	0.668 **	0.329 **	0.284 **
6. Supervisor support						1	0.449 **	0.246 **
7. Fatigue management							1	0.223 **
8. Personal contribution								1

* $p < 0.05$; ** $p < 0.01$.

Table 3. Analysis of variance to compare variables among WP vs. WB.

	WP	WB	F	*p*
	M (SD)	M (SD)		
Exhaustion	2.81 (0.76)	2.76 (0.73)	1.20	0.27
Quantitative demands	3.74 (0.83)	3.70 (0.77)	0.91	0.33
Work contagion	5.04 (2.4)	5.47 (2.4)	9.52	0.002
Co-worker support	7.01 (2.6)	7.28 (2.4)	3.47	0.06
Supervisor support	6.65 (2.95)	6.77 (2.84)	0.51	0.47
Fatigue management	2.72 (1.17)	2.67 (1.12)	0.49	0.48
Personal contribution	3.75 (0.78)	3.68 (0.74)	2.44	0.12

WP = Working in Presence; WB = Working Blended; M = mean; SD = standard deviation.

Among the two samples, differences have been detected regarding gender (Table 4). In the WP sample, females reported significantly higher levels of quantitative job demand overload (F = 12.25, $p < 0.001$; $M_{WOMEN} = 3.85$; $M_{MEN} = 3.53$), whereas in the WB samples, females reported higher levels on quantitative job demand overload (F = 11.86, $p < 0.001$; $M_{WOMEN} = 3.74$; $M_{MEN} = 3.60$) and exhaustion (F = 10.00, $p = 0.002$; $M_{WOMEN} = 2.84$; $M_{MEN} = 2.59$), as well as lower levels of personal contribution (F = 12.25, $p < 0.001$; $M_{WOMEN} = 3.64$; $M_{MEN} = 3.77$).

Differences also emerged regarding contact with service users (Table 5). Specifically, in the WP sample, perceived probability of being infected by COVID-19 in daily work was significantly higher among those employees with frequent contact with service users (FCU, M = 6.04) compared with employees who had no (NCU, M = 4.39) or sporadic (SCU, M = 4.73) contacts with service users (F = 15.30, $p < 0.001$). In the WB sample, perceived probability of being infected by COVID-19 in daily work was significantly higher among FCU (M = 6.28) compared with NCU (M = 5.03) or SCU (M = 5.30) (F = 35.21, $p < 0.001$). Moreover, among the WB sample, it has also been evidenced that exhaustion was significantly higher among FCU (M = 2.87) compared with NCU (M = 2.71) or SCU (M = 2.74) (F = 15.30, $p < 0.001$). In the same vein, quantitative job demand overload was also significantly higher among FCU (M = 3.79) compared with NCU (M = 3.69) or SCU (M = 3.65) (F = 4.64, $p = 0.026$).

Table 4. Analysis of variance to compare variables according to gender among WPs and WBs.

WPs	Females (n = 238)	Males (n = 126)	F	p
	M (SD)	M (SD)		
Exhaustion	2.84 (0.79)	2.75 (0.72)	1.16	0.26
Quantitative demands	3.85 (0.84)	3.53 (0.78)	12.25	<0.001
Work contagion	5.06 (2.6)	4.98 (2.2)	0.82	0.77
Co-worker support	6.99 (2.6)	7.05 (2.5)	0.38	0.84
Supervisor support	6.53 (3.05)	6.88 (2.74)	1.19	0.27
Fatigue management	2.64 (1.18)	2.88 (1.13)	3.40	0.07
Personal contribution	3.72 (0.78)	3.80 (0.78)	0.92	0.33
WBs	**Females (n = 1111)**	**Males (n = 467)**	**F**	p
	M (SD)	M (SD)		
Exhaustion	2.84 (0.73)	2.59 (0.72)	36.7	<0.001
Quantitative demands	3.74 (0.77)	3.60 (0.75)	11.8	<0.001
Work contagion	5.54 (2.4)	5.29 (2.3)	3.73	0.053
Co-worker support	7.27 (2.6)	7.31 (2.4)	0.93	0.76
Supervisor support	6.72 (2.84)	6.89 (2.83)	1.24	0.26
Fatigue management	2.64 (1.11)	2.75 (1.13)	3.25	0.07
Personal contribution	3.64 (0.74)	3.77 (0.72)	10.00	0.002

M = mean; SD = standard deviation.

Table 5. Analysis of variance to compare variables according to contact with service users among WPs and WBs.

WPs	NCU (n = 112)	SCU (n = 138)	FCU (n = 114)	F	p
	M (SD)	M (SD)	M (SD)		
Exhaustion	2.81 (0.72)	2.81 (0.71)	2.83 (0.76)	0.20	0.98
Quantitative demands	3.81 (0.80)	3.66 (0.89)	3.77 (0.78)	1.16	0.31
Work contagion	4.39 (2.35)	4.73 (2.22)	6.05 (2.65)	15.30	<0.001
Co-worker support	7.33 (2.76)	7.12 (2.53)	6.61 (2.52)	2.37	0.10
Supervisor support	6.68 (3.0)	7.01 (2.84)	6.19 (2.90)	2.40	0.09
Fatigue management	2.68 (1.23)	2.73 (1.14)	2.74 (1.16)	1.00	0.90
Personal contribution	3.74 (0.76)	3.70 (0.83)	3.81 (74)	0.61	0.54
WBs	**NCU (n = 518)**	**SCU (n = 642)**	**FCU (n = 418)**	**F**	p
	M (SD)	M (SD)	M (SD)		
Exhaustion	2.71 (0.74)	2.74 (0.72)	2.87 (0.73)	5.89	0.003
Quantitative demands	3.65 (0.76)	3.69 (0.73)	3.79 (0.81)	3.64	0.02
Work contagion	5.03 (2.31)	5.30 (2.26)	6.28 (2.47)	35.21	<0.001
Co-worker support	7.45 (2.39)	7.32 (2.36)	6.99 (2.60)	4.29	0.014 *
Supervisor support	6.82 (2.76)	6.84 (2.74)	6.59 (2.95)	1.09	0.33
Fatigue management	2.67 (1.12)	2.69 (1.10)	2.65 (1.14)	0.20	0.81
Personal contribution	3.70 (0.76)	3.68 (0.83)	3.66 (74)	0.29	0.74

M = mean; SD = Standard Deviation; * = Leven's test significant.

Tables 6 and 7 display hierarchical regressions results for the WP and WB samples, respectively.

In the WP sample, in the first step, both quantitative job demand overload and perceived probability of being infected were positively associated with exhaustion. In the second step, colleague support, but not supervisor support, was significantly and negatively associated to exhaustion, along with quantitative job demands and perceived probability of being infected. In the third step, fatigue management was significantly and negatively associated with exhaustion, along with quantitative job demand overload, perceived probability of being infected, and colleague support. In the fourth step, personal contribution to healthy and safe practices in relation to COVID-19 management was entered by evidencing its negative and significant association with exhaustion. After inserting this variable, fatigue management stopped being significant, whereas both quantitative demands, perceived probability of being infected and colleague support, were still significantly associated with

exhaustion. No control variables were inserted, since no significant differences concerning exhaustion were evidenced regarding gender, age, and frequency of service user contact.

In the WB sample, in the first step, quantitative job demand overload and perceived probability of being infected were positively associated with exhaustion. In the second step, both colleague support and supervisor support were significantly and negatively associated with exhaustion, along with quantitative job demand overload. At this step, perceived probability of being infected was no longer significant. In the third step, fatigue management resulted in being significantly and negatively associated with exhaustion, along with quantitative job demand overload and support from colleagues and the supervisor. In the fourth step, personal contribution to healthy and safe practices in relation to COVID-19 was entered, evidencing its negative and significant association with exhaustion. In the fifth step, control variables were entered, evidencing that being female was associated with higher levels of exhaustion, whereas the frequency of contact with service users evidenced no significant association with exhaustion.

Table 6. Stepwise multiple regression parameters among employees who continued working in presence (WP sample).

		Beta	Standard Error
1			
	Quantitative job demands	0.263 ***	0.186
	Work contagion	0.166 ***	0.046
	$R^2 = 0.11$		
	$\Delta R^2 = 0.10$		
2			
	Quantitative job demands	0.232 ***	0.221
	Work contagion	0.105 *	0.044
	Co-worker support	−0.292 ***	0.015
	Supervisor support	−0.051	0.017
	$R^2 = 0.21$		
	$\Delta R^2 = 0.10$		
3			
	Quantitative job demands	0.22 ***	0.227
	Work contagion	0.111 *	0.044
	Co-worker support	−0.263 ***	0.015
	Supervisor support	−0.015	0.017
	Fatigue management	−0.123 *	0.015
	$R^2 = 0.22$		
	$\Delta R^2 = 0.01$		
4			
	Quantitative job demands	0.24 ***	0.257
	Work contagion	0.104 *	0.044
	Co-worker support	−0.242 ***	0.015
	Supervisor support	0.004	0.017
	Fatigue management	−0.099	0.015
	Personal contribution	−0.153 **	0.035
	$R^2 = 0.24$		
	$\Delta R^2 = 0.02$		

* $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$.

Table 7. Stepwise multiple regression parameters among employees who worked partly remotely and partly in presence (WB sample).

		Beta	Standard Error
1			
	Quantitative job demands	0.344 ***	0.023
	Work contagion	0.061 **	0.007
	R^2 = 0.13		
	Δ R^2 = 0.13		
2			
	Quantitative job demands	0.329 ***	0.022
	Work contagion	0.018	0.007
	Co-worker support	−0.172 ***	0.009
	Supervisor support	−0.123 ***	0.008
	R^2 = 0.20		
	Δ R^2 = 0.07		
3			
	Quantitative job demands	0.319 ***	0.022
	Work contagion	0.023	0.007
	Co-worker support	−0.168 ***	0.009
	Supervisor support	−0.09 **	0.008
	Fatigue management	−0.082 ***	0.017
	R^2 = 0.21		
	Δ R^2 = 0.01		
4			
	Quantitative job demands	0.322 ***	0.022
	Work contagion	0.036	0.007
	Co-worker support	−0.124 ***	0.009
	Supervisor support	−0.079 **	0.008
	Fatigue management	−0.055 *	0.017
	Personal contribution	−0.198 ***	0.023
	R^2 = 0.24		
	Δ R^2 = 0.03		
5			
	Quantitative job demands	0.313 ***	0.022
	Work contagion	0.024	0.007
	Co-worker support	−0.126 ***	0.009
	Supervisor support	−0.079 **	0.008
	Fatigue management	−0.053 *	0.017
	Personal contribution	−0.189 ***	0.023
	Gender (male = 0)	0.10 ***	0.036
	Sporadic contact with service user	0.013	0.038
	Frequent contact with service user	0.04	0.044
	R^2 = 0.25		
	Δ R^2 = 0.02		

* $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$.

The changing in R^2 was significant for all the steps, both in the WP and WB regression models.

4. Discussion

The present study had the aim of investigating employees' wellbeing in the university administration sector during the COVID-19 pandemic. Using the JD-R model as a framework [20], we addressed this issue by investigating the relationship between job demands and job and personal resources relevant for the specific work-related conditions of employees that continued to work in presence or that suddenly returned to work since the first phases of the pandemic. These employees, despite having to readjust to new

ways of working and having to face a higher risk of being infected by COVID-19 in the workplace, have received scarce attention until now. This study thus contributes to the acknowledgement of factors that may influence a psychologically safe return to work and a better adaptation to the so-called "new normal", which will affect workplace organization as long as the pandemic will persist.

Since our sample was composed of workers that continued working in presence (WP) or started working blended (WB), we ran analyses by considering differences between these two groups. ANOVA results evidenced that the only significant difference between the two sub-samples was detected regarding the perceived risk of being infected at work that, contrary to expectations, resulted in being higher among the WB sample compared to the WP sample. By a further inspection, we were able to hypothesize that this result was determined by the higher prevalence of workers in the WB sample in comparison to the WP, which stated that their optimal working condition would have been working completely remotely. This is consistent with past studies that evidenced that remote work can be a useful solution, especially for people concerned about COVID-19 [3,5].

However, no other significant differences have emerged regarding the quantitative job demand overload, nor the job and personal resources or the level of emotional exhaustion between WPs and WBs.

Another notable finding was detected regarding the frequency of contact with service users. Indeed, it emerged that those who had frequent contact with service users reported significantly higher levels of perceived risk of being infected at work in comparison with those with no contact or who had it sporadically. This is in accordance with previous studies in the mental health and healthcare sectors [52], strengthening the evidence of vulnerability for stress reactions, even for with having higher contact frequency with external users in non-healthcare services. Moreover, in the WB sample, having frequent contact with service users was also associated with higher levels of emotional exhaustion and quantitative job demand overload. This result highlights that working partly in presence and partly remotely can lead people to greater difficulties in the management of work tasks, especially when these involve frequent interaction with service users and being more vulnerable to the onset of stress-related symptoms. Gender differences also emerged. Consistently with previous studies [52–54], females reported higher levels of emotional exhaustion and psychological distress, as well as higher levels of perceived risk of being infected. In this regard, Sandín and colleagues [55] have suggested that there a is a gender difference in the psychological experience, somatization, and impact of the COVID-19 pandemic and the emotions it provokes, suggesting that women are more emotionally vulnerable to the effects of the COVID-19 context than men.

Finally, two distinct multiple regression models were run to detect the relationship between job demands and resources and emotional exhaustion for the WB and the WP samples.

First, the findings highlighted that quantitative job demand overload and the perceived risk of being infected at the workplace represent significant psychosocial risk factors. On the one side, the perceived risk of being infected at work was proven to be a salient job demand, capable of depleting psychological resources, as it was previously demonstrated [17], when considering the return to work during a pandemic period by negatively affecting psychological wellbeing. Specifically, the results of the present study evidenced that, despite the fact that the levels of perceived risk of being infected were higher among WBs, the regression results proved that this peculiar job demand, net of other variables, was significantly associated with higher levels of emotional exhaustion among WPs only. This is consistent with our hypothesis and previous evidence [3,5] on the protective role of working remotely for psychological safety by expanding the evidence that even a hybrid form of work can be a resource to preserve a higher psychological wellbeing in times of a pandemic.

On the other side, quantitative job demand overload emerged as a significant job demand in the relationship with emotional exhaustion for both WPs and WBs. Consistent

with existing evidence from different occupations [31,33–35], we can confirm that employees of the public administrative sector that continued, or suddenly returned to work, since the first phases of the pandemic had to significantly bear an increase in job-related demands. This has probably been affected by new work procedures and schedules, as well as the need to manage work with remote colleagues and at the same time having to maintain and comply with the procedures for the prevention of contagion that involved work organization of both WPs and WBs.

Regarding job resources, differences between the two samples emerged. Indeed, if co-worker support resulted in being negatively associated with emotional exhaustion in both samples, for the WB sample, supervisor support and fatigue management were also significantly associated with lower exhaustion levels. This is coherent, on the one side, with the extant literature on the protective role of horizontal and vertical support experienced within the workplace, especially during the COVID-19 pandemic, when it is assumed that employees are under additional and atypical stress [41,42]. In this vein, we can support that working partly in presence and partly remotely may lead to employees feeling more socially isolated and requiring higher efforts on the level of coordination of activities; therefore, the role of the supervisor and the perception of the management's skills resulted in being more salient. Such remarks may on the other hand explain the significant role of fatigue management practices only for the WB sample. For those who had to change their work practices in a hybrid way, perceiving support not only from colleagues and supervisors but also from the organization can be more relevant. Specifically, when such support is directed to the recognition of fatigue states and recovery needs, it can represent a salient job resource.

Finally, the findings of this study highlighted that, beyond the impact exerted from job resources, personal resources—specifically, the personal contribution of workers in managing the COVID-19 risk at work—are also negatively associated to exhaustion. This result has emerged for the WP sample, in which fatigue management stopped being significant after inserting the personal contribution in managing COVID-19 risk at work. In the WB sample, all the job resources remained significant after inserting the personal resource in the last step. We can identify the proactivity behavior toward safety and health at work as a form of engagement with the organization that in turn may limit the risk of exhaustion, especially in times of crisis and uncertainties that, on the contrary, may expose to a greater risk of stress and burnout. This is in accordance with recent qualitative studies conducted in the healthcare sector [34] that reported how proactivity, motivation, and personal initiatives were recognized as personal resources functional to sustain a better adaptation in the difficult times of the COVID-19 pandemic. However, future studies can evaluate more complex relationships between safety participation behaviors and stress reactions. For example, studies showed the moderating role of burnout on the relationship between safety participation and safety outcomes [56]. Moreover, studies may also expand such evidence by applying longitudinal research designs to analyze mutual relationships between emotional exhaustion and safety behaviors.

In this regard, one of the limitations of the present study is the absence of longitudinal data that would have allowed a measurement in different time points during the first year of the pandemic emergency and to control for cross-lagged association. Furthermore, the use of self-reported measurement may affect common method variance [57]. Future studies might utilize data from multiple sources (e.g., co-workers, supervisors) and control for multiple levels of information by employing multilevel analyses. Finally, since the data of the present study were collected from a non-randomized sample of higher education administrative employees, results cannot be generalized to other occupational populations that continued or abruptly returned to work during the pandemic. Research on these topics should therefore be implemented among different occupations by considering other specific job demands and resources that may have significantly affected health and wellbeing when returning to work.

Despite these limitations, the present study offers some reflections and practical implications concerning return to work and the management of the pandemic emergency within occupational sectors such as the public administration. Indeed, looking at both job demands, and job and personal resources may improve the focus on both job-related risk prevention and health-promoting strategies.

Organizations in the public administrative sector that are planning the "new normal" should consider the stressful potential of returning to work, for instance, by monitoring workloads through organizational actions of job design and involving employees through interventions that allow bottom-up work-related management, such as job-crafting [58]. Furthermore, employers should foster actions that can prevent not only the infection, but also the perception to infection exposure at the workplace. According to the present study, specific attention should be paid on how to manage COVID-19-related concerns among employees who return to work in presence. In this vein, secondary prevention strategies aimed at informing employees about COVID-19 health-related risk and organizational actions that have been adopted to effectively prevent contagion should be implemented.

On the other side, this study evidenced the need to pay attention and to sustain social participatory and support practices [59]. Considering the need of social distancing, organizations can support a better social climate between colleagues by providing remote psychosocial intervention at the group level aimed at analyzing group dynamics, improving relationships with colleagues, and improving group climate. Moreover, especially when designing hybrid forms of work, interventions should aim at sustaining leadership empowerment and strengthening leaders' emotion regulation skills that can represent primary prevention strategies able to sustain employees' need of supervisor support. At the same time, supportive organizations should recognize first symptoms of employee's fatigue and how to manage them. Tertiary prevention strategies, such as psychological support through counselling actions, can be implemented to this aim.

Finally, organizational strategies should also support or strengthen personal resources to foster contribution of workers in managing COVID-19-related issues. Specifically, psychoeducational interventions that can sustain people motivation, proactivity, work meaning, and functional behaviors to cope with COVID-19 at the workplace may be effective for a psychologically safer return to work, both for WPs and for WBs.

5. Conclusions

This research approach, theoretically founded, systematic, and on a national scale, represents a working method that can enhance our general understanding of organizational phenomena while also granting a more in-depth reading in a "situated" perspective. This could allow universities and, more generally, public administrations, to reflect on the present situation (with an evidence-based approach) and to define ad hoc interventions addressed to the management and the protection of the health of employees. Future research directions can deepen the knowledge in this field by examining other factors that may be potentially impacting on the process of returning to work. These could include investigations concerning other types of job demands, such as technology use, role, and work–life conflict, as well as aspects that may influence employees needs of working in presence or in a hybrid way, such as quality of commuting or care burden. Moreover, design research methods such as a diary study might capture more accurate information on daily or weekly experiences that can be compared between WP and WB.

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Article

Remote, Hybrid, and On-Site Work during the SARS-CoV-2 Pandemic and the Consequences for Stress and Work Engagement

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Abstract: With the COVID-19 pandemic having disrupted economies, businesses, and individual activities, it is important to examine how different forms of work affect employee behaviour. This study applies work engagement (the key construct in organisational psychology) as the dependent variable and considers its determinants in the form of stress factors and attitudes toward remote work. A cross-sectional study was conducted. A total of 544 (Female = 58.5%) workers were surveyed: remote (n = 144), hybrid (n = 142), and on-site (n = 258). The selection for the study was purposive. Standardised survey questionnaires were used in the study: UWES-9, Stress Management Standards, and Attitudes toward Remote Work. The obtained results indicate that there were no significant differences between groups in terms of the intensity of work engagement, but work engagement was explained by other variables that are different in each of the studied groups. Relationships and use of social media were the most important factors among remote workers. For on-site workers, the most important factors were control and role definition. For practitioners, the results indicate which aspects of work should be considered in order to maintain high levels of work engagement when employees are transferring to other forms of work.

Keywords: COVID-19; remote work; stress; work engagement

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1. Introduction

Over the last 2 years, the SARS-CoV-2 pandemic has greatly affected many people's lives. Carnevale and Hatak [1] indicated the complexity of the changes caused by the pandemic concerning not only work itself but also its environment. The International Labour Organisation (ILO) [2] identifies the main additional burdens in this respect, all of which are mainly associated with remote working, to which a large number of employees around the world have been assigned: isolation, blurring of work-home boundaries, and domestic conflicts. However, the analysis of remote work makes it possible to add several other factors to this list, in particular the inadequacy of equipment and organisation of the workplace. Unlike the employer's workplace, the home does not have adequate equipment and resources. Home equipment is usually not as good as the employer's, and the places where remote work is performed are mostly adaptations of home conditions and are not properly designed work spaces (ergonomics). Moreover, a remote worker does not have the same access to all the necessary resources (documentation, databases, colleague support, etc.).

1.1. Remote Working

The concept of remote work was developed in the early 1970s and simply meant working remotely with the use of IT devices and office equipment. This work was referred

to as teleworking. Teleworking is a method of organising and performing work by which the employee works outside the employer's workplace for a significant part of their working time, providing the employer with work outcomes (results) using information technology and data transfer technologies, especially the internet. In the era of general access to the internet and widespread computerisation, the term "teleworking" has been replaced with the term "remote work".

Therefore, remote work often happens in a home office [3], which has many benefits. Remote work allows people who would not be able to work in the employer's workplace to be employed and perform their professional duties. Examples include people raising disabled children, people living far away from the place of employment, experts, and eminent specialists (providing services as part of additional work). Other advantages include (a) the possibility of free contact with relatives, which makes it easier to maintain a balance between work and family [4]; (b) the possibility of reconciling work and personal life (including family life) by spending more time with loved ones; (c) no need to travel from home to work and back every day, thus saving time and money; (d) environmental protection [5].

Studies on remote working have also highlighted positive management effects: (a) greater involvement of employees in their work (e.g., due to better concentration on tasks as a result of the peace and quiet that can be found at home); (b) faster and more efficient performance of duties; (c) greater efficiency and productivity; (d) greater flexibility in planning one's own activities and adjusting them to one's daily rhythm and way of working; (e) higher employee loyalty to the employer [6].

A few studies on remote work have been conducted during the SARS-CoV-2 pandemic. Yancy [7] arrived at an interesting result: in his study, remote work was perceived as a privilege that is available to only a few. A study conducted in Wuhan, China, showed that almost 30% of patients who contracted COVID did so in an employer's workplace [8]. Employees working from home simultaneously have the opportunity to maintain social distancing and self-isolation in the event of infection or exposure to high-risk contacts. This has become the dominant form of work in numerous sectors [9]. In order to contain the spread of the virus, various measures have had to be implemented at work: reducing face-to-face contact, social distancing, adequate ventilation, hand hygiene, use of personal protective equipment, and self-isolation. In this context, remote or hybrid work was one of the most frequently used solutions [10–13]. Remote work has therefore become not only a privilege but even a necessity to protect employees from infection. Bearing in mind these results, in our study the hypothesis was adopted that perceptions of remote work vary depending on its form (H1). The next hypothesis was that the greatest number of positive effects of remote work are observed in groups of employees who perform their work remotely, slightly less in the case of hybrid work, and least for on-site work (H1a).

On the other hand, several studies have shown that remote work was also perceived as negative by employees [2]. This applies in particular to people who contracted COVID-19 but still had to work remotely. Employees performed their duties because they were concerned about job insecurity and the lack of social protection [14,15]. Therefore, a hypothesis was adopted that employees performing remote work its negative effects, in contrast to employees performing work in the traditional form (H1b), in contrast to employees performing work in the traditional form [14,16].

As shown in many studies on the SARS-CoV-2 pandemic, employees who could not perform their professional tasks remotely found themselves in a difficult situation not only due to greater exposure to infection but also due to (a) pressure from supervisors to continue working, even with flu-like symptoms [17]; (b) little possibility of obtaining paid sick leave [18]; (c) performing work in conditions that do not comply with health and safety regulations in the context of the pandemic [15,19].

The SARS-CoV-2 pandemic situation is particularly difficult for workers with poor economic status and lack of job security [20], i.e., expatriates or temporary workers. Failure to work under the conditions imposed by an employer has sometimes resulted in depor-

tation or loss of residence permits [21,22]. This situation was experienced especially by women, not only first-line staff working with the sick, but also those in other sectors of the economy. As research results show, women were paid worse than men, discriminated against at work on the basis of gender, and even abused [21,23–26]. In addition, on-site work during the pandemic has led to an increase in the perception of somatic ailments, such as fatigue, stomach upsets, sleep disturbances, headaches, or chronic pain [27].

In the situation of remote work, respondents indicated the need to quickly adapt to the new reality of the work organisation and bring work and family tasks into harmony [10,11,28]. In the situation of remotely performed work, there was also a change in the dynamics of teamwork, management methods, and social communication, all of which directly influenced the effectiveness of employees [29]. In the literature, attention is also paid to the discrepancy between the expectations and the real challenges of remote work. The dimension of the employee's control has changed, therefore it can be assumed that employees must gradually get used to working remotely: they should perceive it not only as a necessity in an emergency, but also as a natural change as a result of the Information and Communication Technologies (ICT) transformation. Therefore, the hypothesis was adopted that employees working remotely perceive their form of work as an inevitable necessity that not only protects them from infection but also facilitates and supports the work process (H1c).

The pandemic situation and remote work have significantly increased the feeling of job insecurity [30]. Moreover, changes related to the necessity to work remotely have been imposed, regardless of employees' preferences. This has negative consequences for employees, such as difficulties in disconnecting from job requirements, separating work from private life, and even other psychosocial risks such as isolation [2,31]. In view of the broad context of the possible consequences of remote or on-site work during a pandemic, it is important to investigate how the pandemic situation and the related forms of work translated into employees' functioning and perceived stress. Therefore, crucial aspects of employees' behaviour need to be described as they allow work performance to be perceived from various angles: performance level, satisfaction, job crafting, etc. This concept also includes "work engagement" [32,33].

1.2. Work Engagement

In the last 20 years, the term "work engagement" has become very popular. The EBSCO database (accessed on 28 March 2021) lists 40,645 publications in scientific journals in which "engagement" is a Keywords: In the last 5 years, the number of publications was almost 2.5 times higher than for the previous period (2017–2021: 28,937: 2012–2016: 11,708). This popularity is due to the fact that work engagement seems to be significantly positively related to adaptation to changes [34], job crafting [35], and many constructs that describe employee behaviour, such as work efficiency, creativity, civic behaviour in the organisation, and customer satisfaction [36,37]. Numerous studies have attempted to define work engagement. W. Kahn [38] used the term "personal engagement", which he defined as an employee's commitment to work in the physical, cognitive, and emotional spheres. The physical sphere is expressed in the work of the employee; the cognitive sphere is expressed in the level of concentration; the emotional sphere is expressed in emotional activation during the performance of tasks. Kahn pointed out that a prerequisite of employee involvement is the sense of job security, which is also important if employees perceive their job as meaningful and are autonomous in their work. R. Kanungo [39] defines commitment to work as the cognitive and cognitive-emotional state of mental identification with work. He also distinguished the English terms "Job Involvement" and "Work Involvement". According to him, the former term refers to involvement in a specific job that a person is currently doing; the latter refers to involvement in work understood as a sphere of human activity, regardless of its specificity. Involvement in a specific job is related to the degree to which it meets a person's current needs. The second definition of commitment refers to treating work as valuable and is associated with the construct of

work centrality. This type of commitment is the result of the socialisation process, which emphasises the importance of work.

The most popular approach in scientific research focused on work engagement is that of Schaufelli and Bakker [40], who view work engagement as a positive affective, motivational, rewarding, and work-related state of mind. Baker and Demerouti [32] called it Job Demands–Resources Theory (JD-R). According to them, the symptoms of commitment are a high level of energy combined with a high level of dedication and a strong focus on work. The source of this state is the balance between requirements and labour resources. As Bakker and Demerouti [32] claim, the most significant predictors of work engagement are work resources (e.g., support, autonomy, feedback) and personal resources (e.g., positive self-evaluations, self-efficacy). In line with Hobfol's theory [41], resources are understood as something that is valued in itself or which acts as a means to achieve important goals. Work resources are the physical, organisational, and social aspects of a work situation that help to achieve work goals. On the one hand, resources minimise the negative impact of requirements; on the other hand, they favour the individual development of employees [42]. As a part of the work resources-requirements model, the following personal resources were distinguished: self-efficacy [43], self-esteem based on organisation [44], and optimism [45]. However, these can be broadly defined as a general dimension that refers to individuals' perceptions of their ability to meet requirements in a wide range of contexts [46].

As indicated at the beginning of the article, in remote work, compared to work in the workplace, there are many factors that make it difficult to perform work; these change the resource-requirements relationship and shape completely different conditions for employee involvement. Research indicates a very wide range of responses to increased levels of psychosocial stress [47]. It is necessary to examine whether the changes brought about by even a partial transition to remote work affect the level of engagement in work. Therefore, the exact requirements of on-site, hybrid and remote work need to be analysed. Recent studies suggest that despite the convenience and availability of electronic devices [48,49], remote work is considered inferior to on-site work [48,49]. Additionally, in the population of Polish employees, remote work before the pandemic was rather uncommon, except for in some industries, e.g., IT. Therefore, due to its novelty and the weaknesses described in the aforementioned research, we hypothesised that on-site workers' engagement is higher than that of those working remotely or in a hybrid manner (H2).

1.3. Stress at Work

The drawbacks of remote work described in the literature are generally due to the greater stress generated in this situation [48,49]. Therefore, we hypothesised that the stress of remote workers would be higher than that of on-site workers (H3). It is also worth investigating stress in terms of more basic elements that are analysed separately. Job requirements in the JD-R theory are described as factors that modify (moderate) the relationship between resources and commitment. Bakker and Demerouti [32] enumerate the following work requirement factors as examples: high work pressure, an unfavourable physical environment, and emotionally demanding interactions. In earlier studies underlying the JD-R theory, R. Karasek [50] identified the main work stressors as the main examples of work requirements: work overload, time pressure, role conflict and control of the work situation. Similarly, in their Work-Life Areas model, Leiter and Maslach [51] mention six factors important for burnout and work engagement: Workload, Control, Reward, Community, Fairness, and Values. However, subsequent studies showed that the impact of Work-Life Areas on burnout and commitment turned out to be very complex [52]. In all of the models cited, the key concept—at a higher level of generality—that characterises job requirements is "stress". This is a key concept in occupational psychology, which is interested in distress or eustress. The former focuses on negative work-related phenomena (e.g., burnout); the latter focuses on positive phenomena (e.g., engagement, civic behaviour).

The Health and Safety Executive (HSE) made an interesting attempt to describe work-related stress [53] that assumes the key stressors at work to be (1) "Demands" (workload,

work patterns, and the working environment); (2) "Control" (how much say the person has in the way they do their work); (3) "Support"—Managers' support + peer support at work (which includes encouragement and resources provided by the organisation, line management, and colleagues); (4) "Relationship" (which includes promoting positive working practices to avoid conflict and deal with unacceptable behaviour; (5) "Role" (whether people understand their role within the organisation and whether the organisation ensures that the person does not have conflicting roles); (6) "Change" (how organisational change is managed and communicated). The stressors that are most compatible with the models of Karasek are "Demands" (1), "Control" (2), "Role" (5), and "Change" (6). These stressors cover almost the entire spectrum of possible sources of high work pressure, an unfavourable physical environment, and emotionally demanding interactions, as described by Bakker and Demerouti [32]. On the basis of the JD-R theory, "Support" (3) and "Relationships" (4) should instead be classified as labour resources. The source of negative stress in this case is low levels of these resources.

Demands include factors such as workload, work patterns and the working environment, all of which translate into worse perceived stress [32]. With regard to remote work, it can be assumed that because it causes an overlapping of professional and family obligations, the employee feels more overloaded (Gabr et al. 2021). At the same time, the change of workplace and difficulties related to contact with co-workers create a feeling that the previously used work strategies are inadequate and force the need to experiment with new strategies, which also makes it difficult to perform work. Additionally, since the home environment is not designed for professional work, it causes many inconveniences: especially the need for quick contact with colleagues, but also working conditions, the speed of internet connections, and the condition of equipment, all of which cause stress [54]. The home environment includes many psychosocial distractors, such as the presence of competing roles (e.g., parent) that generate additional tasks and responsibilities for the employee. As indicated in the ILO report [2], work difficulties resulting from remote work can generate anxiety and depression.

Therefore, we proposed a hypothesis (H3a) that the level of work demands is higher in the remote worker group than in the on-site worker group. The level among employees working in a hybrid system will be similar to that of remotely working employees. Moreover, the JD-R model shows that work demands have a significant negative relationship with work engagement.

One of the important characteristics of work situations that influences organisational behaviour is the interpersonal relationships that prevail within the company. These include feelings of fair treatment, trust, and kindness [55], but also rivalry, interpersonal conflict, and related company policies [56]. Research indicates that a pandemic situation affects interpersonal relationships within an organisation [57], and remote working modifies the shape of relationships between workers [58]. Therefore, we hypothesise that remote workers experience less of the negative aspects associated with interpersonal relations (H3b).

According to Karasek [50], in addition to work demands, "control" is one of the two main factors influencing employees' response to work. The literature review shows that control can be understood in three ways: a feature of a work situation, a personality trait of an individual, or a subject's conviction about their influence on the work environment. The latter understanding is most interesting in the context of work. It is understood as an employee's belief in how much say they have in the way they do their work. Research shows that the sense of control in the workplace mainly impacts occupational stress and occupational burnout [59], but it also has an impact on employees' feeling of job satisfaction and selected dimensions of mental health. Remote work involving the physical (geographical) detachment of an employee from the workplace causes a loosening of organisational ties. The supervisor can no longer enter the room where the employee works whenever he or she wants to: they can only contact the employee remotely. However, remote work may also encourage superiors to inspect employees at any time of day. Therefore, the employee is obliged to plan and control the results of his work, which translates into the belief that

the work situation is better. In P. Warr's Vitamin Model [60], control is an AD vitamin: both a shortage and an excess of it are a source of dissatisfaction with work. However, since it is the remote worker who assesses himself, it was assumed (H3c) that remote workers perceive the level of control of work as more suited to their needs.

According to Karasek [50], support is another factor that models the amount of work stress. In the perception of work stress, Karasek emphasised the role of social interactions and thus the form of direct relationships with others. Research by [61] suggests that the relationship with the supervisor plays the dominant role. Superiors' support influences work attitudes and organisational commitment [62]. However, Treiber and Davis [63] indicate that it is also important to gain support from other co-workers, which can also be a source of companionship and is particularly important during teamwork [64]. In both these cases of remote work, due to the remoteness of the resulting form of work, the form of real relationships with colleagues (either managers or colleagues) is changing (which includes dealing with unacceptable behaviour and promoting positive working practices to avoid conflict). However, support can also be understood as a systemic solution in organisations as it is an element of organisational culture that consists in the encouragement and resources provided by the organisation, line management and colleagues [53]. It is based on the empowerment of employees. It can be expected that due to the distance from the organisation, which reduces direct contact, support from management and colleagues in the situation of remote work is weaker in comparison to on-site employees (H3d).

Another stress factor often indicated in the literature is job role, which is defined as the extent to which employees know what to do and what not to do. This phenomenon may consist in a lack of information about the content of the employee's role, or contradictory information from many sources, or from the same source but in different situations [38]. A special example of stress relative to job role is internal role conflict, which consists in the need to act against one's own values in order to achieve job-related goals (whether people understand their role within the organisation and whether the organisation ensures that the person does not have conflicting roles). As the scope of superiors' control in remote work is smaller, a remote employee's freedom to define their own role is greater, thus stress related to this aspect is lower (H3e).

Change (how organisational change is managed and communicated). Many models of employee functioning emphasise the importance of autonomy at work [65], which is sometimes called control of the work situation [50]. Therefore, it can be assumed that an employee may be transferred to remote work mode by his superiors without asking for his opinion. In this situation, this remote worker treats the change as something negative, which will be an obstacle to them feeling engaged in work (H3f).

It is interesting to look at the model of shaping work engagement in respect to on-site, hybrid, and remote work, and to compare these results between groups. Due to the fact that the model of the determinants of engagement is very complex, it can be assumed that completely different aspects of work will be important in the case of employees working in remote or on-site mode. A particular work demand that is relevant to one form of work may be irrelevant to another, in part because of differences in the intensity of work demands, which have been the subject of earlier hypotheses, and because of the different situational context. Therefore, we hypothesised that the micromodel of the determinants of work engagement differs according to the form of work (H4). In our research, there will be three common forms of work: on-site, hybrid (combined on-site and remote work), and remote.

2. Materials and Methods

2.1. Problem and Hypothesis

The presentation of the research method requires a clear formulation of the research focus and problem. The research question of our project is whether the groups (remote, hybrid, and one-site work) differ in terms of work engagement, stress, and the links between these variables. For this purpose, all the hypotheses posed and justified in the

theoretical introduction are collected at the beginning of this section. This makes it easier to understand what is being researched and to see that the research method is well suited to the problem. The subject of our empirical analysis is to check the validity of the following four main hypotheses and some of their details:

H1. *Perceptions of remote work vary depending on its form.*

H1a. *The greatest number of positive effects of remote work are observed in groups of employees who perform their work remotely, slightly less in the case of hybrid work, and least in the on-site form.*

H1b. *Employees performing remote work also see its negative effects, in contrast to employees performing work in the traditional form.*

H1c. *Employees working remotely perceive their form of work as an inevitable necessity that not only protects them from infection but also facilitates and supports the work process.*

H2. *On-site workers' engagement is higher than those working remotely or in a hybrid manner.*

H3. *The stress of remote workers is higher than that of on-site workers.*

H3a. *The level of work demands is higher in the remote worker group than in the on-site worker group.*

H3b. *Remote workers experience less of the negative aspects associated with interpersonal relations.*

H3c. *Remote workers perceive the level of control as more suited to their needs.*

H3d. *Due to the distance from the organisation, which reduces direct contact, support from management and colleagues in the situation of remote work is weaker in comparison to on-site employees.*

H3e. *Remote employee's freedom to define their own role is greater, and stress related to this aspect is lower.*

H3f. *Remote workers treat the change of work form as something negative, which is an obstacle to them feeling engaged in their work.*

H4. *The micromodel of the determinants of work engagement differs according to the form of work.*

2.2. Questionnaires

The UWES questionnaire, which is currently the most widely applied in the world, was used to study the key dependent variable, namely work engagement [40]. It has two versions: a 17-item version and a shortened nine-item version. Validation studies show that the short version has better psychometric indicators, therefore this version was used in our study. It has a three-factor structure: Vigour, Dedication, and Absorption. Each factor is measured by three theorems (Cronbach's Alfa). The respondents use a seven-point scale to state how often the phenomenon described by each statement occurs in their work.

The measurement of variables related to the characteristics of the work situation was conducted using the "Management Standards" questionnaire [66]. This questionnaire consists of 35 statements that measure seven key work-related stress factors: Demands—issues such as workload, work patterns, and the work environment; Support—the encouragement, sponsorship, and resources provided by the organisation, line management and colleagues; Relationships—promoting positive interpersonal relations to avoid conflict and deal with unacceptable behaviour; Control—how much say the employee has in the way they do their work; Role—whether people understand their role within the organisation and whether the organisation ensures that the person does not have conflicting roles; Change—how organisational change (large or small) is managed and communicated in the organisation. The reliability of the individual scales of the questionnaire has been confirmed ($0.66 < \alpha$ Cronbach's < 0.84).

Attitude towards remote work was measured with the Remote Work Test (Test Pracy Zdalnej, TPZ) questionnaire by Bartczak and Wontorczyk [67]. This questionnaire consists of 35 items measured on a five-point scale, where 1 means "I strongly disagree" and

5 means "I strongly agree". It includes three factors related to remote work: positive reinforcement, negative reinforcement, and temporal orientation. This tool has good measures of internal reliability, as measured with Cronbach's alpha coefficient: ranging from 0.82 for Temporal Orientation to 0.92 for Positive Reinforcement. A shortened 11-item version of this questionnaire was used in this study. Four items were for positive reinforcement; four were for temporal orientation; and three were for negative reinforcement. The internal reliability of the subscales of the shortened version of TPZ turned out to be slightly weaker than the full version, but it was satisfactory. Cronbach's alpha coefficient for the subscale was 0.82 for Positive Reinforcement, 0.72 for Negative Reinforcement, and 0.70 for Temporal Orientation. The Positive reinforcement scale describes the positive aspects of remote work, indicating such issues as time saving, greater availability for the family, better organisation of working time, and greater possibility of carrying out tasks outside of work. In turn, negative reinforcement scale indicates the negative dimension of remote work, lack of contact with superiors, a sense of uncertainty regarding the quality of work, as well as further employment, lack of contact with colleagues and management, and conflicts in the family. Temporal orientation describes the perception of remote work as a necessity to which one should adapt, due to not only the circumstances of the SARS-CoV-2 virus but also new challenges related to the organisation of work in the contemporary digital reality.

In addition, in order to also measure physical work conditions, individual questions were asked in the demographics part of the research questionnaire about housing conditions and internet connection speed. To measure time pressure, there were also questions about checking official e-mail accounts and contacting superiors outside working hours.

2.3. Sample

The research was carried out online at the beginning of April 2021, i.e., at the peak of the third wave of SARS-CoV-2 in Poland, when the number of COVID-19 cases exceeded over 30,000 people a day. The research sample consisted of a total of 533 respondents living in three provinces in southern Poland: Małopolskie, Świętokrzyskie and Podkarpackie. One hundred and thirty-nine people worked remotely, 140 were hybrid workers, and the remaining 254 people worked from their employers' offices. The study group included 312 women (58.5%) and 221 men (41.5%). Of the respondents, 42.4% had secondary or primary education, and the remaining 57.6% were people with higher education. 96 people (18%) were employed in managerial positions, 244 (45.8%) worked as specialists, and 193 respondents performed simple work (executive positions). The sample was deliberately selected to ensure large numbers of respondents in both forms of work: remote (n = 286) and on-site (n = 258). Then, the group of remote employees was divided into two subgroups: only working remotely (n = 144); hybrid employees, i.e., those combining on-site and remote work (n = 142). These three groups became the basis of our analysis.

The study was conducted in accordance with the Declaration of Helsinki; it was approved by the Institutional Ethics Committee of the Institute of Applied Psychology of Jagiellonian University (protocol code 109/2021, 30 November 2021) for studies involving humans. Data available in the Institute of Applied Psychology Jagiellonian University, Department of Work and Organizational Psychology

3. Results

This section is divided by subheadings as this should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

3.1. Descriptives Demographic

The demographics data in Table 1 shows that in 33 cases (6.2%) the participants' housing conditions "did not allow them to work from home", and 54 respondents (10.1%) "were probably not allowed to work from home"; however, most of the respondents said they "were definitely allowed to work from home" (n = 142; 26.6%) or were "probably allowed"

(*n* = 181; 34%). The rest of the sample responded without making a clear declaration (*n* = 123; 23.1%). At the same time, most of the respondents declared that they had good internet bandwidth (*n* = 376; 70.5%).

Table 1. Frequencies of describing the working conditions of remote work (*n* = 533).

Do My Housing Resources Allow Me to Comfortably Work at Home?	*n*	%
Definitely not	33	6.2
Probably not	54	10.1
Yes and no	123	23.1
Probably yes	181	34.0
Definitely yes	142	26.6
Internet connection I have at home:	*n*	%
Low bandwidth	57	10.7
Low bandwidth shared with others	84	15.8
Good bandwidth	376	70.5
I have no internet	16	3.0

When describing their internet activity, 476 (90%) respondents stated that they had an account on one or more social networks. A lack of such a profile was declared by the remaining 54 participants (10%). One hundred and sixty-four respondents (30.8%) answered work e-mails containing tasks to be performed after working hours. Ninety-nine respondents reported that they received e-mails from supervisors' containing only work-related content (18.6%). The other 270 respondents did not answer work e-mails at home after working hours (50.7%), which indicates that some remote workers had established a clear boundary between work and home. At the same time, when asked about contact from their superiors after working hours, some respondents (*n* = 249; 46.7%) replied that they did not respond in matters not related to work (*n* = 56; 10.5%). Two hundred and twenty-eight respondents (42.8%) stated that they were sometimes contacted by their superiors after working hours, but only for urgent matters.

3.2. Comparison of Means

The first group of hypotheses was related to the differences between remote, hybrid, and on-site employees in terms of their involvement in work and assessment of working conditions. In order to verify these hypotheses, a series of one-way analyses of variance was performed. The results are shown in Tables 2–4.

Table 2. Means and deviations as well as the analysis of variance of work engagement in individual groups of respondents distinguished according to the form of work.

Group of Workers		UWES Dedication		UWES Vigor,		UWES Absorption		UWES Total Work Engagement	
	n	M	SD	M	SD	M	SD	M	SD
Remote	139	10.26	3.30	11.55	3.21	10.87	3.10	32.68	8.33
Hybrid	140	10.24	3.04	11.52	3.22	11.33	2.85	33.09	8.03
On-site	254	10.66	3.57	11.25	3.64	10.70	3.46	32.61	9.03
Total	533	10.44	3.37	11.40	3.42	10.91	3.22	32.75	8.58
F		0.478		1.00		1.733		0.145	
Df		2/530		2/530		2/530		2/530	
p		n.i.		n.i.		n.i.		n.i.	

n.i.—not important.

Table 3. Means and deviations as well as analysis of the variance of work characteristics in individual groups of respondents distinguished according to the form of work.

Variable:	Work Mode:	Remote	Hybrid	On-Site	F	DF	*p*
Demands	M	21.96	22.06	21.81	0.088	2/530	n.i.
	SD	6.08	5.2	5.96			
Control	M	22.09	22.7	21.26	4.621	2/530	0.01
	SD	3.9	4.4	5.09			
Management Support	M	16.27	16.19	15.7	2.187	2/530	n.i.
	SD	2.94	2.46	3.16			
Colleagues' Support	M	13.56	13.83	13.5	1.144	2/530	n.i.
	SD	2.28	1.68	2.24			
Relationships	M	8.24	7.72	8.54	3.106	2/530	0.046
	SD	3.43	2.6	3.17			
Role	M	19.73	20.55	20.13	2.014	2/530	n.i.
	SD	3.05	3.05	3.74			
Change	M	10.61	10.58	10.51	0.095	2/530	n.i.
	SD	2.14	1.92	2.53			
	n	139	140	254			

n.i.—not important.

Table 4. Means and deviations as well as the analysis of variance of work engagement in individual groups of respondents distinguished according to the form of work.

Group of Workers		TPZ Positive Reinforcement		TPZ Negative Reinforcement		TPZ Temporal Orientation	
	n	M	SD	M	SD	M	SD
Remote	139	12.61	2.96	9.35	2.15	12.62	2.39
Hybrid	140	11.23	3.26	8.39	1.83	12.34	1.79
On-site	254	11.59	2.96	7.78	2.29	11.08	2.51
Total	533	11.76	3.08	8.35	2.23	11.81	2.41
F		7.99		24.13		24.83	
Df		2/530		2/530		2/530	
p		0.001		0.001		0.001	

As can be seen from the data presented in Table 2, there was no significant difference between the groups of remote, hybrid and on-site employees. It can be said that in terms of both the general engagement index and individual factors, these groups do not differ from each other.

However, the analysis of mean work demands showed statistically significant differences between groups only for two variables (see Table 3). These differences concerned the employee having control over the work situation, i.e., the Control variable (F = 4.62; df = 2/530; $p = 0.01$). The lowest results in this respect were obtained by on-site workers (M = 21.26; SD = 5.09). Post hoc analysis with Dunnett's T3 test (which does not assume homogeneity of variance) indicated that a significant difference was found for hybrid and on-site employees ($p = 0.01$). The difference between the group of remote and on-site employees did not reach the level of statistical significance, although it approached it. The second significantly differentiating variable was the assessment of the Relationships variable (F = 3.11; df = 2/530; $p = 0.05$). The lowest results in this respect were obtained by hybrid employees (M = 7.72; SD = 2.60). This group differs significantly from on-site workers ($p = 0.02$).

The most diverse assessments between the studied groups occurred in terms of responses to the TPZ questionnaire. These data are presented in Table 4. In this case, all the dimensions of the attitude described in the test tool have been rated differently. Remote workers perceive the highest number of positive aspects (Positive reinforcement) of this kind of work (M = 12.61; SD = 2.96). In the remaining two groups, the results obtained from

the employees are lower (F = 7.99; df = 2/530; $p = 0.001$). The differences are significant for the groups of remote and on-site employees ($p = 0.004$) as well as remote and hybrid employees ($p = 0.001$). In addition, in terms of perceiving negative aspects, the groups differ significantly (F = 24.13; df = 2/530; $p = 0.001$). In this case, remote workers also perceive the highest number of negative aspects (Negative reinforcement) of their form of work (M = 9.35; SD = 2.15). However, as is easy to see, this is a much lower result than the positive aspects. Compared to hybrid and on-site mode, this difference is very significant: in both cases, it reaches the significance level of $p < 0.001$. The difference between hybrid and on-site employees is also significant ($p = 0.01$). This creates a coherent picture in which the less remote work there is, the less its negative aspects are noticed. In addition, in TPZ Temporal Orientation, the mean obtained by employees in this group is the highest (M = 16.62; SD = 2.39). These results differ from those obtained in the other groups (F = 24.83; df = 2/530; $p = 0.001$). In this case, the groups of remote and hybrid workers are no different. The group of on-site workers gained significantly lower results (M = 11.08; SD = 2.51) than the other two ($p < 0.001$ in both cases). Based on these analyses, it can be said that remote workers see many positives of their work mode; although on-site workers have much less to say about remote work, their cognitive representation of remote work is poorer in all aspects.

3.3. Regression Analysis

Quantitative comparison of regression models is very difficult because it requires the comparison of all relationships in the model, therefore the concept of qualitative comparison of models performed separately for individual groups was adopted. A block regression analysis with the input method (SPSS 21) was used. The first block included demographic variables (gender, age, job position, and seniority in the current position); the second block included features related to the use of the internet at work; the third group included characteristics of the work situation, measured with the HSE questionnaire; the fourth group included attitude towards remote work.

The regression analysis results for the group of remote workers are presented in Table 5. Data on demographics and internet use explain a very small part of the variance of the work engagement variable (8%). Only the inclusion in the model of variables describing the work situation increased the percentage of the explained variance to 30%. The addition of data from the TPZ Questionnaire increased this percentage to 32%, which is on the borderline of significance.

In the first block of data, the position ($\beta = 0.180$; $p = 0.035$; $r_{a(b,c)} = 0.174$) and seniority in the current position ($\beta = 0.372$; $p = 0.004$; $r_{a(b,c)} = -0.243$) were linked with work engagement. This shows that higher position and work seniority are linked with a higher level of work engagement. Gender and age showed no relationship with the dependent variable.

The block of variables describing internet use turned out to be significant only in combination with the characteristics of the work situation. In Model 3, the following factors were important: reading emails ($\beta = -0.179$; $p = 0.032$); having an account on social networks ($\beta = 0.249$; $p = 0.006$); the aspect of work Control ($\beta = 0.253$; $p = 0.006$); and Relationships ($\beta = -0.323$; $p = 0.001$). Reading emails after working hours was associated with lower work engagement, while having social media account/s was associated with a higher level of it. In the case of control, the higher the sense of influence on the work situation, the greater the commitment. Bad relationships in terms of conflicts in the organisation and friction between employees were associated with lower involvement. In the block of variables related to attitude towards remote work, the "Temporal orientation" aspect of remote work and level of work engagement ($\beta = 0.161$; $p = 0.05$) are significant. When employees are able to independently organise their work, this promotes work engagement.

Table 5. Regression coefficients for explanation of work engagement for the group of remote workers.

Variables	Model 1			Model 2			Model 3			Model 4		
	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$
Sex	0.017	0.837	0.017	0.024	0.771	0.024	−0.003	0.972	−0.003	0.020	0.790	0.019
Age	−0.202	0.113	−0.130	−0.181	0.161	−0.115	−0.118	0.331	−0.069	−0.091	0.451	−0.053
position	0.180	0.035	0.174	0.175	0.045	0.165	0.105	0.198	−0.092	0.157	0.061	0.133
How long have you been working in your current position?	0.372	0.004	0.243	0.335	0.011	0.211	0.269*	0.023	0.164	0.256	0.029	0.155
Do your supervisors contact you after working hours?				0.074	0.424	0.066	0.003	0.969	0.003	−0.022	0.796	−0.018
Do you read work emails after working hours?				−0.135	0.151	−0.118	−0.179	0.032	−0.154	−0.193	0.020	−0.165
Do you have any social media accounts?				0.046	0.583	0.045	0.249	0.006	0.200	0.222	0.014	0.175
HSE Demands							−0.027	0.805	−0.018	−0.016	0.887	−0.010
HSE Control							0.253	0.006	0.200	0.191	0.040	0.146
HSE Management support							0.044	0.708	0.027	0.057	0.628	0.034
HSE Colleagues Support							0.171	0.127	0.109	0.157	0.158	0.100
HSE Relationships							−0.323	0.001	−0.236	−0.347	0.001	−0.246
HSE Role							0.142	0.121	0.111	0.162	0.075	0.126
HSE Change							−0.092	0.406	−0.059	−0.135	0.225	−0.086
TPZ Positive reinforcement										0.127	0.102	0.116
TPZ Negative reinforcement										−0.017	0.837	−0.015
TPZ Temporal orientation										0.161	0.056	0.135
AdjR^2	0.080			0.077			0.301			0.320		
Change R^2	0.107			0.018			0.247			0.032		
F of change	3.994			0.874			6.973			2.163		
df1	4.000			3.000			7.000			3.000		
df2	134.00			131.00			124.00			121.00		
p of change	0.004			0.456			0.000			0.096		

In the group of hybrid employees, demographic variables explained only 4% of the variance; adding another block increased this parameter to 7%; this change was close to statistical significance. However, only adding the third block increased the explained variance to 15%. The addition of the fourth block did not change this parameter, which indicates the low importance of this block in the group of employees combining remote and on-site work. In this analysis (see Table 6.), the demographic variable associated with engagement is gender (β = −0.20; $p = 0.020$). Women were more engaged. There was also a weak relationship with the position held (β = −0.156; $p = 0.076$): the higher the position, the stronger the tendency to reveal commitment to work. After adding the use of the internet block, an important relationship was reading work emails after working hours (β = −0.186; $p = 0.051$). The block of variables of stress factors showed "Role" (role-related work characteristics) (β = 0.213; $p = 0.037$) and "Control" (β = 0.206; $p = 0.049$) as being linked to work engagement. "Role" (including items such as better understanding of one's tasks and lack of conflicts related to the role) contributes to work engagement. In the case of control, it was the same as in the group described earlier: if employees perceived that they had an influence on the work situation, they were more engaged.

For the group of on-site employees (see Table 7.), the level of explained variance was similar to that of the group of remote employees: 33%. The demographic block allowed only 4% to be explained. Adding a block of variables related to the description of the work situation greatly increased this parameter to 33%. Adding the fourth block of variables, which relates to attitudes towards remote work, did not increase the level of explained variance. Among the demographic variables, gender (β = −0.121; $p = 0.053$; $r_{a(b,c)} = -0.120$) and position (β = 0.174 $p = 0.007$; $r_{a(b,c)} = 0.168$) were linked with work engagement. The data showed that women and senior employees were more engaged in their work. After adding a block of variables describing the work situation, a significant relationship occurred between involvement and Role (β = 0.268; $p = 0.001$; $r_{a(b,c)} = 0.203$), Control (β = 0.331; $p = 0.001$; $r_{a(b,c)} = 0.269$), and Management support (β = 0.180; $p = 0.019$; $r_{a(b,c)} = -0.121$). Better understanding of one's professional role, the ability to influence one's work, and having supportive supervisors were associated with on-site employees' greater involvement with their work.

Table 6. Regression coefficients for explanation of work engagement for the group of hybrid employees.

Variables	Model 1			Model 2			Model 3			Model 4		
	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$
Sex	−0.200	0.020	−0.196	−0.197	0.020	−0.193	−0.149	0.076	−0.140	−0.142	0.098	−0.131
Age	0.174	0.159	0.118	0.232	0.065	0.153	0.091	0.490	0.054	0.088	0.521	0.051
position	0.156	0.076	0.148	0.178	0.041	0.169	0.097	0.285	0.084	0.110	0.239	0.093
How long have you been working in your current position?	−0.157	0.194	−0.108	−0.160	0.181	−0.110	−0.069	0.568	−0.045	−0.071	0.562	−0.046
Do your supervisors contact you after working hours?				0.092	0.328	0.080	−0.047	0.628	−0.038	−0.038	0.704	−0.030
Do you read work emails after working hours?				−0.186	0.051	−0.161	−0.111	0.240	−0.092	−0.111	0.245	−0.092
Do you have an account on social networks?				−0.149	0.095	−0.138	−0.140	0.107	−0.127	−0.135	0.124	−0.122
HSE Demands							0.042	0.670	0.033	0.046	0.662	0.035
HSE Control							0.206	0.049	0.155	0.205	0.056	0.152
HSE Management support							0.115	0.295	0.082	0.116	0.299	0.082
HSE Colleagues Support							−0.121	0.258	−0.089	−0.114	0.289	−0.084
HSE Relationships							−0.072	0.498	−0.053	−0.078	0.475	−0.056
HSE Role							0.213	0.037	0.164	0.217	0.036	0.167
HSE Change							0.031	0.769	0.023	0.029	0.785	0.022
TPZ Positive reinforcement										−0.029	0.762	−0.024
TPZ Negative reinforcement										0.010	0.910	0.009
TPZ Temporal orientation										0.091	0.311	0.080
$AdjR^2$	0.042			0.068			0.152			0.139		
Change R^2	0.070			0.045			0.122			0.007		
F of change	2.522			2.261			2.855			0.391		
df1	4			3			7			3		
df2	135			132			125			122		
p of change	0.044			0.084			0.009			0.759		

Table 7. Regression coefficients for explanation of work engagement for the group of on-site workers.

Variables	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$	β	*p*	$r_{a(b,c)}$
Sex	−0.121	0.053	−0.120	−0.117	0.061	−0.116	−0.094	0.077	−0.091	−0.095	0.074	−0.092
Age	−0.055	0.477	−0.044	−0.052	0.518	−0.040	−0.005	0.944	−0.004	0.000	0.998	0.000
position	0.174	0.007	0.168	0.165	0.011	0.157	0.069	0.215	0.064	0.066	0.248	0.059
How long have you been working in your current position?	0.124	0.102	0.101	0.098	0.200	0.079	0.073	0.257	0.058	0.069	0.293	0.054
Do your supervisors contact you after working hours?				−0.107	0.105	−0.100	−0.080	0.157	−0.073	−0.076	0.187	−0.068
Do you read work emails after working hours?				−0.073	0.279	−0.067	−0.043	0.456	−0.038	−0.043	0.460	−0.038
Do you have any social media accounts?				0.063	0.366	0.056	0.030	0.611	0.026	0.021	0.718	0.019
HSE Demands							−0.013	0.870	−0.008	−0.014	0.868	−0.009
HSE Control							0.331	0.000	0.269	0.334	0.000	0.271
HSE Management support							0.180	0.019	0.121	0.170	0.028	0.113
HSE Colleagues Support							−0.005	0.943	−0.004	−0.002	0.973	−0.002
HSE Relationships							−0.042	0.601	−0.027	−0.042	0.615	−0.026
HSE Role							0.268	0.000	0.203	0.275	0.000	0.206
HSE Change							−0.054	0.505	−0.034	−0.050	0.545	−0.031
TPZ Positive reinforcement										−0.016	0.821	−0.012
TPZ Negative reinforcement										0.079	0.223	0.063
TZP Temporal orientation										−0.067	0.347	−0.048
$AdjR^2$	0.037			0.048			0.335			0.333		
Change R^2	0.052			0.022			0.298			0.005		
F of change	3.430			1.924			16.222			0.682		
df1	4			3			7			3		
df2	249			246			239			236		
p of change	0.009			0.126			0.000			0.564		

4. Discussion

When starting this study on work engagement among employees during the SARS COV-2 pandemic, it was assumed that it may be related to the resulting diversification of work modes. Studies claim that high work engagement is associated with continuous positive motivational feelings and even enthusiasm for one's job [68]. Employees feel so energised and proud of their work that they often do not control their working time [69].

However, when there are additional non-job-related tasks in the course of work, such as when carrying out professional tasks at home [70], a conflict between work obligations and family obligations may occur. It can be assumed that commitment to work consequently decreases. Hypothesis H2 was thus not confirmed. No statistically significant differences were found in terms of both general and specific forms of work engagement. Employees were equally involved in the performance of professional duties, regardless of whether their work mode was on-site, hybrid, or remote. Interpretation of this relationship should be sought in two directions. The first is related to the good organisation of professional duties performed at home. Workplace management plays a special role here as it allows employees to flexibly manage their work environment [71]. Many studies have found that flexible work arrangements (FWA) improve the well-being and health of employees [72] and even increase work engagement [62,73,74]. A certain exception is the study by Rudolph and Baltese [75], which found that flexible working conditions and organisation had a positive effect on employee work engagement, provided that they were not associated with deterioration of health. Isolation and avoiding contact with management and co-workers through hybrid or remote work prevented employees from becoming infected and thus strengthened the maintenance of health. The obtained results of our study are therefore consistent with these studies. To some extent, these results are also in line with other studies which have shown that work engagement has a positive impact on family life, while workaholism leads to family conflicts and thus has a negative impact [36,76]. Working remotely is conducive to maintaining positive family relationships.

The second way of interpreting the results may be related to the strengthening role of social media, which enables interactivity and openness to social relations in real-time mode. Several studies have confirmed that social media can replace the real social processes that occur in organisations: communication, relationship building, cooperation [77–80], and work engagement [81]. Other studies have shown that active presence on social media also reduces stress at work and even occupational burnout. In our study, as many as 90% of employees declared that they had social media accounts, which could also contribute to the strengthening of social relations with co-workers or management in remote or hybrid work situations.

Our study also attempted to find connections between the form of work environment and stressors at work (H3). Several hypotheses were formulated in relation to this issue. It was assumed that remote and hybrid work would limit demands (H3a). The results of the study did not confirm these assumptions, therefore the following hypotheses were not confirmed: H3d, which assumed weak support from management and colleagues in remote working situations; hypothesis H3e, which concerns the Role variable; and hypothesis H3f, which concerns the Change variable. Statistically significant relationships were found only in the case of two stressors: Control (H3c) and Relationship (H3b). Regarding control, it was assumed that remote or even hybrid work would be more conducive to the feeling of work control than on-site work. In the case of remote work, employees have a greater ability to control their work, both when its organisation is imposed on them and when they are left to make their own decisions. These results are consistent with the assumptions of the theories of Karasek [50], Warr and Clapperton [60], Bakker and Demerouti [32], as well as with the results of other studies [59]. The interpretation is more complex in the case of the second important regression path, which indicates a positive relationship between employees and management in the case of on-site and remote work, and weaker ones among hybrid workers. In the case of on-site work, frequent and positive encounters with supervisors seem logical, provided that employees experience favourable treatment from management, as pointed out by other researchers [82]. The issue concerning the importance of communication between employees and management is also raised by the LMX theory, the validity of which has been confirmed by the results of numerous studies. Several studies have found that employees with high-quality LMX relationships experience higher autonomy at work [83], are more responsible employees [84], and are more likely to speak out about work organisation [85]. In the case of remote work, it can be

presumed that factors that contribute to the perception of good relations with superiors despite the lack of physical contact will be the perception of the employee's obligation to undertake constructive change [1,86,87]; increased sense of responsibility to perform tasks in difficult new conditions [88]; and behaving responsibly at work [89]. In turn, hybrid work organisation forces employees to constantly adapt to the changing work environment, which contributes to the deterioration of relations with superiors and colleagues. This form of work, as confirmed by observations, is conducive to the emergence of conflicts between employees over the question of who will work in the employer's office and who will work remotely. The resulting feeling of inequality, both in terms of distribution and information, is an important stressor at work [90,91]. As shown by the results of some studies, perceiving a lack of distributional justice and a lack of informational justice may consequently lead to a decline in work engagement. Admittedly, our research did not find differences in work engagement due to the three different forms of work, possibly because hybrid and remote workers treated these solutions as temporary during the lockdown period.

Finally, an important aim of the study was to find a relationship between perceptions of remote work depending on whether the respondents' work is performed in the office, in a hybrid manner, or remotely. Statistically significant results were obtained in all three scales of perception of remote work (H1). As expected (H1a, H1b, and H1c), the highest results in all three scales were obtained for people working remotely. Employees perceive all three dimensions of remote work (Positive, Negative, and Temporal). These results are logical because employees who work remotely see its benefits to a greater extent than hybrid workers: protection against infection, flexible organisation of working time, time saving, lower costs, and greater opportunities to pursue hobbies. They understand its limitations (lack of physical contact with superiors and co-workers, job insecurity). Finally, they realise that developing specific organisational strategies for remote work will inevitably make it a reality after the end of the SARS-CoV-2 pandemic. A similar attitude was also detected in employees working in hybrid mode, except for poor perception of the positive aspects of remote work measured by the TPZ questionnaire. In all three aspects, remote work was rated worst by on-site employees. Thus, the obtained results are consistent with other studies that relate to both the positive and negative aspects of remote work. Many studies have found that remote work is a privilege that protects an employee against contracting COVID-19 [7,9–11,13]). Its negative consequences were also noticed: working despite being ill [2]; fear of losing a job and income [14,16]; and little possibility of getting paid sick leave [18]. A question arises as to why the employees in our study who continued to perform their professional duties from the office during the SARS-CoV-2 pandemic did not perceive the value of remote work. After all, many studies have indicated the negative effects of on-site working in a pandemic situation: depression, stress, and fear of getting sick [4,92–94], and a decline in psychological well-being [95,96]. The above-mentioned research was carried out mainly among broadly understood medical staff: nurses, paramedics, orderlies, and doctors. These people were not only susceptible to infection but also came into direct contact with people infected with the SARS-CoV-2 virus. They were not able to perform their professional duties in any other form. Our research did not involve people working in hospitals, therefore our participants did not experience the stress of working with COVID-19 patients, as has been observed in nurses and doctors [97–100]. It is worth emphasising that respondents more often indicated all three aspects of remote work measured by the TPZ questionnaire as important when they longer performed it. This regularity was not observed in on-site employees and was observed only weakly in hybrid employees.

Another important aim of the study was to detect predictors of particular ways of performing professional duties among the various independent variables included in the study (H4). As already mentioned, the explanatory variables (potentially assumed predictors) were divided into four groups: (a) demographic variables; (b) having an internet connection at home, its speed and bandwidth; (c) characteristics of the work situation measured with the HSE questionnaire; and (d) attitude towards remote work. We will

start the analysis of predictors with the case of employees who perform their work only on-site, i.e., the most unfavourable situation from the point of view of the potential risk of contracting the SARS-CoV-2 virus. The largest increase in the explanatory variance for this form of work was obtained when taking into account the total of the first three groups of variables (a, b, and c). When the fourth group of variables (d) was included in the analysis, the value of the variance of explaining the dependent variable decreased. This result is logical because employees working on-site had virtually no experience of working remotely. The predictors turned out to be control, role, and management support. These results are consistent with other studies which indicated that motivation and job satisfaction [60] and, consequently, also engagement [101] depend to a large extent on the sense of control over the environment and tasks performed. The sense of control is also reduced by stress at work [59] and protects against burnout. The same is true for the other predictors, i.e., management support and role definition. Many studies have indicated that management support reduces stress [62,63], promotes teamwork [64] and strengthens organisational culture [53], all of which are very important, especially in emergency situations, and the SARS-CoV-2 pandemic should be considered as such. Similarly, in the case of the Role variable, when it does not conflict with employees' own value systems, it does not raise doubts in terms of how they should behave in a given situation when performing tasks. It is an important work resource. Therefore, it can be assumed that all three resources of the work situation (control, role, and management support) are also important in threatening situations.

In the case of remote work, the best-fit prediction model was obtained when all four groups of explanatory variables (a, b, c, and d) were taken into account. However, only some explanatory variables from groups b, c and d turned out to be predictors. As expected, it was assumed that if someone works longer in a given position, their engagement will not change during a pandemic that requires remote work. Most likely, even before the pandemic, these employees had experienced remote work and their engagement during the pandemic did not decrease but rather increased. Employees in this group had already developed a positive attitude towards this form of work and the pandemic only strengthened it. This model is consistent with another predictor, which concerns the attitude towards remote work (d), in particular the perception of the temporal dimension of remote work. Nowadays, it is natural to use advanced digital technologies at work. It can be assumed that this form of work is treated by employees as a privilege, as has been found in several studies [7,8,10–13].

Another important predictor was the fact that employees had social network accounts. People are social creatures and social isolation emphasises this need even more. This fact has been pointed out in several studies [102]. Nowadays, one substitute for meeting this need for daily contact is virtual contact through social media. Several studies have shown that being active on social networks relieves stress and improves the quality of life. Continuously checking emails, especially after working hours, also turned out to be a negative predictor which significantly reduces employees' engagement in the performance of their professional duties. This fact has already been pointed out in other studies. This factor seems to be particularly important in the situation of remote work performed at home, where the employee should have a precisely defined time structure divided into professional duties and rest. Otherwise, he has a feeling of discomfort and lack of privacy and rest. This has also been emphasised by other researchers, who indicated that for this reason employees negatively assessed work performed remotely [10,11,28]. When it comes to work resources, only two variables turned out to be predictors of engagement. A positive work engagement predictor was the Control variable that was assumed in this study. On the other hand, the Relationships variable turned out to be a strong negative predictor of work engagement. When it comes to Control, the correlation is logical. The Relationships variable has an exceptionally strong impact on well-being and, as a result, on work engagement, especially when the relationships are negative. Reduced engagement in remote work as a result of poor relationships with colleagues and management can be

both an effect and a cause. Several studies have indicated that, during the SARS CoV-2 pandemic, employees experienced job insecurity [103], pay inequality [14], a feeling of unequal burden of duties [23], more exposure to the threat of coronavirus infection and harassment [21], and even deportation in the case of immigrants [21,22]. These factors can lead to conflicts at work.

In the case of work performed in hybrid mode (alternately on-site and remote), the highest percentage of explanatory variations was obtained after excluding the variables from the analysis that describe the attitude towards remote work (d). Then, two explanatory variables, Control and Role, i.e., the variables from group (c), turned out to be work engagement predictors. These results are logical. Having control of the work performed by the employee is important for work engagement, regardless of whether work is performed on-site or remotely. Similarly, in the case of the Role variable, the employee knows what is expected of him and how tasks should be performed. Both these variables are most conducive to work engagement when working in a hybrid manner. Thus, it seems that women show greater engagement in the hybrid form of work, although these results are only on the edge of the statistical trend. The lack of predictive value of the variables from block (d) in the case of hybrid work may be an indication that these results should be analysed in both a positive and negative aspect. In the first case, remote work is perceived as a privilege and applies particularly to employees who also worked remotely before the pandemic [7,8,10–13]. In the second case (negative assessment), employees may have experienced a sense of injustice: why are they the only ones working on an on-site basis while others are working in a hybrid form? Why do managers contact some employees face to face and others only by email? The only factors that do not raise such doubts in our study are control and role.

5. Conclusions

The conducted study has not shown any differences in terms of any type of work engagement, regardless on the form in which it is performed. As for the characteristics of work, it is related to only two variables: Control and Relationships. In the case of Control, the strongest relations occur with respect to the hybrid and remote modes. In the case of the Relationships variable, the strongest relations occur with respect to the hybrid and on-site modes. In turn, the attitude towards remote work is related to each of the forms of work implementation in the situation of the SARS-CoV-2 epidemic. Employees who work remotely on a daily basis perceive the most positive, negative, and temporal aspects of remote work. The temporary aspect of remote work is also noticed by employees who perform their professional duties in hybrid form.

When looking for the predictors of work engagement in the SARS-CoV-2 situation, it was found that they differ depending on the current form of work. In the case of on-site work, its predictors are only factors related to the work situation (Control, Role, and Management Support), similarly as in the case of work performed in a hybrid manner (Control and Role). A broader list of predictors was obtained only in the case of performing work remotely, which is most beneficial from the point of view of protection against COVID-19 infection. These include not only the variables related to the characteristics of the work environment (control, relations), but also demographic variables (duration of remote work), social conditions (presence on social media and the employer's respect for working hours), and attitude towards remote work (in particular, the belief that it is something natural in an emergency).

6. Limitations

The limitation of the study is the fact that it was carried out online. Many respondents could therefore falsify their data or present false opinions. Since the study was carried out at the peak of COVID-19 infections (the third wave in Poland), we may assume that the state of social isolation also translated into the evaluation of every form of work, in particular remote work. Another consequence of the pandemic situation was the reduced

control over the composition of the group. This resulted in a certain inadequacy of the group composition in terms of the demographic characteristics controlled in the study. However, in a situation of a strict sanitary regime and online research, this problem could not be solved otherwise.

Another limitation is related to the size of the group. Although the total size is acceptable, the group sizes are not large when divided into remote, hybrid, and on-site workers. In future research, it should be useful to further increase the number of surveyed participants. A significant limitation of the research was also the deliberate selection of the subjects.

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Brief Report

Improving Surveillance and Epidemic Response in Ohio Childcare Settings

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Abstract: At the start of the Coronavirus Disease of 2019 (COVID-19) pandemic, the risk of cases in childcare programs was unknown. Thus, a rapid-response research approach was launched in Ohio childcare settings. Passive surveillance data from a state-operated incident reporting system were evaluated to estimate the number of COVID-19 cases from 15 August 2020 to 1 January 2021. Additionally, active surveillance with self-administered reverse transcriptase–polymerase chain reaction (RT-PCR) tests were conducted among staff at 46 childcare programs. Finally, six zoom-based focus groups with program administrators were used to gain feedback. Staff and children in childcare settings contributed 0.38% and 0.15% of the COVID-19 cases in Ohio during this timeframe, respectively. RT-PCR testing identified 3 unrecognized cases (0.88% of tests), and all occurred when the statewide positivity rate was >5%. Focus groups revealed that access to affordable cleaning supplies, masks, and reliable staffing were critical. Perhaps most importantly, we conclude that expanding the incident reporting system to include a childcare census would allow for the tracking of future health problems with highly valuable incidence rate estimations.

Keywords: COVID-19; childcare; infectious disease control; occupational health

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1. Introduction

Epidemiologic studies conducted at the start of the pandemic (March–June 2020) found low rates of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission and high rates of mitigation compliance in U.S. childcare settings [1]. However, they also documented asymptomatic transmission events [2] and revealed the deep impact of childcare closures on workforce engagement among parents [3]. Overall, this evidence indicated that the Centers for Disease Control and Prevention and state guidelines for reducing transmission in childcare facilities were effective when community transmission rates were low. However, it was not clear if transmission among children and staff in childcare would increase when community transmission increased. To address this gap, the Ohio Bureau of Workers' Compensation reached out to the academic research community in late spring of 2020 to conduct a rapid assessment of the states' childcare programs. In response, we implemented a study to (1) conduct surveillance for COVID-19 cases within Ohio childcare programs during the fall of 2020 and (2) assess what was needed to maintain the safety of childcare settings. While vaccines are now available for those over 6 months

of age, we still have much to learn about protecting people in childcare settings during this pandemic and the next. Thus, our findings offer key insights into the surveillance and non-pharmacologic mitigation strategies needed to protect the workplace that enable all other workplaces.

2. Materials and Methods

2.1. Passive Statewide Surveillance Data

We evaluated passive statewide surveillance data to determine the weekly number of COVID-19 cases within childcare settings from 15 August 2020 to 1 January 2021. Information on COVID-19 cases among childcare workers and children was obtained from the Ohio Department of Job and Family Services (ODJFS) Serious Incident/Injury Reporting System. This surveillance system captured worksite-reported cases of COVID-19 at all licensed Ohio childcare programs. These reports are mandated, and failure to record an incident, such as a COVID-19 case, lowers a program's quality rating [4]. ODJFS provided the research team with cumulative case numbers by county on a weekly basis for 20 weeks, and weekly case numbers were calculated from these data. Statewide COVID-19 case numbers for this study period were downloaded on 19 January 2021 from the Ohio Department of Health COVID-19 Dashboard to provide a community reference [5,6]. SARS-CoV-2 test positivity rates were defined as the 7-day moving average from the last day of each week [5,6].

2.2. Active Surveillance in Select Ohio Counties

Active surveillance occurred at childcare programs located within 10 counties that collectively contain 64% of all licensed childcare programs in Ohio. These counties were selected to achieve variability in geographic location, population density, sociodemographic characteristics, and COVID-19 burden as of early June 2020. Program administrators from licensed sites in these counties were invited to join the study in July 2020, where eligible sites had at least five people total (staff and children), were open by August 2020, and were able to email study information to staff and families to conduct physically distanced study activities. Forty-six programs were enrolled, including 40 childcare centers and 6 family home providers. Within these programs, participants completed an online enrollment survey and then had the option to participate in (1) weekly online surveys documenting COVID-19-related symptoms they were experiencing, (2) self-administered RT-PCR lower nasal swab SARS-CoV-2 testing, and (3) focus groups. Entry into the weekly symptom surveys (n = 208) and SARS-CoV-2 testing (n = 167) was self-selected and open to all staff. The six focus groups were self-selected and open only to childcare program administrators (n = 28). Informed consent was provided separately and electronically for each data collection method. The study was approved by the Case Western Reserve University Institutional Review Board (STUDY20200949) and conformed with recognized ethical standards for research with human subjects.

The one-time online enrollment survey included self-reports of demographics, family structure, and health status. To identify unrecognized SARS-CoV-2 cases among childcare staff, RT-PCR testing of lower nasal samples was used (Food and Drug Administration emergency use-approved collection kit, Lets-Get-Checked, New York, NY, USA). The swabs were self-administered and mailed in for analysis. All enrolled childcare workers were eligible to complete testing up to three times from September to December 2020. The tests were mailed out in batches from September through November. The testing strategy provided multiple cross-sectional assessments of currently working staff. The participants received USD 50 for completing their first two tests. Brief surveys assessed symptoms experienced over the past week. Participants completing the brief survey were entered into a weekly raffle for a USD 10 gift card, and 10 cards raffled per week.

2.3. Focus Groups

Among the workers enrolled in the study, those identifying as administrators were invited to participate in one focus group conducted via an electronic video conferencing

platform. In total, six focus groups were conducted. Each lasted 90 min, and the participants (n = 28) were compensated with USD 50 for their time. The focus groups included open-ended questions about opportunities and barriers to reducing the spread of COVID-19 in childcare programs. The sessions were recorded and transcribed verbatim. These data were analyzed using deductive coding based on the focus group guide as well as inductive coding of emergent themes. Coding by four team members (O.Y., C.O.-H., D.A.F. and E.A.B.) was conducted using NVivo Plus v12 (QSR International Pty Ltd., Burlington, MA, USA).

2.4. Quantitative Analyses

Wilcoxon–Mann–Whitney tests were used to assess if the number of childcare cases or their percentage among statewide cases were significantly different in the weeks with high versus low community transmission (threshold: 5% positivity rate [7]). Analyses were conducted with SAS 9.4 (Cary, NC, USA). Estimates for the total number of staff and children in attendance at Ohio childcare programs were not available, precluding calculation of the incidence rates or cumulative incidence within these groups.

3. Results

Evaluation of statewide COVID-19 data among childcare programs in Ohio during the last 20 weeks of 2020 revealed 2361 cases among workers and 914 among children. During this same timeframe, there were 618,430 total cases in Ohio, with workers and children in childcare settings contributing 0.38% and 0.15% of the statewide cases, respectively. Community transmission was low in the first 10 weeks of this study ($\leq$5% SARS-CoV-2 test positivity rate [7]) and high (>5%) in the second 10 weeks of observation (Table 1). New COVID-19 cases per week among childcare workers ($p < 0.001$) and children ($p < 0.001$) were significantly higher in the weeks with high community transmission. However, the weekly percentage of statewide cases that were from childcare workers ($p = 0.52$) and children ($p = 0.42$) did not significantly change during the 10 weeks of high community transmission [8–10].

Table 1. New COVID-19 cases by week in Ohio childcare programs from 15 August 2020 to 1 January 2021.

	Statewide		Childcare Overall (Workers and Children)		Childcare Workers		Children in Childcare	
	Cases	Test Positivity Rate	Cases	% of Statewide Cases	Cases	% of Statewide Cases	Cases	% of Statewide Cases
Weeks 1–10: Statewide SARS-CoV-2 Test Positivity Rate $\leq$5%								
15–21 August 2020	6297	4%	50	0.79	40	0.64	10	0.16
22–28 August 2020	7993	4%	26	0.33	16	0.20	10	0.13
29 August–4 September 2020	7714	4%	31	0.40	26	0.34	5	0.06
5–11 September 2020	6811	4%	32	0.47	25	0.37	7	0.10
12–18 September 2020	6178	3%	35	0.57	28	0.45	7	0.11
19–25 September 2020	6984	3%	44	0.63	26	0.37	18	0.26
26 September–22 October 2020	8687	3%	48	0.55	27	0.31	21	0.24
3–9 October 2020	11,454	4%	59	0.52	38	0.33	21	0.18
10–16 October 2020	14,316	5%	81	0.57	53	0.37	28	0.20
17–23 October 2020	18,315	5%	103	0.56	64	0.35	39	0.21

Table 1. *Cont.*

	Statewide		Childcare Overall (Workers and Children)		Childcare Workers		Children in Childcare	
	Cases	Test Positivity Rate	Cases	% of Statewide Cases	Cases	% of Statewide Cases	Cases	% of Statewide Cases
			Weeks 11 to 20: Statewide SARS-CoV-2 Test Positivity Rate > 5%					
24–30 October 2020	23,997	7%	125	0.52	92	0.38	33	0.14
31 October–6 November 2020	39,872	9%	177	0.44	135	0.34	42	0.11
7–13 November 2020	55,903	12%	307	0.55	218	0.39	89	0.16
14–20 November 2020	61,378	13%	395	0.64	289	0.47	106	0.17
21–27 November 2020 [a]	59,064	14%	261	0.44	193	0.33	68	0.12
28 November–4 December 2020	70,565	16%	374	0.53	281	0.40	93	0.13
5–11 December 2020	63,326	15%	404	0.64	285	0.45	119	0.19
12–18 December 2020	55,444	14%	330	0.60	229	0.41	101	0.18
19–25 December 2020 [a]	42,896	13%	201	0.47	142	0.33	59	0.14
26 December 2020–1 January 2021 [a]	51,236	14%	192	0.37	154	0.30	38	0.07

Notes: Childcare case data are from the Ohio Department of Job and Family Services Serious Incident/Injury Reporting System (compiled weekly). Overall COVID-19 case data are from the Ohio Department of Health COVID-19 Dashboard as of 19 January 2020. The weekly SARS-CoV-2 test positivity rates are the 7-day moving average from the last day of the time range. [a] Weeks include holiday closures of most childcare programs due to Thanksgiving, Christmas, and New Years. Therefore, reporting to the JFS Serious Incident Reporting System may not accurately reflect case rates in these weeks.

Within the 10 selected counties, 228 childcare workers enrolled in the study, representing about 40% of the eligible staff at the enrolled sites based on the self-reporting of childcare administrators. Most participants were female (96.1%) with a mean age of 42.1 years. The racial demographics were representative of the state, with 79.8% identifying as white and 14.5% as black. Most of the workers were classroom teachers (50.4%), administrators (26.3%), or teachers' aides (10.1%) working with children of all ages, including infants (19.7%), toddlers (22.1%), preschoolers (36.3%), and school-aged children (12.1%).

In the active surveillance of adult childcare workers, 358 RT-PCR tests were completed, and 341 (95.3%) of these yielded definitive results (Table 2). Indeterminant results were due to user error related to sample collection or registration. Three positive tests were identified, resulting in a 0.88% test positivity rate among workers who volunteered to be tested. The positive cases occurred during the period of high community transmission (statewide positivity rate > 5%). Although this screening was designed to detect SARS-CoV-2 in asymptomatic individuals, the three positive cases each reported a mild nonspecific symptom during the week they tested positive. One participant reported a headache, and two reported congestion or a runny nose.

Six focus groups with 28 childcare administrators revealed that childcare programs were investing substantial effort to comply with statewide mitigation guidelines to reduce the transmission of COVID-19 (Table 3). Several challenges were identified that limited worksite capacity to fully and sustainably comply with guidelines and reduce SARS-CoV-2 transmission in childcare settings. First, there was consensus that operating childcare programming at lower teacher-to-student ratios to promote physical distancing was costly and unsustainable. A variety of specific new costs contributed to this strain, including the purchase of additional learning resources to limit the number of children using common supplies and the provision of Wi-Fi to support remote learning for school-aged children. Second, maintaining staffing capacity amid a global pandemic was identified as a significant challenge. Additional workers were needed for symptom screening, managing outside child drop-off and pick-up procedures, cleaning and sanitizing multiple times per day, and

managing school-aged children who were engaged in remote learning. While workers were encouraged to stay home if sick, lack of access to temporary workers could result in the closure of a classroom. Third, administrators cited limited access to cost-efficient procurement systems to buy personal protective equipment, cleaning supplies, and COVID-19 tests (i.e., tests for use beyond this study). Some of them reported shopping during early hours to secure masks, gloves, and cleaning supplies such as wipes, bleach, and bottles of alcohol. Others shared that they made their own cleaning supplies due to supply chain barriers. The participants also noted that prices for personal protective equipment and cleaning materials had increased significantly.

Table 2. Asymptomatic testing for SARS-CoV-2 with RT-PCR among childcare workers in 46 childcare programs in Ohio, September–December 2020.

Testing Month (2020)	Total Tested	% Positive [a]	Positive	Negative	Indeterminant or Ineligible
September	24	0.0%	0	24	0
October	118	0.0%	0	110	8
November	133	1.57%	2	125	6
December	83	1.25%	1	79	3
Total	358	0.88%	3	338	17

Notes: All tests were conducted using FDA emergency use authorized kits through self-administered nasal collection methods. Indeterminant results were due to user error such as poor sample quality or incomplete registration of testing kit, and 9 of 17 individuals with indeterminant test results were successfully retested. Ninety-three individuals with confirmed results were retested according to study procedures. [a] Percent positive excludes indeterminant results (i.e., percent positive among total with confirmed results).

Table 3. Ohio childcare administrator concerns about COVID-19 from focus groups in Fall 2020.

1. Overall effort and financial costs associated with mitigation were high and unsustainable	
Representative quotes	"I think the lower ratios help, but not everyone can do that. You can't financially do it. There's no way you can financially do it unless you have other funding sources." "The funding is definitely key because I mean, I know our staff feels safer that the lower ratios that we've stayed at and I feel like the longer that we can keep those lower ratios, the safer we all feel and stay and the easier it is for the kids to even do the social distancing through the day so that the funding obviously is key there because there's only so many spaces you can put kids." "Oh, I think for us is that the amount of kids that we have enrolled, we went from . . . .our center can hold up to 92, 93, 94 kids. Now we only have 40 and then still trying to keep all of our staff on board and make sure they're able to come to work and be able to, you know, take care of their household by having a job with us" "My fear is when the grant money runs out. And if I still don't have staff and I'm forced to bring in more kids, does that burn my staff out more? . . . .right now, I am not in a [financial] loss . . . thankfully because of the pandemic support payments."
2. It was hard to maintain a reliable supply of competent staff	
Representative quotes	"I mean, the difficulty is keeping things staffed and keeping groups separate for us right now. That's the biggest challenge we have." "We were having trouble finding teachers that are qualified for [name of accrediting agency]. So, we've gone through how many teachers in the last two months? 13. Some of them only were there a week" " . . . we are struggling with hiring staff and, you know, as we're trying to get back to allowing more children to come in . . . " "I have zero subs. If somebody gets sick, I actually told the parents and put it in my handbook that their class is gonna be canceled. There's nothing I can do. My hands are tied." " . . . it's really been difficult for us to find good quality staff and teachers. And I tried calling the colleges around in the area . . . trying to get a list of people that want to work, along with all the job boards. And I still can't get anybody to come in for an interview . . . .it creates a lot of stress, the difficulty in hiring staff especially during the pandemic."

Table 3. *Cont.*

3. Supply chains for PPE, cleaning supplies, and COVID-19 testing were challenging	
Representative quotes	"Yeah, I mean, everybody is saying the same thing that we're finding out, too. Like we used to buy a box, a case of gloves, you know, for $26. Now it costs $83. And I heard they're going up sometimes to $130 and almost $200. But I've been buying since March 27th. So, I always buy double what we need so that we have it when we need it. Because you go to the store and sometimes you can't find them. They're not available. You can't buy gloves, if you can't buy gloves in order to change diapers, how do you do your job? The teachers can't do it. There's no hand towels. There's no rolls of paper. There's not none of those things. If the state said . . . 'we'll treat you guys like the hospitals because you're providing service for the first responders, here's a supply chain that you could go to.' But that wasn't available." "I think just being able to get the sanitizing things that we need. There is, you know, a shortage of wipes and sanitizing spray and all of that to the point to . . . we had to make our own here at the [name of child care program]. And it's still an issue because you still can't find this stuff, and even if you want to make your own, you still can't find the alcohol or, you know, whatever you need." "It's just so hard to find stuff so we have been doing the bleacher water solution because we haven't been able to find Lysol wipes and things like that." " . . . The Lysol wipes, diaper gloves. Those I have paid . . . oh my gosh . . . like three times what I paid before COVID . . . ." "My director and I kind of, you know, go to stores every other week, just try it, hoping it's [disinfectant wipes] there and hoping that, you know, we can go through the checkout line two or three times to get enough." "It is very hard. You know, I go first thing in the morning, sometimes down to [name of chain superstore], you know, to look for these supplies."

Key Messages: Rapid outreach and funding offers from a state agency at the start of the pandemic attracted academics to quickly implement childcare research that the state was not staffed to conduct. The preexistence of a license-mandated incident reporting system allowed researchers to track the number of COVID-19 cases in Ohio childcare settings. Highly valuable incidence rates could have been obtained for decision making if the numbers of staff and children in Ohio childcare programs were also routinely tracked. In late 2020, childcare-related COVID-19 cases represented a small percentage of the total cases in Ohio, with most cases occurring when statewide positivity rates were over 5%. The focus groups revealed that childcare programs need affordable supplies, personal protective equipment, and reliable staffing to continue non-pharmacologic mitigation strategies in settings with young unvaccinated children.

4. Discussion

Passive surveillance with state agency data revealed that workers and children in childcare made up a small yet consistent percentage of the COVID-19 cases in Ohio during the last 20 weeks of 2020 (0.38% and 0.15%, respectively), and these percentages did not significantly differ in the 10 weeks when transmission rates were high (>5% positivity rate). If the statewide incident system had been equipped to collect the numbers of staff and children in Ohio childcare settings, then valuable incidence rates could have been calculated for government decision making. Perhaps most importantly, the incidence rates would allow for relative risk comparisons with other work and school settings. There will always be tradeoffs associated with opening or closing childcare programs, schools, and workplaces [8–14], but we cannot effectively assess these tradeoffs if we cannot quickly estimate transmission risk.

Active "asymptomatic" surveillance in 10 counties revealed a small percentage (0.88%) of staff volunteers who tested positive for SARS-CoV-2. The positive tests occurred during the period of high community transmission, and each person had at least one mild, nonspecific symptom. Overall, active surveillance with self-administered SARS-CoV-2 tests proved useful for detecting unrecognized cases among childcare workers, and this screening may have its greatest utility when community transmission rates are high.

The focus group findings illuminated the barriers to COVID-19 mitigation in childcare settings, including reduced financial capacity to operate childcare programming with fewer students, limited access to reliable childcare staffing, and a lack of access to cost-efficient supplies (personal protective equipment, cleaning supplies, and COVID-19 tests). Many of these barriers are still in place.

In terms of limitations, the active surveillance diagnostic tests were self-administered, and the data for passive surveillance came from self-reporting to ODJFS. However, the potential for underreporting to ODJFS was discouraged through the state's licensing system, which penalizes a program's quality rating if an unreported COVID-19 case is identified. We do not have information on how many programs received these penalties, and this hampered our ability to estimate the potential error in ODJFS case numbers. Estimates for the total number of staff and children in attendance at Ohio childcare programs were not available, so we were unable to calculate incidence rates or cumulative incidence within these groups. However, this limitation represents a key insight for enhancing the utility of the incident reporting system in epidemics: attendance data provide critical context and should be routinely collected. We also note that statewide surveillance was aggregated at the county level, and this prevented examination of COVID-19 cases by childcare sites. Finally, we note that the focus group findings may not generalize to all childcare worksites.

These findings align with US studies [1–3] and European evaluations [15–17] which indicated that childcare settings did not present elevated risk to the staff, children, or community when SARS-CoV-2 transmission mitigation strategies were in place. However, they also revealed that COVID-19 cases were more likely in childcare settings when community positivity rates were high. This is somewhat reassuring, but we note that new variants continue to change the situation, and the need for improved surveillance strategies is clear. Every childcare-related case has both health and economic consequences related to the role of childcare in supporting workforce participation (especially for women). [18] Overall, our findings provide a childcare research model for epidemic response, and they highlight the utility of collecting attendance information. Importantly, our findings also highlight what is needed to sustain non-pharmacological mitigation strategies. These three insights may be critical in our responses to future pandemics.

5. Conclusions

All public health surveillance strategies have strengths and weaknesses, but the preexistence of a license-mandated incident reporting system for childcare worksites in Ohio provided critical pandemic-related data. Furthermore, rapid-response collaborations between state agencies and academic research institutions provided infrastructure for active surveillance to corroborate and extend the information from passive state-mandated reporting. In this collaboration, we also learned that the routine collection of attendance data could vastly expand the utility of the state's incident reporting data. This would be helpful in infectious epidemic responses, but it would also aid in the tracking of incidence rates for non-infectious incidents. Future coordination between government agencies and universities may aid state and local health departments as they develop systems for reducing infectious disease and environmental health hazards [19,20]. Overall, our findings raise the following question: Could incident reporting systems, similar to the one used in Ohio childcare settings, be leveraged to better protect children, childcare staff, and workers in other industries [21] during this pandemic and the next?

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Informed Consent Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Case Western Reserve University (STUDY20200949 approved on 22 July 2020).

Data Availability Statement: Passive surveillance data (from state agencies) are presented in the tables. De-identified individual data from active surveillance (RT-PCR diagnostic tests) and focus group conversations will not be made available.

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Promoting Strategies for Healthy Environments in University Halls of Residence under Regular Epidemic Prevention and Control: An Importance—Performance Analysis from Zhejiang, China

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Abstract: In the post-epidemic era, regular epidemic prevention and control is a daunting and ongoing task for nations all around the world. University halls of residence have been important spaces where university students balance their studies, work, and personal lives after COVID-19. Therefore, a healthy physical living environment deserves more attention. This paper compares situations before and after COVID-19 in an effort to evaluate the impact of indoor environments in university halls of residence on students. The study proposed eight vital dimensions for creating a healthy university hall of residence environment and, from 14 September to 4 October 2022, used an online questionnaire to collect data from 301 university students studying in Zhejiang, China. The key quality of service characteristics for fostering a healthy environment in university halls of residence were discovered using descriptive statistical analysis and revised importance–performance analysis (IPA). We found that an improved indoor physical environment and efficient arrangement of indoor space were crucial for the health of university students. The quality of educational services could be improved, and indoor exercise should be utilized effectively, both of which can contribute significantly to a healthy indoor environment. This study aims to contribute to the development of future initiatives to support healthy physical living environments in university halls of residence.

Keywords: health promotion; university halls of residence; COVID-19; regular epidemic prevention; importance–performance analysis (IPA)

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1. Introduction

As part of the future workforce, the health and well-being of university students have always been a top priority [1,2]. In February 2020, because of the global spread of COVID-19, China took steps to prohibit early return to study, implemented strict management of campuses, and offered distance learning courses to protect the lives and health of university students [3]. As the global COVID-19 epidemic persists, relevant prevention and control measures cannot be ignored, and China attaches great importance to them. China is still committed to the routine prevention and control of epidemics and places a high value on frequent monitoring and health protection on university campuses in order to provide students with a safe and healthy living, learning, and working environment [4].

Both the physical and mental health of university students have been impacted by COVID-19 [5,6]. One of the factors affecting their physical and mental health during the COVID-19 outbreak was discomfort in the indoor living environment [7]. Researchers are therefore working hard to identify effective interventions to enhance the living situations of students when they return to their studies in the wake of the COVID-19 outbreak. A significant proportion of previous research involves objective evaluations of the potential

risk of virus transmission in the indoor physical living environment of university halls of residence and the protection of the health of university students [8,9]. Effective improvements to the indoor environment have successfully prevented the spread of viruses, but this places more emphasis on an objective assessment of the indoor physical living environment of university halls of residence. Fewer studies have sought to identify measures to improve the indoor physical living environment of university halls of residence from the perspective of their users.

University halls of residence are areas designated for use by a certain social group. University students not only reside here but also engage in behavioral activities such as studying and socializing. They are places where private and public spaces coexist, which is crucial for the development of the physical and mental health of university students [10]. Consequently, in light of regular epidemic prevention and control efforts and longer stays in halls of residence by university students, it is critical to investigate the many indoor environmental aspects that might enhance the health of the students, in addition to objectively evaluating the indoor physical living environment of the halls of residence. The need to protect the health of university students has become more pressing as a result of regular epidemic prevention and control efforts and the reopening of campuses throughout the world [11]. As a result, this study assesses several environmental factors in halls of residence that have an impact on the health of university students from the perspective of student satisfaction. In the main, these indoor environmental factors are physical living environment factors and do not include social and psychological variables, but we do consider the relationship between physical environmental factors and social psychological variables. The logical model for this investigation is depicted in Figure 1.

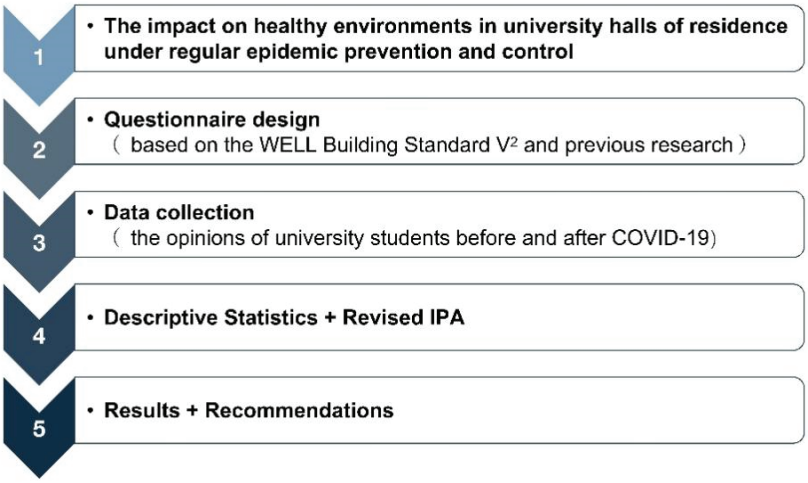


Figure 1. The logical model.

First, in order to create the questionnaire items, we reviewed a large number of studies to identify the elements of the indoor physical living environment that affect the health of university students. Second, from 14 September to 4 October 2022, 301 university students living in university halls of residence in Zhejiang Province, China, responded to surveys distributed via the social networking applications WeChat and QQ (Tencent, Shenzhen, China). Then, our study compared university students' opinions of the health environment in their halls of residence before and after COVID-19 using descriptive statistics and revised importance–performance analysis (IPA). IPA is a diagnostic method that can help to identify the connection between importance and performance to aid future improvement initiatives [12]. Additionally, the elements influencing the quality of service for students in university halls of residence were determined in accordance with the findings of the

revised IPA. Finally, certain supportive actions for the creation of a healthy environment in university halls of residence were also suggested in response to regular epidemic prevention and control.

The paper is structured as follows. The introduction is in Section 1. A survey of the literature on the study topic is presented in Section 2. The data collection and study technique are covered in Section 3. The findings of the study are presented in Section 4. The discussion and future research directions are set out in Section 5. Section 6 summarizes the study and draws conclusions.

2. Literature Review

2.1. From COVID-19 to Regular Epidemic Prevention and Control

COVID-19 poses a risk to public health. COVID-19 is still circulating today all over the world. In January 2020, the World Health Organization declared that COVID-19 was a public health emergency of international significance [13]. In April 2020, through the concerted efforts of the whole country, the spread of the epidemic in Wuhan was effectively controlled [14]. From that time, China actively promoted the orderly resumption of work and production while effectively controlling the epidemic and endeavoring to restore normality to everyday life and economic conditions [15]. Researchers also continue to make efforts to provide healthy and environmentally friendly living environments for individuals [16,17].

However, even with regular epidemic prevention and control, small-scale outbreaks of COVID-19 infection have occasionally occurred, and the crisis of localized outbreaks remains. Managing and controlling COVID-19 is significantly challenging because of the multiplicity of variables that may affect the propagation of the virus, such as population migration and air quality [18,19]. In addition, outbreaks disrupt the physical and mental health of individuals to varying degrees [20,21], and recovery from COVID-19 may still involve one or more persistent symptoms [22]. Therefore, it is impossible to overlook the long-term effects of the epidemic. A high value should be placed on stable measures to curb the spread of the virus and reduce the numerous negative effects of the epidemic on society and individuals, who must learn to adapt to this sustained policy of prevention and control.

2.2. Healthy Environments and Healthy Buildings

In 1948, when the World Health Organization was founded, health was defined as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity [23]. Among the many aspects that affect human health, a healthy living environment is among the most crucial factors for enhancing health and happiness [24]. To ensure human health, creating a healthy living environment requires the cooperation of several policies, organizations, and sectors [25,26].

In order to provide individuals with healthy living environments, the building industry is constantly evolving [27]. Building project teams are able to minimize the environmental impact of buildings by using the Green Building Rating Systems (GBRSs), which provide a helpful framework and tools. LEED (US), BREEAM (UK), and CASBEE (JPA) are a few examples of green building rating systems which provide guidance for the construction of high-performance, sustainable structures [28,29]. Their development has contributed to the achievement of greater environmental and building sustainability. However, green building rating systems place more emphasis on the energy efficiency of buildings, from which most users do not derive benefit. A focus on user welfare and social advantages is required for green buildings to reach their full potential [30]. Currently, as individuals spend more time inside buildings, a condition known as "sick building syndrome" (SBS) has emerged. SBS can make people feel physically and psychologically uncomfortable and negatively affect their health [31]. As a result, there has been an increase in initiatives and attention to building-related human health problems. One example is the WELL Building Standard, developed by the International WELL Building Institute. The WELL Building

Standard is an addendum that completes the scale for green building rating systems. In 2018, the WELL Building Standard V^2 expanded the original seven concepts to ten [32]. Similarly, the Architectural Society of China has released guidelines for creating healthy environments [33]. This has considerably improved the indoor environments of buildings in all respects. Researchers are also increasingly examining the connection between the indoor physical living environment and mental health. According to one systematic review, there is also a significant relationship between specific housing qualities and the happiness of residents, which is crucial for both their health and well-being [34].

According to current studies, the primary focus of research to enhance the health of the built environment is the enhancement of physical elements such as air quality, light, heat, and sound in indoor environment quality (IEQ) [35–37]. Additionally, research has demonstrated that physical environmental factors of indoor environment quality (IEQ) not only have a significant impact on occupants' perception of the building space but also affect their daily performance and productivity [38]. The management of the building and the services offered there are also related to the health of the occupants [39]. Furthermore, one of the aspects that is currently receiving attention is the promotion of healthy indoor activities [40]. The majority of these studies focus on a variety of building types, including apartments [41], office buildings [42], nursing homes [43], commercial buildings [44], and schools [45]. Among the types of school buildings, less attention has been paid to the health environment of university student dormitories. From the perspective of improving levels of satisfaction among university students, some scholars, including D. Amole [46], Thomsen and Eikemo [47], and Oke et al. [48], have offered recommendations for improving some of the functions of university halls of residence. They give particular attention to the distinctive spatial characteristics and facilities that are used daily by students in university halls of residence. However, the discussion of changes to promote the health of university students seems to have received less attention in the context of regular epidemic prevention and control.

2.3. The Impact of COVID-19 on the Health Environment of University Halls of Residence

The mental health and infection risk of university students have come under scrutiny because of COVID-19. The majority of students report that the COVID-19 outbreak has had a negative impact on their daily lives and academic performance [49,50]. Many campuses employ closed management practices, which restrict student movement and exacerbate psychological issues [51]. Additionally, they switched to remote learning as a method of education, and the academic performance of many university students suffered as a result [52]. Students who were isolated at home also frequently experienced symptoms of anxiety, sleep issues, higher levels of perceived stress, and stress related to distance learning [53,54].

Prior to readmitting university students to campus when COVID-19 subsides, campuses need to implement stringent behavioral interventions, comprehensively assess the campus environment for infection risk, and develop mitigation methods [55]. However, university students who must return to class also have concerns and face challenges in relation to their lives upon return. The worries of the students include the efficiency of the university's outbreak prevention measures, the behavioral restrictions in force, living conditions in the dormitories, academic performance, and how often they are able to exercise [56]. Because of the limitations on movement around the university, students are likely to spend more time in their halls of residence each day. According to studies, students who share a bedroom are twice as likely to be infected as those who live alone [57]. In addition, many students find distance learning physically and psychologically stressful and are eager to return to school but reluctant to take the risk [58].

In view of the fact that the vast majority of universities have now reopened, it is reasonable to concentrate on supporting interventions that can enhance the health and well-being of university students once they return to university. However, research exploring how the improvement of the physical living environments of halls of residence impacts

the health of university students is limited. Some studies have described the effects of the COVID-19 quarantine environment on university students' mental health [59]. Others have carried out satisfaction surveys on the types of university halls of residence that find favor with students [60]. One research direction includes surveys of the thermal comfort of university halls of residence [61]. Few studies, however, have examined how satisfied university students are with the indoor physical living environment of their halls of residence under regular epidemic prevention and control compared to before COVID-19. As early as June 2020, university students in Zhejiang Province, China, a low-risk region for the disease, had already returned to class, and each university put stringent control measures in place [62]. In order to better understand how university students perceive the health environment in their halls of residence under regular epidemic prevention and control, we chose university students in Zhejiang Province, China, as the study population.

3. Materials and Methods

3.1. Data Collection

3.1.1. Questionnaire Design

The purpose of this study was to investigate the perceptions and expectations of university students in Zhejiang Province, China, regarding the health of the physical living environments of their halls of residence and the implications of the association between their perceptions and expectations. The logic model for the questionnaire design is shown in Figure 2.

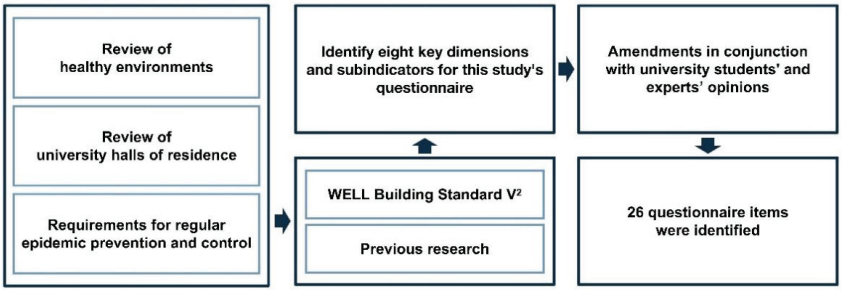


Figure 2. The design logic of the selection process of 26 research variable items.

Firstly, the WELL Building Standard V^2, which evolved from the Green Building Rating Systems, served as the basis for the design of the questionnaire [32]. Compared with the Green Building Rating Systems, the WELL Building Standard offers a collection of guidelines and strategies that support the consideration of occupant health and well-being in the planning and management of the indoor physical living environment of a building. Secondly, we also incorporated pertinent prior research findings to identify 8 key dimensions for creating a healthy environment in university halls of residence and sub-indicators for this study's questionnaire because of the specificity of the student population at universities and the requirements of regular epidemic prevention and control. Additionally, an open-ended question was addressed to students who had been isolated in order to better identify the issues with indoor environments that concerned them most. Finally, the questionnaire was enhanced by combining the views of two professionals and four university students, resulting in a questionnaire with 26 sub-indicators (Table 1). A five-point Likert scale was used to evaluate the views of university students regarding the impact of COVID-19 on the health of the physical living environment in their halls of residence. There were five levels that could be selected in the questionnaire: (1) Importance (after COVID-19): "5 = very important", "4 = important", "3 = so-so", "2 = unimportant", and "1 = very unimportant". (2) Performance (before COVID-19): "5 = very good", "4 = good", "3 = so-so", "2 = not good", and "1 = bad".

Table 1. The 26 items for measurement of healthy environments in university halls of residence before and after COVID-19.

No.	Dimensions	26 Items: Importance (after COVID-19)/Performance (before COVID-19)	QN
1	Air Quality [32,63]	There is a sufficient number of openable windows for natural ventilation and fresh air.	1
		Air quality has improved with the installation of a fresh air system unit.	2
		No indoor odor (e.g., building material odor, tobacco odor).	3
2	Light [32,37]	There is natural sunlight in the room, and the work areas are well-lit and comfortable.	4
		There is no light in the visual field that is uncomfortable for the eyes (e.g., glare).	5
		Artificial lighting fixtures with light adjustment to comfortably meet the needs of day and night use.	6
3	Thermal Comfort [32]	The indoor temperature is comfortable.	7
		The humidity is appropriate, and the body feels fresh.	8
		The heating, fan, and air conditioning facilities are easy to use and comfortable.	9
4	Sound [32,64]	Interior noise exposure with acceptable levels (e.g., talking sound, HVAC).	10
		Walls and doors provide adequate sound isolation in adjacent rooms.	11
		Exterior noise exposure at acceptable levels (e.g., construction-related noise, traffic noise).	12
5	Water [32]	Drinking water of high quality; no contaminants.	13
		Convenient use of facilities for hand washing (e.g., hand sinks, soap boxes, hand dryers).	14
		Toilet and bathroom facilities meet needs while remaining clean and sanitary.	15
6	Space Perception and Mental Health [46,65]	Well laid out indoors with ample storage space.	16
		Personal space is comfortable, and privacy needs are met.	17
		One designated restorative space to support relaxation and rejuvenation within the building.	18
		Natural materials and indoor plants are inside to relieve fatigue and promote relaxation.	19
		Adequate balcony area with pleasant natural outdoor views (e.g., green and blue spaces).	20
7	Ergonomics and Movement [32,66,67]	Flexible and adjustable tables and chairs that can be used without discomfort.	21
		Indoor space can meet the requirements for basic exercise.	22
		A dedicated fitness facility and public space to support physical activity are available within the building.	23
8	Service and Management [1,55,68]	Good wireless internet connection to meet the needs of study and work.	24
		Hygiene services are provided in accordance with regulations (e.g., cleaning and disinfection).	25
		The residence hall management has a contingency plan for emergencies and promotes healthy lifestyles.	26

Note: No. = Dimension number, QN = Question number.

3.1.2. The Collection of Questionnaires

In order to gather feedback from university students in Zhejiang Province, China, this study used an online survey tool, SoJump (Changsha Ranxing Information Technology Co., Ltd., Changsha, China), to create the questionnaire and send it via WeChat and QQ (Tencent, Shenzhen, China), two of the most popular social networking services in China. The relevant datasets were then analyzed using SPSS. To ensure a broad pool of answers, the questionnaires were distributed at random to relevant student groups.

3.2. Importance—Performance Analysis (IPA)

3.2.1. Concept of IPA

Importance–performance analysis (IPA) is a basic evaluation and analysis technique. It was initially employed as a marketing tool to create marketing plans and organize tactical planning for increased market competitiveness [69,70]. IPA is now used in a variety of disciplines, including business management [70], healthcare [71], transport [72], education [73], tourism [74], digital media [75], and the construction industry [76,77]. Through the analysis of data, the primary goal of IPA is to diagnose the performance of various products or services and provide management with useful recommendations [78].

The traditional IPA analysis method investigates the importance and performance (satisfaction or service quality) of a product or service as perceived by respondents in the form of a scale, after which the data collected is statistically processed, and the mean value of the importance and performance of each question in the scale is used as a data point to create a 2-dimensional matrix. Figure 3 shows a 2-dimensional matrix of the performance and importance of the attributes perceived by the respondent based on IPA [69]. In this matrix, attribute importance is described along the *x*-axis, attribute performance (satisfaction or service quality) is described along the *y*-axis, and the matrix is divided into 4 quadrants. To enable managers to identify key characteristics, strengths, and shortcomings in a product or service and improve management methods, the quadrants of a 2-dimensional model each represent a particular strategy [79]. The attributes in Quadrant 1 ("Keep up the good work") are considered major strengths and should be maintained or strengthened. The attributes in Quadrant 2 ("Possible overkill") indicate inefficient use of resources. Managers can reduce their attention to these and redeploy resources where needed. The attributes in Quadrant 3 ("Low priority") are considered to be relatively unimportant, secondary weaknesses, and low priority for management. The attributes in Quadrant 4 ("Concentrate here") are the most critical and considered to be the main weaknesses. Managers need to give immediate attention and the highest priority to these in terms of resources and effort.

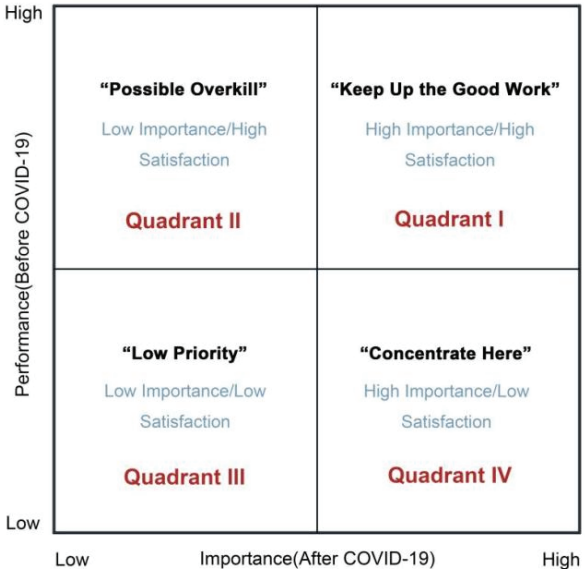


Figure 3. The importance–performance analysis (IPA) model.

Therefore, this study is based on the traditional IPA analysis method. A diagnostic analysis of the perceptions of university students concerning the physical living environment in their halls of residence was used to identify areas of concern and improvement measures for university campus managers and policymakers.

3.2.2. The Revised IPA Approach

Traditional IPA analysis is recognized as an effective analytical technique that requires data collection and analysis of both the respondent's perceptions of attribute performance (satisfaction or service quality) and attribute importance dimensions [69]. The traditional IPA model is based on 2 assumptions: (1) that attribute performance and importance are both dependent variables, and (2) that the relationship between attribute performance and overall performance is linear and symmetrical [80]. A number of scholars have questioned the 2 assumptions of the traditional IPA model and have discussed and criticized them

using proofs. They have suggested that changes in attribute performance (satisfaction or service quality) correlate with changes in attribute importance, findings that call into question the application of traditional IPA [81]. Using inappropriate methods to calculate performance or importance scores may result in incorrect or ineffective management strategies. Therefore, in the acquisition and analysis of importance attributes, scores can be obtained in 2 ways: (1) importance as stated by respondents and (2) implicitly derived importance obtained from some form of calculation.

In view of the limitations of the traditional IPA, as mentioned above, many scholars have revised and extended the importance score analysis of the traditional IPA method. Matzler et al. suggested that implicit importance could be obtained through partial correlation analysis between attribute-level performance and overall customer satisfaction [81]. In addition, Anderson et al. used multiple regression coefficients with natural log dummy variables as a measure of attribute importance [82]. However, the more widely used method for implicitly deriving the importance of attributes is that described by Deng. Based on a summary of previous research, Deng proposed a new method for implicitly derived importance: combining partial correlation analysis and natural logarithm transformation to calculate attribute importance [83]. The method consists of three steps:

- Step 1: Transform the performance of all attributes (AP) into a natural logarithmic form:

$$AP_i \rightarrow \ln(AP_i) \;\; i = 1, 2, \ldots, n \tag{1}$$

where n is the total number of attributes.

- Step 2: Set natural logarithmic AP ($\ln(AP_i)$) and overall satisfaction (OS) as variables in a multivariate correlation model;
- Step 3: Execute partial correlation analysis for each attribute performance with OS. For example, if it is assumed that X_1, X_2, X_3, X_4, ... , X_n are included in a multivariate correlation model, the coefficient of partial correlation between X_1 and X_2 when X_3, X_4, ... , X_n are fixed is given by

$$\rho_{12 \cdot 34 \ldots n} = \frac{\sigma_{12 \cdot 34 \ldots n}}{\sigma_{1 \cdot 34 \ldots n} \, \sigma_{2 \cdot 34 \ldots n}} \tag{2}$$

Therefore, where OS is X_1, $\ln(AP_i)$ is X_2, and the rest of $\ln(AP_i)$ are X_3 to X_n; the partial correlation coefficient of the no. 1 attribute can be obtained using Formula (2).

The implicit derivation of attribute importance using Deng's modified IPA method thus takes full account of the predictive validity of importance and optimizes it in the following three ways: (1) implicitly deriving importance eliminates the effect of correlation between attribute performance (AP) and overall satisfaction (OS); (2) biased correlation analysis eliminates multicollinearity between attribute variables; and (3) the natural logarithmic transformation captures the relevant attribute variables more sensitively [84].

Therefore, because traditional IPA studies do not adequately consider the predictive validity of self-stated absolute importance versus implicitly derived relative importance, this study used Deng's revised IPA analysis method to further analyze the data to determine the impact of COVID-19 (before and after) on satisfaction with environments in university halls of residence from a health point of view.

4. Results

4.1. Descriptive Statistics

4.1.1. Profile of Survey Respondents

The empirical data for this study came from a survey questionnaire distributed to most public and a small number of private colleges and universities in Zhejiang Province, China, between 14 September and 4 October 2022. The questionnaire received valid responses from a total of 315 respondents. As the target population for this study was residential students in Zhejiang Province, excluding students from outside Zhejiang Province and nonresidential students, 301 questionnaires were obtained after screening.

Table 2 describes the demographic profile of the respondents and the accommodation overview. Firstly, of the 301 university students, 40.20% were male (n = 121) and 59.80% were female (n = 180), and undergraduates and postgraduates accounted for 73.09% (n = 220) and 26.91% (n = 81), respectively. Secondly, the majority of university students lived in 3–4-bedroom halls of residence (70.43%, n = 212). In addition, on average, university students spent significantly more time in halls of residence on a daily basis after COVID-19 compared with before COVID-19. There was an increase in the proportion of students spending an average of 12–18 h per day in halls of residence (before COVID-19: 18.94%, n = 57; after COVID-19: 37.54%, n = 113) and a significant increase in the proportion spending an average of 18–24 h per day in halls of residence (before COVID-19: 3.32%, n = 10; after COVID-19: 14.95%, n = 45).

Table 2. Profile of survey respondents (n = 301).

Variable		Number	Percentage
Gender	Male	121	40.20%
	Female	180	59.80%
Educational level	Undergraduate	220	73.09%
	Postgraduate	81	26.91%
Number of persons in halls of residence	1–2	13	4.32%
	3–4	212	70.43%
	5–6	69	22.92%
	7 and above	7	2.33%
Average daily time in halls of residence (before COVID-19)	0–6 h	42	13.95%
	6–12 h	192	63.79%
	12–18 h	57	18.94%
	18–24 h	10	3.32%
Average daily time in halls of residence (after COVID-19)	0–6 h	29	9.63%
	6–12 h	114	37.87%
	12–18 h	113	37.54%
	18–24 h	45	14.95%
Placed in quarantine	Yes	109	36.21%
	No	192	63.79%

Finally, we assessed whether the respondents had experienced isolation and asked them an open-ended question: "What was the indoor environmental problem that was most detrimental to your health during the isolation period?" The statistics showed that 36.21% of university students had experienced isolation (n = 109). Twenty-one of these students provided feedback on the open-ended question, stating that they were troubled by poor air circulation, poor sound insulation, lack of space, lack of sunlight, dust, untimely removal of rubbish, inadequate or dilapidated equipment, and other problems during their time in isolation (Table 3).

Table 3. Results of the open-ended question survey (n = 21).

Indoor Environmental Problems	Number (n = 21)
No air circulation; no fresh air	6
Poor sound insulation	3
Only one public toilet	2
Indoor space is insufficient	2
Garbage was not disposed of in time	2
Insufficient sunlight	2
Poor hygiene conditions	2
Dusty	2

Table 3. *Cont.*

Indoor Environmental Problems	Number (n = 21)
Inadequate or dilapidated equipment (e.g., no washing machine, dilapidated air conditioning)	2
Fewer green plants	1
Unable to exercise	1
Inadequate water resources	1

4.1.2. Reliability and Validity Analysis

Questionnaires were analyzed using SPSS 26 statistical software (IBM, New York, NY, USA). Internal consistency reliability tests are often conducted using Cronbach's alpha [85]. Cronbach's alpha values greater than 0.70 for each dimension were considered reliable [86]. The alpha for this questionnaire was 0.971 (alpha > 0.70), indicating relatively high and acceptable reliability. In addition, the questionnaire was further examined for construct validity, sample adequacy, and data fitness using the Kaiser–Meyer–Olkin (KMO) test [87]. When KMO > 0.70 and the p-value of Bartlett's sphericity test is <0.05 (i.e., sig. < 0.05), the criteria are met. The questionnaire had a KMO of 0.972 (KMO > 0.70) and p = 0.000 (p-value < 0.05), indicating satisfactory construct validity (Table 4).

Table 4. Reliability and Validity Statistics.

Number of Attributes	Cronbach's Alpha	KMO	p-Value
26AP + OS	0.971	0.972	0.000

Note: AP = Attribute Performance, OS = Overall Satisfaction.

4.1.3. Importance-Performance Scores

In order to compare management strategies between the traditional IPA and the revised IPA, the importance, as stated by respondents, was also collected using the questionnaire. The third and fourth columns of Table 5 list the data for self-reported importance and implicitly derived importance, respectively.

Table 5. Traditional IPA data and Revised IPA data (n = 301).

QN	AP	SSI	IDI	QN	AP	SSI	IDI
1	3.571	4.156	−0.025	14	3.528	4.096	0.012
2	3.266	3.957	0.087	15	3.485	4.090	0.150
3	3.528	4.073	0.008	16	3.485	4.143	0.035
4	3.518	4.047	0.072	17	3.468	4.060	0.002
5	3.635	4.070	−0.064	18	3.329	3.890	0.079
6	3.608	4.056	0.108	19	3.332	3.987	−0.055
7	3.631	4.086	−0.015	20	3.365	3.983	−0.067
8	3.631	4.116	−0.040	21	3.502	4.080	0.140
9	3.748	4.186	0.008	22	3.329	3.967	0.136
10	3.568	4.090	0.015	23	3.199	3.847	0.009
11	3.429	4.033	−0.092	24	3.429	4.143	0.126
12	3.535	4.040	0.151	25	3.561	4.166	0.061
13	3.525	4.120	0.046	26	3.515	4.100	−0.020

Note: SSI = Self-Stated Importance, IDI = Implicitly Derived Importance.

Using the IPA framework, the average response for attribute performance and implicitly derived importance of the 26 attributes was analyzed (Table 6). Variables in each category were ranked in order by paired differences (AP–IDI). The results showed that all data points (Sig. 2-tailed) were significantly below the 0.01 level, demonstrating that the variables were largely independent of one another, the data were spherically distributed, and the test results were acceptable and adequate.

Table 6. Rank means of attribute performance and implicitly derived importance and paired samples (n = 301).

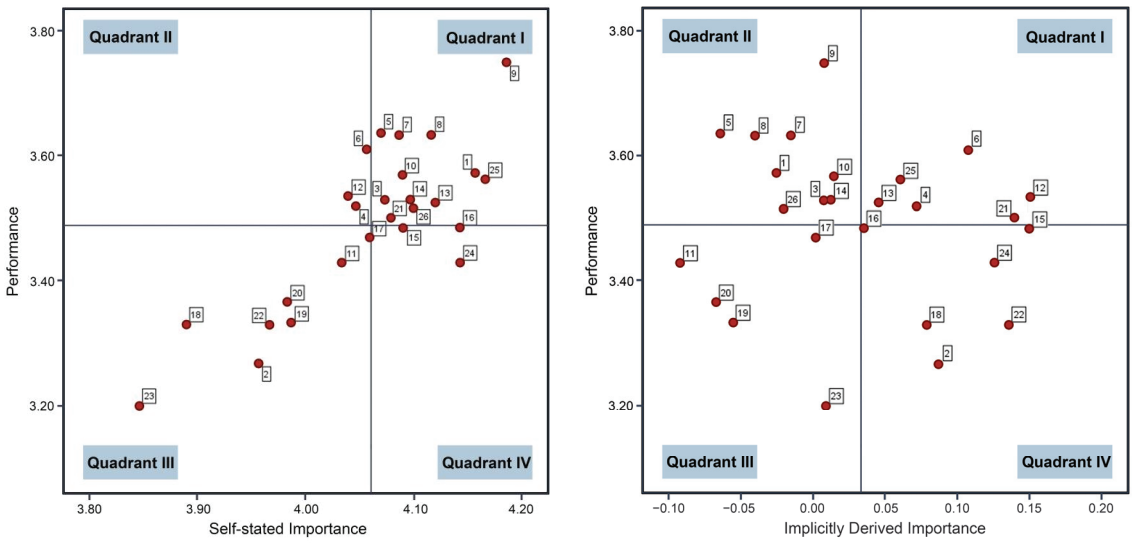
Paired Differences (AP-IDI)				AP		IDI		Pearson Correlation	Sig. (2–Tailed)
QN	Mean	Rank	Std. Deviation	Mean	Rank	Mean	Rank		
9	2.487	1	0.713	3.748	1	0.008	16	0.968	0.000
5	2.406	2	0.697	3.635	2	−0.064	24	0.968	0.000
8	2.398	3	0.705	3.631	3	−0.040	22	0.969	0.000
7	2.396	4	0.696	3.631	3	−0.015	19	0.969	0.000
6	2.390	5	0.737	3.608	4	0.108	6	0.971	0.000
10	2.365	6	0.722	3.568	6	0.015	13	0.970	0.000
1	2.363	7	0.722	3.571	5	−0.025	21	0.969	0.000
25	2.362	8	0.732	3.561	7	0.061	10	0.969	0.000
12	2.349	9	0.761	3.535	8	0.151	1	0.969	0.000
13	2.342	10	0.732	3.525	11	0.046	11	0.971	0.000
3	2.339	11	0.754	3.528	9	0.008	17	0.970	0.000
4	2.336	12	0.738	3.518	12	0.072	9	0.970	0.000
14	2.334	13	0.716	3.528	10	0.012	14	0.969	0.000
26	2.330	14	0.733	3.515	13	−0.020	20	0.969	0.000
21	2.314	15	0.715	3.502	14	0.140	3	0.969	0.000
16	2.314	16	0.732	3.485	15	0.035	12	0.969	0.000
15	2.307	17	0.729	3.485	16	0.150	2	0.971	0.000
17	2.298	18	0.751	3.468	17	0.002	18	0.968	0.000
24	2.280	19	0.750	3.429	18	0.126	5	0.971	0.000
11	2.279	20	0.752	3.429	18	−0.092	26	0.970	0.000
20	2.238	21	0.765	3.365	19	−0.067	25	0.969	0.000
18	2.214	22	0.797	3.329	21	0.079	8	0.971	0.000
22	2.213	23	0.774	3.329	21	0.136	4	0.970	0.000
19	2.209	24	0.753	3.332	20	−0.055	23	0.971	0.000
2	2.167	25	0.735	3.266	22	0.087	7	0.969	0.000
23	2.145	26	0.824	3.199	23	0.009	15	0.972	0.000

4.2. Attribute Performance—Implicitly Derived Importance Analysis (Revised IPA)

Figure 4 shows the different analytical models obtained using the two different IPA methods described above. Different management strategies could be formulated according to the distribution of attribute satisfaction and importance. According to Figure 4b, i.e., using the modified IPA, the ranking by attribute number (QN) and the distribution of the 26 attributes in the obtained two-dimensional matrix is shown in Table 7.

Table 7. Distribution of 26 attributes in revised IPA.

Quadrant	Quadrant 1 (Keep Up the Good Work)	Quadrant 2 (Possible Overkill)	Quadrant 3 (Low Priority)	Quadrant 4 (Concentrate Here)
Attribute Distribution (QN)	4	1	11	2
	6	3	17	15
	12	5	19	16
	13	7	20	18
	21	8	23	22
	25	9		24
		10		
		14		
		26		



(**a**) (**b**)

Figure 4. Analytical models for the traditional and revised IPA: (**a**) The performance–self-stated importance analysis model; (**b**) The performance–implicitly derived importance analysis model.

5. Discussion

Because of the effects of COVID-19, more attention has been given to healthy buildings, but the health environment in university student halls of residence has received less attention. By examining university students' expectations of the health environment in their halls of residence before and after COVID-19 using the revised IPA method, this study expands on previous research in the context of regular epidemic prevention and control. Understanding the management strategies related to the improvement of the indoor environment of university halls of residence could be very beneficial for campus administrators and policymakers and will be highly applicable for future optimization and enhancement. The findings indicated that there was a degree of discrepancy between university students' expectations of the health environment in their halls of residence and actual performance under regular epidemic prevention and control. This was because of the significantly increased amount of time spent by students in their halls of residence, with a large number of attributes performing below their expectations. This leads to the following three conclusions.

Firstly, after using the revised IPA analysis, the installation of a fresh air system unit, a designated restorative space to support relaxation and rejuvenation, and an indoor exercise function moved from Quadrant 3 to Quadrant 4. Satisfaction levels remained low, but the importance scores were higher and demanded the attention of the relevant departments. In addition, the sanitary conditions of the toilet and bathroom, the indoor storage space, and wireless internet services for study and work consistently showed lower performance and higher expectations. University students who had been placed in quarantine provided responses that reflected similar worries. Students at universities generally expressed their discontent with poor indoor air quality and bathroom odor issues. Individual students reported that isolation damaged their mood and prevented them from exercising.

Secondly, in Quadrant 3, sound insulation of adjacent rooms and comfortable and private personal space had low performance, and the expectations of university students were also low for these attributes. Similarly, university students were less satisfied and less concerned regarding the use of natural materials and real plants in interior design and pleasant natural outdoor views from balconies. In addition, the public space exercise area

inside the building had the lowest satisfaction rating when compared to indoor exercise and was less appealing to university students. We discovered that among the responses from students who had been placed in quarantine, a small number still felt that the isolation space was inadequate, and some thought that the sound insulation of the room was inadequate and would have liked more indoor greening. Even though there is no urgent need to improve these characteristics, the relevant departments should not ignore them.

Thirdly, in Quadrant 1 and Quadrant 2, regardless of whether revised IPA analysis was used, the majority of the indoor physical environments and epidemic-related services performed well. In general, with the exception of the factors in Quadrant 4 that required improvement, the performance of the air quality, sound environment, and water was good, with the lighting and thermal comfort of dorm rooms demonstrating the best performance. According to many previous studies, indoor environmental quality (IEQ) improvement was given a high priority by university campus managers as a result of COVID-19, and this is borne out by the results of our study [55,88]. However, there were still a small number of students who had been placed in quarantine and thought that some factors performed poorly. In addition, in Quadrant 1, university students regarded the comfort of tables and chairs and outside noise levels as being quite important. However, the comfort of tables and chairs and the provision of adequate natural sunlight in work areas were at risk of falling into Quadrant 4.

5.1. Implications for Theory

The main purpose of this study was to compare the effects of the indoor physical living environment in university halls of residence on the physical and mental health of students before and after COVID-19. Because of the recurrence and persistence of COVID-19, researchers are paying increasing attention to the health of university students, a susceptible population. We used the modified IPA analysis approach as the foundation for the study in order to better understand how the indoor physical living environment of university halls of residence affected the health of students from the perspective of the users. The modified IPA can help relevant departments to make defensible decisions that will maximize the satisfaction of university students and provide them with a better living environment while still adhering to regular epidemic prevention and control. IPA can effectively represent in a graphical form how university students perceive the indoor physical living environment in their halls of residence. Although IPA is a very useful technique, traditional IPA analyses have a number of significant flaws, in particular ignoring the relationship between changes in attribute importance and performance (satisfaction or service quality). Therefore, we adopted the modified IPA analysis method to make a better and more comprehensive judgment and analysis of the results. In addition, in order to address the drawbacks of the modified IPA, to perfect the usage of the IPA technique, and to give a useful theoretical explanation and practical test, our empirical comparison of the two IPA analysis methodologies highlighted discrepancies in the results. Overall, our work extends the use of modified IPA analysis in certain respects. It demonstrates that the application of the modified IPA technique may deliver more insightful and collaborative data to enhance the health benefits of the indoor physical living environment in university halls of residence under regular epidemic prevention.

5.2. Recommendations for Practice and Policy

As previously mentioned, university halls of residence have become crucial locations in which university students manage their studies, work, and personal lives since COVID-19. This study highlights several areas that require attention from university campus administrators and policymakers, as well as university students. The research aims to inform future efforts to develop healthy environments in university halls of residence.

The survey's findings indicate that in order to meet the pressing needs of university students who must live, study, and work in halls of residence, university officials and decision-makers must improve the distribution of resources and provision of support.

University students were eagerly anticipating the installation of new fresh air system equipment to improve the current interior air quality [89], as evidenced by the low satisfaction and high importance of this attribute (Quadrant 4) and comments from students who have been placed in quarantine. This might be connected to the condition of the toilets and the requirement for the relevant management department to promptly assess the toilet situation in their hall of residence and create an improvement plan. Additionally, even if a residence hall's capacity is constrained as a building type for communal living, efforts should still be made to provide university students with some storage space [48]. Secondly, a designated space for relaxation and rejuvenation within the building is more crucial to the recovery of university students' mental health than other strategies. Campus administrators and decision-makers should give more attention to the exercise of university students. University students considered that the indoor exercise facilities provided had poor performance, but they were considered relatively important. Related research has indicated that appropriate daily exercise during the epidemic could mitigate mental health problems. Administrators and policymakers should consider initiatives to encourage university students to exercise because this can help them to build stronger bodies and improve their mood, given that COVID-19 is a significant health-related concern [90,91]. Finally, it should be taken into consideration that, as part of the regular epidemic prevention and control measures, methods used to control the behavior of students can prevent them from meeting the demands of study and work in halls of residence. Better wireless internet connections are viewed as an urgent improvement issue for university students, which is closely related to their productivity [1].

In general, the factors in Quadrant 1 and Quadrant 2, with which university students expressed a high level of satisfaction and for which performance was better, should be maintained by campus administrators and decision-makers. It is important to note, too, that a small percentage of the university students who were placed in quarantine indicated in their feedback and responses to open questions that they were still bothered by interior lighting, sound insulation, and poor water supply. These factors play a very important role in the revised IPA chart. For instance, in future construction work, attention can be paid to adjusting the natural lighting of university students' halls of residence so as to determine the visual comfort threshold for university students and provide more healthy natural lighting [92]. In addition, relevant studies show that the balcony, as a buffer space between the occupants and the outdoor green space, plays a critical function in helping to alleviate the mental health problems of university students and can help to improve their resilience [60]. Furthermore, the green visual ratio and areas of indoor and outdoor green space are also worth considering for improvement, as these are considered effective measures for enhancing resilience [93,94]. These two elements had a lower performance even though the study found that university students did not consider them very important. In order to ensure the healthy development of university students' halls of residence in all respects, campus administrators and decision-makers should continuously work to provide a healthy indoor environment for students.

5.3. Limitations and Future Research Directions

This study is one of the first in China to reveal the satisfaction of university students with the health environment of their halls of residence in the context of regular epidemic prevention and control. The nature and breadth of this study have some limitations, notwithstanding the contributions it has made. Firstly, our study may not be indicative of a nationwide sample because we only surveyed university students in Zhejiang Province, China. Future research might include university students in other locations to produce more generalizable conclusions for reducing the health effects of COVID-19 on university students. Secondly, the WELL Building Standard V^2 and earlier study findings provided the foundation for our eight key elements for a healthy environment in university halls of residence. A more in-depth analysis could be carried out in the future to determine the extent to which the relationship between these variables affects the development of a healthy

environment in university halls of residence. Thirdly, based on the responses of quarantined students to the open-ended questions, several environmental characteristics that were not quantitatively examined in our study—such as garbage odor and outdated facilities—were also inferred. In addition, there are certain deviations according to individual preference regarding the indoor environment; for example, the importance of greenery varies from person to person. In the future, focus groups could be formed with subject-matter experts to actively explore additional qualities and facets of indoor environments that support the physical and mental health of university students, their perception of the effects of individual factors on the health environment of halls of residence, and to suggest strategies for improvement.

6. Conclusions

In this challenging period, although the COVID-19 outbreak is subsiding, the health of university students continues to cause concern. This study adds to the body of knowledge on the impact of COVID-19 on the physical and mental health of university students by contrasting conditions before and after COVID-19. It also uses the revised IPA to examine how university students perceive the performance of the health environment in their halls of residence and their expectations of it. Additionally, this study provides recommendations for practice and policy that can help university administrators and decision-makers enhance the health environment of university halls of residence under regular epidemic prevention and control measures. We recommend improving the indoor physical environment and arrangement of indoor space in university halls of residence, which can effectively promote a healthy environment. Furthermore, the focus should be placed on raising the bar for improving the standard of educational services and strengthening indoor exercise facilities, which are of great importance to the health of university students. In conclusion, in line with the development goal of various countries to create a healthy environment for university students, all stakeholders must work together to offer supporting interventions for the health and well-being of university students as the country's future workforce.

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Fluorescent Marker as a Tool to Improve Strategies to Control Contaminated Surfaces and Decrease Danger of Cross-Contamination in Dental Clinics, during and beyond the COVID-19 Pandemic

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Abstract: The COVID-19 pandemic posed an increased threat to dental personnel and patients. Close encounters with patients' breath and saliva and the use of intraoral rotating instruments which disperse microscopic airborne particles both increase the possibility of environmental infection. In this study, fluorescent marker (FM) was used to assess and enhance surface cleanliness in the dental clinics and public areas of a major dental school. Initially, 574 surfaces in various areas of a dental school were marked with FM for 3 consecutive months to monitor the surface cleanliness. The initial evaluation results were visually presented to both students and para-dental and cleaning personnel during a designated educational session, and were used to stress the importance of preventing cross-contamination. Following educational intervention, 662 surfaces were re-examined for an additional 3 months, using the same method. A significant improvement in the surfaces' cleanliness (ANOVA, $F_{(1)} = 10.89$, $p < 0.005$) was observed post-intervention. The results were more prominent in students' clinics, which were the students' cleaning responsibility. The results show that fluorescent markers can serve as an educational tool to improve strategies to control contaminated surfaces in large clinics, such as dental schools. Their use can substantially decrease the hazard of cross-contamination during the pandemic and beyond.

Keywords: fluorescent marker; infection control; SARS-CoV-2; COVID-19; dental clinics

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1. Introduction

The worldwide state of emergency declared in March 2020, and the rapid spread of the COVID-19 pandemic, increased the need to develop protocols to prevent cross-contamination in medical settings, as well as in other public areas [1]. Traumatic events such as the COVID-19 pandemic can have negative physical and psychological consequences, not only among the general public but also among medical and dental personnel [2–4]. The situation for dentists and para-dental personnel was especially complex. Economic worries, a fear of contagion, concerns for family and friends, and conflicts concerning patients' treatment caused considerable psychological distress [2].

Coronavirus disease 2019 (COVID-19) is a novel severe respiratory syndrome caused by a new beta-coronavirus, known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [5–7]. SARS-CoV-2 can be transmitted through droplets, aerosols, or contact (direct or indirect via fomites). Direct transmission can occur through close contact with infected people through secretions (such as saliva and respiratory secretions) or their respiratory droplets which are expelled when a person is in close contact with an infected person who has respiratory symptoms (e.g., coughing or sneezing) or who is talking or singing [8]. Asadi et al. [9] showed that speech has a greater ability to transmit respiratory

infectious diseases compared to breathing due to a greater quantity of particles that are emitted when compared to breathing and the larger size of particles which can carry a larger number of pathogens. The authors conclude that physiological factors, varying among individuals, can affect the probability of respiratory infectious disease transmission.

Indirect contact transmission involving contact between a susceptible host and a contaminated object or surface (fomite transmission) is also possible. The SARS-CoV-2 virus can be found on surfaces for periods ranging from hours to days, depending on the ambient environment and the type of surface. Although there are no specific reports which have directly demonstrated fomite transmission for SARS-CoV-2, it is considered a likely mode of transmission, given the consistent findings on environmental contamination in the vicinity of infected cases and the fact that other coronaviruses and respiratory viruses can be transmitted this way [8].

The danger of being infected by the SARS-CoV-2 virus was especially significant for dental personnel [10]. It is now evident that short-range (conversational) and long-range aerosol transmission plays at least some part in how all respiratory viruses are transmitted between people [11]. In a dental office, verbal communication with patients is carried out in close vicinity to the patient's mouth. Infected individuals could transmit significant numbers of respiratory pathogens via speech, even in the absence of overt clinical signs of illness [9].

Additionally, due to the nature of dental treatments, saliva-contaminated aerosols are routinely created during treatment. It was found that the viral load of SARS-CoV-2 ribonucleic acid (RNA) in participants' naso-pharyngeal swabs is positively correlated with the RNA viral load that is emitted in both droplets >10 μm and in bio aerosols <10 μm [12]. Respiratory droplets from infected individuals can also land on objects, creating fomites. As environmental contamination has been documented by many reports, it is likely that people can also be infected by touching these surfaces and touching their eyes, nose, or mouth before cleaning their hands [8]. Thus, although COVID-19 fomite transmission has not been demonstrated, until the risk of COVID-19 fomite transmission is fully understood, continued efforts to frequently clean and disinfect environmental surfaces are needed [13].

The control of contaminated surfaces in medical settings is important at all times, but its importance increased during the pandemic. The pandemic emphasized the importance of continuously cleaning, disinfecting, monitoring, and controlling surfaces and equipment [14,15], and increased the need for simple detection tools that would enable continuous safe dental care during the pandemic, as well as in everyday dental practice [16,17].

In 2003, the Center of Disease Control (CDC) updated the guidelines [18] for infection control in dental healthcare, which were adopted by most dental schools around the world [19]. The guidelines recommend maintaining hand hygiene, disinfecting and sterilizing medical equipment, and improving the quality of water in treatment [20]. General cleaning and disinfection with chemical or physical agents (such as ethylene oxide, peroxide hydrogen, and peracetic acid) can reduce the risk of contamination associated with medical equipment [20]. Fortunately, although the SARS-CoV-2 virus may persist on surfaces such as glass, metal, or plastic for up to 9 days, it is very sensitive to the action of disinfectants [21].

Most healthcare facilities use disinfectants approved by the Environmental Protection Agency (EPA), such as sodium hypochlorite solution [22]. According to various tests, the virus responds better to ethanol than isopropanol, following contact of at least 30 s [1]. Tan et al. [23] developed a systematic procedure to establish the correlation between particulate matter (PM), a mixture of solid particles and liquid droplets found in the air, and microbial counts in hospital operating rooms. The procedures verified the operating parameters of air change rate, room differential pressure, relative humidity, and air temperature. The authors proposed the frequent monitoring of PM5 and PM10 before each surgical procedure.

Dental procedures are usually ambulatory and relatively short in nature. Monitoring PM before each procedure is impractical. Nevertheless, the control of contaminated surfaces

is crucial to decrease the dangers of cross-contamination. The CDC suggested several modes to test the quality of surface cleanliness. One such tool is a fluorescent gel, which has the advantage of easy use and is useful in detecting spreading infections from bodily fluids [24,25]. A fluorophore is a fluorescent chemical compound that can re-emit light upon light excitation. When a fluorophore absorbs light, its electrons become excited and move from a resting state to a maximal energy level, called the excited electronic singlet state. Fluorescent markers are useful in a wide range of applications, such as in identifying and quantifying distinct populations of cells, cell surface receptors, etc. [26]. Fluorescent tracer dye intervention can also be used to quantify dermal exposure to agrochemicals among farmers and serve as an educational intervention, which reduces the risk of adverse health effects [27].

Different stages of the dental curriculum require students to demonstrate and adopt different skill sets. In essence, the first stage of the curriculum is mostly theoretical. When students progress to the clinical stage of the curriculum, they learn not only new fine motor and precision skills but also contamination control. All dental schools operate within large dental clinics, in which senior dental students practice their skills as future dentists. Preventing cross-contamination through surfaces and educating students to detect and prevent possible contamination became primary goals during the COVID-19 pandemic.

The surfaces most frequently touched inside the dental clinic are drawer knobs, light handles, unit switches, dental radiograph equipment, reusable containers of dental materials, drawer handles, and dental chairside computers [28]. Certain sites such as the handle of the dentist's chair and computer surfaces are mostly problematic [20]. In the public areas, the most frequently touched surfaces are door handles, countertops, waiting room chairs, elevator buttons, etc. [15,29].

The aim of this study was to assess the cleanliness of surfaces in clinics and in the public areas of a major dental school and to evaluate the effectiveness of fluorescent markers as an educational intervention to control contaminated surfaces and decrease the dangers of cross-contamination.

2. Materials and Methods

The study received the approval of the academic head and the chief administrative director of the dental school, and was carried out at the dental clinics and public areas of the School of Dental Medicine, Tel Aviv University, Israel. It was carried out during the first year of the COVID-19 pandemic (June 2020–May 2021).

2.1. Study Design (Figure 1)

Pre-intervention evaluations (pre-I): A total of 13 evaluations (on different days) of various surfaces' cleanliness were carried out, twice a week, during a period of 3 months, as described below. Students, faculty members, administrative staff, and the managers and employees of an external cleaning company responsible for cleaning the public areas were oblivious to this part of the study. Personal protective equipment (PPE) was mandatory for all personnel. Students' PPE included gowns, medical protective masks, goggles, gloves, disposable cap masks, disposable clothing, and full-face holds. Cleaning personnel used disposable clothing, medical protective masks, and gloves.

Intervention: There was an intervention process during which the initial findings were displayed and demonstrated to students, faculty, administrative staff, and managers of the cleaning company who take care of the public areas. Each of the relevant groups was invited to an educational session in which pre-I results were visually presented and the importance of cleaning was explained and emphasized. An updated cleaning protocol, based on the CDC 2003 and CDC COVID-19 recommendations [18,30], was formulated and presented. Stations of disinfectant solution (chlorhexidine gluconate 0.5% and ethanol 70%) were scattered throughout the relevant areas and subjects were encouraged to use them at all times.

Post-intervention evaluations (post-I): A total of 9 evaluations (at different days) were carried out twice a week 6 months after the educational intervention, with the use of FM, as described below.

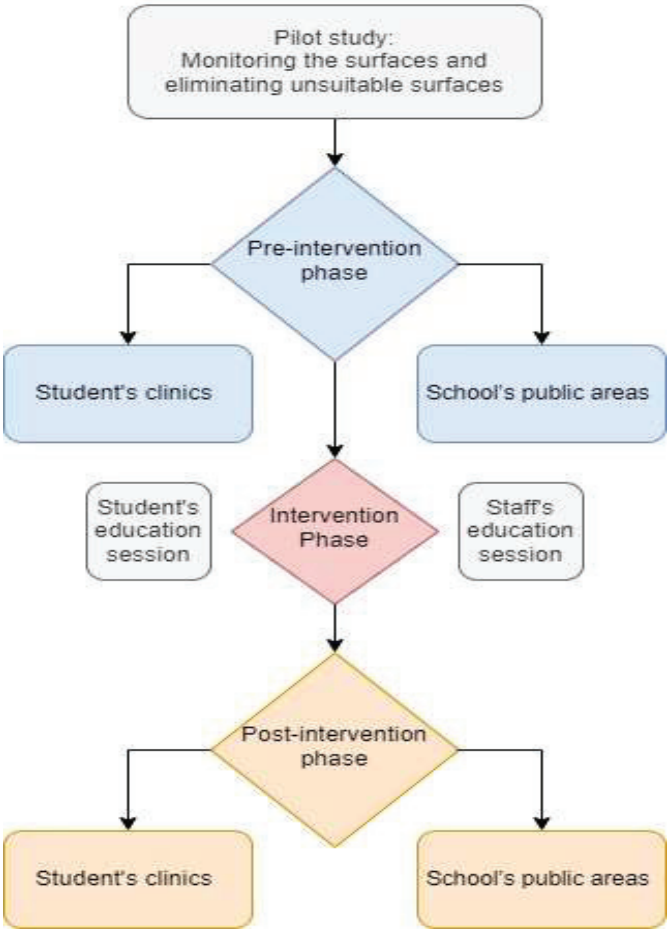

Figure 1. Study design flowchart.

2.2. Evaluation of Surface Cleanliness

Fluorescent marker (FM) gel (Glo Germ, Moab, UT, USA) was used. The FM used in the present study is a lotion base containing fluorescent plastic particles (total ingredients are purified water, glyceryl monostearate, ceteareth-20, cetearyl alcohol, white petrolatum, glycerin, organic soybean oil, isopropyl myristate, mineral oil, carbomer 934, disodium EDTA, triethanolamine, methylisothiazolinone, phenoxyethanol, and propylene glycol). The lotion's use is recommended to avoid cross-contamination and ensure surface cleaning effectiveness, and specifically to avoid the transmission/spread of microbes.

FM was applied with a cotton swab on chosen surfaces in students' clinics and the school's public areas (see below). The FM application protocol was based on Dewangan and Gaikwad [31,32]. In brief, FM was applied to an area with a diameter of approximately 1.5 cm to most tested surfaces, except for elongated areas, such as banisters, in which the applied area was approx. 1.5 × 6 cm.

Applications were carried out at the end of a working day, twice a week, for 3 months. Twenty-four hours later, at the end of the following working day, surfaces were examined with a UV flashlight, 51 LEDs, and a 395 nanometer UV light (UV-Rev, Escolite, Dallas, TX, USA). Findings were recorded with a Canon 70D camera (Tokyo, Japan) and photographs were evaluated for the absence or presence of residual gel. The area was considered clean if no FM was detected on the surface (0 FM present). If any FM was visible in the next day's assessment, the area was marked as unclean/dirty (Figure 2).

Figure 2. Application of FM to elevator buttons; (**A**): Elevator buttons following FM application; (**B**): elevator buttons 24 h post-application (scored as unclean).

2.3. Surfaces Examined

In order to choose adequate surfaces to be examined with the use of FM, a pilot study was carried out in which FM was applied to 50 surfaces and examined in the following 24 h. Three surfaces were found to be inadequate for FM use (e.g., LED X-ray apron and wood banisters) and were excluded.

Forty-seven surfaces which were found to be adequate for FM application belonged to the following categories.

2.3.1. Students' Working Areas

Students' working cubicles (the students' cleaning responsibility)—13 points of application (e.g., dental chair handles, countertops, suction handles, unit handles, computer mouse). Before the intervention, 2 random dental units were evaluated each time, at 13 different time points. After the intervention, 3 random dental units were evaluated, at 9 different points of time (Figure 3).

X-ray areas (the students' cleaning responsibility)—9 points of application (e.g., handle of the examination chair, computer mouse, X-ray conus). The surfaces were evaluated at 13 points of time pre-I and at 9 points of time post-I.

Clinic service areas—3 points of application are as follows: assistants' desk (the dental assistants' cleaning responsibility), and external and internal doorknobs (the cleaning responsibility of employees from an external cleaning company). The surfaces were evaluated at 13 points of time pre-I and at 9 points of time post-I.

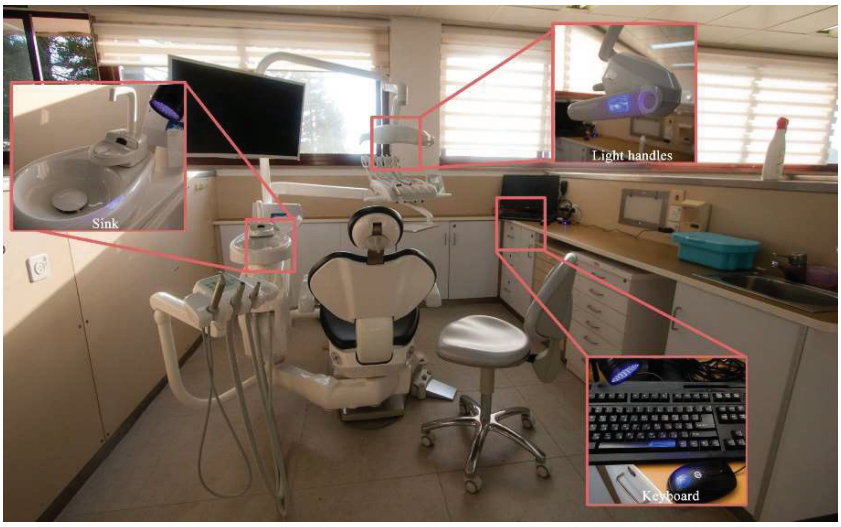

Figure 3. Example of surfaces examined in students' working cubicles.

2.3.2. Public Areas

Public areas in the dental school (the cleaning responsibility of employees of an external cleaning company) (Figure 4). All public surfaces were evaluated at 13 points of time pre-I and at 9 points of time post-I, which are as follows:

Figure 4. Example of surfaces examined in the school's public areas.

Elevators—4 points of application (e.g., internal and external buttons and banisters);

Public areas—10 points of application (e.g., reception desk, chairs, banisters, employees' time clocks);

Lavatories—9 points of application (e.g., door handles, water flush knobs, tap knobs).

The total number of examined surfaces was 1236. As examinations were carried out during the first year of the COVID-19 pandemic, clinical work was restricted by the

Ministry of Health, State of Israel (e.g., working periods, the number of active dental units). Therefore, the number of examined surfaces was different between the two examination periods (574 pre-I and 662 post-I).

Statistical methods: Surface cleanliness for 24 h. After the application, each of the surface categories (students' dental units, service areas, X-ray areas, elevators, public areas, and lavatories) were calculated as percentages of clean surfaces of the total number of surfaces examined in each category (pre-I and post-I). The higher the percentage, the cleaner the surface.

A one-way ANOVA was performed to evaluate the effect of intervention (the pre-I percentage of clean surfaces compared to the post-I percentage of clean surfaces) for the different surface categories.

3. Results

The percentages of clean surfaces in each category are presented in Table 1 and Figure 5.

Table 1. The percentage of clean surfaces at pre- and post-intervention evaluations (pre-I versus post-I).

Cleanliness (%) / Surface Category	Pre-I *	Post-I	ANOVA-$F_{(1)}$	p ***
Students' cubicles (n = 13) **	24.24 ± 16.14	48.48 ± 11.53	12.41	**0.003**
X-ray areas (n = 9)	19.23 ± 18.33	46.03 ± 23.17	10.03	**0.006**
Clinic service areas (n = 3)	50.00 ± 29.65	49.74 ± 40.06	NS	NS
Elevators (n = 4)	32.69 ± 12.00	61.11 ± 18.16	19.192	**0.000**
Public areas (n = 10)	30.42 ± 17.16	36.41 ± 16.76	NS	NS
Lavatories (n = 9)	26.02 ± 18.87	44.44 ± 23.57	3.717	0.072

* The percentage of clean surfaces (mean ± SD) in each category. ** In parenthesis—the number of examined surfaces in each category. *** Significant differences are marked in bold.

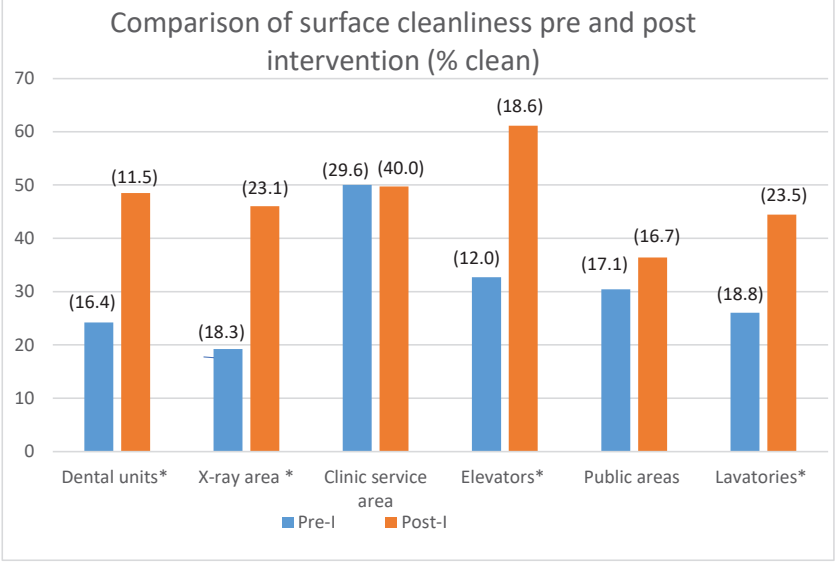

Figure 5. Comparison of surface cleanliness pre- and post-intervention (% clean). * Surfaces in which significant differences were found between pre-I and post-I; numbers in parenthesis represent the standard deviation (SD) values for each bar.

One-way ANOVA revealed statistically significant differences in surface cleanliness between pre-I and post-I evaluations in the following surface categories: students' dental cubicles, students' X-ray areas, and elevators. The difference in the lavatories was borderline.

When mean values of the surfaces in the students' clinics (students' cubicles, X-ray areas, and clinic service areas) and the surfaces in the school's public areas (elevators, public areas, and lavatories) were collapsed and compared to one another, no significant differences between the two groups could be detected in both the pre-I and post-I evaluations. The mean surface cleanliness post-I was 45.08 ± 22.67 for students' clinics and 47.32 ± 15.04 for the school's public areas (Figure 6). The difference between pre- and post-intervention values was significant (ANOVA with repeated measures; mean square = 2645.223, $F_{(1)} = 10.89$, $p < 0.005$).

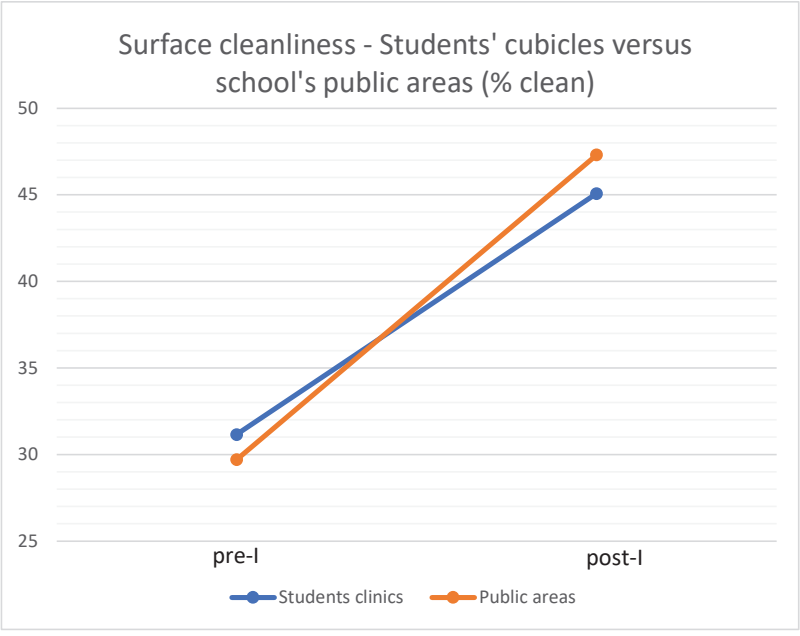

Figure 6. The mean values of surface cleanliness pre-I and post-I in students' cubicles and in the school's public areas.

4. Discussion

In the Summary of Infection Prevention Practices in Dental Settings [14], the CDC refers (among others) to environmental infection prevention and control. The document emphasizes the importance of cleaning and disinfecting surfaces that are most likely to become contaminated with pathogens, including clinical contact surfaces (e.g., frequently touched surfaces such as light handles, bracket trays, switches on dental units, and computer equipment) in the patient care area. The CDC points out that ongoing education and training of dental healthcare personnel are critical for ensuring that infection prevention policies and procedures are understood and followed. A successful infection prevention program depends, among other things, on developing standard operating procedures, evaluating practices, and providing feedback to the personnel [18].

The need for infection control and for personnel education and training increased substantially during the COVID-19 pandemic when dental treatment became increasingly hazardous to both dental personnel and patients. The ADA recommended cleaning frequently touched services a minimum of four times a day, depending on the patient load, with a combination of detergent/disinfectant wipes to achieve mechanical cleaning [15].

FMs have been used to assess cleanliness levels in clinical settings due to their easy application and ability to provide a quick assessment of cleanliness [33,34]. FM seems to be a useful analog of contaminated bodily fluids because it spreads easily [25]. In a recent study, Dewangan and Gaikwad showed a strong correlation between a liquid detergent with FM properties and the microbiological gold standard, indicating that it could serve as a simple and cost-effective alternative for assessing cleaning practices on a daily basis [31].

In the present study, FM was used as a feedback-based educational tool to reduce environmental contamination in the dental setting. Results showed that the use of FM as a demonstration of surface cleanliness was effective in increasing surfaces' cleanliness in both students' clinics and in the school's public areas. The percentage of completely clean surfaces (0 FM) increased from around 30% pre-I to around 45% post-I. This indicates that the FM demonstration, in conjunction with increased impact given to environmental infection control, was effective in decreasing surface contamination in the dental school.

The effect of intervention was especially prominent among dental students who showed a significant improvement in the cleanliness of surfaces that were their responsibility (students' working cubicles, dental units, and X-ray areas). The results were less impressive among para-dental personnel (dental assistants and employees of a cleaning company), with only some of the areas under their responsibility (elevators) showing significantly better results post-I as compared to pre-I. This may be due to COVID-19 restrictions which instructed para-dental personnel (including assistants) to minimize their contact with patients. Employees of the cleaning company were allowed to work only after hours when patients were absent from the building. Thus, dental students were in most direct contact with patients, making them more concerned about personal safety. An additional difference between students and the cleaning personnel may have been in the personal protective equipment used. While students were very strict about changing their gloves between patients, cleaning personnel might have used their disposable gloves for longer periods of time. In such cases, FM could have accumulated on the gloves during the day, a fact which might have created "false positive" results. Although the percentage of completely clean surfaces post-I did not exceed 50% (except in the elevators, approx. 60% completely clean), one has to bear in mind that the dichotomous scoring system (clean/unclean) might have biased the results toward lower scores. To ensure better control over surfaces cleanliness, additional measures can be used (such as plastic covers) for elevator buttons, computer keyboards, etc.

The manual cleaning and disinfection of environmental surfaces in healthcare facilities are essential elements of infection prevention programs, especially during the COVID-19 pandemic [31]. The ability to visualize unclean areas through the use of FM has a potential to reduce the hazard of environmental contamination. The use of fluorescent dye to enhance safety demonstrations has been shown to result in the greater self-reporting of behavioral changes in comparison to other educational techniques [35].

Clearly, pre-dosing surfaces with FM and examining the extent to which it remained on the surface 24 h later represent a crude way of examining the potential of fomite contamination risk. Nevertheless, the ability to demonstrate the uncleanliness of surfaces may have a beneficial effect on the subjects' future cleaning behavior. Dental students are not too experienced in clinical procedures. Therefore, the implementation of standard universal precautions in dental schools is especially important to control cross-infection [36,37]. Emphasizing environmental infection control and educating dental students to apply appropriate infection control strategies enable a healthy environment in which both dental students and patients are protected [38].

Limitations: Fomite contamination/transmission for SARS-CoV-2 has not been unequivocally proven. No study has yet convincingly shown that directly touching contaminated surfaces leads to self-inoculation and infection in the absence of any other exposure from aerosols. It is also noteworthy that FM cannot be used to detect the presence or absence of specific organisms, so its use in pathogen-specific outbreak evaluation is not practical [24]. FM removal represents merely a physical removal of the applied substance,

and, in some cases, surfaces which were not adequately clean may still have been effectively disinfected [30]. Moreover, the spread on unclean areas may have occurred from bags, coats, and other fomites, rather than by hands. Furthermore, some of the beneficial effect of the educational intervention might have been due to an increased awareness to cleaning and disinfection, and not necessarily due to the ability to actually see the contamination. Nevertheless, the significant increase in surface cleanliness following the FM demonstration indicates its potential to promote strategies for environmental infection control in dental clinics during and beyond the COVID-19 pandemic.

5. Conclusions

Cross-infection in dental clinics represents a major enduring public concern, but it increased significantly during the global pandemic. Academic training, strict control guidelines, and supervision using efficient low-cost instruments are essential for a safe environment for both dental personnel and patients. FM can act as an efficient educational tool to increase awareness of the control of environmental contamination in large clinics with multiple personnel, such as dental schools.

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Article

Psychological Impacts of COVID-19 on Healthcare Trainees and Perceptions towards a Digital Wellbeing Support Package

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Abstract: We explore the impact of COVID-19 on the psychological wellbeing of healthcare trainees, and the perceived value of a digital support package to mitigate the psychological impacts of the pandemic (PoWerS Study). This mixed–methods study includes (i) exposure to a digital support package; (ii) participant survey to assess wellbeing, perceptions of work and intervention fidelity; (iii) semi–structured qualitative interviews. Interviews were digitally recorded and transcribed, data were handled and analysed using principles of thematic framework analysis. Participants are 42 health and medical trainees (9M, 33F) from 13 higher education institutions in the UK, studying during the COVID-19 pandemic. Survey findings showed high satisfaction with healthcare training (92.8%), but low wellbeing (61.9%), moderate to high perceived stressfulness of training (83.3%), and high presenteeism (50%). Qualitative interviews generated 3 over–arching themes, and 11 sub–themes. The pandemic has impacted negatively on emotional wellbeing of trainees, yet mental health is not well promoted in some disciplines, and provision of pastoral support is variable. Disruption to academic studies and placements has reduced perceived preparedness for future clinical practice. Regular check–ins, and wellbeing interventions will be essential to support the next generation health and care workforce, both in higher education and clinical settings. The digital support package was perceived to be accessible, comprehensive, and relevant to healthcare trainees, with high intervention fidelity. It is a useful tool to augment longer–term provision of psychological support for healthcare trainees, during and after the COVID-19 pandemic.

Keywords: COVID-19; pandemic; psychological wellbeing; digital; healthcare; students

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1. Introduction

The psychological impact of COVID-19 on healthcare workers is well documented [1,2]. A recent review and meta–analysis identified risk factors for psychological distress following the outbreak of any emerging virus [2]. Those at greatest risk tended to be female, younger, parents of dependent children, and those with an affected family member. Healthcare workers with pre–existing physical or mental health conditions, those who experience social isolation or prolonged quarantine, and those with concerns about infecting family members are more vulnerable to psychological impacts, as well as those who experience societal stigma from their healthcare role. Work–related risk factors for psychological distress include having greater contact with affected patients, having less clinical experience, and lacking access to appropriate organisational support and training, work wear or personal protective equipment (PPE). There are differences between clinical professions, with nurses found to be at greater risk than doctors in most studies [2].

Healthcare trainees share similar risk factors but are an under–researched and often overlooked group. They make a valuable contribution to the health and care workforce,

and many senior trainees have been voluntarily mobilised into healthcare services, to support patient care during COVID-19 [3]. In general, college students have reported fear, disturbed sleep, depression and anxiety during COVID-19 [4–10] and anxiety levels for college students have been found to be higher than that reported by university staff [11] and almost double that of healthcare professionals [12]. The psychological impacts can be higher in students in their graduating year or those living in severely afflicted areas [5]. A study in the United States of America found that a high proportion of college students also reported concerns for the health of their families, difficulties in concentrating, decreased social interactions (due to physical distancing) and increasing concerns about their academic performance [7].

With regards to healthcare specifically, high numbers of healthcare trainees report feeling mentally unwell during the pandemic (e.g., [13], 52.4% of medical students) with delays in academic activities being positively associated with anxiety [14]. Many healthcare trainees report high 'fear of COVID-19', particularly those who are female, younger, in their earlier years of training or with financial challenges [5,15]. In the United Kingdom (UK), the COVID-19 pandemic has resulted in significant impacts on clinical learning opportunities in health and medical education, and disruptions to clinical placements affecting students' confidence and preparedness for clinical practice [16,17]. It is imperative that education systems adapt to meet the needs of healthcare learners during and beyond COVID-19 [18], and as such there has been a rapid transition to alternative forms of learning involving virtual learning, videoconferencing, social media and telemedicine [19], which has brought additional and unique stressors.

Undoubtedly, access to psychological support has been identified as important to mitigate the psychological impacts on healthcare workers of a public health crisis [2] and provide support during a pandemic for higher education students, globally [20]. Healthcare trainees should be afforded such provisions, which may help to improve aspects of their psychological wellbeing, for example, reducing fear and improving sleep difficulties [5]. Digital interventions can provide information, guidance, signposting and support while offering flexibility for use while remote working. At the time of writing, during the COVID-19 pandemic, universities in the UK have been largely delivering education remotely with plans to return to a hybrid model of remote and face–to–face delivery, post–pandemic. A digital support package is available that was released just three weeks after COVID-19 was declared a pandemic in the UK [21], with the aim of mitigating the psychological impact of COVID-19 on healthcare workers. The package was the first of its kind to provide education and supportive strategies focused on the psychological impact of COVID-19, self–management approaches to self–care and psychological wellbeing. It is based on a conceptual model for mitigating the impacts of COVID-19 on health and care workers (Figure 1).

Content of the package draws on the principles of positive psychology which is advocated for the prevention of mental health problems (general population: [22,23]; student sample: [24]) and focuses on the strengths that enable individuals and communities to thrive. In the context of health and care workers' wellbeing during a pandemic, this includes attention to the organisation (e.g., proactive organisational structures and approaches, communication strategies, prioritising staff wellbeing); leaders and teams (e.g., psychologically safe environments, compassionate leadership and role modelling, team collaboration, building team resilience, peer support); and individuals (e.g., building self–esteem and self–efficacy [25], self–care, staying connected and managing emotions). The content of the digital package is informed by effective health policy and leadership models [26–28], and aligns with the Five Ways to Wellbeing model [29,30] which identifies the five activities most likely to promote individual wellbeing: (i) connect (e.g. access social support), (ii) be active (e.g. self–care), (iii) take notice (e.g., risk awareness, mindfulness), (iv) keep learning (e.g., strategies for supportive teams, effective communication, cultural competence), (v) give (e.g., supporting others, psychological first aid). While the package is highly accessed globally, and has been found to be appropriate, meaningful and

useful to health and care workers from diverse disciplines [31], the value to healthcare trainees is not yet established. The current study aimed to ascertain whether the digital package has relevance and value for healthcare trainees, as the next generation of the healthcare workforce.

Figure 1. Conceptual model for mitigating the impacts of COVID-19 on health and care workers.

The aims of the research were to:

(i) explore the experiences of healthcare trainees during the COVID-19 pandemic and any impacts on their studies and psychological wellbeing,

(ii) describe trainees' mental wellbeing and perceptions of training (in terms of work stressfulness, satisfaction and engagement, presenteeism and intentions to leave).

(iii) determine the acceptability, fidelity and utility of a digital package to support psychological wellbeing in healthcare trainees,

(iv) establish recommendations for approaches to augment longer–term provision of psychological support for healthcare trainees, during and after the COVID-19 pandemic.

2. Methods

2.1. Study Design

This was a mixed–methods study involving individual qualitative interviews accompanied by a questionnaire survey with interview participants. The research was reviewed and approved on 11 June 2020 by the University of Nottingham Faculty of Medicine & Health Sciences Research Ethics Committee (FMHS REC 39–0620) and the study was pre–registered (PoWerS Study on clinicaltrials.gov, ID: NCT04429828).

2.2. Participants and Setting

Eligible participants were health and medical trainees registered for study at the time of the COVID-19 pandemic, purposively selected to represent diversity across higher education institution, gender and discipline of study (including medicine, nursing, and allied health). Female participants were purposely over–sampled. This was to reflect a higher proportion of women in the UK healthcare workforce overall (NHS employees: 77% female [32], and the gender balance in healthcare education (nursing students: 90% female; allied health students: 75% female [33]; medicine and dentistry students: 64% [34]. Participants were recruited from 13 universities in the UK, including the Universities of Aberdeen, Birmingham, Bradford, Cardiff, Central Lancashire, Coventry, Liverpool, Leicester, London (University of Central London, Imperial College London), Nottingham, Oxford Brookes and Teesside.

2.3. Procedure

Trainees were recruited over a six–week period between June and August 2020, via advertisements circulated by email and notifications on student–facing and healthcare social media sites. Interested individuals were asked to contact the research team to express their interest in taking part and were subsequently provided with an information sheet, a consent form and a link to an evidence–based digital package [21], described by Blake et al. [31]. This package was designed to provide psychological support to health and care workers during and after the COVID-19 pandemic. It covers psychological impacts of COVID-19, psychologically supportive teams, communication, social support, self–care, managing emotions and further resources. Further details about the development of the package and fidelity testing with healthcare workers is published elsewhere [31].

2.3.1. Data Collection

Data collection approaches are mapped to study aims and corresponding results sections (Figure 2). Data were collected by qualitative interviews and a structured survey was completed by all interview participants (to meet aims i–iii). Findings are synthesised in a discussion with recommendations (to meet aim iv). All data were collected by independent researchers who had no involvement in the design or development of the digital package.

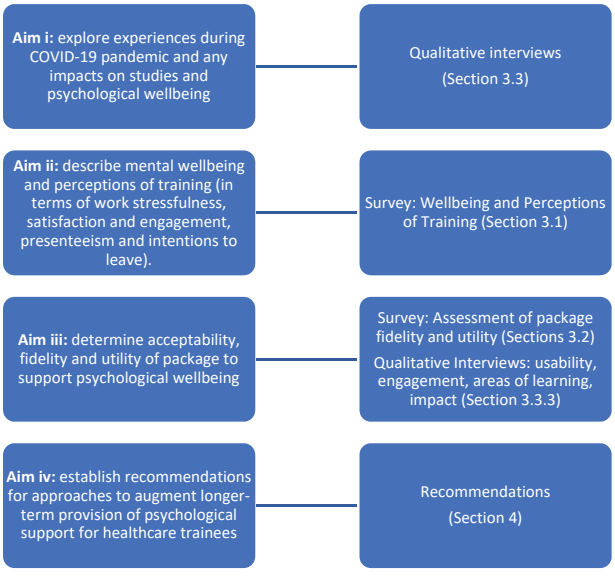

Figure 2. Approaches to data collection.

(a) Qualitative Interviews

Eligible participants were invited to take part in a semi–structured interview, conducted one–to–one by telephone or video–conferencing facility (Microsoft Teams) and audio–recorded with consent. Interested participants provided their contact details to a member of the research team and arranged a time that was mutually convenient. Participants were not reimbursed for their time, although to maximise participation they were offered the opportunity to take part in a prize draw for a £30 online shopping voucher. Consenting participants provided both verbal and written signed informed consent. Interviews were informed by a semi–structured topic guide (Supplementary File S1) developed using the five–step process outlined by Kallio et al. [35]. The topic guide considered the following broad areas: to gather insight into the emotional highs and lows of being a healthcare trainee during the pandemic; to identify any facilitators, obstacles or barriers to accessing the e–package; to identify perceptions of healthcare trainees towards the value of the e–package during and after the COVID-19 pandemic; and to gather views on longer–term support for psychological wellbeing in healthcare trainees.

All project team members had completed training on interview approaches, research integrity, research ethics and Good Clinical Practice (GCP). Two researchers undertook interviews (IM, EG). Digital recordings of the interviews were then transcribed verbatim with 100% cross–checking for accuracy (conducted by IM, EG, GD). The number of participants interviewed was based on the number needed to achieve theoretical data saturation. With each interview conducted, the research team judged whether the data emerging was new and satisfied the research purpose. The researchers deemed no new data to emerge at the 42nd interview, at which point recruitment ceased.

(b) Structured survey

Wellbeing and Perceptions of Training

Prior to the start of the interview, consenting participants were asked to complete a brief survey (Supplementary File S2). This included questions about their age, gender, ethnicity, year of study, and whether or not they had worked in the UK health or social care services and specifically, in a COVID-19 high–risk area during the pandemic. The survey included measures of wellbeing, and perceptions of work adapted for a trainee sample, for whom work in this context is either study or clinical placements.

The measures included a 14–item measure of wellbeing (WEMWBS: Warwick Edinburgh Wellbeing Scale, [36]). The WEMWBS is a widely used scale which is a measure of mental wellbeing focusing entirely on positive aspects of mental health. It has been validated in the general population, and student populations [37]. The scale has five response categories, summed to provide a single score, with higher scores indicating more positive wellbeing.

The survey included the following four single–item global measures that were adapted for use with trainees (students). Job stressfulness [38] was measured by the item: 'In general, how stressful do you find your course/training?' with responses on a 5 point scale ranging from 1 = 'not at all stressful' through to 5 = 'extremely stressful'. Job satisfaction [39] was measured by the item: 'Taking everything into consideration, how do you feel about your course/training as a whole?' with responses ranging from 1 = extremely dissatisfied through to 5 = extremely satisfied. Turnover intentions [40] were assessed using the item: 'Are you considering leaving your course/training?' (yes or no). Presenteeism was assessed using an item adapted from [41]: 'As far as you can recall, has it happened over the previous 12 months that you have gone to work (including placement or studies) despite feeling that you really should have taken sick leave due to your state of health?' with responses options 1 = no, never, 2 = yes, once, 3 = yes, 2 to 5 times, 4 = yes, more than 5 times.

The trainees were also asked to complete the dedication sub–scale of the 9–item Utrecht Work Engagement Scale (3 items: DE2, DE3, DE4) [42] as applied to healthcare training. This required respondents to report their level of agreement with the following statements: '*I am enthusiastic about my training*', '*My training inspires me*', '*I am proud of the work I do*'. Responses were on a 6–point scale ranging from 0 (never) to 6 (always/every day).

Assessment of Package Fidelity and Utility

In the same survey, intervention fidelity was determined through quantitative assessment of user experience, content relevance, utility and accessibility. We replicated procedures and success criteria described elsewhere for the evaluation of digital packages [43,44], using 20 questions about the usability and utility of the e–package with pre–defined success criteria that had been used in a prior evaluation of the same package with a sample of healthcare professionals [31].

2.3.2. Data Analysis

Participant survey data were analysed using IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA) [45]. Survey data were analysed by an independent researcher (MY) who had no involvement in the digital package development, or the recruitment, intervention, data collection or analysis of qualitative data. Descriptive statistics were provided by characteristics based on clinical exposure. Chi square test was applied to compare Likert scale items between participants who were working in a COVID-19 high-risk area, or not. Roughly normally distributed WEMWBS mean scores were compared between participants with COVID-19 high/low risk using independent samples *t*–test.

Analysis of qualitative data was guided by principles of framework analysis [46,47] with a combined deductive–inductive approach. Framework analysis is a hierarchical, matrix–based method developed for applied or policy relevant qualitative research where timescales are limited, and the goals of the research are clearly defined at the outset. Interview data was mapped onto thematic matrices to allow for interrogation to address the research aims and objectives. Starting with a deductive approach, an analytic framework was used that pre–selected matrices to consider (amongst other things): personal wellbeing; impacts of being a healthcare trainee during COVID-19; perceptions and views of the e–package; whether they had gained any new knowledge; what was the most and least useful aspect of the package; whether (and how) they had used any of the information or resources; and preparedness for return to the 'new normal' in the recovery phase of COVID-19. Thematic summaries from the 'personal wellbeing' matrix established the level of user demand for the digital package during COVID-19. Summaries from the 'knowledge' and 'most/least useful' matrices captured user–driven perspectives on the use of the digital package and how to improve educational provision around psychological wellbeing going forwards. The '*perceptions*' and '*impact*' matrices provided more general insight about how trainees felt that the digital package (and other educational resources or inputs) could support their psychological wellbeing during or after the pandemic, any potential influences of the support package on their wellbeing and work, and potential future sustainability of this digital support package. Then taking an inductive approach, we included additional themes generated from the data though open (unrestricted) coding. Higher–level codes within each theme were refined by grouping lower–level codes found in the data. One author (HB) generated the analytic framework and oversaw the process of analysis, with three team members (EG, IM, GD) populating the framework, interpreting data and validating the form and content of the framework. In the report of the findings, verbatim quotes with ID codes in parentheses representing gender, discipline and ethnicity have been used to represent each theme and subtheme.

3. Results

Forty-three people expressed an interest in participating, and 42 of these provided written consent, and completed both the interview and survey (see Table 1). The sample consisted of trainees in eight disciplines including medicine (Med: $n = 28$), nursing (Nurs: $n = 7$), midwifery (Mid: $n = 2$), physiotherapy (Phys: $n = 1$); ambulance (A: $n = 1$); other, e.g. health–related PhD (Oth: $n = 3$) and 19 (45%) were from Black, Asian or other minority ethnic groups (see Supplementary File S3). The sample included participants at all stages of study (undergraduate, masters and doctoral level). Thirty–one per cent ($n = 13$) of

the participants had worked in a COVID-19 high–risk area during the pandemic (e.g., dedicated COVID-19 +ve ward, intensive care unit, emergency department or ambulance services, ward with COVID-19 +ve patients, entrance meet and greet, staff or regular visitor to care or residential home, or other self–defined high–risk area).

Table 1. Participant Characteristics by Clinical Exposure.

Characteristics (*n* = 42, 100%)	Clinical Exposure [+] (*n* = 20, 47.6%)	No Clinical Exposure [+] (*n* = 22, 52.4%)	Full Sample (*n* = 42, 100%)
Age			
16–20	4 (9.5)	9 (21.4)	13 (31)
21–30	8 (19)	10 (23.8)	18 (42.9)
31–40	7 (16.7)	3 (7.1)	10 (23.8)
41–50	1 (2.4)	–	1 (2.4)
Gender			
Male	6 (14.3)	3 (7.1)	9 (21.4)
Female	13 (31)	19 (45.2)	32 (76.2)
Prefer not to disclose	1 (2.4)	–	1 (2.4)
Ethnicity			
White	14 (33.3)	9 (21.4)	23 (54.8)
Mixed Ethnicity	–	1 (2.4)	1 (2.4)
BlackAfrican/Carribean/Black British	1 (2.4)	–	1 (2.4)
Asian/Asian British	5 (11.9)	10 (23.8)	15 (35.7)
Other ethnic group	–	2 (4.8)	2 (4.8)
Year of Study			
1	3 (7.1)	2 (4.8)	5 (11.9)
2	7 (16.7	12 (28.6)	19 (45.2)
3	7 (16.7)	5 (11.9)	12 (28.6)
4	1 (2.4)	1 (2.4)	2 (4.8)
5	2 (4.8)	1 (2.4)	3 (7.1)
6+	–	1 (2.4)	1 (2.4)

Note: White–British: White, White–Irish, White—any other White background; Mixed: White and Asian, Any other mixed background, White and Black Caribbean; White and Black African; Asian/Asian British: Indian, Pakistani, Bangladeshi, any other Asian background; Black/Black British: Caribbean, African, any other Black background. [+] Clinical exposure refers to having been working in clinical settings at any point during the pandemic (placement or work).

3.1. Survey: Wellbeing and Perceptions of Training

Scores on the WEMWBS ranged from 13–56 (mean = 36.1, s.d. = 8.74), with 61.9% of participants classed as having poor mental wellbeing. There was no significant difference in wellbeing scores among gender, year of study, discipline, or whether participants had clinical exposure during the COVID-19 pandemic or not. Among 42 participants, the majority reported moderate–to–high job stressfulness with relation to their course (83.3%, *n* = 35). Almost half of the trainees (47.6%, *n* = 20) reported presenteeism (going into placement/studies when they should really have taken sick leave due to their health), and one participant did this more than five times in the previous 12 months. Two trainees indicated that they had considered leaving their course, but neither reported any clinical exposure during the pandemic. The vast majority expressed that they were satisfied with their training (92.8%, *n* = 39). With regards work engagement, 79.6% (*n* = 33) reported that they were *enthusiastic* about their training (either often, very often or always), 74.8% (*n* = 31) felt that their training *inspired* them (either often, very often or always) and 79.6% (*n* = 33) felt *proud* of the work they did (either often, very often or always). There was no significant difference in overall work engagement scores with gender, year of study, discipline, or whether they had clinical exposure during the pandemic. However, trainees who had worked in clinical areas during the pandemic reported higher work enthusiasm compared to trainees who had not. Full details are available in Table 2.

Table 2. Wellbeing and perceptions of training by clinical exposure (n = 42).

Item	Clinical Exposure Mean (s.d.) or n (%)	No Clinical Exposure Mean (s.d.) or n (%)	Comparison (p)
Course/training stressfulness	3.23 (0.92)	3.24 (0.73)	0.96
Course/training satisfaction	3.46 (1.12)	3.90 (0.81)	0.16
Intentions to leave	–	2 (4.8)	–
Presenteeism			0.18[a]
No, never	4 (9.5)	17 (40.5)	
Yes, once	3 (7.1)	9 (21.4)	
Yes, 2 to 5 times	5 (11.9)	3 (7.1)	
Yes, more than 5 times	1 (2.4)	0	
Work engagement			
Enthusiastic about training	5.08 (1.11) ^^	4.38 (0.97) ^	0.04 *
Training inspires me	4.69 (0.94) ^	4.17 (1.22) ^	0.18
Proud of my work	4.92 (1.24) ^^	4.38 (1.47) ^	0.27
Total UWES [+]	4.76 (0.2) ^^	4.31 (0.19) ^	0.46 [b]
WEMWBS Total	34.15 (8.13)	36.97 (9)	0.34 [c]

* Significant at 0.05 alpha level; WEMWBS Warwick–Edinburgh Mental Wellbeing Scale; [+] UWES Utrecht Work Engagement Scale, dedication sub–scale ^ average (2.91–4.70), ^^ high (4.71–5.69); [a] Pearson correlation co–efficient; [b] Fisher–Freeman–Halton Exact Test; [c] Independent samples t-test.

3.2. Survey: Assessment of Package Fidelity and Utility

Results of the intervention fidelity testing (Table 3) show high fidelity and excellent implementation qualities. Twenty (of 21) pre–defined success criteria were met for the fidelity assessment (6/7 across delivery and engagement), and implementation qualities (14/14 across practicality, resource challenges, attitudes, acceptability and usability). While intervention receipt (perceived knowledge) rate appeared lower than the pre–defined figure of 90%, either immediate new knowledge enactment and/or intention to act on knowledge in the future was subsequently reported by 92% of respondents (39/42). Many healthcare trainees reported that following engagement with the package, they had already taken further actions ('intervention enactment') e.g., engaging with sleep and night shift tips, better communication with colleagues, emotionally supporting peers and family members, balancing responsibilities to themselves, family and friends, considering training in psychological first aid, engaging with advice around coping with emotions, and seeking individual discipline–specific help by accessing telephone helplines or web support found in the extra resources. Many had accessed the interactive elements (e.g., video clips), used apps signposted from within the package and shared the information with others.

Table 3. Intervention fidelity and implementation testing.

Assessment Type (n = 42)	N	Actual Success Rate	Pre–Defined Success Rate
Fidelity Assessment		N (%) or mean (SD)	N (%) or mean
Fidelity of Delivery			
Per–protocol delivery (functioning link)	42	41 (97.6)	>90% *
Toolkit completion rate:			
Main sections	42	41 (97.6)	>75% *
Further resources	42	19 (45.2)	>30% *
Fidelity of Engagement			
Understanding of the toolkit	42	41 (97.6)	>90% *
Intervention receipt (perceived knowledge)	42	33 (78.6)	>90%
Intervention enactment (knowledge use [a])	19	19 (45.2)	>30% *
Perceived enactment (future use [b])	23	20 (86.0)	>50% *

Table 3. *Cont.*

Assessment Type (n = 42)	N	Actual Success Rate	Pre–Defined Success Rate
Implementation Qualities		N (%) or mean (SD)	N (%) or mean
Practicality			
Use by any healthcare professional	42	40 (95.2)	>75% *
Relevance to any healthcare professional	42	7.24 (2.28)	>6 *
Level of burden	42	5.55 (2.24)	<6 *
Resource Challenges			
Time challenges	42	13 (31)	<25%*
Technical challenges (skills)	42	1 (2.4)	<25% *
Financial challenges	42	0 (0)	<25% *
Attitudes			
Perceptions toward availability	42	8.9 (1.41)	>6 *
Would recommend to others	42	37 (88.1)	>75% *
Acceptability			
Appropriate for needs	42	34 (81)	>75% *
Contains meaningful information	42	39 (92.9)	>75% *
Perceived usefulness of the toolkit	42	7.9 (1.96)	>6 *
Usability			
Ease of navigation	42	8.5 (1.83)	>6 *
Technical difficulties (functioning)	42	3 (7.1)	<25% *
Cost			
Acceptable cost implications	42	42 (100)	>75% *

[a] Immediate actions following access to the package. [b] Item relates to hypothetical future action (intention) and is completed only those who had not enacted immediately. Note: * Meets pre–defined success rate.

3.3. Qualitative Interviews

Interview data analysis generated three over–arching themes, with 11 sub–themes (see Table 4). Interview length ranged from 11 to 51 mins and the average duration of interview was 21 mins.

Table 4. Analytic Framework.

Overarching Themes	Sub–Themes	Codes
Impact of COVID-19 on studies	Level of exposure to COVID-19	Clinical work in high–risk areas Placement exposures Contacts with family, partners or peers NHS deployment
	Impact of COVID-19 on healthcare studies	Remote/online working Changes in timetabling Student experiences (clinical practice, workload, isolation, work–life balance) Communication and information Quality of academic support
Emotional impacts of COVID-19	Emotional highs of the pandemic	Positive emotions Dealing with a crisis situation Knowledge and support
	Emotional lows of the pandemic	Negative emotions Concerns for the future Lack of support
	Discipline–specific impacts	Role responsibilities Expectations of the profession
	Ethnicity–specific impacts	Perceived vulnerability Risk and inequity
	Return to the 'new normal'	Preparedness for practice Returning to study and placements Mental health validation and support

Table 4. *Cont.*

Overarching Themes	Sub–Themes	Codes
Digital support for psychological wellbeing (e–package †)	Usability and engagement	Accessibility and use Functionality and technology Comprehensiveness
	Areas of learning and impact	Most useful content New knowledge and learning
	Areas for future development	Least useful aspects Future support required
	Application of knowledge and learning	Personal value (new knowledge) Signposting resources (helplines, apps, links, videos) Attitude change (cultural competence, leadership) Behaviour change intentions

† Mitigating the psychological impact of COVID-19 on health and care workers [31].

3.3.1. Theme 1: Impact of COVID-19 on Studies

Sub–Theme 1: Level of Exposure to COVID-19

The perceived level of exposure to COVID-19 through studies and clinical placements was highly variable in this sample. Many of the participants were deployed to frontline clinical areas during the pandemic or they were engaged in some form of clinical work outside of scheduled study time. This included work as a healthcare trainee, or bank staff (agency workers) in intensive care units, COVID (+ve) wards, the ambulance service, and care homes as well as other clinical areas perceived to be lower risk, such as outpatient clinics or non–COVID wards, without any positive cases. There was a general consensus that healthcare trainees had experienced greater impacts during the pandemic (both on their studies and through personal exposure to COVID-19) than students from other disciplines.

Sub–Theme 2: Impact of COVID-19 on Healthcare Studies

Participants alluded to the abruptness of the national lockdown and the significant disruption to student life: "*university just got cut short . . . when lockdown happened in March, I thought . . . my time as a student ended then . . . everything was just not involving university at all" (101FPhysioW).* The experience was described as "*daunting*" and "*no–one really knew what was happening*" *(121FMedM).*

There were mixed views about the transition to remote learning during the pandemic. Trainees recognised that the switch to online approaches to learning had been essential: "*that's the cards we've been dealt, and obviously I don't really think there's any, there's no other way of doing it*" *(109FMedW).* For some, the change of study environment was perceived to negatively impact their productivity and engagement: "*I personally haven't been very interactive with some of the stuff, because I find it quite difficult to learn like online through that kind of method*" *(127FMedM).*

There was a perception that academic staff understood the challenges of remote working for students and had quickly adapted their approach and lecture materials to accommodate this: "*I feel like the lectures are more informative now, because the lecturers are working harder, because they know that we can't ask them questions as we can in a, you know, in–person lecture*" *(108FOthM).*

The changes to timetables, cancelled lectures and training sessions had resulted in fewer support sessions for some participants (e.g. revision sessions for exams), and areas of learning that trainees perceived had not been covered adequately, or at all: *"we lost out on a lot of like communication sessions, they were never picked back up" (112FMedW).* Nevertheless, participants spoke of adjusting to remote learning over time, and highlighted the availability of online lectures and learning materials not only from their own institution but from other universities and healthcare organisations, demonstrating a marked increase in the visibility of shared learning resources as a result of the pandemic. For some, the transition to online learning approaches had increased their capacity for independent study and actively seeking out learning materials by necessity: *"I've had to do more, more so by my*

own initiative by joining online webinars and you know, finding stuff out by myself instead of it being provided for me" (124MMedW).

Some expressed a preference for (and reminisced about) face–to–face learning, in particular since this was seen to be a more effective platform for questions and discussion. A minority of participants perceived greater challenges in accessing individual–level support from academic staff during this time. The perceived inability to interrupt online sessions mid–flow with questions made it difficult for some trainees to engage in complex discussions via these remote methods. This seemed to be more problematic for trainees learning in large cohorts, for example, where teaching delivery was in the format of large–group online lecture. In those healthcare disciplines where cohorts were smaller, it had been easier to sustain small–group tutorials which had led to high quality discussion and feedback and a willingness to ask questions.

The rapidity of the transition to online learning and adapting to new approaches and systems had generated significant stress for many participants: "*it was all a bit stressful because I've never done online studying before*" *(122FMedM).* This was notable for those participants who had outstanding exams or assessments: "*I felt like we weren't getting the right education we should've been getting, and our exams got cancelled, everything got crammed into one which was really stressful" (122FMedM); "I feel like we weren't assessed properly and so I hadn't studied properly because everything just seemed a bit . . . no–one really knew what was going on with our exams and stuff" (108FOthM).* For some of the trainees, the pandemic had led to a dramatic shift in assessment timings which was generally perceived to have been inevitable. Some of the participants admitted that the cancellation of scheduled lectures and placements had offered some respite from the intensity of healthcare training: *"a lot of people were really burnt out at that point in March, very anxious about exams, so when they cancelled everything, it was actually quite a relief" (111FMedW).* However, there was a certain level of anxiety regarding the additional workload that would be added to the next academic year. The emotional burden of the impacts of COVID-19 on workload and timings was evident, and one trainee described this as: "*emotionally taxing, stressful, because it's all being like crammed into a short period of time, it might be quite stressful to, to get it all done*" *(111FMedW).*

Balancing academic studies with personal responsibilities during the pandemic generated stress for some. Assessment deadlines were automatically extended for students at some institutions, and this was appreciated, for others this was not the case: "*I've been having to do all this and then like neighbours' shopping and you know a bit of, a bit more time to study would've been appreciated but they didn't extend any deadlines" (140FNursW).*

There were marked differences in the experiences of trainees at different stages of their study, with greater impacts on clinical experiences perceived by those in the later stages of study and those who were deployed into clinical areas during the pandemic, and fewer impacts perceived by those who were in their earliest stages of study with fewer placements, or for those who had already completed their placements, taught sessions and assessments prior to the lockdown. Those who had experienced disruption to clinical placements had concerns about their development of clinical skills, and overall quality of their education. For some, the disruption had significantly reduced opportunities for clinical experience. One trainee reported: "*The ambulance service won't take us . . . we weren't allowed on our second placement block which was supposed to start in May. They won't take us until this thing has blown over*" *(103MParaW).* A medical trainee stated: "*We should have been now just doing two years straight of placement, but it's been put on hold*"; "*we've missed all of that and had to kind of learn something that's very physical and very practical in a non–physical and non–practical way*" *(110FMedW).* Some participants perceived that clinical exposure had been prioritised for those in later years of study (e.g. the final years of medical training) and while they were not critical of this approach and recognised the need for certain groups of students to attain the correct number of hours in practice to qualify, it left some trainees in the earlier stages of study concerned about the lack of opportunities during this time and any long–term implications of this: "*We're tryna learn things that can't be learnt from*

home at home basically and its very, very, up in the air so we don't really know when we're gonna be back on placement, and there's obviously a lot of anxiety around how it's gonna impact us now cos we are very behind in terms of where we should be at, at this point" (110FMedW).

There were concerns raised about clinical subjects being taught fully online, and this negatively impacting their learning and the development of clinical skills: "*there's only so much you can learn you know from like a Teams lecture like you do need like the hands–on practice you know on the wards" (112FMedW).* However, the efforts of clinical teams to develop new learning approaches for trainees was welcomed: "*Making us take histories from each other via Microsoft teams and . . . for . . . critical care where you're kind of trying to hand back, handover patients via Microsoft teams to just kind of try and put some interactivity into it" (113MMedM).*

For those in their final year of studies, the transition from trainee to healthcare practitioner was perceived to have accelerated. For some, the pandemic seemed to have shifted their identity as a 'student' to that of a 'professional', although some admitted to struggling with the adaptation to their new role: "*still technically finishing my final year . . . with dissertation and things . . . and then having to just go straight into practice as a qualified member of staff, it is really tough" (101FPhysioW).* Some students raised concerns over the impact of the pandemic on specific processes, such as the application process for foundation year doctors (in the UK this is a two–year, general postgraduate medical training programme which forms the bridge between medical school and specialist/general practice training) or the completion of elective placements (in the UK, the content and setting of elective placements are largely decided by the student undertaking it). Those participants who were on clinical academic pathways (a planned progressive development through undergraduate, masters, doctoral and post–doctoral levels of study, spanning clinical and academic environments) reported significant challenges of engaging in part–time study alongside their clinical roles, particularly those who had been redeployed during the pandemic to intensive care or COVID-19 wards, leaving little time for their studies.

Some students who were not working in clinical environments during the pandemic reported feeling 'cut–off' from the university during the early months of the pandemic. Feelings of isolation were generally reported by students who were registered for part–time study, or those who were undertaking doctoral degree programmes in the healthcare disciplines, rather than undergraduates who were part of a large cohort of trainees, or those working in clinical environments.

The need for regular communication was paramount. Trainees generally reported a high level of support from their institutions. They applauded the detailed information that had been delivered at speed to assist them with decision–making around opting in for COVID-19 extended placements to support frontline healthcare staff. The majority were positive about the regularity and clarity of information and communications coming from their university at the outset of the pandemic: "*We had so much information on that, meetings by zoom and emails, constant communications so I felt really supported to make my choice to opt in for that placement" (102FNursW).* However, some of the trainees had a less positive view of communications and it was apparent that the frequency, and clarity of information was not consistent across institutions. Some trainees felt that their university had not efficiently communicated changes in working hours and expectations of trainees to placement mentors, which caused difficulties on clinical placements and was anxiety–provoking.

While there appeared to be a satisfaction with the level of information provided around the move to remote learning, or the processes for opting in for clinical placements, some trainees felt there was a lack of detail in areas that mattered to individuals personally. For example, one medical trainee referred to COVID-19 risk assessments being conducted on healthcare students with medical conditions, in preparation for practice, but they perceived there to be a lack of clarity around how this related to their personal circumstances, particularly if they lived with a vulnerable person: "*what if you live at home with, you know, who, someone whose severely immunocompromised or something like that, how do you go around that? Are you expected to move out of that home?" (110FMedW)*

The uncertainty of COVID-19 had led to confusion that was seen to impact on the clarity of communications from the university to trainees across the board. Trainees viewed late messaging from course leads and changing plans to be a significant source of stress which prevented planning, and adequate preparation related to their studies or placements: "*here's the plan, and then a week later it changes and then it might go back to the original plan, and so it's a bit hit and miss, because you can't really adequately prepare*" *(127FMedM).* However, trainees commonly made a point of stating that the situation was outside the control of their educational institution: "*I don't blame the medical school whatsoever, but nobody's really knowing the future, what's going to happen*" *(127FMedM).*

Trainees often referred to being appreciative of the support they had received from clinical educators, academics, and from their university more broadly. They discussed the way in which support had been rapidly mobilised by academic teams: "*I think they've [the medical school] kind of done the best–case scenario in a worst–case situation*" *(109FMedW).* Participants reinforced that their universities had endeavoured to provide them with opportunities, whilst ensuring no trainee was exposed to situations that they would be ill–equipped to manage: "*as a student it's very flexible . . . we've very much been told that if there is any scenario that we don't feel we're comfortable with in terms of COVID, then we are allowed to opt out of it*" *(109FMedW).*

Building high quality relationships with academic tutors and feeling able to access support was seen to be essential for coping during the pandemic. One trainee discussed the benefits of receiving regular contact, one–to–one explanations and support from a tutor: "*[she] really made me understand what is going on and how to overcome these challenges, and basically I could say that it helps to prepare yourself and be ready for any hard time*" *(106MNursM).*

3.3.2. Theme 2: Emotional Impacts of COVID-19

Sub–Theme 1: Emotional Highs of the Pandemic

Despite the stress of the pandemic, among trainees that had been deployed to support the UK National Health Service (NHS) during the crisis, some viewed this moment as their 'calling': "*very excited to want to be on the front line, to support and do my duty. That's why I trained to be a nurse*" *(102FNursW)* and an opportunity to: "*witness the changing of the system*" *(102FNursW).* There was a prevailing sense of pride in viewing themselves as the next generation of healthcare staff: "*I feel like I am really enjoying working and enjoying being part of it and seeing all of this change . . . we're kind of that next generation of staff*" *(101FPhysW).* One nursing trainee described the opportunity to work alongside patients who have suffered with or been impacted by COVID-19 as a 'privilege'. The learning opportunities provided by the pandemic were seen to be exceptional; observing major organisational changes such as areas being rapidly segregated for COVID cases, and the implementation of national and local policy changes in response to a pandemic. The value of teamwork in healthcare was very much at the forefront: "*I've been able to be part of team who have survived the COVID outbreak and still stuck together, and I think that's brought a sense of unity*". On the whole, trainees demonstrated that there had been a wealth of learning opportunities that had arisen from the pandemic. Many of them found value in the opportunities to see new ways of working, and work with new teams in different areas. They spoke of huge collaborative efforts to troubleshoot, find solutions and new approaches during the crisis with a shared goal of providing high quality patient care.

The trainees felt they were able to make a positive contribution to healthcare when it was critically needed, and in very diverse ways. Those who were unable to independently provide clinical care reported having contributed to the pandemic through infection prevention and control action (e.g., cleaning of ward areas and emergency vehicles), or supporting patients: "*When it comes to working in hospital, it would be going and sort of either feeding or speaking to patients who are lonely because they can't have their visitors. Or it may be going and helping HCAs [healthcare assistants] with their daily tasks working on COVID and non–COVID wards*" *(126MMedM).* While not all trainees were able to offer their support

in this way, for those that could, these actions appeared to engender a sense of personal value, and their contributions were often confidence building.

Despite the stress experienced by the majority of trainees, those that had worked in high–risk areas during the pandemic, such as critical care, COVID-19 positive wards, or care home facilities perceived a positive side to the situation: *"I can tell a story that actually I did my last year of nursing during a pandemic, that's a story and an achievement in itself" (102FNursW).*

Sub–Theme 2: Emotional Lows of the Pandemic

The stress and anxieties surrounding the impact of COVID-19 on studies was evident across the sample. For some of the trainees, the lockdown had taken a significant toll on their mental health: *"Staying at home really affected my mental health because towards the start of it, of lockdown, I was a bit, it got me depressed because I couldn't go out anymore and nothing was the same, so I was just stay in bed all day, do nothing and barely even feed myself and things like that" (121FMedM).*

Some of the participants reported a lack of recognition of the impact of the pandemic on their mental health, and experienced feelings of abandonment by their academic institutions: "*I felt quite let down with what the university provided us with in terms of support and help for our well–being during this time*" *(101FPhysW).*

Course–related stress and anxiety primarily related to the confusion surrounding processes, cancellation of assessments, rapid changes in traditional learning approaches and/or the reduction or cessation of clinical placements. There were high levels of anxiety among those who were working in clinical environments during the pandemic; there were initial concerns about access to appropriate personal protective equipment (PPE), and access to training in appropriate use of the equipment, although these concerns reduced over time with increasing availability of PPE within the NHS. For some, the extent of the changes, and continual high stress had been overwhelming and was showing no sign of reducing: "*I've been working since April and even now I'm still feeling very overwhelmed*" *(101FPhysW).*

Participants discussed feelings of helplessness when faced with patients who were seriously ill with COVID-19, and the uncertainty of not knowing how ill a patient would become presenting a mental challenge. Trainees spoke of learning how to step back in cases where there was nothing further they could do: "*seeing those really poorly people and actually not been able to do huge amount for them and kind of just letting things happen . . . it's been really hard to do and kind of wanna get stuck in, actually most the time the having to, urm really just kind of, fight it for themselves as well, with our help . . . " (101FPhysW).*

The impacts on trainees of what they saw, and heard, from healthcare professionals during the pandemic was at times profound, but trainees had found the positives by using reflection to channel negative experiences and emotions into learning experiences: "*the most shocking thing for me was just hearing the staff's experiences where they were frontline in the, what we call 'hot Covid' areas. Hearing their stories, that was quite impacting, and I actually did a reflective piece on that as part of my work and the moral distress they experienced during the pandemic" (102FNursW).*

Participants expressed a fear over the possibility of a second wave, and the impacts that might have for them as healthcare trainees, with relation to how they would cope. Those in their final year raised concerns over whether it would hinder their transition to becoming a healthcare professional.

Trainees commonly experienced conflicting emotions due to perceiving themselves (and others perceiving them to be) part of the healthcare workforce, yet at the same time, limited in knowledge and experience by nature of being a trainee: "*it's quite tough like being a student, because you feel like you should be helping, but, we've, we haven't really been taught that much, like, clinical stuff yet in the preclinical stages. So, I feel like if we did help out, we wouldn't be able to do a great deal*" *(107FMedM).* Similarly, there were feelings of 'imposter syndrome' expressed, with stories of discomfort at times when trainees perceived themselves to have limited knowledge but were seen by those in external communities as medical experts. Due to the national uncertainties around the transmission of COVID-19

and expectation behaviours, many trainees had been asked for advice by friends and family members which at times, had been a source of stress: "*it's difficult to try and, try and help reassure people, without being worried about giving them, not necessarily false hope but . . . false information*" *(125MMedW).* Comparable discomfort was experienced by some on their clinical placements: "*there's been more expected of you than what you would've liked, and you're sort of assumed to know things that you don't know*" (139FNursW).

Trainees were concerned about their own exposure to COVID-19 when working in clinical environments, and the risks to children or other family members with chronic conditions which increased their anxiety. This had led to some trainees making significant personal sacrifices in order to attend clinical placements, such as sending their children away to be looked after by relatives during this time.

Personal circumstances generated varying levels of stress—those living with their families mostly reported stress and anxiety associated with COVID-19 transmission, or caregiving responsibilities, and isolation due to not living with, or having face–to–face contacts with their peers. For those living in university accommodation or shared housing off campus, living with peers during the pandemic was at times supportive, and at other times a more challenging experience: "*living in a group together in lockdown was . . . quite a new experience, it had its ups and downs sort of took a toll on everyone's mental health" (139FNursW).*

The psychological impacts of the pandemic were not always immediately evident to some trainees while working in clinical environments who, aside from those in intensive care units or dedicated COVID-19 wards, tended to view themselves and colleagues to be engaging in "*business as usual*". However, several of the trainees alluded to experiencing delayed shock and psychological impacts once their shift was over: "*After we would get home, home into the bays, we would leave the ambulance, put a bit of masking tape over the doors, and say it's a Corona–Van, and er, get another ambulance . . . .it started to make an impact sort of, when you had three ambulances sitting in the bays, that you're not allowed to touch*" *(103MParaW).*

Sub–Theme 3: Discipline–Specific Impacts

Trainees often referred to the uncertainties in how to manage a patient with COVID-19 and worries about adverse effects of any interventions or treatments they might provide. This was particularly evident in comments made by allied health professionals: " *. . . as a physiotherapist, going in, providing treatment and thinking okay I'm not sure how that's going to go. Erm, whereas with kind of some other diseases and illnesses that we know a little bit more about, you can be a bit more certain of what your effect of your intervention's gonna be" (101FPhysW).*

Moral distress was a common theme among nursing trainees, for whom education focuses around the delivery of person–centred care. Some participants reported having struggled with the concept of having to prioritise patient safety over holistic patient care due to the excessive demands on healthcare systems and resources: "*it got to a point where some nurses were looking after four critical care patients, rather than one or two. So, as you can imagine the workload had increased, so they often felt that they couldn't fulfil their nursing duties, not fully as they would pre–covid, and things like mouth care was being missed . . . because there was no time" (102FNursW).*

Medical trainees experienced a certain level of pressure, mostly from healthcare professionals in other disciplines, who seemed to have high expectations of them with regards level of knowledge and understanding of virus transmission: "*because I'm a medical student it was a bit more stressful for me because people expected me to know something about this virus" (122FMedM).* Medical students were more likely than students from other disciplines to report feeling unable to disclose concerns relating to mental wellbeing, or worries about the future, with peers, academic staff, or clinical mentors.

Sub–Theme 4: Ethnicity–Specific Impacts

Those trainees who were from minority ethnic groups, expressed a high level of fear and anxiety around COVID-19. These students expressed concerns about their exposure

to COVID-19 on clinical placements, and the implications that may have for vulnerable family members.

> *"I'm actually going to bring the coronavirus home . . . infect those who are, you know, immunocompromised and who are more likely to . . . suffer from long lasting damages from the coronavirus or . . . possibly even death" (108FOthM)*

One nurse trainee spoke of her competing responsibilities in the dual role of parent of a child from an ethnic minority, as well as a healthcare worker and the life decisions this had led to: "*for me as both a healthcare professional in training and as a mother, seeing that COVID impacts on certain communities, it doesn't discriminate as such, but I think it does favour the black and minority ethnic groups" (102FNursW, mother of dual-heritage child).*

Those trainees who identified as White recognised the increased risks for ethnic minority populations primarily from the media coverage, and believed they had a certain level of social responsibility towards patients from higher-risk groups:

> *" . . . it's changed my mind, it's changed my opinion in terms of you just got [COVID-19], for me I've got to look out even more so for . . . those types of patients that I really am looking towards their best interests and making a big conscious effort to really ensure their recovery from this illness" (101FPhysW).*

Trainees who had accessed COVID-19 wards spoke of the impact of the virus on certain populations, and the visibility of this in certain hospital wards: *"I was asked to do a few shifts on the COVID areas, so I wore the full PPE, and when I walked into there, the patients were majority of black and minority ethnic groups, and that was like whoa. And that took me back, as I live in a community where there is a lot of black and minority ethnic groups . . . so I was like woah actually this is very close to home, and that got me worried for their health, for their safety".*

Sub–Theme 5: Return to the 'New Normal'

Concerns about the future were primarily related to an uncertainty around where trainees would 'fit' in the new normal of healthcare, the impacts of the pandemic on healthcare education and whether gaps in provisions would reduce preparedness for practice. There was also a recognition that the psychological impacts of the pandemic would generate support needs that may continue for the longer term. Healthcare trainees recognised that they would need to adjust to studying and working in a new way and there was widespread concern about what the 'new normal' post–COVID would entail, particularly relating to practice placements. It was generally accepted that most trainees would return to practice '*before we are post–pandemic*' and all participants were anticipating change to their placement experiences as a result of this, associated with the strain on healthcare services during this time and the high workloads of healthcare professionals. For some, concerns about their exposure to COVID-19 patients, and a lack of clarity around what might be expected of them on future placements generated significant anxiety: *"I think it's quite scary . . . we're not being thrown into it by any means, but it is a bit fearful . . . you don't really know what you're going into." (127FMedM)*

Some of the trainees were worried about the level of support that would be provided from clinical mentors and supervisors going forwards because of competing demands on their time, and this led to trainees feeling concerned about the potential for gaps in their knowledge that could impact on patient care in the future: *"A lot of us are feeling like we're gonna be a burden on the healthcare staff 'cause they're all gonna be so busy, so a lot of us do feel a bit apprehensive about, you know, asking questions, asking to be involved" (112FMedW); "there may be a gap in knowledge . . . for certain things which were rushed or perhaps not given enough attention to" (138MMedM).*

While some trainees enthused about returning to face–to–face teaching and placements and spoke of feeling '*energised*' from time out: *"I've had time to refresh" (110FMedW)*, it was recognised that others would need support to make this transition. There was a prevailing view that living through the COVID-19 pandemic, and the significant disruption to healthcare education during this time would be likely to have had long–lasting psycho-

logical impacts on many healthcare trainees. Participants commonly alluded to their own mental health concerns, or those of others, and proposed that mental health problems were likely to become more prevalent in healthcare trainees over time.

> *"I don't think it will be normal. Everything will change. I don't think people will be the same as before, especially me, talking personally. I've been impacted by this honestly, mentally, emotionally." (106MNursM)*

> *"I think it [low mood] will decline quite significantly, I think a lot of people have been just quite low mood anyway purely because of the lack of social interaction and the fact that we've now been inclined to revise for three and a half months for medical exams." (129MMeMB)*

Wellbeing support for trainees was not perceived to be universally available. Healthcare trainees alluded to significant differences in the value placed on student wellbeing by different institutions and between disciplines: *" . . . the university that I was affiliated with, I didn't hear of any sort of support systems from them" (132FOthW).* Further, trainees perceived there to be notable differences between the level of concern for welfare shown by individual staff members (e.g., supervisors, tutors, mentors). Some trainees reported a high level of support from staff, whereas others experienced challenges in accessing support or a lack of compassion and understanding around issues of wellbeing or personal circumstances impacted by COVID-19. The support of fellow trainees and friends was seen to be a mitigating factor against psychological stress, and trainees with robust support systems felt more confident in their capacity to cope with returning to studies and placements than those with fewer support networks.

Participants discussed possible approaches to supporting the 'return to the new normal'. Validating mental health concerns was seen to be essential, and trainees highlighted the value of this validation coming from senior staff (*'at the top, reassuring you' (127FMedM)*) as well as tutors. A widely shared sentiment concerned the 'normalisation' of psychological impacts of COVID-19, since healthcare trainees in particular tend to suppress mental health concerns and struggles due to the nature of their degree: *"I think a big thing within the NHS is that people don't feel like they can talk about something and they don't feel like they're almost allowed to have any sort of mental health or any sort of detriment to them because they're worried that that will put them and their job at risk" (142FMedW).*

It was universally accepted that trainee stress levels could be reduced through more effective communication from the university throughout decision–making processes rather than waiting for top–down delivery of final decisions; *"Be more open about what's happening I think behind the scenes." (122FMedM).*

There was a strong view expressed that wellbeing should be embedded within education and training programmes for healthcare trainees, with efforts to build robust relationships and support systems within cohorts, and timetabled opportunities for wellbeing support "*instead of just relying on students seeking out help" (120FMidM).* Many of the trainees advocated that more mental health awareness was needed generally within universities to reduce the stigma associated with mental ill–health. One participant suggested social media might be one approach to reaching healthcare trainees with mental wellbeing campaigns. There was a general consensus that universities (and workplaces) needed to reduce the waiting times for counselling services in order for them to be timely in preventing or managing the likely escalation of mental health concerns post–pandemic. It was also advocated that trainees would benefit from regular opportunities to openly discuss their worries or pastoral concerns with either a member of staff or another trainee in '*quick, one–to–one meetings, just to check in' (112FMedW).* Active listening, understanding and compassion were seen to be critical in helping trainees to successfully navigate through this difficult period.

> *"If supervisors can understand us, that we are humans, you know we have got feelings, we feel, you know what I'm saying. That is what I think is most important during this time" (106MNursM)*

"It's been quite difficult to find who to talk to . . . if everyone is more supportive, ready to listen and actually willing to listen and makes the time for that" (101FPhysW)

3.3.3. Theme 3: Digital Support for Psychological Wellbeing (the E–Package)

Sub–Theme 1: Usability and Engagement

The vast majority of participants felt that the package was easy to access and navigate, including those who did not consider themselves skilled with information technology: "*no one said that they've struggled with it at all*" *(110FPhysW).* There were no reports of technical issues, and the package was viewed to have high functionality. The layout was deemed to be appropriate and facilitated engagement with the materials: "*I really liked just how simplistic the layout was and how concise it was*" *(127FMedM)*, "*the way it was laid out was brilliant with the sections, so you could jump to the section if you needed to*" *(110FNursW).* Whereas some students found that the package was long, others referred to the value of subsections for selecting relevant content: "*there's a lot of reading to it but they also seem to be sort of quite short bursts of it which makes it doable and obtainable, and it's clearly set out so you know you can read the bits that apply to you*" *(140FNursW).* The collation of materials into a single package was seen to increase the accessibility of support for psychological wellbeing. The content was seen to be relevant to healthcare professionals and students alike, and the package was seen to be a 'go–to' resource for many: "*it's kind of become like a, like a small encyclopaedia" (116FOthW).* Participants valued the variety in terms of the media used (text, audio podcast, video) and presentation of materials. Overall, the content was unanimously seen to be highly comprehensive and appropriate for healthcare trainees of any discipline "*it goes into a good level of depth, and then if they want to find out more about it, there were some quite good signposts" (107FMedM), "I like how it has so many links to lots of different resources that you'd otherwise have no idea existed" (136FMedM).*

Sub–Theme 2: Areas of Learning and Impact

Overall, the vast majority of healthcare trainees reported that they learnt something new from the package. The section on managing emotions was deemed to present the most important content by most of the trainees. There was a general consensus that one of the most important messages trainees took away from the package was the importance of having a self–awareness of their psychological wellbeing and reflecting on their own emotional wellbeing: *"managing the emotions and understanding the emotions, like the anxiety and the anticipation. That section was really, really good." (104FNursW);* "*it's actually just making myself aware of feelings that I might have maybe suppressed because of the psychological impact of them." (101FPhysW)*

Participants admitted that topics such as stress, anxiety and low mood were not typically discussed in their areas of study or professions despite the fact that mental health was something many healthcare trainees struggled with: *"you just have to deal with it' (122FMedM).* Several of the participants discussed a newfound recognition of the signs and symptoms of stress and alluded to feeling sanctioned by the package to consider their own wellbeing: *"it helped me spot . . . warning signs of being really stressed . . . the feeling of being stressed and panicked, I should probably get help for that" (123FMedM).*

There was a recognition that burnout was common in healthcare professionals and healthcare trainees, although the participants reported that they had little prior knowledge on this topic: *"so it talks about burnout . . . I didn't really know like the signs . . . I didn't really know about the different options before the package." (107FMedM).* The inclusion of material on moral injury and guilt was valued. Many trainees had experienced feelings of guilt but felt unable to discuss this openly: "*I don't think it's something spoken about a lot . . . in a time when so many people are passing away and getting ill, you're always gonna tell yourself, oh I should have done better I should have done better, and I love the fact that I think a recurring theme was you are doing enough." (127FMedM)*

Healthcare trainees spoke of the value of learning about the psychological impact of COVID-19 in different types of job role, and this engendered a sense of social responsibility

towards their peers and colleagues in health and social care: *"Now I know sort of which friends perhaps I ought to check in on and see how they're doing and how they're coping with this." (142FMedW).* It was particularly notable that none of the participants had undertaken any training relating to mental health (either as part of their course, or elsewhere) and many highlighted a lack of knowledge and low confidence around signposting people with mental health concerns. As such, the inclusion of material on Psychological First Aid within the digital package, was welcomed.

Participants valued the inclusion of practical advice related to work breaks, and self–care. Most of the healthcare trainees talked about difficulties with disrupted sleep during the pandemic and the challenges of getting into sleep routines. Practical advice related to sleep and managing fatigue was therefore seen to be particularly useful and something that healthcare trainees could put directly put into practice after accessing the package, particularly those who were on clinical placements and working night shifts: *"it was the information about kind of sleep . . . managing fatigue, which was very useful" (113MMedM), "I really liked how there's like focus on sleep a lot because . . . I think that's such a big thing" (123FMedM).*

The collation of resources for wellbeing within a single package was highly valued. Many trainees reported that one of the most important aspects of the package was the fact that it signposted them to resources such as apps and links related to wellbeing which they had previously not been aware of and which they could now access when needed: *"like mindfulness and managing stress, anxiety and low mood and having it all there and it's so accessible for everyone because you've got all the links in one place." (128FMidW); "I didn't know that the NHS . . . has free access until December to a load of wellbeing apps." (103MParaW); "there is a lot of . . . help out there but people don't know where to go to get it so if this tool was more widely available, people would actually use these resources because they are so needed." (134FMedB)*

For some, this provided a resource that would help them with signposting when discussion psychological wellbeing with the peers and colleagues: *"if they come in and have a chat to me, I'll be like right, you know, go and have a look at this" (118MMedW)*

Materials on leadership were seen to be more or less useful to trainees depending on the stage of training the individual was at, with those working on clinical placements or associated with clinical teams being more able to set the learning in context than those in their first year of study. However, several participants reported that the management and leadership section helped them to understand the context of leadership during a pandemic, and more broadly, what might be expected of seniors and mentors when trainees entered clinical practice: *"if you're . . . a leader, what to do if some of your colleagues and staff are affected by what's going on . . . as a leader . . . it's important to be aware of how your staff are feeling as well as the job they're doing". (107FMedM); "I think about what our employers . . . have to go and implement, or what your managers should implement" (126MMedM)*

Understanding stigma related to COVID-19, and communication about COVID-19 was an important area of learning for these healthcare trainees. Participants reported that stigmatising language was an issue they had not previously considered, but learning from the package would influence their future communications with colleagues, their patients, and the general public: *"it's quite easy for us to go . . . assuming that we understand what communication is, but actually we're working with people who don't have the same experiences or backgrounds as us. So, it's really clarifying what communication is expected from us with everyone, not just our patients." (126MMedM); "because I was guilty of using those words, you know, automatically so it will, like, change my conversations now". (112FMedW)*

Many of the participants alluded to an increased sense of cultural competence following engagement with the package. For example, trainees spoke about new learning related to Ramadan and the impact of fasting on patients and shift–working colleagues: *"it wasn't something that I hadn't necessarily immediately thought of" (110FMedW)*

Sub–Theme 3: Areas for Future Development

Although trainees were positive towards the package accessibility, function and content, several of the participants commented on the length of the package. It was proposed that a shorter package, covering few topic areas perhaps in greater depth, may be valued by healthcare trainees to avoid '*information overload*' in a single package. A potential solution was to segment content into a series of shorter packages to create a collection of tools each covering one specific area. There were no technical problems reported. Despite the function to allow return to the main menu, it was noted that it was not possible to go backwards using an arrow key, and for a minority of users, it was unclear how to return to the main contents page. It was proposed that the functionality of the package could be improved to make it more accessible on a mobile device as many trainees had chosen to access it on their phones. Some participants proposed suggestions to increase the accessibility of the package. For example, one participant suggested colour–coding sections, and another proposed the use of audio subtitles to be more inclusive to people with disabilities. One participant proposed that the package could incorporate more video clips to increase interactivity.

Whilst views on the relevance of each section varied according to participants' prior knowledge and experience, trainees were broadly positive about the utility of the information provided to themselves, or others. The package contained student–specific information in the additional resources section, but the main body of the package was targeted to healthcare professionals. Trainees found the package useful but expressed a desire for additional content that was specific to students (noting that some was available within additional resources), and specific to their own educational institution. One example was the inclusion of strategies and tips for coping on placements, particularly those that were some distance from their homes and required stays in hospital accommodation.

4. Discussion

This is the first study to explore the perceived value to healthcare trainees of a digital intervention designed to mitigate the psychological impact of the COVID-19 pandemic on health and care workers.

First, this study contributes to an emerging evidence–based on the impact of the COVID-19 pandemic on healthcare trainees. Our sample was diverse; participants from 13 universities, studying medicine, nursing or allied health subjects, at various stages of training, shared their experiences. Irrespective of level of exposure to COVID-19, most of our participants reported high levels of job stressfulness associated with healthcare training, and low mental wellbeing was evident in almost two thirds of our participants. This aligns with prior research identifying high stress, anxiety and depression in healthcare trainees, pre–pandemic (e.g., health professions: [48], medicine: [49–51], nursing: [52,53]. The COVID-19 pandemic is associated with high levels of psychological distress, globally [9,54,55], particularly in healthcare workers [56–60], younger populations [54,61,62] and student groups [4,6–10,15,63], including healthcare trainees [5,13].

Our findings support prior research and suggest that mitigating the impacts of COVID-19 on mental health of healthcare trainees should be prioritised by higher education institutions and healthcare employers. However, current provisions to support mental health appear to be inconsistent across health and medical disciplines, and institutions. There is a perceived stigma surrounding both prevention and help–seeking for mental health concerns, particularly among medical trainees. Efforts need to be made to validate those with mental health concerns by normalising discussion about mental health and promoting interventions to support healthcare trainees with all aspects of physical and mental wellbeing. Protecting and promoting the mental wellbeing of the health and care workforce and trainees will be essential for the future of healthcare services post–pandemic.

One approach to achieving this is the digital package explored in this study. Globally, this was the first digital intervention to support the psychological wellbeing of health and care workers during the COVID-19 pandemic, developed in the UK, in March 2020 [21]. It is

highly accessed - in the first 12 months, there were over 66,820 package users, worldwide—and it is deemed to be appropriate, meaningful and useful for the needs of health and care workers [31]. The focus of the digital package is on protecting and promoting mental wellbeing through raising awareness of the mental health impacts of COVID-19, providing education around positive strategies and signposting to supportive resources.

Subjective well–being (SWB) refers to how people experience and evaluate their lives and specific domains and activities in their lives [64]. The construct of mental wellbeing is complex and covers both affect and psychological functioning, with two distinct perspectives: the hedonic perspective, which focuses on the subjective experience of happiness and life satisfaction, and the eudaimonic perspective, focusing on psychological functioning and self realisation [37,65]. Elements of the digital package content draw on the core principles of positive psychology. Positive psychology is the scientific study of the factors that enable individuals (e.g., health and care workers, health and care trainees) and communities (e.g., healthcare workforce, healthcare organisations or educational institutions) to flourish. Positive mental wellbeing has major consequences for health and social outcomes [66,67], but is under–researched [37]. Our survey findings identified low mental wellbeing in healthcare trainees, as measured on a scale focusing entirely on the positive aspects of mental health (WEMWBS) [37]. This, coupled with our qualitive findings from the same sample, demonstrates a clear need to support and promote wellbeing in healthcare trainees. The package explored in this study provides a wealth of support and advice to facilitate engagement and motivation, build resilience and foster self–compassion—all factors that have been associated with mental wellbeing in students from the caring professions [68].

The pandemic was associated with significant disruption to studies, and major changes in ways of working. Prior studies have shown that delays in academic activities are related to aspects of mental health, such as increased anxiety [14]. Our qualitative findings showed that experiences of trainees varied dramatically, with some experiencing isolation due to fully remote working, and others rapidly deployed to support the healthcare services somewhat earlier than planned. All trainees experienced some level of disruption to academic studies and assessments, and/or opportunities for clinical learning, and for some this generated significant worry. Perceived access to academic and welfare support, the quality of relationship with (and regularity of contact from) academic tutors, and the transparency and timeliness of communication were highly variable across disciplines and institutions, but were uniformly perceived to be critical to mitigating the impact of the pandemic on healthcare trainees. While healthcare trainees are at risk of psychological distress, conversely, the disruption to learning and deployment into clinical roles for some, may also have provided self–efficacy building opportunities to identify new goals and approaches to facing the unknown [69], contribute to the global emergency effort, and 'become stakeholders in the expansion and delivery of healthcare' [70]. Some trainees have experienced a challenge of dual identity during this time; being part of the healthcare systems' response to COVID-19 as a future healthcare professional, while at the same time perceived to be non–essential in clinical delivery [71] and occupying the position of learner in both the university and health sectors [72]. Importantly, many of our healthcare trainees alluded to imposter syndrome, and reported feeling trepidatious and unprepared for future clinical practice. It is essential that healthcare employers recognise the potential impacts of the COVID-19 pandemic on trainees' confidence and preparedness for practice, as well as the mental health impacts of the pandemic which are prevalent and likely to be long–lasting.

The current study demonstrates that healthcare trainees perceive the digital package explored in this study to be a useful tool to augment the longer–term provision of psychological support for trainees and healthcare professionals alike, that will be useful during and after the pandemic. We found the package to have high fidelity (in terms of delivery and engagement) and excellent implementation qualities (in terms of practicality, resource challenges, attitudes, acceptability and usability) with a healthcare trainee sample. Qualitative findings showed that healthcare trainees found value in this resource, in terms of it

raising awareness about mental wellbeing, validating mental health concerns in healthcare professions, and providing new knowledge and resources for personal use or signposting for their peers. This study demonstrates the potential for this resource to change attitudes in healthcare trainees, by enhancing their understanding of the impacts of a pandemic on other professional groups and across levels of seniority (thus promoting interprofessional learning and team cohesiveness), increasing sense of cultural humility (identified as important in client–facing professions [73]) and engendering positive behaviour change intentions with relation to identifying and managing signs of mental ill–health.

We propose that this digital support package is widely distributed to healthcare trainees, but should be accompanied by details of local, institutional support for academic and welfare concerns. Regular check–ins, and wellbeing interventions will be essential to support the next generation health and care workforce, both in higher education and clinical settings. Trainees in our study suggested regular individual or small group check–ins from their institutions and future employers, to discuss educational or welfare concerns. They advocate for the provision of scheduled wellbeing activities to reduce isolation and alleviate stress, anxiety and low mood. Well–managed interventions should be put in place to ensure that qualifying trainees enter the health and care workforce adequately supported and mentored.

5. Conclusions

Healthcare trainees are experiencing significant psychological impacts of COVID-19, primarily related to risk of COVID-19 transmission, concerns about personal circumstances, and the longer–term impacts of disruption to studies during the pandemic and preparedness for future clinical roles. Negative culture within certain disciplines appears to hamper help–seeking around mental health, and provision of high–quality pastoral support is variable. Action should be taken to encourage open conversation about mental wellbeing. Wellbeing interventions will be essential to support the next generation health and care workforce, both in higher education and clinical settings. We found that an existing digital intervention that was developed to support wellbeing in health and care professionals is appropriate for healthcare trainees, with high fidelity and excellent implementation qualities. It is perceived to be a useful tool to augment longer–term provision of psychological support for healthcare trainees and professionals, during and after the COVID-19 pandemic.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/ijerph182010647/s1, Supplementary File S1: Interview topic guide; Supplementary File S2: Survey; Supplementary File S3: Participant ID and details. The digital package is available online: https://www.nottingham.ac.uk/toolkits/play_22794.

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Article

A Qualitative Evaluation of the Barriers and Enablers for Implementation of an Asymptomatic SARS-CoV-2 Testing Service at the University of Nottingham: A Multi-Site Higher Education Setting in England

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Abstract: Asymptomatic testing for SARS-CoV-2 RNA has been used to prevent and manage COVID-19 outbreaks in university settings, but few studies have explored their implementation. The aim of the study was to evaluate how an accredited asymptomatic SARS-CoV-2 testing service (ATS) was implemented at the University of Nottingham, a multi-campus university in England, to identify barriers and enablers of implementation and to draw out lessons for implementing pandemic response initiatives in higher education settings. A qualitative interview study was conducted with 25 ATS personnel between May and July 2022. Interviews were conducted online, audio-recorded, and transcribed. Participants were asked about their experience of the ATS, barriers and enablers of implementation. Transcripts were thematically analysed. There were four overarching themes: (1) social responsibility and innovation, (2) when, how and why people accessed testing, (3) impact of the ATS on the spread of COVID-19, and (4) lessons learned for the future. In establishing the service, the institution was seen to be valuing its community and socially responsible. The service was viewed to be broadly successful as a COVID-19 mitigation approach. Challenges to service implementation were the rapidly changing pandemic situation and government advice, delays in service accreditation and rollout to staff, ambivalence towards testing and isolating in the target population, and an inability to provide follow-up support for positive cases within the service. Facilitators included service visibility, reduction in organisational bureaucracy and red tape, inclusive leadership, collaborative working with regular feedback on service status, flexibility in service delivery approaches and simplicity of saliva testing. The ATS instilled a perception of early 'return to normality' and impacted positively on staff feelings of safety and wellbeing, with wider benefits for healthcare services and local communities. In conclusion, we identified common themes that have facilitated or hindered the implementation of a SARS-CoV-2 testing service at a university in England. Lessons learned from ATS implementation will inform future pandemic response interventions in higher education settings.

Keywords: qualitative; SARS-CoV-2; COVID-19; health protection; health testing; pandemic

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1. Introduction

COVID-19 is a major global public health burden, associated with high morbidity and mortality [1]. In a higher education context, the negative impacts of COVID-19 and social restrictions on students and faculty are well-documented [2–6]. On university and college campuses, virus transmission risk is high, associated with a social culture [7]. During the COVID-19 pandemic, regular surveillance testing of asymptomatic individuals for severe

acute respiratory syndrome coronavirus 2 (SARS-CoV-2; a strain of coronavirus that causes COVID-19) has been adopted as one approach to identifying and managing virus outbreaks in higher education settings [8]. Internationally, regular testing regimens have been shown to be cost-effective, reduce infection rates and increase confidence in safety among staff and students in other educational settings (i.e., kindergarten to 12th grade (K-12) schools in the United States) [9,10].

Evaluations of testing programmes conducted on university settings commonly focus on test performance [11], number of tests performed, disease transmission and infections detected, or the technical, logistical, and regulatory processes that enabled the scale-up of testing onsite [12–25]. Some studies include surveys which are primarily focused on student transmissibility or symptom reporting [23,26].

There are few evaluations of the implementation of SARS-CoV-2 testing programmes or services in universities, from the perspectives of service users or service delivery personnel. Some studies have investigated students' views towards the service, or established testing acceptability among service users [27–29]. A recent study explored the facilitators and barriers to the implementation of SARS-CoV-2 testing in a university setting [30]. This was a mixed-methods process evaluation of the University of Nottingham asymptomatic testing service (ATS), investigating adherence to a specific residence-based testing protocol and the views of students and staff towards the service offer, after 7–8 months of service operation. Data were collected during the national escalation of the Delta variant in England in spring 2021. This service continued to deliver testing over an extended period (two years: September 2020–July 2022), through multiple national surges of COVID-19, and the emergence of several new variants. The aim of the current study is to explore the views of service personnel towards the implementation of a SARS-CoV-2 testing service over a sustained period during a pandemic. The research questions (RQs) were: (RQ1) What are staff views towards the availability of the ATS? (RQ2) What are the barriers and enablers of service implementation? (RQ3) What was the perceived impact of the ATS on the spread of COVID-19? (RQ4) What lessons can we learn from ATS implementation to inform future pandemic responses in universities?

2. Materials and Methods

This was a qualitative study using semi-structured interviews [31,32] with university employees involved in the delivery of the University of Nottingham ATS. The study was approved by the University of Nottingham Faculty of Medicine and Health Science Research Ethics Committee (REC reference: FMHS 96-0920). We used an interview topic guide, consisting of key open-ended questions and probes, to guide our interviews (Supplementary File S1). This was developed by the lead author (health psychologist and health services researcher), based on review of relevant literature, and reviewed by the research team (health researchers), service lead, and two service users (university employees). The interview guide was pilot tested and minor edits were made to improve flow and clarity.

The sample was identified and recruited through the service administrator. Potential participants received an information sheet stating the research aims and could take part by emailing the researchers to state their interest. The information sheet informed them that they could withdraw from the study at any time without giving reason. All participants gave written consent to take part via an online consent form hosted on Jotform survey software. We adopted a convenience sampling approach and gave the opportunity to participate to all individuals who had undertaken a role within, or associated with, the ATS and were available for interview during the study timeframe. The intention was to interview people with either strategic or operational roles in service implementation and gather insights from staff with involvement in diverse aspects of the ATS (e.g., service administration or management, technical or laboratory staff, and research staff), including those at the early stages of their careers, through to senior leaders.

Interviews were conducted between May and July 2022. For national and local context, this follows a period of dominance of the Omicron BA.2 variant in the UK from January to May 2022 and the emergence of several recombinant variants (e.g., XF; a recombinant of Delta, XE; a recombinant of Omicron BA.1 and BA.2). Omicron BA.4 and Omicron BA.5 were declared Variants of Concern in May 2022 and Omicron BA.5 became more prevalent, and subsequently, the dominant SARS-CoV-2 variant by August 2022. Concurrently, the emergence of variant BA.2.75 resulted in a small number of cases identified in the UK in July 2022 [33]. Over a two-year period, the University's ATS tested over 150,000 samples for SARS-CoV-2 RNA, identifying almost 2000 positive cases in staff and students who displayed no symptoms of COVID-19 at the time of testing. Further details about service provision from pilot stage to rollout of the full service are provided elsewhere [28,30]. Details of the ATS delivery and timeline, within the changing pandemic context, are provided in Figure 1. The methods and validity of the testing approach have been published elsewhere [34–37].

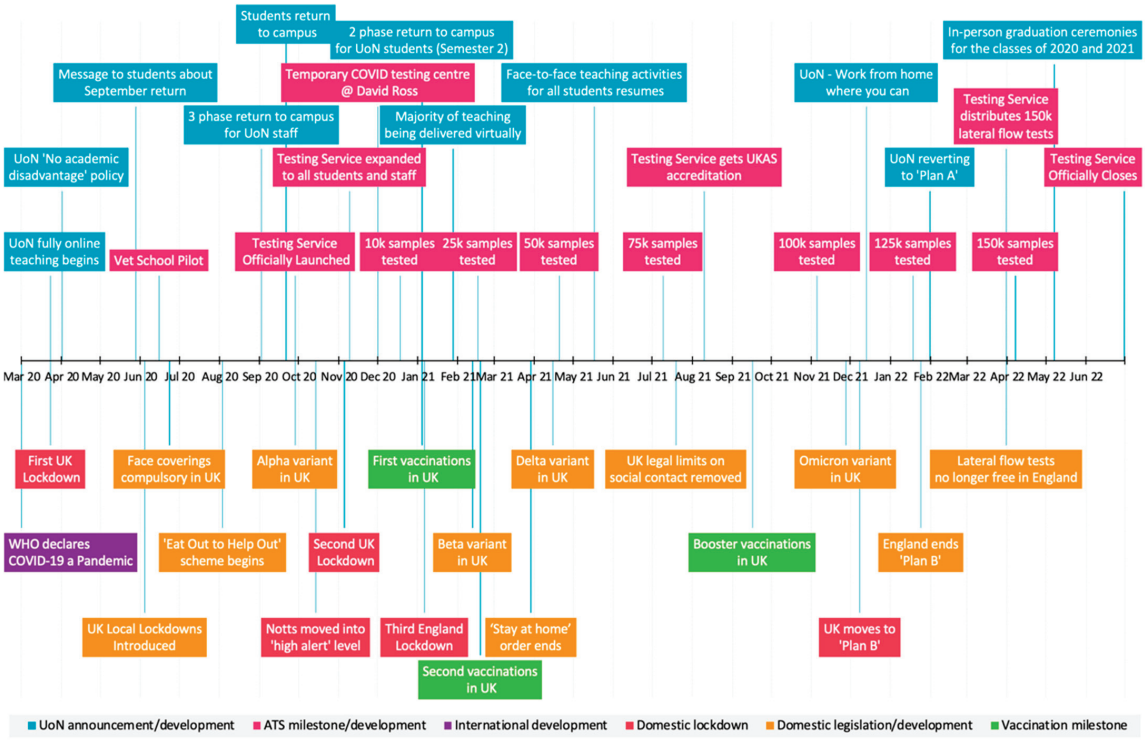


Figure 1. Asymptomatic testing service and COVID-19 timeline. UK: United Kingdom; WHO: World Health Organization; UoN: University of Nottingham; Notts: Nottingham; Vet School Pilot [19]; David Ross: University sports facility and temporary testing site venue; Plans A and B (see www.gov.uk (accessed on 8 October 2022)).

Interview data were collected using a video-conferencing platform, were audio-recorded with consent and fully transcribed. Field notes were taken during interviews. Researchers who conducted the interviews (IM, NM) and the researcher leading the data analysis (SS) had no prior relationship with any of the participants and were not involved in any aspect of service delivery. All researchers had a background in health disciplines and were trained in interview skills and good clinical practice. No incentives were offered for participation. Interview length varied from 24 to 80 min (mean: 44 min).

We adopted thematic analysis as our analytic approach, informed by Braun and Clarke's six-phase guide for inductive thematic analysis [38]. Analysis of data was undertaken in tandem with data collection, using NVivo (Release 1.0). Coding and analysis were led by an experienced qualitative researcher (SS) who familiarised themselves with the data through repeated readings of transcripts and note-taking. SS generated initial codes which were refined and added to as interviews were revisited over time. IM and NM independently analysed a subset of 30% of the transcripts, then reviewed and cross-validated the coding for the whole dataset. All three researchers (SS, IM, NM) and the lead author (HB) discussed and reflected on codes which informed the ongoing coding of the data. Once coding was complete, SS developed larger patterns across the dataset and grouped the codes into potential themes [38,39]. Related clusters of coded text were then grouped together conceptually to form subthemes under the main themes to describe the interpretation of the data. Themes and subthemes were then reviewed by IM and MN and discussed between the three researchers, to check they captured the essence of the coded extracts and dataset. The researchers worked together to refine the themes through investigator triangulation [39]. The final analysis reported is based on the combined interpretation of the data. Respondent verification was undertaken to strengthen trustworthiness; one participant listened to nine (36%) of the interview recordings and checked transcripts for accuracy. To focus this paper, we have chosen to analyse data from question items related to views towards the service and the barriers and enablers of service implementation. Data on specific workforce and career impacts of service involvement were collected in the same interviews but are explored in depth elsewhere.

3. Results

In total, 58 employees were invited to participate in an interview. Of these, 25 participated (men: $n = 8$, 32%; women $n = 17$, 68%) in the interviews, 1 declined, and 32 did not respond. Interview participants were aged 26 to 63 years (mean = 40.72, s.d. = 12.64). We did not collect reasons for non-participation, although those who offered reasons for decline commonly reported competing demands on their time. Participant characteristics are provided in Supplementary File S2. The analysis produced four overarching themes and nine sub-themes, shown in Figure 2.

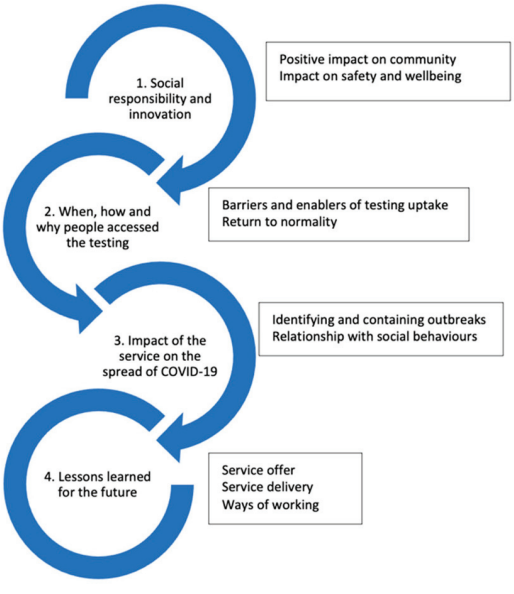


Figure 2. Overarching themes and sub-themes.

3.1. Theme 1: Social Responsibility and Innovation

3.1.1. Sub-Theme 1: Positive Impact on Community

In establishing the service, the institution was seen to be socially responsible, valuing its staff and students, and the general public through actions to prevent onwards transmission. Participants felt that the availability of the testing at the institution sent a broader message that it cares about its staff, students, and the local community. The visibility of the ATS within and outside of the institution showed that the University was taking the pandemic seriously.

> *" . . . whenever we started the testing site momentum, that had a very strong and positive impact on the community . . . by us taking the testing out to the community area and being visible it showed how serious we took the pandemic itself . . . just being more visible was pretty big."* (Respondent 5)

3.1.2. Sub-Theme 2: Impact on Safety and Wellbeing

For University staff the availability of the testing had a positive impact on wellbeing, particularly for those feeling pressure to return to face-to-face teaching. The availability of testing for their students helped to alleviate some of the worry associated with returning to campus and the potential for increased exposure to the virus.

> *" . . . having these sorts of testing things would mean that if they were in, they knew that most of the people there were being tested and were therefore safe . . . I think it was incredibly reassuring."* (Respondent 12)

There was a sense that the availability of the testing helped people to feel safe, particularly those who were at increased risk from COVID-19, or those with vulnerable family members. The testing offered peace of mind that might not otherwise have been achieved.

> *"They were incredibly grateful for it because a number of members of staff had 'at risk' partners for health reasons to covid so to know that they could test regularly and know that they were not going to put their partner or family member at risk was a huge benefit for them."* (Respondent 15)

> *" . . . they've been getting tested to make sure that they, they keep their, their partner safe and therefore they, the, the wider population safe as well."* (Respondent 8)

Some participants suggested that the ATS was perceived to be of greater value by staff than students; this belief was associated with a perception that becoming infected with the virus would have greater impacts for staff (compared with most students) in terms of family life and work commitments.

> *" . . . Staff would have been more worried because the isolating for 10 days would have meant losing 10 days of work, or potentially bringing COVID to their family, kids etc and I think, if anything it was the value of the service was appreciated more by staff in my opinion for these reasons."* (Respondent 3)

3.2. Theme 2: When, How and Why People Accessed the Testing

3.2.1. Sub-Theme: Barriers and Enablers of Testing Uptake

Although the service was consistently utilised, there were some challenges with encouraging regular testing, particularly among students. This was evidenced by a notable variation in testing uptake observed by ATS staff at different times of the year. ATS staff reported a surge in testing at critical times, for example, around the departure of most students from university campus for the winter break. This was associated with students' desire to protect friends and family members back at home.

> *" . . . the sheer demand of the test at peak times like end of terms or before holidays, like Christmas, they were very popular times for the test, people heavily relied on the test to feel safe, to go home to their family . . . "* (Respondent 3)

An incentives scheme was introduced to facilitate the uptake of testing with the ATS, based on a trial-and-error approach. While some incentives were more effective than others at encouraging testing uptake, the scheme was perceived to work well, with reports of increased uptake by students and in some cases, staff.

> *"we always saw an uptake in the number of students who were testing when, when it was incentivised."* (Respondent 24)

> *" . . . it's a great window into human psyche that offering a relatively small treat as it were, gave people a positive reason to, uh, to, to want to donate a, a saliva sample rather than just being told that they had to . . . "* (Respondent 8)

ATS staff felt that the type of test on offer helped to encourage testing uptake. At the time of the COVID-19 pandemic, the ATS was offering a novel method of testing for SARS-CoV-2 RNA. The testing involved the provision of a saliva sample in a tube which was then taken and analysed in the lab. Many participants saw the saliva test as more comfortable to administer than the available alternatives (e.g., nasal swab, throat swab).

> *" . . . they just simply didn't like the swab testing . . . the ability to just basically dribble into a tube and then pop that in a bag and leave it somewhere for somebody to collect and then report back whether you're positive or not positive . . . seemed very beneficial."* (Respondent 8)

The testing was free and readily available onsite to maximise uptake. It was provided in central locations with heavy footfall, student residences, and offices: *" . . . the accessibility of the testing, and the fact that, there were so many locations where... it could, you know, you could drop off a sample, whenever it suited you."* (Respondent 1). While this facilitated access to testing, particularly for students, its impact on uptake was unclear. It was proposed that some students may simply not engage in testing irrespective of convenience or location, as they would be required to isolate if they received a positive result.

> *" . . . the students were so worried that they would test positive, and then the whole floor [of the residence] would need to isolate . . . human nature was different to what we predicted."* (Respondent 13)

ATS staff identified the accessibility of testing, free tests, and the availability of tests for family members as key facilitators for uptake of testing. Participants perceived the ATS to be responsive to a rapidly changing external context; as government guidance changed and children were required to have a COVID-19 test to access school, the service expanded to accommodate this.

> *" . . . we extended our provision to cover primary school age children of staff to help them when the schools were requiring regular test . . . I do believe that the staff really value the service that we provide."* (Respondent 16)

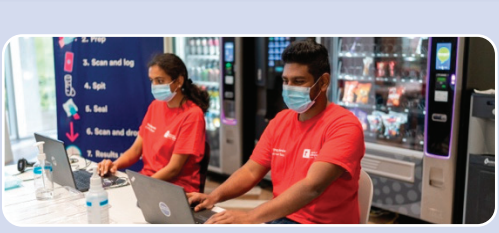
However, the rapidly changing government guidance led to some confusion among staff and students around when, and how, people should test. This was perceived to be one of the greatest barriers to the implementation of the testing service. For example, when national social restrictions were relaxed, it then became more difficult to engage students with the testing service even when incentives were used.

> *" . . . the easing of . . . the rules to a way that negatively impacts on the people's desire to test."* (Respondent 7)

> *" . . . when the national regulations were eased off and pretty much scrapped it meant we got less people testing . . . our sample numbers fell through the floor . . . government guidelines definitely hindered the sort of, the input and output of the service."* (Respondent 10)

Participants observed some variation in the uptake of testing between student groups. They reported that undergraduate students appeared to access the testing less frequently than postgraduate students: *"I think maybe postgrads were more keen also because you know*

some of them are a bit older . . . " (Respondent 2). There was higher testing frequency observed among students registered for healthcare degrees, and this was associated with the requirements of their course of study (i.e., testing being a requirement to attend placements): *" . . . students who were on placements so, especially medics and nursing, midwifery, those students tested regularly with us as did the vets."* (Respondent, 15). A summary of ATS staff views on the factors that helped or hindered uptake of testing is shown in Figure 3.



Barriers to ATS testing uptake

- Students' fear of self-isolation;
- Changing, conflicting or unclear government guidance impacting on communications;
- Ambivalent attitude towards COVID-19 (ie., "it won't affect me");
- Strong personal views (ie., "anti-Covid brigade"; "testing doesn't work").

Enablers of ATS testing uptake

- Positive attitude and action from University (in establishing the service);
- Availability and convenience of testing;
- Ease of saliva testing as a novel test approach;
- Provision of inventives;
- Time of year (surges at critical times);
- Study stage/course of study (more frequent testing by postgraduates, and those on healthcare courses for placement access).

Figure 3. Barriers and enablers of ATS testing.

3.2.2. Return to Normality

The provision of the ATS testing service enabled *"return to relative normality earlier than other people"* (Respondent 12). The availability of the service also enabled students and staff to test daily, and within a much shorter time frame than the alternatives available at the time of the pandemic.

> *" . . . that thing with the NHS, which was the alternative . . . you could order lateral flows, or you could ask for PCR [polymerase chain reaction], but the PCR you were supposed to have symptoms to get it but with our PCR test, they could be testing daily, even without having the symptoms so they could catch the infection extremely early on."* (Respondent 2)

3.3. Impact of the Service on the Spread of COVID-19

3.3.1. Identifying and Containing Outbreaks

The launch of the ATS coincided with a national increase in positive cases of COVID-19, and therefore, a changing national context. Although the ATS was perceived to be positive action taken by the University to identify and manage outbreaks of COVID-19, most staff on the ATS reported that the service had minimal impact on spread of the virus at the outset. Nevertheless, it was generally thought that the ATS was successful in highlighting where outbreaks were taking place at that time, although there were some concerns relating to how positive cases should be managed and advised on an individual basis, given frequently changing, and often ambiguous, government advice at the time.

> *"I think we ended up just chasing outbreaks rather than preventing them, which was fine because we just identified lots of problems, but we didn't know what to do with*

the outbreaks once they were there other than to say isolate but because the government guidance changed so much, you know Halls are not a household, household isn't a massive building so how you know, it's almost like we needed some clearer guidance on what to tell students once they were positive." (Respondent 1)

ATS staff felt that after the initial surge of COVID-19 in autumn 2020, the service was able to help contain outbreaks of COVID-19 within the student population, and that this had a knock-on effect in the wider community by preventing onwards transmission. However, how effective the testing could be at containing COVID-19 outbreaks depended heavily on individuals with a positive test observing an isolation period. Self-isolation was recognised as a situation that some students were keen to avoid, particularly in the early days of the pandemic: *"I think there were a couple of instances where a few students were are not happy about the isolation that came with positive results".* (Respondent 9). Given the challenges of ensuring that students engaged with the testing during national surges of COVID-19, some ATS staff felt that testing should have been mandated at that time, to contain outbreaks within the University population.

" . . . if testing was mandated, it would be a more effective service, and a large amount of time and thought was given to how we engage with students, where it's an optional process." (Respondent 24)

"I don't think it was helpful in stopping spread, because of, the inability of the university to make it a requirement . . . I was met with, well, they can't mandate testing . . . " (Respondent 21)

The service overall was viewed as an asset to the university. The staff of the ATS felt the service helped to contain COVID-19 outbreaks through the pandemic, but they could not always fully prepare for surges on the university campuses. The ATS was seen to have significant impact beyond the university; staff from the ATS were able to offer testing assistance to local NHS services during peak times. It was perceived that, without the support from these extra staff from the University, local outbreaks in the community might have either continued for longer or become more widespread in the general population.

3.3.2. Relationship with Social Behaviours

One barrier to containing COVID-19 outbreaks was the perceived inability of the ATS to influence social behaviours. There was a general feeling that: " . . . *you can lead a horse to water, but you can't make it drink*". (Respondent 6). Those accessing testing regularly were viewed to be individuals who would be more likely to be following government guidance in other areas (e.g., testing, social distancing, hand hygiene, face coverings) to reduce the spread of COVID-19.

"I think the people who were going to follow the rules and social distance and wash their hands . . . they would have done so even if the Testing Service wasn't in place, but it might have been a good reminder." (Respondent 21)

ATS staff reported that people who accessed the testing had a mixed response to their test results. Some students and staff receiving a negative test result would minimise contact with others and follow the government guidance at that time (i.e., social distancing). For others, the relief of receiving a negative test result facilitated social behaviours that were seen as "taboo" at the time, such as hugging and close contact.

" . . . people went to the either extreme . . . you would have people who were like 'I am negative, so give me a hug, so it's fine, we will share a drink' or whatever and then you had other people who were the opposite who said 'I'm negative, I don't' want to get it, so don't go near me.' But it forced people into two very extreme views and behaviours, I think. I don't think anyone was really in the middle by the end." (Respondent 1)

3.4. Lessons Learned for the Future

3.4.1. Service Offer

Those working in the ATS offered suggestions for improving the service offer. Many interviewees felt that the service needed to offer the entire package from the initial testing through to support for isolation.

> *" . . . but I guess that what the service is a testing service, you know if it wanted to also, it could have extended to isolation service and wellbeing, but we gave that back to the Uni to do really. It was like at the end of our remit, erm, which you know, was hard because we were the ones telling people, and 'cause it was a telephone call, it wasn't just an email, that you didn't know these people, you got to hear their voices, got to hear how they reacted, it was quite hard, because you want to do more . . . "* (Respondent 1)

At the outset, the ATS only offered testing to students at the University, and this was later extended to staff and their families. In the view of ATS staff, this was an oversight; many expressed views that the testing should have been opened to university staff and their families sooner. When the service was opened to staff, the process to do so was slow and this was a barrier to uptake of staff testing.

> *" . . . I was pushing in those early days that we had opened up the testing service much more quickly to, to staff members . . . better integration of, of the students and the staff early on, and then expanding it out more rapidly to the, the family members."* (Respondent 8)

3.4.2. Service Delivery

Regarding service delivery, participants felt that the planning and rolling out of the ATS service could have been quicker. While the service itself was visionary and innovative, some ATS staff perceived that there was not enough forward thinking in preparation for the return of students to campus in September 2020, and that more work could have been done over the summer to ensure the testing service was up and running prior to student return to campus: "*By the summer it was obvious this wasn't something that was going to go away.*" (Female, 26).

Several ATS staff felt that the service did not have enough authority to deal with the behavioural consequences of testing. Following government guidance, the ATS was unable to enforce isolation for those testing positive for COVID-19 and that this in turn created challenges in containing virus outbreaks.

A small number of participants felt that there was a missed opportunity to roll the ATS out at a national level. This was associated with a lack of knowledge on how to achieve policy change, or a lack of essential contacts within a "*it's who you know*" culture at government policy level. There appeared to be unmet training needs among staff working towards service accreditation regarding the appropriate mechanisms and platforms for influencing policy.

> *" . . . a bit of a regret there that we weren't able to get better engagement with the government departments to roll out what arguably is a simpler and an easier test."* (Respondent 8)

3.4.3. Ways of Working

Given the rapid set-up and deployment of the ATS, the nature of the service provision involving development of new technology, and the establishment of new teams at pace, participants shared lessons to be carried forward. The prevailing view was that the ATS has created a footprint for more collaborative ways of working: "*I think it's spearheaded an inclusive approach for collaboration across professional services and faculties.*" (Respondent 15). It was perceived that, prior to the pandemic, the organisation was "*incredibly risk averse*", with organisational bureaucracy and "*institutional barriers*" which hindered or prevented action or decision-making. The structural changes afforded by the organisational response to COVID-19 and reduction in formalities and administration, was seen to increase efficiency.

> *" . . . throw money and give us roots to get problems solved without a huge amount of red tape . . . we can just operate to get something done...having a hotline to the people that can actually make decisions that the university will follow was particularly welcome."* (Respondent 12)

This allowed the ATS team to respond rapidly to changes in the external environment that impacted on service offer or delivery: "*We changed and adapted so quickly to new guidelines*." (Respondent 16).

A key facilitator to the success of the service was a positive, inclusive leadership team, who were perceived to be approachable and: "*created a very special atmosphere where it is 100% two-way communication*." (Respondent 5). Participants valued the regular communication with updates on service status and arising issues (e.g., low testing uptake, logistic problems, changes to government guidance impacting on communications with staff or students); this facilitated team problem-solving and in turn, service responsiveness given the changing external context.

4. Discussion

To the best of our knowledge, this paper reports the first qualitative study focused on the views of service operations personnel towards the rapid establishment and implementation of an asymptomatic SARS-CoV-2 testing service in a higher education setting, through the changing but sustained context of the COVID-19 pandemic. The findings of this study, conducted at a multi-site university in England, have relevance for health protection initiatives in educational settings worldwide.

The research questions (RQs) generated data that are discussed in line with the four over-arching themes: (1) social responsibility and innovation, (2) when, how and why people accessed testing, (3) impact of the ATS on the spread of COVID-19, (4) lessons learned for the future. The discussion of themes 1–3 maps to RQ1–3. Theme 4 maps directly to RQ4, which is cross-cutting (across all themes 1–4).

4.1. Theme 1: Social Responsibility and Innovation

We explored staff views towards the availability of the ATS (RQ1), which pointed to the perceived positive impact of the service on community, safety, and wellbeing. This theme highlights the importance of the organisational context as a barrier or enabler of service set-up and implementation (RQ2). Published views towards mass asymptomatic testing in university settings have been mixed [40–42], although our participants were largely positive about, and took pride in, the ATS and what it set out to achieve. Our findings show that by establishing the ATS as a pandemic response, the institution was perceived by the ATS workforce to be socially responsible, demonstrating value for its community of staff and students, and the wider public. Universities must contribute to addressing urgent global social and environmental challenges; the COVID-19 pandemic offers ample opportunities for organisations to actively engage with corporate social responsibility strategies and agendas [43,44]. In our study, the ATS was recognised as an act of social responsibility in extraordinary times. Social responsibility is aligned with university values and is purported to foster empathy in organisations and mobilise leaders in the creation and implementation of new practices [45]. The operation of a SARS-CoV-2 testing service was seen to protect the university population and extend wider societal benefit through provision of testing support for partner organisations to achieve mutually beneficial goals associated with containing the spread of COVID-19 (e.g., working in partnership with, and supporting the NHS, local government, Public Health England—"we are all in it together"). This was enhanced by high visibility of the service within and outside the university, a marker of authenticity, exposing social impact through visible actions and impact.

Within the university, implementation of the ATS was facilitated by the internal context; primarily, a reduction in bureaucracy and red tape that allowed decisions to be made, and processes implemented, at pace. Examples include streamlined approvals processes, direct and visible support from senior leaders, 'flattening of the hierarchy', inclusive and

collaborative teamworking and clear channels of communication. This had important implications for the pandemic response at this institution. Red tape is negatively associated with proactive behaviour [46]. Proactive behaviour is future-focused, change-oriented, and associated with innovation [47]. It plays a key role in the effectiveness of organisational responses to changing conditions [48], such as the COVID-19 pandemic. Within the ATS, transformational leadership (e.g., influencing, transforming, and inspiring others), a distributed leadership style (e.g., where teams share responsibility and work towards a common goal) and proactive individual and team behaviour facilitated the implementation of the service. The impact of university investment in employee development through the ATS is evident in our data and interrogated elsewhere [49].

The ATS was the first accredited asymptomatic testing service in a university setting in the UK (one of only eight accredited SARS-CoV-2 testing laboratories at the time). There were some challenges experienced in engagement between ATS scientists and policy makers throughout the ATS accreditation and implementation, which led to delays and barriers to roll out and upscaling of the ATS novel testing approach. In part, this was perceived to be due to a lack of clear routes into policy from academia, with opaque decision-making and impenetrable institutions. Nonetheless, the different mentalities and imperatives of scientists and policy makers, and the challenges of establishing "mutualistic relationships" between these two populations are well recognised [50].

4.2. Themes 2 and 3: Testing Uptake and Service Impact on the Spread of COVID-19

Themes 2 and 3 are inter-linked, focusing on practical and behavioural aspects of testing uptake in the target university population (Theme 2: how, when and why people accessed testing), and the consequences of service delivery for outbreak prevention or management (Theme 3: perceptions of the impact of the service on the spread of COVID-19). This generated insights into the practical and logistical factors that enabled or hindered testing for students and staff (RQ2), and the perceptions and behavioural response of students and staff as the ATS was delivered (RQ3).

The negative impact of the pandemic on university staff and students has been recognised [2–6,51]. Our participants indicated that the provision of testing onsite was beneficial, both for wellbeing and a perception of feeling safe on campus. Our findings align with those of a previous study which revealed a strong appetite for widespread testing across all campuses to maximise perceptions of safety in the student and staff body, and positive impacts on wellbeing (for staff and students) that were directly associated with the provision of virus testing at the same university [28].

In a pandemic context, there is a need to act in situations of high ambiguity and uncertainty, often using trial-and-error strategies [52]. In this context, staff viewed the ATS to be flexible and highly adaptive over time. It was broadly successful in identifying outbreaks, and to some extent managing them, although the latter was challenged by factors external to the ATS (e.g., fluctuating, conflicting or ambiguous national messaging and the behavioural consequences, low personal risk perception in the student population, signposting elsewhere for follow-up support for students needing to isolate). Others have shown that regular surveillance testing, alongside other measures (e.g., isolation, contact tracing, quarantine) offers an effective means of identifying breakthrough infections, halting onward transmission, and reducing total caseload [22,53]. In this service, gaining consistency in testing uptake was difficult, and others have also reported that achieving high levels of participation in university settings is challenging [31]. Incentives were used to maximise participation, although the effectiveness of incentives was variable. Simple incentives, such as free food or drink for those who were tested, was seen to encourage testing uptake in students. Financial incentives have been used with some success to promote uptake of other types of health testing in university settings (e.g., sexual health screening [54]) and in studies of university-based COVID-19 surveillance testing (to nudge testing uptake and daily questionnaire-based symptom and exposure reporting) [23]. However, monetary incentives may not be feasible to increase frequent testing uptake

at scale, and over a long period, and staff/student views towards incentivisation are mixed [32]. In our study, the flexibility, convenience, and accessibility of testing, coupled with the simplicity of saliva testing were viewed by ATS staff to be key facilitators of testing uptake, as found in previous research [3,28]. Others have also found that convenience is necessary to ensure engagement with COVID-19 testing programmes [55].

ATS staff indicated that healthcare students were frequent testers, which likely reflects the requirement at the time that students undergo the same regular testing as other patient or client-facing staff in NHS and social care placements. Postgraduate students were more likely to be frequent testers than undergraduates, perhaps since they are more likely to be mature-aged, with family or work responsibilities [56]. Young adult undergraduates may perceive themselves to be at lower risk from COVID-19, since greater perceived risk is associated with higher uptake of preventive behaviours [57]. Indeed, prior research has shown that students with lower perceived risk of contracting COVID-19 take fewer tests in asymptomatic testing programmes [32]. Furthermore, COVID-19 and testing ambivalence was observed by ATS personnel in some students. Prior research has noted that the more ambivalent people are toward the behavioural recommendations associated with the COVID-19 pandemic, the less they report following them [58].

Our participants observed that testing participation rates significantly varied through the year, with higher uptake at critical points, such as the mass departure of students from campus, for vacations. Increased uptake at these times was viewed positively; testing was strongly advocated at these times to reduce community spread of COVID-19, since travel associated with academic calendars may influence the evolution of COVID-19 case rates [59].

ATS staff proposed that some students did not engage in testing to avoid the possibility of self-isolation. Self-isolation has been particularly challenging for university students, as evidenced by studies exploring the practical, social, and psychological impacts of social restrictions in student samples at the same institution, across various stages of the pandemic [2,3,60]. Regarding testing uptake, it has previously been advocated that uptake, adherence and satisfaction with testing is likely to be influenced by the level of support provided to students who are self-isolating [28,61]. This concern was echoed nationally at the time; with regular COVID-19 testing recommended in England from 9 April 2021 [62], the public's social media response to government testing recommendations highlighted a major concern about support for self-isolation [63]. At our institution, some initial 'teething problems' were evident in student support during self-isolation during the pilot phase of the service [28], which were quickly resolved. However, the ATS remit only included testing and provision of results; those required to self-isolate were signposted to other university services for welfare support and follow-up. ATS staff believed this led to a lack of continuity in student support—this has important implications for student experience during a pandemic, and potentially, mental wellbeing, if students with support needs 'fall through the cracks' in service provision.

While the ATS helped to identify virus outbreaks, service operations staff observed that the availability of testing had mixed effects on student and staff behaviours; for some, it provided them with reassurance to engage in already permitted activities, whereas for others, it encouraged increased socialising and physical contact. The variation in individual risk perception and behaviours was also reported by service users (students and staff) engaging in university-based asymptomatic testing programmes [61,64].

4.3. Theme 4: Lessons Learned for the Future

This theme highlighted the lessons that can be learned from ATS implementation (RQ4). Staff reported lessons learned, which build on cross-cutting insights from themes 1–3 (RQ1–3) in which we described the key benefits of the ATS and the barriers and enablers of service implementation. These are summarised in Figure 4, together with lessons learned from ATS delivery. These insights can inform future pandemic responses in universities and educational settings worldwide.

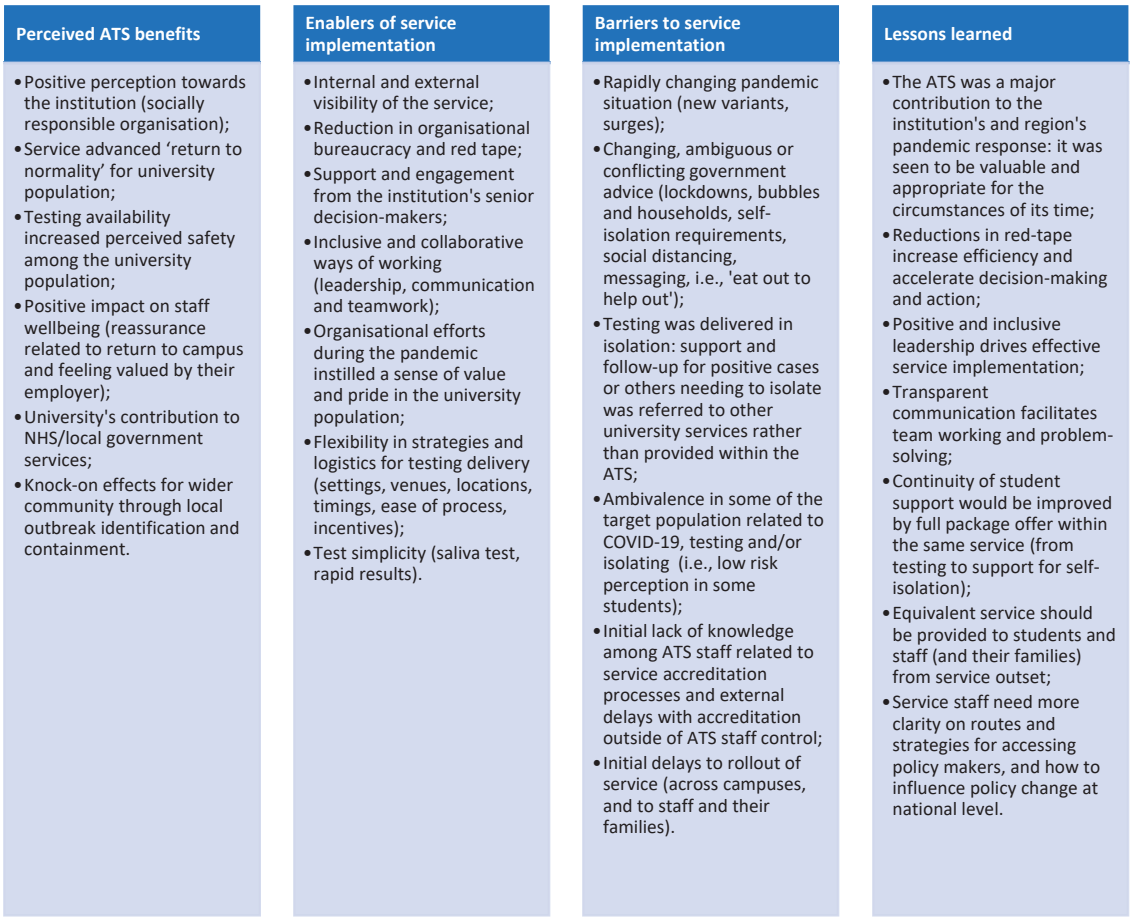


Figure 4. Perceived benefits, key enablers and barriers to service implementation, and lessons learned.

4.4. Limitations

Data were collected at a single university in England. Although this institution hosts students and staff on multiple campus sites, the barriers and enablers of asymptomatic testing service implementation may vary across institutions, and geographical regions (nationally, and internationally). Data were collected during a period of service decommissioning, during an ongoing (albeit improving) pandemic situation, which impacted on job roles for many of the participants and may have influenced their views or capacity to take part. Time constraints did not allow for longitudinal research, or more extensive respondent verification.

5. Conclusions

The COVID-19 pandemic presented a significant challenge to higher education settings. With the global spread of SARS-CoV-2, the University of Nottingham ventured into unchartered territory with the rapid establishment of a mass asymptomatic testing service for students, staff and their families, and the provision of support to local public health stakeholders for broader societal benefit. The development and implementation of diagnostic assays, the accreditation of the service and delivery of testing across multiple campuses of a large university, for almost two years, was a major contribution to the sector's pandemic response, informing decision-making and actions by institutions within

and beyond the UK. In establishing the service, the institution was seen to be valuing its community and socially responsible; the service was viewed to be broadly successful as a COVID-19 mitigation approach, particularly for the identification of outbreaks. Challenges to service implementation were the rapidly changing pandemic situation, delays in service accreditation and rollout to staff, ambivalence towards the virus, testing and isolating in the target population, and an inability to provide follow-up support for positive cases within the service. Facilitators included the simplicity of saliva testing, service visibility, reduction in organisational bureaucracy and red tape, collaborative working with regular feedback on service status, inclusive leadership, and flexibility in service delivery approaches. These factors will benefit future service delivery, accelerating decision-making and action. Future services should target both staff and students from the outset, and ideally offer testing in combination with follow-up support within the same service. More work is required to facilitate staff in mechanisms for upscaling service models beyond individual institutions and influencing national and international policy at pace. Overall, the ATS instilled a perception of early 'return to normality' and impacted positively on staff feelings of safety and wellbeing, with wider benefits for healthcare services and local communities.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph192013140/s1. File S1: Interview topic guide; File S2: Participant characteristics.

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Informed Consent Statement: Informed verbal and written consent was obtained from all participants involved in the study.

Data Availability Statement: The data that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

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Conflicts of Interest: C.D. is Academic lead and co-founder of the ATS. J.K.B. is co-founder of, and virology advisor to the ATS. H.B. is behavioural advisor to the ATS. No other conflicts of interest are declared.

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Article

Impacts of the COVID-19 Pandemic and Self-Isolation on Students and Staff in Higher Education: A Qualitative Study

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Abstract: This qualitative study explored the impact of COVID-19 self-isolation and social restriction measures on university students, through the perspectives of both students and the staff supporting them. The study comprised 11 focus groups (students) and 26 individual interviews (staff) at a higher education institution in England during a period of national lockdown (January–March 2021). Participants were university students (n = 52) with self-isolation experiences and university staff (n = 26) with student-facing support roles. Focus group and interview data were combined and analysed using an inductive thematic approach. Four themes emerged: 'Adaptation during the pandemic', 'Practical, environmental, and emotional challenges of self-isolating', 'Social factors and their impact on COVID-19 testing and self-isolation adherence', and 'Supporting self-isolation'. Students and staff struggled with the imposed restrictions and shift to online education. Students found it difficult to adapt to new expectations for university life and reported missing out on professional and social experiences. Students and staff noted concerns about the impact of online teaching on educational outcomes. Students endorsed varied emotional responses to self-isolation; some felt unaffected whilst others experienced lowered mood and loneliness. Students were motivated by pro-social attitudes; campaigns targeting these factors may encourage continued engagement in protective behaviours. Staff struggled to manage their increased workloads delivering support for self-isolating students. Universities must consider the support needs of students during self-isolation and prepare for the long-term impacts of the pandemic on student wellbeing and educational attainment. Greater support should be provided for staff during transitional periods, with ongoing monitoring of workforce stress levels warranted.

Keywords: COVID-19; SARS-CoV-2; coronavirus; workplace; workforce; social isolation; mental health; students; staff; focus groups; semi-structured interviews; qualitative

1. Introduction

The ongoing SARS-CoV-2 (COVID-19) pandemic has triggered national and global restrictive measures in an effort to contain the virus. In the UK, measures such as stay-at-

home orders, social distancing, and travel restrictions have been implemented at multiple points over the course of the pandemic, impacting the higher education sector substantially [1]. Despite returning home early in the pandemic, subsequent reopening of university campuses for the new academic year (September/October 2020) led to widescale student movement across the country and coincided with a second surge of COVID-19 within the UK [2]. The introduction of a national tiered system in October 2020 brought rapidly changing social restrictions, impacting not only the delivery of education, but also the mechanics of the wider university workforce. As well as abrupt changes to their method of learning, students have faced changes to their exams, placements, and electives [3]. Both home and international students have contended with prolonged separation from family and friends, with many being required to self-isolate in the confinement of their room or home. In parallel, academic staff have also been faced with sudden and ongoing changes to the delivery of teaching, requiring the adoption of remote working, ensuring in-person teaching is delivered in a COVID-safe way, and the frequent adaptation of materials, all with very often minimal notice and preparation time. This has resulted in an increase in workload related to the ever-changing guidance, restrictions, and support needs of students [4].

In addition to the rapid transition to online teaching, multiple universities developed capacity to conduct mass asymptomatic COVID-19 testing programmes in an effort to combat transmission between students [5,6]. Successful mass testing relies not only on testing uptake, but also on adherence to containment strategies, such as self-isolation, following a positive result [7,8]. ONS data suggest high levels of adherence to social distancing and isolation behaviours in university students [9], with Nixon and colleagues reporting that 99% of their student sample testing positive in the prior fortnight had been self-isolating [10]. It has been suggested that adherence to self-isolation may be more heavily impacted by the availability of resources rather than psychological motivation [11]. Other factors, including a drive to socialise and personal concern about the mental health implications of isolation, may also contribute to students' willingness to isolate [12]. Whilst there has been a deluge of research studying the effects of the COVID-19 pandemic on mental health in the general population, there is less specifically focusing on university students and staff. Further, of the research that does exist, the evidence points to wide-ranging negative impacts on wellbeing, including significantly lower mood [13], reduced mental wellbeing and increased stress [14], and increased depression [15]. There is even less information on the impact of self-isolation on students and the staff supporting them. At present, mental health problems are a primary cause of sickness absence in the UK, accounting for 17.5 million days of lost workforce productivity each year [16]. University students represent a significant proportion of the future workforce and, as a result, understanding the impact of the COVID-19 pandemic and self-isolation measures on students' wellbeing is paramount.

This qualitative study was conducted at a large, campus university in central England (University of Nottingham), which implemented mass asymptomatic testing and recorded a large increase in the number of positive COVID-19 cases and, therefore, self-isolation during the Autumn term (2020). The aim of this study was to explore the impact of the COVID-19 pandemic on university students from the perspectives of both students and the staff supporting them, with particular emphasis on the wellbeing and support needs of students who were required to self-isolate. Our intention is to reflect upon the experiences of students and staff, informing future policy and practice in the context of university settings as we continue to navigate the COVID-19 pandemic.

2. Materials and Methods

2.1. Study Design

This qualitative study included focus groups with students and individual interviews with university staff members from the University of Nottingham campuses in central England. This institution has the ninth largest student body of all British academic institutions [17] with both on and off-campus accommodation and communal living spaces to those in on-campus housing. The institute provides both undergraduate and graduate taught and research

courses. A total of 11 online focus groups with 52 student participants and 26 individual interviews with staff members were conducted. The study design aligned with the consolidated criteria for reporting qualitative studies (COREQ) guidelines [18] (Supplementary File S2). The study protocol was approved by the Research Ethics Committee of the University of Nottingham Faculty of Medicine and Health Sciences (Ref: FMHS 76-0920).

2.2. Study Context

This study took place between January and March 2021 at the beginning of Spring term, starting shortly after the third national lockdown was announced. During this time, national restrictions were in place, limiting movement outside of the home unless for work that could not be done at home, exercise once per day, and to get essential items such as food. Additionally, household mixing was restricted, and there were restrictions on travel, access to facilities and services. Easing of national restrictions did not begin until after data collection was completed.

2.3. Participants, Recruitment and Sampling

Focus group participants were university students who had experienced a period of self-isolation for any reason, including receiving a positive test, being in contact with someone who has tested positive, or pre-cautionary self-isolation. Recruitment occurred through two routes: (1) Students who had taken part in an established cohort study [19], and (2) Students who had received a positive COVID-19 test result through the university medical centre and had, therefore, undergone a period of self-isolation. Both home and international students were recruited. Recruitment took place between January and February 2021. Students received a £20 voucher as compensation for their participation.

University staff were purposively sampled for one-to-one interviews, to ensure a variety of roles within the university were represented. Specifically, staff with student-facing roles, or a role relating to COVID-19 strategies or student support were invited to interview, including staff in teaching and/or research, leadership, support, and pastoral care roles. Individual interviews were offered to ensure staff were able to attend at a time that was convenient to them, bolstering uptake. Recruitment took place between January and March 2021. Students and staff provided both written and verbal informed consent. Sample characteristics are provided in Tables 1 and 2.

Table 1. Sample characteristics of students.

Characteristics (n = 52)		Mean (Range)/n (%)
Age *		19.7 (18–33) years
Gender		
	Male	10 (19.2)
	Female	42 (80.8)
Student status		
	Home students	43 (82.7)
	International students	9 (17.3)
Accommodation type		
	On-campus	5 (9.62)
	Off-campus	42 (80.8)
	Unclear/missing	5 (9.6)
Academic Status		
	Undergraduate	46 (88.6)
	Postgraduate	5 (9.6)
	Unclear/missing	1 (1.9)
Year of study		
	Undergraduate first year	12 (23.1)
	Undergraduate second year	8 (15.4)
	Undergraduate third year	17 (32.7)
	Undergraduate fourth year	1 (1.9)
	Postgraduate	4 (7.7)
	Missing	10 (19.2)
Testing status		
	Not tested	3 (5.8)
	Received any test	49 (94.2)

* 5 missing data.

Table 2. Sample characteristics of staff.

Characteristic (n = 26)	n (%)
Gender	
Male	7 (26.9)
Female	19 (73.1)
Role category	
Student health and wellbeing	4 (15.4)
Accommodation support and residential experience	11 (42.3)
Teaching and academic support	4 (15.4)
COVID testing operations	2 (7.7)
Student experience and pastoral care	5 (19.2)

2.4. Qualitative Interviews and Focus Groups

Given the rapidity of the required data collection, we hosted a total of 11 focus groups, including a mix of smaller groups of between two to four participants, larger groups of between five and eight participants and one individual interview with a single participant (due to non-attendance). Focus groups were held online using video-conferencing facilities (Microsoft Teams). Online data collection was necessary due to the national lockdown imposed at the time, as well as social isolation policy. This form of data collection has been commonly used as means of improving access for geographically dispersed or hard-to-reach populations [20]. All focus groups took place within a period of three weeks in January and February 2021. Focus groups lasted for 54 to 81 min (mean 70 min). Two psychologists generated the question guide (HB, HK, Supplementary File S3) and focus groups were facilitated and moderated by two PhD students who were part of the research team (SC, MO). All focus groups were conducted in line with NHS England guidance on focus group delivery and followed the same questioning route [21]. All members of the team were trained in qualitative research and interview skills.

A total of 26 staff interviews were conducted via online video-conferencing facilities (Microsoft Teams), lasting between 21 and 100 min (mean 65 min). Recruitment for the staff interviews was high to ensure representation of the range of student facing roles and recruitment across all role families continued until data saturation occurred. The individual interview modality was chosen for staff data collection to encourage openness and to enhance uptake by allowing flexible scheduling. Interviews took place between January and March 2021. A separate question guide was used that had been generated by the same two psychologists (HB, HK). Interviews were carried out by two PhD students (MO, LF) and followed the same questioning route. All student focus groups and staff interviews were audio and video recorded and transcribed verbatim. To expedite the process, transcription was conducted by both a professional transcription company and by two members of the research team (MO, SC), with all transcripts checked for accuracy.

2.5. Data-Analysis

Data were analysed using inductive thematic analysis [22], which benefits from theoretical flexibility and simplicity, and the ability to identify, organise, and describe the experiences of students and staff through the identification of key themes and subthemes. Focus group and individual interview data were reviewed separately in the first instance to identify unique factors and commonalities in the data, with both datasets subsequently combined to create a nuanced understanding of self-isolation experiences. One researcher (LB) conducted a preliminary scan of the student focus group and staff interview data, allowing generation of initial codes for data extracts. To ensure reliability of the data analysis, a second researcher (HK) independently examined the emerging coding, allowing further refinement. Codes and subcodes were subsequently grouped into themes, ensuring that the data cohered together meaningfully, whilst themes were clear and distinct. Finally, a detailed analysis was conducted for each theme and data excerpts were identified to illustrate the final themes. Combining data sources allowed iterative triangulation of an

initial coding scheme using individual and group level input. Staff interviews provided additional contextual information, improving interpretation of the focus group data and providing stronger understanding of the academic landscape during the pandemic. Convergence of focus group and individual interview data enhanced the reliability of the coding scheme [23]. Both researchers (LB, HK) reviewed the final thematic outcomes. NVivo 11 (QSR International Ltd., Melbourne, Australia) was used as a data management tool throughout data analysis.

3. Results

Four key themes were interpreted from the combined staff and student data: adaptation during the pandemic; the practical, environmental, and emotional challenges of self-isolation; social factors and their impact on COVID-19 testing and self-isolation adherence; and supporting self-isolation. A thematic map illustrating the relationships between the key themes and subthemes is provided in Supplementary File S4. Table 3 shows the list of all the key themes and subthemes and representative quotes. A description of each theme and subtheme, along with representative quotes is presented in more detail in Supplementary File S1.

Table 3. Examples of key themes, subthemes, frequency, and their representative quotes.

Theme 1: Adaptation during the Pandemic	
A new normal	I think that just prolonged isolation in general, the whole thing being in lockdown since March and whatnot since March, but just not really going out and socialising has changed me in a way that made me really comfortable with solitude and a little bit distressed when I'm outside. FG7, S1 I think it's getting back to normal now because, I don't know, I think at first it was a bit weird again to see each other. It almost felt like we were doing something wrong, but we've got over that stage and it's far more natural now to just, you know, chill and chat. FG7, S2
Challenges of adapting during COVID-19	We were wondering whether our marks would get negatively affected from not being legally allowed to go to those things. FG1, S8 Most students I know do think that we are definitely at a disadvantage because it's just a completely different environment to be learning in really. FG6, S3 And then we had to do the remote teaching including you know, we're just different because we've got this dual cohort not that started for the first time last year so we had 150 students start in April during lockdown, so we were remote teaching them without them ever having been on campus. And then they came on campus in July to catch up on the practical teaching so they're just completely different to the normal university students. Staff interview 18 I just think there's a huge expectation about you're going to come to university and there's going to be parties and you're going to make loads of friends. And even though they came to university understanding that they weren't going to get that, I guess it was kind of inevitable that to repress and suppress those expectations, was always going to be verging on impossible. Staff interview 14 There's one concern, particularly for the practical people on the ground which is obviously their fear of contracting the virus, you know and the sense that the University is putting them in jeopardy, and is not sufficiently supporting the health and wellbeing, through a health and safety prospective. Staff interview 2 It was quite frightening at first because you just feel like you're forever firefighting, because it was en-masse people were told to, like, you know, pack up and all move down to our hall, I mean, we had no masks, you know, there were people who were frightened. Staff interview 5

Table 3. *Cont.*

Theme 2: The Practical, Environmental and Emotional Challenges of Self-Isolating	
Self-isolation environment	The thing that I couldn't even cope with for that 24 h I was there, was doing everything in one room, like exercise, uni work, sleeping, relaxing, reading, eating, all of it in one single room. I need separation, I need to be able to step away from things. FG1, S2 I was in a house with 8 so there was 8 of us there and we could all do things like, I don't know, we sat down and watched some TV together or we watched a movie or we played a game. I think just having a lot of people there helped to keep me distracted and not get as worried about the whole situation. FG27, S3 I've had quite a few conversations with international students more recently where I've had a student that recently said "I've not been in the presence of another human being since September" and they've been in Nottingham. They've moved away from their home country to come here and not had virtually any contact with anybody at all and have been self-isolating by their own choice. And again, that is a real issue because they literally have no support network here whatsoever. Staff interview 14
Emotional effects of self-isolation	To me it didn't really make much of a difference because we were already in lockdown but yeah, I think some of my friends found it a bit harder because they had other friends outside the house that they enjoyed seeing, but personally I was fine with it. FG17, S3 I found it hard to concentrate on my studies because I was stuck in my room all day, I just found the motivation side really tricky. FG1, S7 When I had to self-isolate it was a bit like, for me I was like missing out on the social part of it, which affected my mood a bit and like my motivation to work was really affected at the time. FG17, S2 I was the first person in my household to actually test positive for Covid and have symptoms I felt quite guilty that the rest of my house had to isolate. FG5, S2
How self-isolation affects university service provision	Some halls we were at 70% students in isolation. So, the biggest issue was how we serviced these students, how we got food to these students from a catering perspective, dealing with um, you know dietary requirements and getting all of that information through. Um, cause we, we just didn't have a system that could cope with that to be fair. Staff interview 11 I think it would be nice if the staff had something, you know, more than just a letter to say, you know, this week we're going to say thank you to other people, you know, the gardeners for making the area look nice, you know, it should be that the staff can be able to talk to somebody and there's nobody to talk to private and confidential. The staff have got problems at home as well, you know, they're coming into work with families that's ill and then we've got schooling problems. And I don't think the university are looking at that. Staff interview 12 It's been so difficult this year to plan any work, I definitely feel that the majority of my work has been reactive. Staff interview 7
Theme 3: Social Factors and Their Impact on COVID-19 Testing, Vaccinations, and Self-Isolation Adherence	
Testing: social factors, barriers and enablers	I'd say that one of the best parts that the university—well, one of the best things the university has done was that big mass testing that they did when everyone was leaving. When I was speaking to some of my friends at other universities, they didn't actually have that, which I was kind of surprised about because I thought it would be every university. It was organised very well, it was carried out super efficiently. FG27, S4 I was definitely happy to have it cause it meant I could come home and not feel guilty for being 'a spreader'. FG3, S1 I think um, that a need to avoid self-isolating has led to people not following the guidance, and has actually led to people harassing other students. Um, because someone goes and has symptoms and gets a test, it then means everyone's got to self-isolate, so I think there's been pressure to either for people not to test, um, and for people to, or not to share that they've tested. Staff interview 20

Table 3. *Cont.*

Compliance with self-isolation	I think also people with um like mental illness, or, not necessarily illness but just, um, er struggling with their, with poor mental health. And I think if, if obviously it's better to probably, I mean I know it's technically breaking the law but it's probably better to meet up with someone when you're in self-isolation if you're having for example suicidal thoughts. FG4, S3 I think where other people before they thought they might have to go into isolation they quickly did a food shop, we were able to not do this because we all had friends that weren't in isolation and didn't have any symptoms, so they could bring us food to last us until we could get a delivery slot. FG5, S1 I think not all students take it equally seriously, and I think that's the main thing is that a lot of them just kind of don't see the point, and there's also a lot of misleading information that young people are less likely to get covid badly. FG3, S1 They absolutely weren't happy and I don't think they understood why they should be self-isolating. But on the other hand we have students who always follow the rules and do as they're told. Staff interview 15 Almost 100% of those students who were found to repeatedly breach Covid rules, and their letters of appeals to the registrar, cited severe mental health problems as a reason to not adhere to the rules... and actually we found that almost 100% of the students didn't have significant mental health problems. Staff interview 17
Theme 4: Supporting Self-Isolation: Factors with the Potential to Help	
Self-isolation mind-set	It was quite nice and it very much lifted the mood of kind of—because before isolation it's, kind of, you don't really—you kind of just take it for granted because, as I said, I wasn't going to the university really at all, so actually being able to isolate and then come out made me feel a lot better about being out. FG5, S4 I think when they first got there, whole blocks were having to isolate. It was almost excitement, 'ohh, we'll do it together', do you know what I mean? Staff interview 22 I think after a couple of days I started coping a bit better because I had ways to distract myself, occupy myself with work or other things. So it got a lot easier throughout it. FG27, S1 I think that what the university wants to say is that it's important to self isolate, so, and it is also an incentive for them to self isolate for all the period, not only for the few days and maybe you've got your fever is just disappeared and you're young and so you want to go out. Giving them something to do for seven days, ten days makes them maybe feel that it's really important to do that and it's also an incentive. Staff interview 16
University support	I was made aware of the options that were given because I remember when the first lockdown started, we received loads of emails from the university telling us about options if we wanted to get in contact with anyone about mental wellbeing, or any kind of support from either the university or your own course or department, which I found very helpful but personally I didn't use any of those. FG14, S2 I really liked the university doing was they had a lot of sessions about kind of mental health, but one of the problems is you had to search for them, or they were hidden in the, halfway through an email, so it wasn't that the university hadn't provided it, it was that kind of, it was there but you have to go and find the necessary links and kind of do it. FG2, S7 I mean for the students in Halls it's better because they should get their food deliveries every day and they've got the duty hall managers that will be checking in and checking they're all right. But for students who are living in their own accommodation, they're going to become very isolated and I mean there's no guarantee that they've got anybody than can get food to them. Staff interview 9 I mean generally there would have been face-to-face contact. This year we've tried to do that via Teams, but students haven't particularly engaged in that, to be fair, it's been, it has been quite difficult in that respect. Staff interview 11

Table 3. *Cont.*

Social support	I cope with that a lot of the time by socialising and seeing people a lot, um so I was lucky my girlfriend came and spoke to me through my window. FG1, S7 What made it a lot easier for me was like a lot of my friends knew I was in isolation so they'd call me very often. But I guess if it was a day where I didn't get like a phone call or one of them was busy or something like that, because I wasn't living with my family or housemates or anything, I'd just spend like the whole day by myself. FG27, S2 I think being part of the community where they kind of make it easier and more enjoyable to stay at home, I think that definitely, definitely made it easier to stay at home and adhere to it. FG4, S3 I think that's been especially hard on the first year students, especially first year international students where they don't have a support network. Staff interview 14 I think the most vulnerable were also the first year students so they were here for the first time. They didn't know anybody and it's tougher for them so probably they also tend to approach the university more because they don't know how to ask for help and support. Staff interview 16 I think someone said earlier, but it was a bit of a, like being in first year and with like um, seven people you'd sort of just met, um there was a bit of a like blame game going on where it was like, oh who got the test, who meant we had to isolate, like that caused a bit of tension, and so yeah that was sort of a challenge like to get through like, when you've only known these people y'know a few weeks. FG2, S6

3.1. Adaptation during the Pandemic

3.1.1. A New Normal

Many students reported initial difficulties adapting to periods of self-isolation, particularly because they felt the lines between self-isolation and lockdown became blurred due to national restriction measures. This sentiment was exacerbated for students living in halls, who were often exposed to extended periods of isolation with other students due to high case rates. For many, these lockdown measures elicited changes to their sense of normal.

3.1.2. Challenges to Adaptation

The challenges of adapting to the pandemic were multifactorial for students and staff, but many reported that these challenges reduced as the pandemic progressed and they adjusted to meet the new normal. For students, challenges centred around disruptions to their studies (particularly as a result of self-isolation), which required increased flexibility from the university and variable teaching methods. Some staff felt that the online teaching modality had created a unique cohort of students with unique needs, with multiple students reporting that they felt disadvantaged by the new learning environment.

A broader challenge was the discrepancy between students' expectations of a normal university experience and the infringements placed on this by national measures, particularly for first-year students. For staff, there was a similar adjustment period to the variable teaching methods and different ways of working, alongside trying to meet the expectations of students (which caused students to drop out in some cases).

For staff in student-facing roles, there was a general concern about contracting COVID-19, despite being provided with protective equipment. Although the transition was mostly well received, multiple staff members noted that ground staff did not feel their own health and wellbeing was sufficiently supported, creating anxiety and the sense that the university was putting their staff "in jeopardy".

3.2. The Practical, Environmental and Emotional Challenges of Self-Isolating

3.2.1. Self-Isolation Environment

The environment in which students self-isolated was a significant challenge for many, particularly for those confined to small rooms with no outdoor spaces. Feelings of boredom and entrapment were common.

The restrictions presented by being required to isolate within a household also had broader impacts, affecting students' relationships with other housemates (both positively and negatively). Despite this, both students and staff generally felt it was more positive to self-isolate with others rather than alone.

From a staff perspective, most appreciated the role that environment played in coping with self-isolation, particularly for students living in university accommodation. For staff working with international students, there was recognition that self-isolation presented nuanced challenges, particularly for new international students without existing social networks or supports.

3.2.2. Emotional Effects of Self-Isolation

The emotional effects of self-isolation were variable; some students reported feeling unaffected by self-isolation, whilst others reported experiencing low mood, loneliness, frustration, and a lack of purpose. Many students reported notable decreases to their motivation due to the disruption that self-isolation had on their daily routines and social connectedness. Some students also described feeling guilty if they had received a positive COVID-19 test prompting isolation, given that this would impact others in their accommodation.

3.2.3. Self-Isolation Impacts on University Service Provision

Staff reported being significantly impacted by students' self-isolation. This included dealing with frustrated or non-compliant students, ensuring those who required greater mental health input were cared for, and outreach to students who were self-isolating regularly. Staff noted this added significant burden to their workloads and for some, affected their mood. These experiences were further exacerbated by external pressures, such as adherence to government regulations and balancing this with recognition of the mental health impacts that isolation had on students. In some cases, staff reported "firefighting" throughout the pandemic, being unable to do their usual work, or make developments in other areas of their role due to these additional pressures. It was also noted that additional support for staff would be welcomed, with one staff member feeling that there had been limited support provided.

3.3. Social Factors and Their Impact on COVID-19 Testing and Self-Isolation Adherence

3.3.1. Testing: Social Factors, Barriers and Enablers

Many students felt that frequent asymptomatic testing was useful. However, some staff reported groups of students who refused to participate in testing because they feared repercussions (such as having to self-isolate, being blamed for making others isolate, or being unable to go home for Christmas). Students and staff felt that greater flexibility in testing delivery and incentives might improve adherence.

3.3.2. Compliance with Self-Isolation

Almost all students in the study described feeling that self-isolation was important but acknowledged that some students did not comply with regulations. Many factors appeared to affect students' self-isolation adherence behaviours, and this variability was recognised by staff. These factors included: moral views about adherence (the 'right' thing to do), lack of understanding of the rules, protecting others, rules not being enforced by the university, peer pressure, fear of missing out on social activities, inconsistent or confusing communications, and repeated self-isolation for long periods of time.

Students also suggested this resulted from the perception of being at low risk or through general misinformation about health risks. However, there were also many situations where students considered compliance in balance with other needs, such as the availability of external support (to support practicalities such as shopping), professionalism (if they felt non-adherence would put their future career at risk), risk to others (if they felt their overall risk of having COVID-19 at that time was reasonably low), or for mental health support.

Some staff also felt the reasons given for non-compliance were not genuine in some cases, for example blaming non-compliance on mental health difficulties that did not exist.

3.4. Supporting Self-Isolation: Factors with the Potential to Help

3.4.1. Self-Isolation Mindset

In several cases, students adopted a positive outlook about self-isolation. These students felt appreciative of their normal, everyday lives, and for some, isolation fostered a sense of community with others in the same situation. Students described using distraction as a primary tool to help cope with being in isolation. Staff noted that it was important for the university to incentivise compliance with self-isolation by providing activities to support students for the full period of isolation.

3.4.2. University Support

For those self-isolating, the university provided a variety of support measures, including: the logistical aspects of self-isolation (such as meal delivery, care packages, and rubbish collection), emotional support (such as general phone or email communication to offer support, or online self-help tools), activities (such as online social events, tiered isolation), and teaching variations (offering flexible options for teaching). In a small number of cases, students felt that this support was not enough or had not been communicated well.

A small number of staff and students also felt the support was inequitable across faculties and different accommodation locations, with some students receiving greater support than others. This was also visible in how students described their knowledge and experiences of the support available, with some receiving additional support and others saying that receiving this would have been useful.

Staff also described the increased workload and pressures associated with trying to sufficiently provide this range of additional support services to students. Despite support being available, some staff reported low student uptake of the supports offered, in particular the services designed to support student mental health.

3.4.3. Social Support

As a final consideration, peer support was seen by students and staff as being extremely valuable during the pandemic, for both emotional wellbeing and practical support through self-isolation. Both staff and students recognised the need for increased social support for first year and international students, on the basis that their social support networks were likely impeded because restriction measures limited opportunities to build friendships. There was a predominantly positive view towards self-isolating in a group compared to isolating alone, as many students and staff felt that this social support made a significant difference to wellbeing. However, this also came with its own challenges, particularly if there were disagreements, or extended periods of self-isolation due to large numbers of students in a household who may potentially test positive.

4. Discussion

The current study provides a qualitative exploration of university students' and staffs' experiences of the COVID-19 pandemic, with a focus on the impact of self-isolation. Although the UK government's roadmap [24] provides a positive route out of national restrictive measures, rising rates of new COVID-19 variants, particularly amongst university students who remain largely unvaccinated, may continue to warrant containment behaviours. We present learnings and potential long-term implications that can be gleaned from the experiences of both students and staff, representing a sector of the current and future workforce.

Students and staff reported initial difficulties adapting to the imposed restrictions and shift to online education. Students, particularly those living in halls, described feeling as though they were trapped in prolonged periods of isolation, given spikes in infection rates within the student body, in tandem with strict national lockdown measures. This

posed a significant challenge to students' expectations of university life, with both students and staff noting that the diminished opportunity to socialise meant many new students were missing out on vital formative experiences. The long-term impact of such experiences should not be overlooked; studies demonstrate that relationships with peers and a sense of university belonging significantly impact students' social, psychological, and academic outcomes [25,26]. Our findings demonstrate that first year students and international students were particularly impacted by these periods of isolation and lockdown, struggling to develop friendships and social networks as would normally be expected. Although it is unclear whether we will see further periods of enforced isolation following testing, universities must consider the impact that over a year of engaging in stringent protective behaviours has had on student wellbeing, offering opportunities to foster connectedness for students who might have missed them these during the pandemic.

Rapid changes to the modality of teaching provision, i.e., moving from face-to-face to online teaching, were challenging for both students and staff alike. For students, self-isolation was particularly disruptive to their studies and led to concern about the impact of isolation on their learning outcomes. Concern was also noted in relation to general educational outcomes, with some students feeling they had been disadvantaged by this shift. To date, evidence on learning outcomes from online teaching has been mixed, with some studies reporting comparable outcomes to face-to-face teaching [27] and others concluding that online learning leads to worsened outcomes [28]. Both students and staff noted concerns about the impact of online learning on educational outcomes. Monitoring the impact that this year of flexible learning has had on students' attainment, whilst considering mechanisms to enhance learning outcomes in those affected, will be invaluable. Assessing for professional or educational disadvantages to this model of learning will be particularly important as students transition into the workforce. Similarly, as universities continue to navigate new formats for education delivery, the impact of this delivery on staff who might already face high workloads should be assessed, with appropriate supports put in place to support staff wellbeing.

The emotional impact of self-isolation was multifaceted and diverse, with some students coping well and others experiencing deleterious effects on their mood. For some, self-isolation also fostered a sense of positivity and appreciation of their daily lives post-isolation. In line with these findings, early qualitative work suggests the pandemic has fostered opportunities for appreciation and gratitude by considering one's personal experience in comparison to others who have been adversely affected (i.e., relative fortune) and has increased time spent with family and engaging in new hobbies or activities [29]. However, burgeoning research has reported the negative impacts of the pandemic and national lockdowns on students' ability to regulate their attention and motivation levels [30] and to develop studying networks [31]. This was particularly true within our sample, with students reporting reduced motivation to engage with their academic work during isolation. Van Der Feltz-Cornelis and colleagues found that social-isolation was a significant predictor of vulnerability to psychological distress in both students and staff members [15], with additional research reporting increases in self-reported stress, anxiety, loneliness, and depressive symptoms [32–34] during the pandemic more broadly. Our findings suggest that environment during isolation is a significant contributor to wellbeing, with those isolating with others seeming to fare better. Similarly, Worsley et al. found that student accommodation offers the opportunity to cultivate a sense of community, with accommodation-based pastoral staff providing an important source of support for general student wellbeing and mental health concerns [35]. This echoes our finding that for some, isolation fostered a sense of community with others who were also isolating. However, for others, feelings of boredom, loneliness, and a lack of separation between work and personal space likely contributed to downturns in their mood. Importantly, both access to greenery or green space and the ability to be physically active offer protective mechanisms against the negative mental and physical impacts of isolation [36,37]. Although we may see a return to pre-pandemic levels of anxiety and depression, this pandemic has highlighted

the impact that personal environment and accommodation can have on mental health. Looking forward, as many workplaces and academic environments begin to embrace a work from home culture, consideration for the potential negative impacts on social network building, a lack of division of personal and professional space, and an increased risk of loneliness should be considered.

Despite negative media attention, university students demonstrate high rates of adherence to self-isolation following testing [9]. Students in this study described being mostly adherent, although multiple factors appeared to influence adherence to self-isolation. Students frequently reported pro-social factors as positive influencers of adherence (e.g., moral obligation). Recent research suggests a drive to socialise also impacts adherence to COVID-19 protective behaviours [12]. Indeed, both staff and students viewed peer support as being instrumental during the pandemic, bolstering emotional wellbeing and providing practical support through periods of self-isolation. Students and staff noted that communication factors, such as confusing messaging or general misinformation about health risks may negatively impact compliance. Younger adults frequently derive health information from social media platforms [38], however, there is ongoing concern about the spread of misinformation on through these channels [39]. Importantly, government-supported messaging accounted for only 11% of COVID-19 information on YouTube [40]. Ultimately, students appeared to consider adherence to isolation in balance with practical, professional, and mental health factors. These factors indicate that a multi-pronged approach to facilitating adherence in young adults is required. First, staff noted that adherence to isolation could benefit from incentivisation, aligning with government recommendation [41]. Universities should focus on promoting clear and targeted messaging through relevant channels, such as social media, to help combat misinformation and non-compliant behaviour. Novel campaigns targeting pro-social behaviour may reinforce key drivers of student adherence. Consideration should also be given to the future impacts of isolation on students' professional goals, for example working with students to develop learning plans for practical placements impacted by isolation. Finally, some students felt that support was not clearly sign-posted and differed by department, whilst staff felt that the offered supports were underutilised at times. The discrepancy between perceived availability and uptake of services warrants further exploration to ensure barriers to access are minimized. Beyond self-isolation, the competing demands placed on young adults to manage practical and professional needs with protective behaviours should be recognised, particularly as rates of COVID-19 infection continue to rise nationally.

To date, there has been limited exploration into the impact of the pandemic on university staff. Stadtlander and Sickel conducted interviews with university faculty and found that whilst staff were generally satisfied with their home workplace, they felt more negative about online work and a loss of freedom and independence. The authors noted that some staff experienced an increase in their working hours as a result of the transition to online working, with some feeling overwhelmed by this transition [42]. The current study purposively sampled staff in student-facing roles from a variety of role families to represent the make-up of the university workforce. Our work suggests staff across all role families struggled to adapt. Many staff reported continued contact with students throughout the pandemic, leading to personal concern about contracting COVID-19, particularly when thinking about their own families and caring for vulnerable others. This anxiety occurred despite recognition that the university provided sufficient protective equipment. The need to support students who were self-isolating also presented a significant challenge to staff, who were expected to deal with a range of resulting issues, from mental health difficulties to non-compliance. Some staff noted changes to their mood as a result, with others finding this additional work added substantially to their workload. For many, this new and reactive way of working induced significant stress, meaning that they were unable to direct attention to other aspects of their role during this time. This led some to feel that greater support for staff was required from the university. Although the initial stressors of adaptation have subsided, we may begin to find that there are mental health sequelae of the

prolonged state of reactivity and stress induced by the pandemic. We have seen the impact of this reactivity on the mental health of health care workers [43]. In the current study, it was noted that whilst staff felt services were widely available to students, university support programmes were lacking for staff. As we continue to move through the pandemic, care should be taken to monitor staff stress levels and mental wellbeing, ensuring staff specific support services are available and accessible.

Strengths and Limitations

This study has several strengths and limitations. The interest and uptake of the focus groups and interviews amongst students and staff demonstrates that remotely conducted focus groups are an acceptable and suitable approach for exploring experiences of self-isolation in both university students and staff during the pandemic. Study rigor was strengthened as all focus group data were collected by two researchers. Additionally, whilst analysis was conducted by one researcher, a second was involved in checking of codes to ensure reliability and rigour of the data. The student sample included both home and international students, although the proportion of home students in our sample is slightly higher than the proportion of home student registrations at the university during the 2019–2020 academic year (82.7% versus 67.9%) [44]. Although measures were taken to improve representative sampling, many students had undertaken asymptomatic testing and were actively involved in COVID-19 related research. Most students also reported being compliant with guidelines, thus, the views of those who are disengaged, ambivalent, or largely non-compliant are likely not represented. We also attempted to recruit a minimum of four participants per focus group and to maximise attendance by offering gift vouchers and scheduling focus groups around the academic schedule. However, given the rapidity of data collection and student non-attendance, we hosted a mixture of larger and smaller student focus groups and one individual interview. Despite the discrepancy in group sizes, the authors felt that the data collected from the smaller groups and individual interview were meaningful, informative, and warranted inclusion within the study. Although our recruitment strategies aimed to achieve demographic representativeness, there were more female than male participants in the sample, with this proportion being higher than the estimated proportion of females across higher education in the UK (80.7% versus 57%) [45]. Studies demonstrate that females find coping with social isolation more difficult than their male counterparts [46] and are more likely to engage in protective behaviours [47] and comply with public COVID-19 measures [48]. Given the gender discrepancy of the sample, our findings are likely skewed towards female viewpoints and experiences and should, therefore, be considered within this context. Future research should endeavour to over-recruit male participants to ensure a reflective gender balance is obtained. During the recruitment period, students received a high volume of COVID-19 related university email correspondence. As our recruitment predominantly occurred through email, students may have missed recruitment emails and focus group reminders. To improve attendance, future studies might consider offering greater incentivization and alternative communication strategies, perhaps through social media or text messaging. Additionally, the proportion of undergraduate compared to postgraduate students was slightly higher than that of student registrations (88.56% versus 72.7% undergraduates) [44]. The majority of students lived in off-campus accommodation and, therefore, the experiences of students living in on-campus university halls of residence may be under-represented. Future research should attempt to explore the views of those who are non-compliant with isolation measures, perhaps through recruitment from university disciplinary channels.

This study has important implications; it is one of the first studies to explore the impact of self-isolation on students and staff in British higher education. However, the data should be considered in terms of the context in which they were collected. Focus groups and interviews were conducted during the third national lockdown, during which many students were, in effect, experiencing self-isolation to some degree. Thus, some of the findings may not be specific to containment behaviours, but more reflective of

the experience of lockdown measures in general. Groups took place shortly after the winter break, and so attitudes towards testing and uptake of symptomatic testing may be influenced by the fact that these were encouraged before travelling home, and so may not be representative of students' attitudes during other time-points. Finally, it is worth noting that all students and staff were from a single institution, which experienced a large COVID-19 outbreak at the beginning on the Autumn term, resulting in a large number of students self-isolating and the imposition of stringent local restrictions. However, data were collected during a national lockdown and, thus, likely represent the student and staff experiences of large campus-based universities in England.

5. Conclusions

The COVID-19 pandemic has significantly impacted students and staff, who were required to make rapid adjustments to novel learning environments. Although adherence to containment behaviours appears high amongst students, current and future mental health implications of isolation should be considered. Ensuring adequate practical, social, and emotional support for both students and staff will be paramount moving forward, given that containment behaviours may be required until high rates of vaccination are achieved in this population. Greater support should also be provided for staff during transitional periods, with ongoing monitoring of workforce stress levels warranted.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/ijerph182010675/s1, File S1: Study themes and subthemes with supporting quotations, File S2: Consolidated criteria for reporting qualitative studies (COREQ), File S3: Student and staff interview Guides. Supplementary File S4. Thematic map illustrating the relationships between key themes and subthemes.

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Conflicts of Interest: All authors were employees of University of Nottingham (UoN), the institution at which data were collected. JC sits on the Executive Board for UoN. JB and CD were involved in the delivery of the university's asymptomatic testing service but were not involved in data collection or analysis for this research. No other conflicts of interest were declared.

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Article

COVID-19 Vaccine Education (CoVE) for Health and Care Workers to Facilitate Global Promotion of the COVID-19 Vaccines

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Abstract: The COVID-19 vaccine is being rolled out globally. High and ongoing public uptake of the vaccine relies on health and social care professionals having the knowledge and confidence to actively and effectively advocate it. An internationally relevant, interactive multimedia training resource called COVID-19 Vaccine Education (CoVE) was developed using ASPIRE methodology. This rigorous six-step process included: (1) establishing the aims, (2) storyboarding and co-design, (3) populating and producing, (4) implementation, (5) release, and (6) mixed-methods evaluation aligned with the New World Kirkpatrick Model. Two synchronous consultations with members of the target audience identified the support need and established the key aim (Step 1: 2 groups: $n = 48$). Asynchronous storyboarding was used to co-construct the content, ordering, presentation, and interactive elements (Step 2: $n = 14$). Iterative two-stage peer review was undertaken of content and technical presentation (Step 3: $n = 23$). The final resource was released in June 2021 (Step 4: >3653 views). Evaluation with health and social care professionals from 26 countries (survey, $n = 162$; qualitative interviews, $n = 15$) established that CoVE has high satisfaction, usability, and relevance to the target audience. Engagement with CoVE increased participants' knowledge and confidence relating to vaccine promotion and facilitated vaccine-promoting behaviours and vaccine uptake. The CoVE digital training package is open access and provides a valuable mechanism for supporting health and care professionals in promoting COVID-19 vaccination uptake.

Keywords: COVID-19; vaccine; healthcare; social care; digital; health education; health protection

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1. Introduction

The World Health Organization (WHO) declared the outbreak of coronavirus disease (COVID-19) a pandemic in March 2020. COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of June 2021, there were over 176 million cases, and 3.82 million confirmed deaths attributed to COVID-19 worldwide [1]. In response to its high mortality and rapid spread, new vaccines have been developed and tested at an unprecedented pace, described as the 'prime weapon' in the fight against escalating daily death rates [2].

The success of COVID-19 vaccination programmes relies not only on high population coverage, but also on high rates of acceptance amongst the general public and healthcare workers. A recent systematic review including studies from 33 countries showed that vaccine acceptance is highly variable, ranging from 23.6% to 97% in the general public [3]. Other systematic reviews and meta-analyses showed that rates of vaccine acceptance and intention to vaccinate declined during 2020 [4,5], with evident social inequalities in vaccine hesitancy [4]. The most frequently raised concerns are related to side effects of the vaccines, and a belief that the vaccines were not sufficiently tested [6].

Although trust in the vaccines has been climbing in 2021, there is a need to reassure the public about the importance of the COVID-19 vaccine, and its safety and effectiveness [6]. Healthcare professionals are a trusted and credible source of vaccine-related information [7,8] and play an important role in dispelling myths about vaccines and building public confidence in vaccination. They have a powerful influence over vaccination decisions of members of the public [9]. However, vaccine acceptance in healthcare workers (HCWs) is also variable, ranging from 21% to 71.8% [3]. COVID-19 vaccine hesitation has been identified among HCW in many countries [10–16]. There is variation in vaccine acceptance and uptake between occupational groups [17,18], and ethnic minority HCWs are less likely to take up vaccination [4,18,19]. Although rates vary across countries, one recent survey (Libya, n = 15,087) found that only 14.9% of respondents believed that vaccination benefits outweighed the risks [20]. This is important since health professionals are more likely to recommend vaccination if they themselves have been vaccinated [21] and people are more willing to receive the vaccine if a healthcare provider recommends it [22]. HCWs with less confidence in the benefits and safety of vaccines are less likely to recommend vaccines to patients and their families [23–26].

Behavioural research has shown that, beyond creating an enabling environment, vaccine acceptance and uptake can be increased by harnessing social influences and increasing motivation [7]. Leveraging the role of HCWs is one approach to harnessing social influences. Vaccination decision-making is influenced by HCWs [22], and vaccine acceptance is known to be associated with greater COVID-19 knowledge [27]. Therefore, improving HCWs' knowledge about the COVID-19 vaccine, and providing evidence-based tools to support their promotion of vaccination, could lead to greater vaccine uptake. Educating healthcare professionals about the risk of COVID-19, efficacy of the vaccine and tackling disinformation is crucial to increasing vaccine uptake globally [28]; and in HCWs, healthcare students, and the general public by maximising opportunities for validation, endorsement, or persuasion [7]. Anecdotally, healthcare students and healthcare professionals who are not trained vaccinators have reported feeling ill-equipped to advocate the COVID-19 vaccine to patients, clients, and the public, or to answer their questions about the value of the vaccine, its safety, and effectiveness. To better equip HCWs with the knowledge and skills to increase peoples' motivation to vaccinate, educational interventions for HCWs should address motivational barriers such as low perceived risk and severity of infection, fear, worry, and low confidence in vaccines [7]. Low confidence in vaccination may result from a lack of knowledge about effectiveness, concerns about side effects, influence of religious values, and exposure to misinformation, conspiracy theories, and rumours [7].

Since COVID-19 and its associated vaccine only emerged very recently, healthcare curricula have not previously incorporated education on this subject and so the subject area is relatively new for many healthcare professionals and healthcare trainees who are not trained COVID-19 vaccinators. Healthcare professionals, healthcare educators, and healthcare trainees hold positive attitudes towards online learning [29] and digital approaches to learning are now mainstreaming in health education [30]. Advantages of online learning include flexibility, self-pacing, catering to different learning styles and reducing resource costs associated with time, travel, and trainer availability [31–34]. With the urgency of COVID-19 vaccine (including booster vaccine) rollout globally, the overall aim of this study was to rapidly develop and test an internationally relevant, multimedia e-learning package providing education about the COVID-19 vaccine for health and care workers (and trainees), in order to facilitate global promotion and uptake of the COVID-19 vaccines. The research question was: Does this digital training package improve users' knowledge and confidence for promoting the COVID-19 vaccine and/or lead to changes in behaviour around vaccine promotion?

2. Materials and Methods

A reusable learning object (RLO) was developed, released, and evaluated using ASPIRE methodology [35], drawing on Kirkpatrick Foundational Principles and Kirkpatrick levels of training evaluation [36,37]. The development process was undertaken rapidly during a 6-week period in March–May 2020 to ensure that the resulting RLO would be timely for distribution during the COVID-19 pandemic and rollout of vaccination worldwide.

2.1. Reusable Learning Objects

RLOs are short, self-contained, multimedia web-based resources including audio, text, images, and/or video and which engage the learner in interactive learning through the use of activities and assessments [38] towards a single learning objective or goal. They typically have four components: Presentation of the concept, fact, process, principle, or procedure to be understood by the learner in order to support the learning goal. An activity: something the learner must do to engage with the content to improve understanding. A self-assessment: a way in which the learner can apply their understanding and test their mastery of the content. Links and resources: external resources to reinforce the taught concept and support the learning goal [39]. The reusability of a RLO is established through licensing models such as a Creative Commons License, which allows the owner of the material to distribute RLOs freely for use whilst retaining the ownership.

2.2. ASPIRE Methodology

A rigorous design and development approach for materials is important: a clear, simple, and consistent conceptual model will increase the usability of a system [40] and support widespread uptake and use of digital resources. Therefore, development and testing of the RLO was undertaken using ASPIRE methodology (Figure 1) which is a well-used and validated tool for RLO development [35] and an approach that is suggested to fit optimally with requirements for designing high quality digital training in healthcare [41]. ASPIRE methodology uses participatory co-design principles and is centred on developing a 'community of practice' [42] of experts and potential future users who work together at each stage of the process, to identify learning needs and create content supported by instructional designers and multi-media developers.

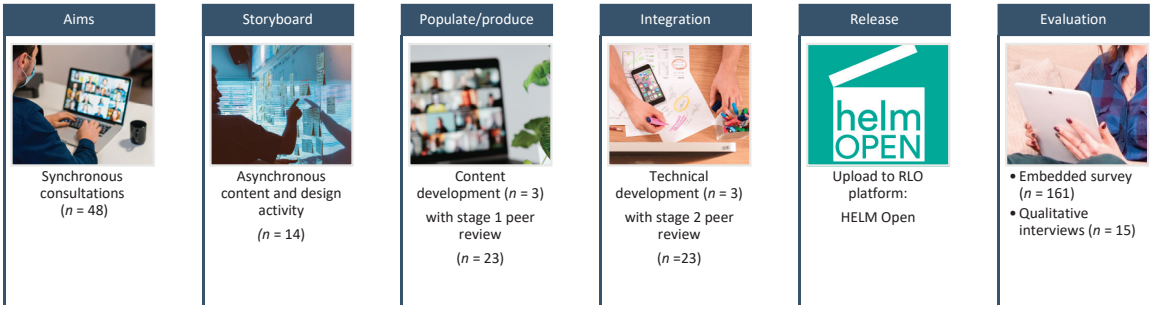

Figure 1. ASPIRE methodology for CoVE package development.

ASPIRE has a six-step process [35,43] including: (1) establishing the aims of the RLO, (2) storyboarding, (3) populating/production, (4) integration, (5) release, and (6) evaluation, which we aligned to the New World Kirkpatrick Model [36,37,44]. 'Aims' refers to the need to have a clear focus for the resource. This includes the topic area to be covered or learning goal, and the characteristics of the target group of learners. 'Storyboarding' is where stakeholders come together to work creatively on ideas for the content and design of the resource using storyboards. 'Populate and Produce' is where the ideas are translated into media components ready to be 'integrated' together using a suitable platform such as HTML5. 'Release' relates to how the resource will be made available to learners via a

virtual learning environment (VLE), repository, or website, for example, and how will it be promoted. The final stage, 'evaluate' is determining the efficacy of the learning resource in a real learning situation.

Two synchronous consultations with members of the target audience identified the support need and established the key aim for the RLO (Step 1, 2 groups: $n = 48$). Asynchronous storyboarding was used to co-construct the content, ordering, presentation, and interactive elements (Step 2: $n = 14$). The project team populated the content template and produced relevant graphics and media (Step 3, $n = 3$). This was integrated into a RLO template through a technical development process. Both content (specification) and technical (media) development were undertaken by the project team ($n = 3$). Two-stage peer review of content and technical presentation was undertaken (Step 3: $n = 23$). The final RLO was uploaded to HELM Open (https://www.nottingham.ac.uk/helmopen/ (accessed 17 December 2021)) and released in May 2021, with evaluation data collected via an embedded survey, and post-training qualitative interviews. The process is shown in Figure 1, and details for each step are described below.

2.2.1. Step 1: Establishing the Aims

Two synchronous group consultations were undertaken in February 2020 with healthcare professionals (Group 1) and healthcare students (Group 2) in the UK, aligned with scheduled public health education and training sessions. The purpose was to establish the topic area to be covered and the learning outcomes, and the characteristics of the target audience. The focus of these consultations was to explore participants' views towards, and knowledge of, the COVID-19 vaccine and to discuss barriers and challenges in communicating with patients and clients about vaccination with intention to encourage vaccine uptake. The consultations were led by a health psychologist and health educator, who delivered a 20-min introductory presentation on 'Public health and vaccines', followed by a 40-min group discussion. The two sessions were held remotely using Microsoft Teams (Redmond, WA, USA).

Group 1 included 28 nurses, who had been registered between 2 and 40 years (86% female, 32% delivering vaccinations; 25% from ethnic minority groups). Group 2 included 20 healthcare students aged 18–42 years (55% female; 10% delivering vaccines as registered nurses, 65% from ethnic minority groups). Ethnic minority groups were purposely oversampled due to the variations in the prevalence of vaccine hesitancy, since vaccine uptake (for COVID-19 and previous national vaccination programmes in the UK) has been lower in areas with a higher proportion of minority ethnic groups. Additionally, ethnic minority HCWs are less likely to take up vaccination themselves [4,18,19]. The views of ethnic minorities were therefore essential in this study. The proportion of attendees from ethnic minority groups was higher than the proportion of minority groups in the general UK population (13%) [45] and the UK National Health Service (NHS) (22.1%) [46] and was higher in Group 2 than the proportion of 'non-White only' people within the general US population (33.7%) [47] and US healthcare workforce (35.6%) [48].

The key points for each discussion group were:

- Would you have the COVID-19 vaccine if it was offered to you?
- Would you encourage others to have the COVID-19 vaccine? Why?
- How confident do you feel in your ability to communicate with patients, clients, or the general public about the COVID-19 vaccine?
- Are there any barriers and challenges to effective communication about the vaccine?

The vast majority of participants were highly positive towards vaccination and believed that it was important for healthcare professionals to encourage uptake of the COVID-19 vaccine, and other vaccines in general. Many participants indicated that they would take (or had taken) the vaccine themselves and would encourage (or had) their families to vaccinate. However, 25% (5/20) of the healthcare students and 14% (4/28) of the healthcare professionals reported that they would not personally take the vaccine or advise family members to do so. Of the 9 participants who were hesitant to vaccinate, 8 were from ethnic

minority groups and they highlighted the speed of development of COVID-19 vaccines, concerns about contracting COVID-19 from the vaccine, and discussed rumours about the vaccine's purpose and possible side effects circulating within their community groups. These views dominated conversations and led to some group members who were initially positive about the vaccine being unable to respond or doubting their initial response or own knowledge. Most of the healthcare students and many of the healthcare professionals reported having low confidence in their ability to describe key facts relating to the COVID-19 vaccine and to respond to questions from others.

Many participants (particularly those who were less knowledgeable about the vaccine) felt that access to evidence-based information would increase their knowledge and confidence to promote uptake of the COVID-19 vaccine and improve their ability to discuss the vaccine with, and answer questions from others (Figure 2). It was perceived that the volume of online information in public-facing websites was overwhelming and needed to be more digestible. It was unanimously agreed that a digital resource, such as an e-learning package, would be the most appropriate format.

Figure 2. Core outcome of Step 1.

Based on the group discussions and expertise within the project team, the agreed aim of the e-learning resource was to 'increase understanding about the COVID-19 vaccine and provide a resource that will help healthcare professionals and healthcare students to explain to patients and clients why vaccine uptake is important for individual and societal health'.

2.2.2. Step 2: Storyboarding

In this step, the content for the RLO was drafted, through a process called 'storyboarding'. A rapid storyboarding exercise was undertaken over a period of one week, with a group of 14 healthcare professionals and members of the public, to establish the key messages, content, and design for the RLO. Due to the urgency of the COVID-19 pandemic situation, the storyboarding was asynchronous (conducted virtually, using prepared resources and without real-time facilitator interaction). This was to ensure that all participants could contribute within a short timescale, with the overall aim of developing a timely and high-quality output that would be of genuine value to health and social care organisations during a global pandemic situation. Individuals were purposively selected via professional networks to ensure participants represented the views of those with knowledge of vaccination programme delivery in different contexts and settings, vaccination uptake and decision-making; the group included 2 medical doctors, 2 health psychologists, 5 nurses, 2 occupational health specialists, and 3 members of the general public. This group constituted an expert 'community of practice' to assist in refining the storyboard.

The questions put to the group were:

- What are the major areas to be covered?
- What is the best sequence and structure for the material?
- What do you want the users to be doing at each stage of the process?
- How will users assess whether they have achieved the learning goal?

The storyboarding activities resulted in a final contents list (Figure 3) and framework for the resource specification, with agreement on ordering, presentation, and the use of interactive elements. The agreed learning outcome was to understand the importance of the COVID-19 vaccine for individual and societal health. Although RLOs are designed to address a single learning outcome, it was agreed that the release of the resource during a global pandemic meant that additional information was needed to ensure that learners fully understood the need to promote adherence to behavioural measures concurrently with vaccine uptake, and to carefully consider mechanisms for promoting vaccine uptake. Therefore, the agreed key message of the RLO content was that 'a COVID-19 vaccine, when used in combination with current public health measures such as physical distancing, face masks, respiratory etiquette, and hand hygiene has the potential to reduce the significant burden of COVID-19'. It was proposed that general information about the value of vaccines was required to set the context prior to presenting materials on COVID-19 and the COVID-19 vaccine. It was also agreed that the content should communicate that the evidence situation is evolving with relation to COVID-19 and the vaccines. Following the storyboarding exercise, the initial full content draft was co-created by the project team. The project team consisted of a health psychologist, an occupational health nurse, and a learning technologist.

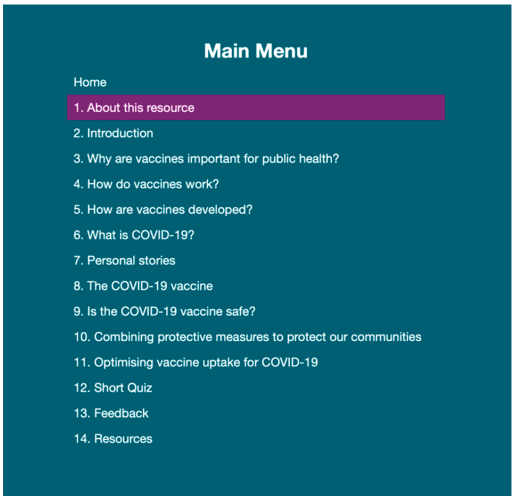

Figure 3. Final RLO contents list resulting from asynchronous storyboarding.

2.2.3. Step 3: Populate and Produce

The content template was then populated by the project team. Interactive images, information buttons, a quiz, and reflection through a feedback survey were included. Pedagogical design principles for multimedia learning were adopted from Wharrad and colleagues [41] to translate ideas into media components (Table 1).

The technical presentation of the RLO allowed for the user to adapt the type of media used to deliver the content, to allow reduction in cognitive load, to maximise accessibility and to improve learning experience. For example, the learner might switch text and audio on or off, and control media elements, by pausing video or slowing down the audio narration. A user can therefore decide how the information is delivered and so the RLO is adaptable to different contexts and devices.

Table 1. Mapping of design principles to RLO design feature.

Design Principle	Learning Approach for the RLO
Multimedia	Combination of words, video, and images.
Segmenting	Eleven learner-paced segments (rather than a continuous unit).
Pre-training	Learning outcomes provided, menu provides names of the key concepts.
Modality	Contains animation and narration (in addition to on-screen text).
Coherence	Exclusion of extraneous words, pictures, and sounds through colours, boxes, and moving materials to further resources.
Redundancy	Removal of superfluous on-screen text. Inclusion of slides with visuals and audio only.
Signalling	Use of a menu, navigation buttons, and section numbering.
Spatial contiguity	Ensuring proximity of related words and images.
Temporal contiguity	Ensuring related words and images appear at the same time.
Personalisation	Text is presented in the active voice (conversational style).
Voice	Human narration of text content.

Once the proposed RLO was complete, an international peer review panel of 23 experts was established. Panel members were purposively selected via professional networks to ensure participants represented a range of health and social care disciplines, levels of seniority, and settings. They had expertise in health and medical education, public health strategy, virology, biology, medicine, nursing and allied health, pharmacy, health psychology, sociology, and occupational health. Reviewers included COVID-19 vaccinators and experts in digital health communications and design. Reviewers were from seven countries (United Kingdom, United States of America, Pakistan, Jordan, Turkey, Thailand, and Malawi) to establish the relevance and appropriateness of content across a range of cultures and geographical regions. The review panel completed standard Stage 1 specification review forms accessed from HELM Open (Supplementary File S1).

2.2.4. Step 4: Integration

The media components of the RLO were integrated using a bespoke, accessible, and user-friendly HTML5 template which embraces a mobile-first design philosophy. The template ensures the best possible user experience whatever device is being used to access the resource. This technical development stage was undertaken by a learning technologist from the Health E-Learning and Media Team (HELM) at the University of Nottingham working together with the project team. To evaluate this, the expert review panel completed standard Stage 2 media review forms accessed from HELM Open (Supplementary File S2). Taking a pragmatic approach in the context of a pandemic, expert peer review of both specification and media aspects was undertaken concurrently, and the final resource was also tested for understandability and functionality with 5 members of the general public. Iterative review of the resource by all project team members continued throughout the process. The key revisions and overall findings from the peer review process are shown in Figure 4.

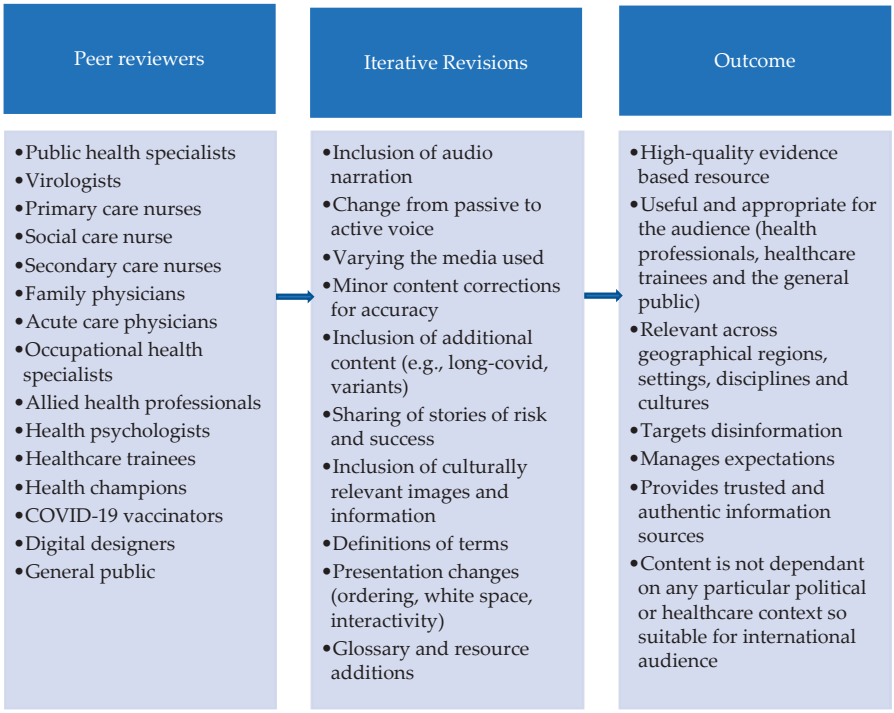

Figure 4. Co-design through expert and lay peer review.

The outcome of content and technical development is shown in Figure 5 (screen examples). The final version of the RLO included audio narration and allowed users to download a certificate of completion.

Figure 5. Screen examples from the final developed RLO.

2.2.5. Step 5: Release

The final RLO was uploaded to HELM Open, a repository of over 200 freely available RLOs at the University of Nottingham. It was released as an open access resource on 3rd June 2021 at the following URL: https://www.nottingham.ac.uk/helmopen/rlos/practice-learning/public-health/CoVE/, version 1.0, accessed on 17 December 2021) and made available to users by circulating through professional networks and social media.

2.2.6. Step 6: Evaluation

Evaluation aligned with the four levels of the New World Kirkpatrick Model [36,37,44], which is a widely used approach to analysing and evaluating the results of training and educational programs. The aim of the evaluation was to explore the perceived influence of CoVE training for health and social care professionals, through:

(i) Level 1: determining user reaction. This is reflected in the degree to which participants found CoVE training favourable, engaging and relevant to them, and/or their job role.

(ii) Level 2: establishing new learning. This is reflected in the degree to which participants acquired knowledge ('I know it'), skills ('I can do it right now'), attitude ('I believe promoting the vaccine is worthwhile'), confidence ('I think I can promote the vaccine'), and commitment ('I intend to promote the vaccine') based on participation in CoVE training.

(iii) Level 3: describing knowledge transfer/behaviour. This is reflected in the degree to which participants applied what they learned from the CoVE package in their job role or daily lives (behaviour change). Required drivers for behaviour change include any processes and systems that reinforced, encouraged, or rewarded promotion of the COVID-19 vaccine.

(iv) Level 4: exploring results and impact. This is reflected in the degree to which targeted outcomes occurred as a result of CoVE training. Leading indicators for this impact included observations that critical behaviours were on track to create a positive impact on desired results.

Table 2 shows a mapping of data collection approaches for each sub-component within the four Kirkpatrick levels. The evaluation took place over an 8-week period July-Sept 2021. Data were collected using pre (2 items) and post (14 items) survey questions embedded within the e-learning package, and a post-exposure interview. Survey items (Supplementary File S3) were adapted from the 'Evaluation Toolkit for Reusable Learning Objects and deployment of e-Learning Resources' [49]. Post-exposure semi-structured interviews were conducted by an independent researcher who had not been involved in the RLO design or development. Interview participants were recruited through health and social care professional networks and promotional mailings. Female participants were purposely over-sampled. This was to reflect the gender balance in health and social care (70% female, across 104 countries [50]). Potential participants were provided with a link to Jisc Online survey, where they could access the participant information sheet, and provide online consent to take part. Interviews took place shortly after participants had completed the training package (within four weeks) lasted between 12 and 36 min (average 18 min) and followed a topic guide (Supplementary File S4). They were conducted remotely by telephone or Microsoft Teams, audio-recorded with consent, and were fully transcribed. Analysis followed principles of framework analysis [51] to allow insights from the interview data to be mapped directly to the Kirkpatrick Evaluation Framework [36,37]. On the basis of the researchers' prior experience in the development and evaluation of digital training packages, and qualitative samples in published evaluations of RLOs or participants' views towards them [52–55] (n = 6–15), we estimated that recruitment of 12–15 interview participants would achieve sufficient information power to map data to the pre-defined criteria of the framework and meet the study objectives. The study protocol was considered exempt from full research ethics review by the University of Nottingham Faculty of Medicine and Health Sciences Research Ethics Committee in July 2021 (Ref: FMHS 310-0721).

Table 2. Measurement aligned with the New World Kirkpatrick Evaluation Framework.

Level (1–4) †	Sub-Component	Measure	Data Collection		
			Pre-Survey	Post-Survey	Interview
1	Reach	Channel for receipt of the resource User role: healthcare professional or student Geographical region		X	X
	Use	Ease of use Helpfulness for learning Main reason for accessing Problems with use (technical, level of difficulty, context, cultural)		X	X
	Satisfaction	Overall view and rating of the resource Elements most liked Elements least liked Recommendation to others		X	X
	Engagement	View towards interactive elements (menu, narration adjustments, video clips, information boxes, click boxes, quiz, extra resources)		X	X
	Relevance	Relevance to self or others Opportunity to use the resource		X	X
2	Knowledge	Evidence of new learning	X	X	X
	Skill	Feeling equipped with useful knowledge		X	X
	Attitude	Views towards COVID-19 vaccine/change in views		X	X
	Confidence	Changes in confidence to communicate (patients or clients)	X	X	X
	Commitment	Estimated future use and resource sharing		X	X
3	Behaviour changes	User application of knowledge Reported behavioural changes		X	X X
	Required drivers	Target audiences Mechanisms for dissemination		X	X X
4	Leading indicators	Changes in user confidence Changes in user communication Resulting patient, client or general public actions Additional perceived benefits or applications		X	X X X X

† Level descriptors—Level 1: Reaction; Level 2: Learning; Level 3: Transfer/Behaviour; Level 4: Results/Impact.

3. Results

Mixed-methods analysis aligned with the New World Kirkpatrick Evaluation Framework [36,37] is provided in Table 3. This includes data from 162 online survey participants, and qualitative interviews conducted with 15 participants, (13 health or social care professionals, 3 students; 1 held both roles). Interview participants were nurses (n = 12), social scientists (n = 2), occupational health specialists (n = 1) and COVID-19 vaccinators (n = 2), who identified as British, Filipino, Polish, Lebanese, and Pakistani.

3.1. Level 1 (Reaction: Reach, Use, Satisfaction, Engagement, Relevance)

CoVE had wide reach, with participants from 26 countries: Algeria, Australia, England, Finland, Ghana, Greece, Guernsey, France, Ireland, India, Indonesia, Italy, Jordan, Lebanon, Malawi, Nigeria, Pakistan, Philippines, Poland, Romania, Scotland, South Africa, Thailand, Uganda, United States of America, Wales. Participants had mostly accessed the package through employers (public and private hospitals, public health or clinical commissioning groups, family doctors, local government networks), professional networks, charitable or volunteering organisations, and higher education institutions. Most survey participants were health and social care professionals (and trainees), or public health specialists. The main reasons for accessing CoVE and the elements of the package that were most valued are presented in Figure 6. Almost all participants found CoVE easy to use and helpful, reported high satisfaction with the training and would recommend it to others. Recommendations for improvement were few and related mainly to the inclusion of additional detail (which was beyond the scope of the learning objective or was already included in additional resources). A small number of users highlighted a need for additional material to meet specific needs of their culture or region, although there were no barriers raised to use of the existing material. Technical issues were few and mostly related to issues with individual devices or internet access. Participants were highly engaged in the package—there were 3653 page views during the data collection period; records only include individuals who consented to web analytics tracking and so the actual engagement figure is likely to be significantly higher. Overall, the content was perceived to be highly relevant across health and social care professions, and diverse geographical regions.

3.2. Level 2 (Learning: Knowledge, Skills, Attitudes, Confidence, Commitment)

Following exposure to CoVE there was a significant increase in the proportion of participants who rated their knowledge level as 8/10 or higher (pre-survey: 35.5%; post-survey 84.6%). Most participants reported increased skills to facilitate conversations with others about the COVID-19 vaccine and respond appropriately to questions, particularly from individuals who were more hesitant towards vaccination. There was evidence of change in attitudes towards the vaccine. For those with existing positive attitudes, their views had been consolidated by the evidence-based materials. However, some participants spoke of their own hesitancy towards the COVID-19 vaccine (e.g., general worries about vaccines, or specific concerns about the speed of vaccine development) but noted that their concerns had been allayed after engaging with the package. Most of the participants felt that their confidence in promoting vaccine uptake had improved. Participants believed that the package had helped them to communicate more effectively about the COVID-19 vaccine with diverse audiences, including patients and clients, healthcare students, peers, and the general public, including their own family members. They referred to having increased confidence that they could present the facts (including benefits and risks), while dispelling myths and rumours. While this view was common across the sample, increased confidence was particularly notable in health and care professionals who were working in areas with high levels of vaccine hesitancy, and/or low vaccine uptake rates. Many of the participants demonstrated a commitment to adoption of CoVE within their setting that they believed would have a future impact, and some had already made firm plans to do so. Beyond personal use of the materials, participants intended to share the materials with others (work colleagues, professional networks, family), use the package for continuing

professional development training within their teams, and incorporate the materials into new staff inductions (e.g., in care homes).

3.3. Level 3 (Transfer/Behaviour and Required Drivers)

While most of the participants reported commitment and future intentions, many participants had already enacted changes in their own vaccine promoting behaviour, as well as supporting their peers with the same. Many of the participants had subsequently engaged in conversations with others about the COVID-19 vaccine and felt that they were able to do this more effectively with their newfound knowledge and confidence. Participants proposed a range of required drivers for knowledge transfer and effecting behavioural change. It was proposed that CoVE training could be targeted to specific professional groups who had high levels of patient contact (e.g., nurses, healthcare assistants, healthcare students, and community pharmacists), or in specific settings with lower vaccine uptake rates, lower levels of knowledge and awareness, and greater vaccine hesitancy (e.g., specific geographical regions, community or ethnic groups, or settings such as care homes). Centralising access was proposed as a mechanism for wider distribution (and resulting behaviour change), for example, through higher education settings, professional networks, or governments. While the digital presentation was unanimously positively received, one participant suggested that a paper-based format may help to widen access (e.g., in rural areas with lower levels of internet access, and fewer people with access to electronic devices).

3.4. Level 4 (Impact)

Participants reported positive impacts of CoVE on vaccination uptake. Since accessing CoVE, a few participants shared that they had personally been vaccine hesitant and had re-considered their own decision not to vaccinate following use of the package. Others believed that the knowledge and confidence they had gained from using CoVE had facilitated their discussions about vaccination with vaccine-hesitant individuals who had subsequently vaccinated. Participants reported positive outcomes for vaccination uptake with relation to their peers (health and care professionals), patients, and family members. There were many leading indicators of future impact. For example, participants had used their newfound knowledge and confidence to engage in individually focused vaccination-promoting activities and had been successful in changing people's attitudes towards the COVID-19 vaccine to reduce vaccine hesitancy and encourage future uptake. Others had utilised the package for wider knowledge-exchange activities, such as the establishment of COVID-19 awareness events and new vaccination programmes, and provision of training for health and care staff, or students.

Table 3. Mixed-methods analysis aligned with the New World Kirkpatrick Evaluation Framework.

Level (1–4) †	Sub-Component	Measure [a]	*N* (%)
(1) Reaction	Reach	Channel for receipt of the resource [a]	
		Through employer	81 (50)
		Through educational institution	22 (13.6)
		Via professional network	35 (21.6)
		Recommended by peer/colleague	22 (13.6)
		Through digital catalogues	3 (1.8)
		Other route (e.g., family, manager)	9 (5.6)
		User [a]	
		Health or care professional	116
		University or college students	(71.6)

Table 3. *Cont.*

Level (1–4) †	Sub-Component	Measure [a]	*N* (%)
		Tutor/teacher/lecturer	22 (13.6)
		General public	16 (9.9)
		Other (e.g., public health specialist/	8 (4.9)
		researcher, professional network manager)	20 (12.3)
	Reach	"in Indonesia particularly, we are struggling for vaccination today...by providing this educational package it helps health care professional to explain clearly for the patients the technical point...of vaccinations that it will make and convince people to get vaccinated." (109)	
	Use	Easy to use	160 (98.8)
		Helpful or very helpful rating	162 (99.4)
		Problems with use (% yes)	
		No problems	152 (93.8)
		Technical issues	7 (4.3)
		Level of difficulty	1 (0.6)
		Language difficulty	0 (0.0)
		Contextual or cultural differences	1 (0.6)
		Other issues (e.g., personal device	3 (1.9)
		issue, lack of time to complete)	
(1) Reaction		"easy to follow and informative and it wasn't too long but I felt it covered everything that needed to be covered" (114) "we have a lot of staff who English is not their first language and I felt it was understandable and easy" (105) "a variety of ways of accessing the information" (S)	
	Satisfaction	Good or excellent rating	161 (99.9)
		Would recommend to others	160 (98.8)
		"I would say this is, I think, is the material that I was looking for. I am really impressed with this" (106) "this is very beneficial for us, our welfare. Removing the rumours about... the COVID-19" (110) "brief and to the point, but extensive extra resources giving further detail if you want it" (S)	
	Engagement	View towards interactive elements: "very interactive and engaging—information buttons to explain all the terms, text boxes to expand, images, videos, narration and additional reading. I revisit it and find more information each time" (S) "the graphics of it, the way it was quite interactive, you can click on different things... you don't have to sit and read. You could just listen to it and that was really good" (113)	

Table 3. *Cont.*

Level (1–4) †	Sub-Component	Measure [a]	*N* (%)
(1) Reaction	Relevance	Relevance to self or others: "I think this one is really timely because the level of vaccine hesitancy among nurses in the Philippines is a bit high as well" (106) "the patient experiences... I feel these are the stories that will help others understand the need more" (S) "I know a lot of my colleagues, it's information they don't have access to" (102) "I work in...the front line...COVID dilemmas happen every day. So, yes, I, I do believe that this information is pertinent" (112) "contain a very reliable information that we can share to the patient and convince them' (109)	
(2) Learning	Knowledge	Pre-knowledge score $\geq$ 8/10	57 (35.2)
		Post-knowledge score $\geq$ 8/10	138 (84.6)
		Learned something new (% yes)	139 (85.8)
		"almost everything is new for me in this resource" (115) "I found the explanation of the clinical trials and the different phases quite useful 'cause that wasn't something I knew about and it's where a lot information I've seen being spread through social media is about." (102) "it gave me better insight into the actual client t hat I'm dealing with and all the emotions" (111)	
	Skill	Feeling equipped with useful knowledge: "now...I'm armed with new information and how to explain it to them [patients]" (106) "the learning is really related to how to present the facts...really hones in on how to communicate that knowledge I think" (114) "It would help me facilitate a conversation about COVID to people" (112)	
	Attitude	Views towards COVID-19 vaccine: "after assessing the resource it makes me more confident about the vaccines" (109) "I can imagine if somebody was very anxious, and quite sceptical. I think this this will be very good for them" (113) "It will erase their individual beliefs about the negative things about or information about COVID-19 vaccine" (107) "it strengthened my belief now that now we have to tell people the correct information" (106) "I wouldn't say it changed my views 'cause I was always very positive about the vaccination . . . but it has cemented t hem." (105) "I manage a care company with 108 staff, 13 of those are currently refusing the vaccination. I wish to support them to gain further correct knowledge to hopefully dispel any fears and take up the vaccine" (S)	

Table 3. *Cont.*

Level (1–4) †	Sub-Component	Measure [a]	*N* (%)
(2) Learning	Confidence	Pre-confidence score $\geq$ 8/10	72 (44.5)
		Post-confidence score $\geq$ 8/10	130 (80.2)
		"now that I have this resource behind me. It [gives me] more credibility. It's not just my opinion now" (105) "There are lot of rumours regarding the negative reaction of vaccine in my society, but by using this resource I can better explain the effectiveness of vaccine with opponents and encourage them to get vaccine." "gave me more confidence. it was very transferable knowledge" (112) "in terms of talking to a stranger about vaccines and, you know, how they work, I'm more confident now" (101)	
	Commitment	Estimated future use and resource sharing: "I'm going to promote this material because this is relevant. There's no such materials, I would say at the moment in the Philippines." (106) "we've got some healthcare staff that are resistant...because of the propaganda...I would be quite happy to use this resource in a discussion forum with a group of staff. To enable us to have those difficult conversations really" (105) "I definitely share the package to my students." (110) "support workers...or students... I could use that knowledge to help and support them for s ure" (103)	
(3) Transfer/ Behaviour	Behaviour changes	User application of knowledge and reported behavioural changes: "I have already applied it. I applied it on my family because I am encouraging my parents to get vaccinated with the COVID-19 vaccine... they are afraid to get vaccinated." (109) "I have shared this resource to all my family members, society and colleagues. I have planned to conduct awareness session at District level." (115) "I have applied this at my workplace and shared link... among my colleagues and representatives of NGOs [non-profit organisations]. They all given me a good response." (115)	

Table 3. *Cont.*

Level (1–4) †	Sub-Component	Measure [a]	*N* (%)
(3) Transfer/ Behaviour	Required drivers	Target audiences and mechanisms for dissemination "Maybe in the pharmacy, actually like community pharmacists when patients come in to get the medicine" (113) "I think nurses are a good place to start because they can, they can pass the knowledge onto others. Students are a good one I think because obviously they're going into all these different places and meeting all these different people" (101) "looking at more of the health care assistants . . . I think I've found that they're the ones who are more likely to have their own misunderstandings, which makes it harder for them to give suitable information to patients" (102) "State Governments may adopt this for sharing through Health Departments" (115) "In our place, there a lot of rural area where they don't have much, uh, like cell phones or technology. So probably we, we can have like giving them a hard copy about this" (107) "We talked at the vaccination centre about how it might be useful for everybody to do and be part of the training process. I've shared it on WhatsApp and quite a few people have done it already. I also shared it in my trust with our new vaccination lead" (114)	
(4) Results/ Impact	Leading indicators	Changes in user confidence or communication; Resulting patient, client or general public actions; Additional perceived benefits or applications: "I am about to receive a vaccine this weekend" (S) "Being able to answer the questions about how they got a vaccine available so quickly, which is the one I seem to be faced with a lot... [I am] having these conversations with the public" (102) "I've shared the knowledge presented in the package to my colleague and now as well as my family...they become more confidenced that this is one of our way to protect our family and our self" (109) "I have applied this knowledge and I am shocked that I have convinced each of them to take vaccine and answers their queries better and changed their view and mind about the negativity of vaccine. It is wonderful experience and I have observed that if one's can explain better, he definitely will get the goals". (115)	

† Level descriptors—Level 1: Reaction; Level 2: Learning; Level 3: Transfer/Behaviour; Level 4: Results/Impact [a] Multi answer: Percentage of respondents who selected each answer option (e.g., 100% would represent that all this question's respondents chose that option). [a] Quotations provided are from interviews (labelled with participant number) or Survey (labelled S).

Reasons for accessing CoVE [a]	Most valued elements [b]
• Support vaccine advocacy through sharing of evidence-based materials • Acquire new knowledge or check accuracy of current knowledge • Obtain phrases to use to promote the vaccine to individuals or groups • Gain knowledge to dispel myths and counter the arguments being presented by those who do not agree with, or understand, the need for vaccinations • Gain skills to answer questions about the vaccines and their development • Increase competence and confidence to discuss the vaccines with patients and clients • Engage in continuing professional development • Check suitability of CoVE for adoption of a resource for health and social care staff training • Check suitability of CoVE for adoption as a teaching resource for healthcare trainees	• Concise, bite-sized resource • Ease of use • Visually appealing • Multiple interactivity options (menu, narration adjustments, video clips, information boxes, click boxes, quiz, extra resources) • Focus on inclusivity (variety of ways to access information - menu, narration with speed adjustment and replay options, accessible language, information buttons for terminology) • Real-life experience stories (video material of patients and healthcare professionals) • Relevance across all professional groups in health and social care • Relevance across geographical regions and cultures • Tips about how to convey messages to different audiences • Knowledge testing through quiz • Links to additional evidence-based information

Note: [a] Provides additional support for Level 1: Reach and Relevance; Level 2: Skills, Attitudes, Confidence, Commitment; Level 3: Required Drivers; [b] Provides additional support for Level 1: Use, Satisfaction, Engagement, and Relevance.

Figure 6. Reasons for access and most valued training elements.

4. Discussion

The aim of the study was to rapidly and rigorously develop and test a multi-media digital package providing timely education about the COVID-19 vaccine for health and care workers. The CoVE package was developed and tested in collaboration with international experts, using ASPIRE methodology [35] with a mixed-method evaluation mapped to the New World Kirkpatrick Model [36,37]. To our knowledge and at the time of writing, CoVE is the first internationally relevant digital training resource for health and care professionals, focused on advocating the importance of the COVID-19 vaccine to individual and societal health.

The package has global reach and was positively received by users from 26 countries, spanning geographical regions with higher and lower rates of vaccination at the time of the study [56]. CoVE was perceived to be timely, and relevant across professions, cultural groups, sectors, and occupations (health and social care, education, charitable and volunteering organisations, local government).

Package users were highly engaged with the materials. Digital learning is known to be enhanced by multimedia [57,58] and the RLO therefore included a mix of text, embedded video, and audio narration which was well-received. Interactivity is recognised as a key method for increasing knowledge through e-learning by keeping users active in the process [59,60]. In this study, the high level of engagement translated into knowledge acquisition and a perceived increase in skills and confidence for promoting vaccine uptake. As a result, package users reported or observed positive changes in attitudes towards the COVID-19 vaccine. This is important since positive attitudes towards vacci-

nation (the 'proximate behaviour') have been linked to vaccination uptake (the 'ultimate behaviour') [61] which has been demonstrated in other vaccination contexts (e.g., childhood vaccinations [62]).

Participants in CoVE training reported increased confidence and skills and feeling better equipped to communicate with others about the COVID-19 vaccines. Many found the package useful in helping them to correct misinformation (which is known to be associated with changing health beliefs) [63]. Their increased confidence translated into behavioural changes related to engagement in health protection activities (e.g., peer-to-peer training, student education, organisation of vaccination advocacy events, supporting COVID-19 vaccination programmes). The immediate impact of CoVE was evident in reports of vaccination uptake (e.g., themselves, their peers or family members, or members of the general public they had communicated with).

Although the package was valued by users irrespective of their job role or country of origin, changes in confidence and vaccine-promoting behaviour were particularly evident in those health or social care professionals who were not trained vaccinators, or were from geographical areas which have seen lower rates of COVID-19 vaccination [64], and/or high levels of vaccine hesitancy (e.g., [3,10,65,66]). Vaccine hesitancy refers to adults who have been offered the coronavirus vaccine and have chosen not to be vaccinated or report being unlikely to have the coronavirus vaccine if it is offered to them [67]. The causes of vaccine hesitancy are complex and context specific [68]. While CoVE training includes information on development, safety and effectiveness, its primary learning objective relates to the importance of the COVID-19 vaccine for individual and societal health. This was deemed to be an appropriate focus since prior research (using data from 149 countries and 284,381 individuals) has shown that confidence in the importance of vaccines (rather than in their safety or effectiveness) had the strongest univariate association with vaccine uptake compared with other determinants considered [69]. Nevertheless, since health workers are the most trusted sources of guidance about COVID-19 vaccines, messages included within CoVE highlighting vaccine efficacy and safety, when delivered by healthcare workers, may be an effective approach for addressing any vaccine hesitancy [70].

Due to the rapid nature of the study, in the context of global rollout of COVID-19 vaccination programmes, the evaluation data were collected immediately after participants had accessed CoVE. As such, the longer-term impact of this training on vaccination outcomes is not yet known. Nevertheless, even in the short timescale, there was clear evidence of behaviour change in terms of participants reporting marked changes in their confidence to promote the vaccine, or immediate changes in their own actions around health protection (i.e., COVID-19 vaccine advocacy work). Users had applied their learning in practice and also demonstrated a high level of commitment to future use of the resource, resource sharing, and application of knowledge and skills. Interview participants identified the key drivers of future change primarily with relation to occupational groups that could be targeted for distribution of CoVE training (e.g., nurses, healthcare assistants, pharmacists, healthcare students), and routes for embedding training (e.g., staff inductions, continuing professional development programmes in health and social care organisations or through professional networks, higher education curricula). The training package takes a proactive approach to vaccine education by targeting training to health and care professionals for three reasons. First, the confidence of those who interface with patients in a clinical setting is critical for presenting a unified message of vaccine support in the medical community [71]. Second, people's trust in messages communicated by the health and medical community is a key determinant of vaccine uptake [72]. Third, the beliefs and actions of health professionals can influence vaccine uptake in hesitant others [73].

Study Strengths and Limitations

The evaluation was mapped to specific indicators on the New World Kirkpatrick Evaluation Model [36] as a theoretical framework and focuses solely on these outcomes. The model has been used to evaluate technology-based interventions in a range of other

health contexts [74–76]. While few studies adopting this model assess outcomes at all four levels, the meaningfulness of the findings is maximised here through assessment of levels 1–4, allowing for the study to demonstrate the Return on Expectations (RoE) of CoVE as a digital training package. In this context, the RoE is the perceived value of the package in improving knowledge, confidence and intended or actual behaviour change related to promotion of the COVID-19 vaccine. The timescale from package exposure to interview data collection varied between participants up to four weeks, due to the need for rapid completion of the evaluation. This was to ensure that the findings would be available (and therefore timely and relevant) within the changing context of a global pandemic and rapid rollout of vaccination programmes worldwide. This meant that some interview participants had more time to reflect on, or act on, information in the package than others. Further research is needed to explore in more depth any influence of the training on intended and actual behaviour change (levels 3 and 4 of the model), especially given the escalation in and varying COVID-19 vaccine information that individuals obtain from friends, family, community groups, the media, and social network platforms. The pre-post assessment of knowledge was based on participants' self-rating of knowledge (and knowledge change), and so we do not know whether objective knowledge changed. However, this approach was intentional, to allow for 'ipsative assessment' in which participants measured their current perceived knowledge and confidence level (on completion of the training) against their perceived knowledge and confidence level at some point in the past (immediately prior to completing the training), to allow for a self-assessment of improvement. This is pertinent since perceived knowledge (and not just factual knowledge) can increase one's confidence in their own skills [77].

We did not collect sociodemographic information from survey participants (e.g., age, gender, ethnic minority status, religious group, socio-economic status, and underlying health conditions), so the potential influence of these factors on our participants' views is not known. However, the content of the CoVE package addressed all of the causal factors for hesitancy—including mistrust, concerns around safety and future health risks, (mis)information, societal attitudes, beliefs, and values [78]. The sample of survey participants (n = 162) was adequate to address the study objectives and comparable with, or larger than samples in other evaluations of digital training for health and care workers [29,79]. However, evaluation with a larger cross-country sample (or studies with a focus on specific cultural groups) would be valuable to further establish whether the CoVE training represents the specific needs of diverse cultures and regions. The approach to sampling for the evaluation interviews through professional network and promotional mailings allowed participants to self-nominate to participate, thus reducing potential for selection bias. However, it is possible that healthcare workers opting to participate may have a more favourable view towards either COVID-19 vaccination, or digital approaches to education and training.

5. Conclusions

The COVID-19 Vaccine Education (CoVE) training package increases users' knowledge and confidence in communicating with patients, clients and the general public about the importance of the COVID-19 vaccine for individual and societal health. CoVE is internationally relevant, and timely for distribution to health and care professionals and healthcare trainees during the COVID-19 pandemic. We recommend that healthcare organisations and educational facilities widely distribute CoVE to facilitate global promotion and uptake of the COVID-19 vaccines. While CoVE has shown to be globally relevant and provides a wealth of additional evidence-based resources, in certain contexts the training could be delivered alongside additional materials that are tailored to the concerns of motivations of specific cultural groups, or the package could be distributed by trusted members of community groups. The package content has high value at the time of this study but will need to be periodically reviewed and updated. This is because the pandemic's trajectory (and the response to it) will evolve, vaccines will be more widely distributed, the extended

period of media coverage may raise additional questions, and post-vaccination surveillance data will provide greater insights over time.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19020653/s1; File S1: Stage 1 specification review form; File S2: Stage 2 media review forms; File S3: Survey items; File S4: Interview topic guide.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and classed as educational evaluation by the Research Ethics Committee of the University of Nottingham Faculty of Medicine and Health Sciences (ref. no. FMHS 310-0721).

Informed Consent Statement: Informed consent was obtained from all participants involved in the evaluation interviews.

Data Availability Statement: The CoVE package is open access on HELM Open: https://www.nottingham.ac.uk/helmopen/rlos/practice-learning/public-health/CoVE/ (accessed on 17 December 2021). The evaluation data presented in this study are available on request from the corresponding author. The data are not currently publicly available due to risk of participant identification.

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