It was the best of times
it was the worst of times

Health and wellbeing in Nottingham during the 2022 heatwave

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Project Team

Dr Charles Ogunbode, Assistant Professor/Principal Investigator, University of Nottingham (charles.ogunbode@nottingham.ac.uk)

Dr Liz Cooper, Research Associate, University of Nottingham

Dr Annayah Prosser, Research Associate, University of Nottingham

Hollye Kirkcaldy, Research Assistant, University of Nottingham

Dr Ada Hui, UK Professional Lead for Research, Royal College of Nursing; Honorary Associate Professor, University of Nottingham

Production

Abi May (abimaydesign.co.uk)

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"I wish it could be a bit more sunny sometimes. I mean, I particularly enjoyed the heatwave. It was hot, but it felt like being on holiday, you know, like real heat. Proper heat."

"...It was miserable. I think that's the thing. It was quite miserable time as well. Even though I love the sun. I would not want to go back to it. So I think of the summer of 22. It was miserable."

Executive summary

The UK witnessed an unprecedented heatwave in summer 2022 during which temperatures exceeded 40°C in multiple locations. Heatwaves are projected to become more frequent in the UK in future, with increased likelihood of temperatures reaching thresholds that pose a danger to human health. Nottingham is especially vulnerable to negative impacts from extreme heat. The city ranks fifth, among 156 local authorities in England, on a list of those with the highest number of neighbourhoods needing to be prioritised for adaptation to hot weather.

Previous research provided indications of areas in Nottingham that face higher risks during hot periods based on social and geographical data, but there was little insight into lived experiences of dealing with heat among Nottingham communities. We designed this study to provide an account of the health and wellbeing impacts of the 2022 heatwave in Nottingham based on residents' recollections of their lived experience during the peak of the heatwave in mid-July 2022. The research aimed to capture how the heat affected people's wellbeing, how the impacts of the heatwave were shaped by social inequalities, and whether people connected their experiences of the heatwave to the broader issue of climate change.

We conducted in-depth interviews with a diverse sample of 45 Nottingham residents (25 members of the public and 20 professionals working in health, social care, and the emergency response services), and an online survey of 500 Nottingham residents. Our analysis sought to identify wellbeing impacts of the heatwave and coping responses across home and work environments.

Christian Julliard

The key findings include:

- Everyone we interviewed (N = 45) experienced negative impacts on their wellbeing during the 2022 heatwave. Among survey participants (N = 500),

  71% experienced at least one heat-related impact on their physical health.

  55% experienced mental health impacts.

  31% reported that the heatwave affected their ability to work or earn money.

- Professionals reported experiences of increased demand for care and emergency services during the heatwave. They also reported difficulties with operating effectively in the heat due to inadequate cooling facilities and challenges with personal protective equipment (PPE) or uniforms that were unsuitable for hot weather.

- Workers in precarious jobs, zero hours contracts, those who are self-employed, and small business owners lost earnings during the heatwave due to factors like employers cancelling work without pay, or reduced custom when more people stayed at home to avoid the heat and fewer were out spending money.

- People expressed mixed attitudes toward heat and the 2022 heatwave. Accounts of negative effects endured during the heatwave were often counterbalanced with reflections on positive experiences like spending more time with family, socialising with friends, and being outdoors. People's evaluation of their experiences of the heatwave generally tended to be shaped by context (being at work versus being at home), duration (a couple of hot days versus protracted periods of elevated temperatures), and temperature preference thresholds (some people like it hot).

- Participants recounted various coping strategies taken during the heatwave including purchasing fans and air-conditioning units, wearing hats and sunscreen when outdoors, making efforts to spend time in air-conditioned public spaces like shops and cinemas, taking more showers, changing diets, closing windows and blinds, and sticking aluminium foil on the outside of windows.

- Few people had spontaneous recollections of receiving heat-related health advice from official channels during the heatwave. The most common/salient sources of information were social media, and family, friends, and/or colleagues.

- Many people talked about making efforts to look after others around them during the heatwave including children, elderly relatives, pets, colleagues, and vulnerable people in the community.

- Adaptations made to living and working arrangements during the COVID pandemic were seen by many participants as highly facilitative of effective coping during the heatwave.

- Most people assumed that the heatwave was linked to climate change. One interviewee described how witnessing the effects of the heatwave on a local park triggered an experience of climate anxiety.

This study provides unique insight into Nottingham residents' multifaceted experiences of living through an unprecedented heatwave. Our findings show that while the health and wellbeing of people in Nottingham were negatively affected by the heatwave in various ways, people also showed remarkable levels of caring, responsibility, and initiative in looking after themselves and others around them. We hope that our analysis will help foster climate change adaptation narratives and policy interventions that reflect the lived experiences of people in Nottingham – extending from a focus on vulnerability toward recognising and championing the ways that Nottingham communities are showing resilience in the face of extreme weather and climate change.

Recommendations

Communicators

- People in Nottingham have a strong sense of neighbourliness, and many were concerned about how others were coping during the 2022 heatwave. Campaigns should leverage this knowledge, recognise what people are already doing, and champion Nottingham community spirit to encourage more people to help others.
- Work with trusted community members and harness social media to ensure that official health advice reaches the most vulnerable groups.
- Provide information in multiple formats and languages.

Organisations and businesses

- Review COVID-19 adaptations to identify and retain working arrangements that facilitate effective coping with heat (e.g., flexible working hours, working from home, taking plenty of breaks).
- Protect economically disadvantaged groups (e.g., workers on zero hours contracts, gig workers) from disproportionate negative impacts when work is cancelled without pay through paid time-off or other financial support mechanisms.

Health and wellbeing practitioners

- Adopt monitoring systems for heatwave impacts that extend beyond mortality and hospital admissions data to encompass mental, social and economic wellbeing indicators.
- Offer central support or advice for how people can help others in the community during extreme heat events, and what to do to help people who are unwell or badly affected by heat.

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Introduction

Unusually hot days and heatwave events are part of natural weather variability, but the frequency, intensity and duration of heatwaves occurring around the world have increased due to climate change (Perkins-Kirkpatrick & Lewis, 2020; Stott et al., 2004). With continued global warming, extreme temperature thresholds relevant to human health are likely to be exceeded more frequently, which will lead to an increase in heat stress and heatwave-related deaths in the future (Chen et al., 2022; Jenkins et al., 2022; Murari et al., 2015).

The 2022 UK heatwave

In summer 2022, the UK witnessed an unprecedented ***heatwave*** during which daytime temperatures in parts of the country breached 40°C for the first time in recorded history. There were five ***heat periods*** in the UK between June and August 2022. Our study focuses on the second heat period (10 – 25 July), at the peak of which a maximum daytime temperature of 40.3°C was recorded on 19 July 2022 in Coningsby, Lincolnshire (Met Office, 2022).

A national emergency covering large parts of England was declared on 15 July 2022 due to the extreme heat (Faulkner & Adams, 2022). Office for National Statistics (ONS) data show that 2,227 excess deaths were recorded across England and Wales in the period between 10 to 25 July; a figure estimated to be 10.4% above average for the time of year (ONS & UKHSA, 2022). Researchers at World Weather Attribution (WWA) estimate that the 2022 UK heatwave was made 10 times more likely, and 4°C warmer, by anthropogenic climate change (Tandon, 2022).

Early effects of the 2022 heatwave in Nottingham

Following several days of high 20- to mid 30-degree temperatures starting on 16 July, the maximum daytime temperature in Nottingham peaked at 40°C on 19 July 2022. The impacts of the heat were readily apparent around the city. Grass in parks dried out and turned yellow, causing damage to wildlife habitats and raising risks of fires (Moore, 2022). Several wildfires occurred across Nottinghamshire due to dry vegetation being easily set alight. On 18 July, a grassfire in Bestwood damaged nearby homes and gardens; leading to 26 homes being evacuated (ITV News, 2022a; Phipps, 2022a).

The transport system across the city was also affected. Rail services were limited, and people were advised not to travel by rail in the hottest part of the day (Hartley & Brigstock, 2022). The tram service in Nottingham was reduced and some roads were gritted to protect the surfaces from softening in the heat (Hartley & Brigstock, 2022).

Why we conducted this research in Nottingham

Nottingham has been identified in previous research as being highly vulnerable to extreme heat. Out of 156 local authorities in England, Nottingham ranks fifth on a list of those with the highest number of neighbourhoods needing to be prioritised for adaptation to hot weather (Friends of the Earth, 2022). The evaluation underlying this ranking was based on assessments of ***social vulnerability to heat***. There is a need to take action to protect Nottingham residents from the adverse effects of future heatwaves.

In addition, the city of Nottingham has an ambitious plan to achieve ***carbon neutrality*** by 2028 (CN28). The plan includes steps to improve climate change adaptation and resilience among Nottingham communities. A stated objective in the CN28 plan is to 'understand the current and future impacts of extreme weather events and climate change, with an in-depth knowledge of the most vulnerable citizens' (Nottingham City Council, 2020).

Although the evidence from past research had identified areas of Nottingham that are likely to be severely affected by heat based on geographical and social data, there was no indication of how heatwave impacts are experienced or how people cope with heat in Nottingham. This is an important research gap because understanding how people experience and respond to heat can help us identify opportunities for interventions to strengthen community resilience and minimise the negative impacts of extreme events on vulnerable groups.

Furthermore, experiences with extreme events like heatwaves and flooding can have a strong influence on how people understand and engage with the broader issue of climate change (Sambrook et al., 2021; Hoffmann, 2022). Considering the projections of increased future risk of heatwaves due to global climate change, building community resilience is contingent on moving people on from perceptions of heatwaves as one-off events to a mindset of long-term preparedness and planning for extreme heat.

Definitions

Carbon neutrality

A state of balance between the amount of carbon that is released from activities like producing goods, transporting them around, and heating our homes with the amount of carbon that is absorbed by carbon sinks like forests, bogs, and the ocean. Efforts at achieving carbon neutrality typically involve lowering carbon emissions from our everyday activities and investing in the quality and maintenance of carbon sinks so they can draw more carbon out of the atmosphere.

Heat period

Defined as day(s) in which a Level 3 health alert is issued and when the mean Central England Temperature exceeds 20°C (ONS & UKHSA, 2022).

Heatwave

A period of abnormally high temperatures that persists for three to five consecutive days or more (McCarthy et al., 2019; Rafferty, 2023).

Social vulnerability to heat

An index derived from considerations like demography (e.g., proportion of elderly residents, toddlers, people living with health conditions), nature of the housing stock, environmental factors (e.g., tree cover, availability of green spaces), and average distance from healthcare facilities. It plays a part in explaining links between heatwave vulnerability and factors like ethnicity. People of colour are four times more likely than white people to live in areas considered to have high social vulnerability to heat risks (Friends of the Earth, 2022).

Our research questions

We designed this study to answer three main research questions:

01

How did the 2022 heatwave affect the wellbeing of people in Nottingham?

02

Did social inequalities shape the nature and severity of impacts experienced by different groups of people?

03

Do Nottingham residents make a connection between climate change and their experiences of the 2022 heatwave?

Below we present a brief review of prior findings regarding the impacts of heatwaves, as well as conceptual considerations, that shaped the design of our study.

Health and socio-economic impacts of heatwaves

Mortality

The severity of heatwaves is commonly assessed in terms of mortality (excess deaths) or increased demand for hospital care. In the last two decades, extreme heatwaves have claimed thousands of lives in Europe. During the 2003 heatwave, over 70,000 excess deaths were recorded in Europe (Robine et al., 2008), including 2,091 excess deaths in England (Johnson et al., 2005). A heatwave also caused over 11,000 excess deaths in Moscow in 2010 (Shaposhnikov et al., 2014). The effects of the 2003 heatwave prompted the introduction of more sophisticated heatwave surveillance and advance warning systems in the UK.

Physical and mental health

Heatwaves can have negative effects on physical and mental health (Arbuthnott & Hajat, 2017; IPCC, 2022). Excessive heat is linked to elevated risks of cardiovascular and respiratory diseases (Arbuthnott & Hajat, 2017). These, in turn, operate as mechanisms for heightened mortality rates. Mental health also commonly deteriorates in periods of excessive heat (Obradovich et al., 2018). For example, higher summer temperatures in the US have been linked with an increased likelihood of people visiting hospital emergency departments for mental health reasons (Nori-Sarma et al., 2022). Studies in Mexico and the US also show that suicide rates increase during hotter periods (Burke et al., 2018).

Sleep

People commonly report having poorer sleep when night time temperatures are high (Obradovich et al., 2017). Poor sleep is associated with a range of negative psychological and health outcomes including cognitive and behavioural deficits in children (Beebe, 2011), increased risks of hypertension, heart disease, dementia and stroke (Durgan & Bryan, 2012), as well as potentially elevated tendencies toward aggression among adults (Kamphuis et al., 2012). Data from 765,000 US residents collected over a 10-year period (2002 – 2011) revealed that a deviation of +1°C from normal average night time temperatures produces an increase of roughly three nights of insufficient sleep per 100 individuals per month (Obradovich et al., 2017).

Crime and aggression

Associations between hot weather and crime have been observed in several countries (Hambling, 2019). For example, riots in the UK and US have occurred when temperatures are relatively high (McGregor et al., 2007). Research suggests that high temperatures increase rates of violent crimes, including sex offences (Mahendran et al., 2021). This may either be because hot weather can make people more uncomfortable and frustrated, or because more social interaction occurs outdoors when temperatures are higher (Mahendran et al., 2021; Tiihonen et al., 2017). Higher rates of intimate partner violence against women have also been observed during heatwaves (Sanz-Barbero et al., 2018).

Economic losses

Heatwaves can have a range of economic impacts. People may be unable to carry out work due to health impacts caused by excessive heat, or due to outdoor activities becoming uncomfortable or dangerous (Adélaïde et al., 2022; García-León et al., 2021; IPCC, 2022). Deaths caused by heatwaves also contribute to a loss of economic productivity (Adélaïde et al., 2022). Transport infrastructure may be affected by the heat, leading to disruption of movement of people and goods. For example, road surfaces can melt, and railways can buckle (UK Health Security Agency et al., 2022). High temperatures also increase demand for energy for fans and air conditioning, which means power supplies that are vital to businesses and services can be at risk (UK Health Security Agency et al., 2022).

The 2003 European heatwave caused over €13 billion in economic losses (De Bono et al., 2004). Similarly, the health impacts of heatwaves occurring in France between 2015 and 2019 have been estimated to have cost up to €25.5 billion due to deaths, illnesses, and associated losses of working days (Adélaïde et al., 2022). A recent study showed that the reduced productivity of European workers caused by heatwaves that occurred between 2003 and 2018 adds up to total losses of 0.3 to 0.5% of European GDP (García-León et al., 2021). In the most vulnerable parts of Europe, particularly in southern regions with higher temperatures and greater reliance on outdoor activities like agriculture and tourism, losses of more than 1% of GDP were observed (García-León et al., 2021).

How heatwaves interact with social inequalities

Heatwaves do not pose equal risks to all members of society. Factors like age, health condition, and socioeconomic status moderate the health effects of heat. Elderly people and children under five are more likely to suffer serious health impacts (Rizmie et al., 2022). Pregnancy and pre-existing medical conditions can also increase the health risks posed by heatwaves (Climate Just, 2022; IPCC, 2022). People with low incomes are more likely to be admitted to hospital during extreme temperatures (Climate Just, 2022; Rizmie et al., 2022). Heatwaves can pose life-threatening risks to people experiencing homelessness due to their higher likelihood of exposure to extreme heat (Askew, 2023). People living in poorly ventilated dwellings, top floor flats, and overcrowded homes are also more likely to suffer negative health impacts from excessive heat (Climate Just, 2022). Furthermore, people who are socially isolated face greater risk of serious health impacts as they may not receive appropriate help and advice (Benzie et al., 2011; Climate Just, 2022).

Importantly, vulnerability to heat is not inherently determined by the personal attributes of individuals. It is shaped by interactions between individuals and their context. For example, approximately 20% of global electricity consumption is currently used for cooling buildings, and this is expected to triple by 2050 (Khosravi et al., 2023). With rising energy costs, low-income earners may be unable to pay for energy to sufficiently cool their homes and thus face a higher likelihood of experiencing severe heat-related impacts. So, low-income does not simply make people vulnerable in this instance. Instead, it is the interaction of low-income and high energy costs that makes people more likely to be severely impacted. In the UK, it is common for low-income earners to live in homes fitted with prepayment meters, which means that these people also end up paying more per unit of energy (End Fuel Poverty Coalition, 2023). Low income also tends to overlap with health vulnerabilities. Around 58% of people on prepayment meters in the UK have been found to have health conditions or disabilities (End Fuel Poverty Coalition, 2023). Consequently, the intersection between factors like income and health status is also important to consider when addressing vulnerability to heat.

'living a good life'

Our approach to assessing heatwave impacts

In assessing the impacts of the 2022 heatwave on people in Nottingham, we grounded our analysis in the broad spheres of wellbeing and social justice. The wellbeing standpoint provides an overarching perspective on the multiple interconnected domains of human flourishing that together constitute 'living a good life'. These include physical and mental wellness, economic security, positive social relationships, and having a sense of purpose and meaning (See O'Mahony, 2022; Adler & Seligman, 2016; King et al., 2014 for reviews). Furthermore, varying experiences of climate impacts on wellbeing among a population cannot be disentangled from prevailing structural inequalities, especially inequalities in the distribution of assets and capabilities. Our approach is therefore guided by an understanding of climate change as a social justice issue (Preston et al., 2014).

Method

Research participants and data collection

We conducted interviews with 25 Nottingham city residents and 20 Nottingham-based professionals working in health (N = 10), social care (N = 5), or the emergency response services (Notts County Fire and Rescue, Notts Police; N = 5) in March 2023. Interviews were conducted online. The mean age of the interviewees was 39.3 years (SD = 12.13; Range = 22 – 70 years). Other characteristics of the interviewees are summarised in Table 1.

Interview participants were recruited by Code3Research, a Nottingham-based market research agency using sampling specifications provided by the research team. Sampling of Nottingham residents for interview prioritised residents in areas identified in previous research (Friends of the Earth, 2022) as socially vulnerable to heat (e.g., parts of Aspley, Basford, Bestwood, Hyson Green, Radford, Sherwood, and St Ann's). Over half of the sample of Nottingham residents we interviewed (56%) were recruited from socially vulnerable neighbourhoods. In addition, we oversampled participants from ethnic minority backgrounds (48%) to reflect the diversity of the Nottingham population, and we targeted people living with children or dependants aged under 18 (40%) and people aged over 50 years old (20%). We were restricted by practical limitations in our capacity for targeted demographic sampling of Nottingham-based professionals. Therefore, recruitment of this group of respondents was determined primarily by employment in relevant roles at the time of the heatwave.

Details of the research were advertised to a register of Nottingham residents previously signed up by the market research agency to participate in paid research. Recruitment of Nottingham-based professionals necessitated reaching beyond this register and soliciting target participants from professional networks with which the agency was connected.

The interviews were complemented with an online survey of Nottingham residents (N = 500) conducted in May 2023. Online survey participants were recruited from commercial research panels maintained by Qualtrics Research Services. The only eligibility criterion for participation was residency in Nottingham at the time of data collection and during the period of 10 – 25 July 2022. The distribution of demographic characteristics was left to natural fall out. Characteristics of the online survey participants are presented in Table 2.

The research materials used for data collection including the participant invitation, information sheet, interview guides, questionnaire, and debriefing forms can be found in Annex 1. Ethics approval for the study was granted by the University of Nottingham School of Psychology ethics committee (ref: F4120).

Table 1. Characteristics of interview participants

		Residents		Professionals		Total	
		N	%	N	%	N	%
Gender	Woman	12	48	15	75	27	60
	Man	13	52	5	25	18	40
Education	University degree	16	64	13	65	29	64.4
	Other	9	36	7	35	16	35.6
Employment	Full time work	18	72	15	75	33	73.3
	Part time work	4	16	5	25	9	20
	Homemaker	1	4	0	0	1	2.2
	Unemployed	1	4	0	0	1	2.2
	Retired	1	4	0	0	1	2.2
Ethnicity	Asian/Asian British	5	20	0	0	5	11.1
	African, Caribbean or Black British	4	16	2	10	6	13.3
	Mixed	3	12	2	10	5	11.1
	White	13	52	16	80	29	64.4
Total		25	100	20	100	45	100

Table 2. Characteristics of online survey participants

		N	%
Age	18 – 24	135	27.0
	25 – 34	123	24.6
	35 – 44	121	24.2
	45 – 54	51	10.2
	55+	70	14.0
Gender	Woman	338	67.6
	Man	157	31.4
Education	University degree	216	43.2
	Other	284	56.8
Ethnicity	Asian/Asian British	37	7.4
	African, Caribbean or Black British	40	8.0
	Mixed	19	3.8
	White	400	80.0

Data analysis

The interviews were professionally transcribed before being analysed to identify recurring concepts and themes in what people said. Candidate themes were identified by two researchers in an initial round of coding, discussed within the wider research team, and subsequently verified in a second round of coding by a third researcher. A preliminary set of findings from the interview data was shared with the project advisory panel in April 2023 to help ensure that the analysis was focusing on the most relevant insights. Responses to the closed-ended questions in the online survey were analysed with SPSS version 27.

Research findings

Participants' accounts of their experiences during the July 2022 heatwave were largely negative. All 45 people we interviewed reported experiencing negative impacts during the heatwave.

A large proportion of participants in the online survey (44.8%) reported having 'very negative' or 'somewhat negative' feelings about the weather during July 2022 (Figure 1), which contrasts with previous research showing that people generally have positive attitudes toward hot weather in the UK (Erens et al., 2021; Lefevre et al., 2015).

Notably, participants' accounts reflected a significant degree of ambivalence. People made contrasting claims about the heat either having positive or negative effects on their mood. Accounts of worry or concern about participants' own wellbeing and/or that of their relatives, pets, neighbours and colleagues during the heatwave were often counterbalanced with positive accounts of communal support; people looking after each other, spending more time with family, and spending more time outdoors or socialising.

The negative effects of the hot weather were amplified for some participants by physical and economic factors. People with pre-existing health conditions suffered more severe impacts on their wellbeing. Those on zero hours contracts, or in otherwise precarious jobs, enjoyed less flexibility and were more likely to suffer losses of income during the heatwave.

Experiences from, and adaptations made to cope with, the COVID pandemic also helped facilitate effective coping during the heatwave.

Most participants assumed that the heatwave was linked to climate change.

A more detailed summary of our findings is presented under the following thematic headings:

a. **Attitudes towards the heat and/or heatwaves**
b. **Negative impacts of the heatwave**
c. **Adaptation and coping**
d. **Heatwave attributions**

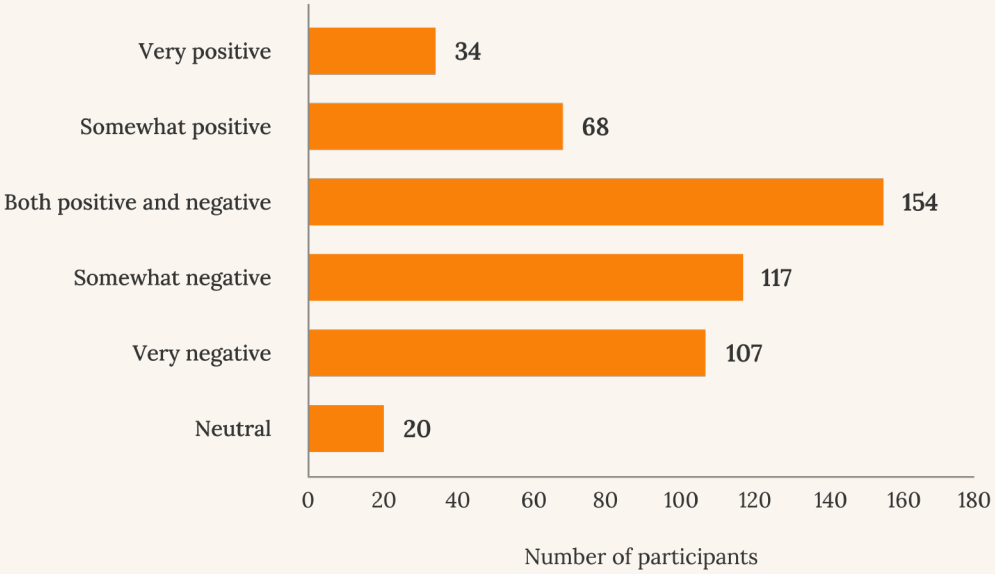
44.8%

reported having 'very negative' or 'somewhat negative' feelings about the weather during July 2022.

Attitudes towards the heat/and or heatwaves

Figure 1. Valence of feeling about weather during mid-July 2022 among survey participants (N = 500).

Focusing on your recollection of events from mid-July 2022, how would you describe your feelings about the weather during that period?



"...I do like heat. So, for me, I enjoyed the warmth. But it's different when you've got to work in it and it's not just a leisure experience."

(Sherwood resident, Woman, Age over 55)

Many participants in our interviews reported negative attitudes towards the heatwave, or extreme heat in general. Several people expressed particularly strong negative feelings towards the heat, whereas others displayed more mixed attitudes. For instance, they said that they loved the heat when on holiday but found it challenging in the UK; that they liked the heat but only over short periods or that they enjoyed warm weather but only below a certain temperature. As such, the context, duration, and temperature threshold of the heatwave were all demonstrated to be important factors in shaping people's attitudes and feelings.

A small number of participants reported positive attitudes towards the heat and described feeling the positive effects of spending more time than usual outside or socialising with family and friends. They also described seeing similar positive feelings and moods in others around them.

Alongside mixed attitudes towards the heat, participant accounts displayed further significant contradictions and inconsistencies in recollecting their experiences. Even people who reported loving the heatwave described challenging circumstances they faced during that period, such as difficulty sleeping or working. Indeed, everyone we interviewed reported at least one negative impact on their life, irrespective of whether they felt they had enjoyed the heatwave. Furthermore, some people reported enjoying the heat whilst also expressing concerns about the impact of global climate change.

"I just remember the amount of time that we were able to spend as a family and my social circle and with my kids and with my friends outdoors. It was just amazing. I live not far from lots of different parks and we were literally going on to a different park each evening and staying there till about 9:30, ten o'clock at night. And you wouldn't normally do that because you know, you'd want a jumper or something, or you're wrapping a blanket around you. But ohh, we absolutely loved it."

(Basford resident, Man, Age 35 – 44)

Negative impacts of the heatwave

Physical health

Accounts of the negative impacts of the heatwave were a dominant theme in our interviews with Nottingham residents and professionals. People described their experiences of various negative physical health impacts during the hot weather in mid-July 2022 including sunburn, dehydration, heatstroke, excessive sweating, fainting, general tiredness and lethargy.

Some mentioned that the heat exacerbated pre-existing conditions, such as asthma and diabetes, and menopausal or other hormone-related symptoms. They reported perceptions of claustrophobia and suffocation amid the hot heavy air, and the decision to stay inside out of the sun.

"... it was just lethargic. You know, not wanting to do anything and energy had gone, and it was those headaches, not like taking tablets headaches but almost like dehydrated because you're sweating more. I remember feeling just tired..."

(Mapperley resident, Woman, Age 35 – 44)

"... it was really hard to breathe. I remember being like, wow, there's literally not much air in the outside air or in my flat. That was one thing I kind of...for maybe 20 minutes or so, I wasn't panicking, but I was like, wow, this is quite serious now. And what I was trying to do to get air wasn't really working."

(Sneinton resident, Man, Age 35 – 44)

"One of the first days when it was, you know, incredibly warm. I think I got sunburn[ed] quite badly because I just hadn't anticipated it was- it didn't feel as warm as it was recorded or reported.. So, I think it was a bit beguiling [...] it was quite, quite painful the following day."

(City centre resident, Man, Age 35 – 44)

Figure 2. Reported physical health impacts of the hot weather during July 2022 among survey participants.

During mid-July 2022, did you experience any of the following as a result of hot weather or heat?

71.0%
Difficulty sleeping

49.2%
Headaches

37.6%
Dehydration/ intense thirst

35.4%
Irritability (bad mood, tendency to be easily annoyed)

30.8%
Sunburn

21.0%
Dizziness

17.8%
Heat rash/ red and dry skin

17.0%
A high temperature

6.6%
Nausea and vomiting

5.8%
Muscle weakness or cramps

0.6%
Need to contact a GP, NHS 111, call an ambulance, go to hospital or Accident and Emergency (A&E)

Total N = 500

Nearly three-quarters of participants in the survey reported suffering at least one negative physical impact during the heatwave, with the three most common impacts being sleep disruption, headaches, and dehydration (Figure 2).

In addition to describing physical impacts of the heatwave on themselves, many people also recounted their worries about the physical welfare of others around them during the heatwave period, particularly children and elderly relatives or neighbours.

"So the day after the 19th, [...] that was the day my daughter had her first jabs. [...] the jabs can give you a high temperature. I was quite concerned as it was already really hot. So that day, her room, we had like a grow egg that tells you the temperature of the room. And her room was like 31 degrees, like her room was boiling hot."

(Bestwood resident, Woman, Age 25 – 34)

Professionals within the health and social care sectors also described witnessing the physical health impacts of the heatwave on people, as well as indications of increased demand for hospital care for illnesses associated with the heat.

"I couldn't say 100% without numbers, but I would say generally people were visiting A&E more, [.....] more problems associated with heat. You know, like heatstroke. Um, dehydration like that. We saw quite a few patients have really, really bad burns as well and people obviously just not taking the right care of their skin in the sun. A lot of kids, we saw probably more children in A&E, coming in with heat related issues like fatigue and the parents were just worried that something had happened, but a lot of the time extra heat stroke."

(Professional, Trainee Cardiac Physiologist)

"Our elderly patients and those who were over 65 and have health conditions [...] there were a lot of patients that were coming in with family members or those from nursing homes [...] that were dehydrated. [...] a lot of people coming in with confusion and urine infections from being dehydrated. So that was definitely something that I feel like maybe we did notice at the front door a little bit more."

(Professional, Physician Associate)

"... I remember there was a lady that I saw as well whose baby lost about 17% of the [sic] weight, which is a lot. Anything over 10%, we class as abnormal. And so it was dehydrated. And I don't know if that was because the mother, I mean, I think there was some attachment issues with the breastfeeding, but it could well be that the mother probably wasn't hydrating that well in the heat wave."

(Professional, Community Midwife)

Mental wellbeing

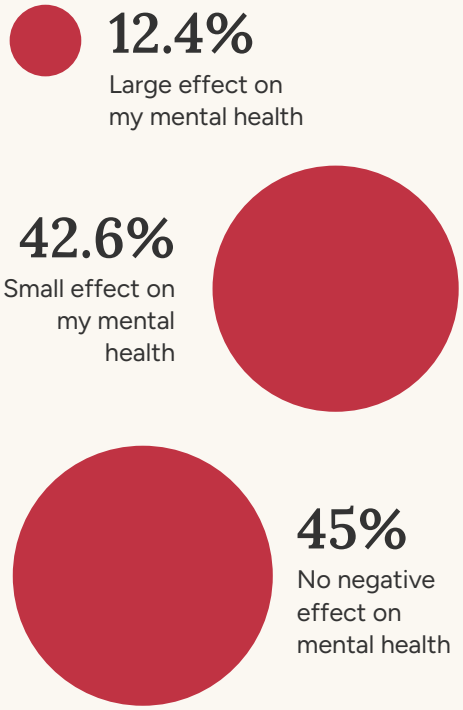
The hot weather also caused a significant strain on the mental wellbeing of many. Fifty-five percent of participants in the survey (Figure 3) reported that the heat had an impact on their mental health. In interviews, people told us about experiencing bad moods, heightened irritability, and severe distress caused by the visible impacts of the heat. Participants often identified feelings of brain fogginess, difficulty concentrating, and irritability as consequences of sleep disruption. Inability to sleep due to the heat was a commonly reported challenge (Figure 2), with particular difficulties faced by those working shift patterns and trying to sleep during the day. Many participants reported feeling isolated as a result of being unable to socialise normally, and being unable to exercise.

"The weather was that disgusting, people couldn't sleep and people felt ill all the time during the night and it was like not in the sense of 'I need help', but just oh God this is awful. Yeah. And then, you know, probably when you're, there's nothing worse than, when you're actually tired, not being able to get to sleep, is there really, it's, I mean they keep people awake as torture for a reason, don't they?"

(Sherwood resident, Man, Age 25 – 34)

Figure 3. Distribution of survey participants reporting negative effects of the 2022 heatwave on their mental health.

To what extent during mid-July 2022, if at all, did the hot weather have a negative effect on your mental health? (mental health in this instance refers to your psychological and emotional wellbeing)



As with physical health impacts, several participants reported that the extreme heat exacerbated their own existing mental ill health, that of family members or individuals they care for in a professional capacity. Conditions highlighted as particularly sensitive to the heat included Alzheimer's, low moods, and Post Traumatic Stress Disorder (PTSD).

"My daughter has post-traumatic stress disorder [....] and one of the things that triggers that is heat and cars [...] it was a case of getting in the car ten minutes early before we leave rather than just getting in and going, making sure it was cool first, two of us going on the school run, so my husband could stay in the car with the air con going and then getting them in the car, calming her down before she got in the car [...]. So that was a quite a big challenge to for her mental health....."

(Bestwood resident, Woman, Age 35 – 44)

Work

Many people struggled to keep cool at work due to broken, malfunctioning or inadequate fans and air conditioning systems. Professionals in health, social care and emergency services roles described challenging conditions in the workplace, often related to uniform. The heat made physical work more tiring, particularly for those with jobs requiring use of personal protective equipment (PPE) like masks, aprons, and gloves. Uniforms for specific jobs that require closed-toe shoes, thick fabrics, and stab vests were even less readily adaptable for comfort in the heat.

Workers in precarious jobs and zero hours contracts saw their work cancelled without pay when employers decided to take actions presumably aimed at avoiding exposure to heat-related risks in the workplace.

"....it did get too hot, and you had to use fans on the labour suite. [...] it was absolutely stifling and anywhere outside of labour suite because of the AC not working as well. Well, to be honest, it wasn't really working at all [...] people were delivering and very, very desperate to go home, to get out of the heat. It was stifling."

(Professional, Midwife)

30.8%

indicated that the 2022 heatwave negatively affected their ability to work or earn money

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PARTICIPANT:

"We had one day where we didn't go in because it was [too hot]. We got an email off the manager that morning saying it's going to be too hot, don't come in. And then another day where we started earlier..."

INTERVIEWER:

"And just out of interest, that day when you, when your boss told you not to come in, did you still get paid?"

PARTICIPANT:

"No, I'm on a zero hours contract."

(Hyson Green resident, Woman, Age 18 – 24)

"Lost a day's pay, work was closed and I'm zero hours."

(Forest Fields resident, Woman, Age over 55)

"Work was called off. My partner had to finish half a day loosing [sic] quite a lot of money too."

(Beechdale resident, Woman, 25 – 34)

The economic impacts of the heatwave were also reflected in the survey data where roughly 1 in 3 people (30.8%) indicated that the 2022 heatwave negatively affected their ability to work or earn money (Figure 4). When asked to describe how the heatwave affected them economically, people mentioned being unable to work due to health impacts of the heat and consequently losing income, losing days off work due to school closures, loss of custom among small business owners due to potential customers choosing to stay at home and not spending money, and increased spending on cooling (e.g., higher energy bills associated with running air-conditioning and fans for long periods).

"My husband is a van driver, [...] has no air con in the van. He had to come home because of that extreme heatwave as he felt like he was getting heatstroke. So, it effected [sic] his work pay which effects the whole house."

(Survey participant no. 16, Woman, Age 35 – 44)

Figure 4. Frequency of self-reported economic impacts of the 2022 heatwaves on Nottingham residents (online survey participants).

During mid-July 2022, to what extent, if at all, did the hot weather have a negative effect on you economically (i.e., affect your ability to work or earn money)?

69.2%
The heatwave had no negative effect on me at all economically

24.2%
The heatwave had a fairly small negative effect on me economically

6.6%
The heatwave had a very large effect on me economically

Total N = 500

Infrastructure

In our interviews, people discussed the negative impacts of the heatwave in terms of infrastructure, with most participants describing their home as difficult to keep cool during that period. According to their accounts, the type and style of house in which they lived, as well as factors such as the position of a flat within a building, direction it faced, and number of windows, moderated the impact of the heatwave.

"Yes, it has massive bay windows on the front and the sun rose through the front windows, so it heated up the front room and our, me and my partner's, bedroom all through the hottest part of the day. Then it caught the kids' bedroom with the back end of it on the other side. But yeah, it didn't, it didn't help. The massive windows were not a help for that."

(Basford resident, Man, 25 – 34)

"... I'm thinking back to the house that my partner's parents live in. It was, it was literally walking into a sauna and that is the old sixties, seventies build. One of the very sort of typical of Nottingham erm typical house. Yeah. So old social housing that's been bought, those sorts of things. That was, it was stifling, like you could barely breathe in in there whenever we were in the front room."

(Professional, Mental health nurse)

Several participants recounted experiences of negative impacts of the heat on transport infrastructure such as train cancellations disrupting their travel plans or riding on buses that were uncomfortably hot.

"...I just remember like my face was sweating and the air was just so thick and even though the windows were open, it wasn't making any kind of a difference and sometimes you just think in your mind like Oohh bus driver, can you please just drive and move so some kind of air was flowing through the bus."

(Sherwood resident, Woman, 25 – 34)

Adaptation and coping

"Like tin foil on the outside. So amazingly I did that for a little bit and that kind of worked. Although there was still stifling heat, I'm sure it blocked some of the heat coming in, but I ended up taping a load of that to the window. I'm sure it looked ridiculous, but it looked quite, it was quite effective at blocking any indirect heat coming in, I think."

(Sneinton resident, Man, Age 25 – 34)

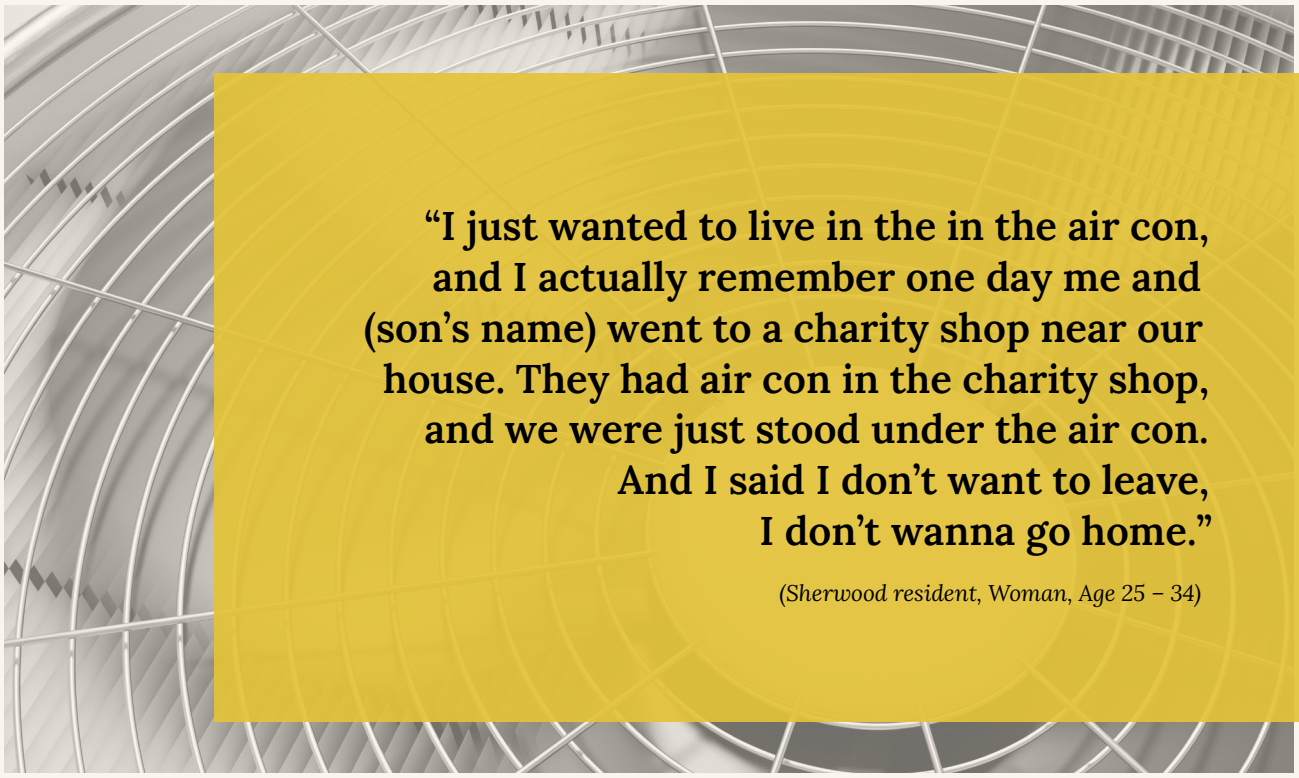
Physical adaptation strategies

Unsurprisingly, people tried various strategies to cope with the heat. At home, one of the most common strategies mentioned by participants was using fans and air conditioning units during the heatwave. Some tried covering windows with tinfoil after hearing about it on social media.

Many also mentioned wearing hats and/or sunscreen when outdoors and making purposeful efforts to spend more time in air-conditioned public spaces like cinemas and shopping centres. Other coping strategies mentioned include taking additional showers, staying hydrated, changing diets, wearing lighter clothing, closing windows and blinds to keep the heat out, and changing daily routines (e.g., getting up earlier or socialising later than usual).

"It was a bit horrible and you're having a lot more colder showers getting in from work. You have to peel off uniform, shower. You generally get up after sweating in the night and then shower again and then having a lot more showers through the day to sort yourself out really."

(Professional, Notts Police officer)



"I just wanted to live in the in the air con, and I actually remember one day me and (son's name) went to a charity shop near our house. They had air con in the charity shop, and we were just stood under the air con. And I said I don't want to leave, I don't wanna go home."

(Sherwood resident, Woman, Age 25 – 34)

"They made really good provisions at work for us. We were having people come round with drinks trolleys, not alcoholic. Yeah, we even had an ice cream van on site one afternoon and yeah everybody just, they gave everyone like you know, when you used to go to the club many years ago and they would give you that little token with the number on it like a raffle ticket and you just give it to the ice cream man and then yeah you, you claimed your free ice cream. So, you could have anything basically up to the value of three pounds ..... they took care of everybody a lot. It was good."

(Basford resident, Man, Age 35 – 44)

Workplace productivity was sustained by taking advantage of opportunities to work flexibly or work from home where possible. Some people simply took time off. Within office environments, key coping measures that people reported taking to minimise negative effects of the heat included deploying additional resources, adapting uniforms where possible and keeping hydrated with extra water, ice creams and ice lollies. Many participants praised the actions put in place by employers and managers during the heatwave to protect their staff members.

"My manager is very... she was very accommodating [...] and she was always like, you know, take breaks. There was lots of fans. They were very, very good about it."

(Hyson Green resident, Woman, Age 18 – 24)

"... We had an e-mail from work about like when we're supposed to wear tights with our dresses but we could choose to not wear tights and wear scrubs instead of our thicker uniforms in anticipation for how hot it was going to be."

(Professional, Midwife).

Information sources

In the interviews, people mentioned obtaining tips and tricks on how to mitigate the impacts of the hot weather predominantly from social media.

"...More from social media, I think, you know, there's little tips and tricks where it's, shut your blinds in the day and the windows because I think people did the opposite until people started reporting on it, you know, you fling everything open and then yeah, no, that's not working."

(Basford resident, Woman, Age 45 – 54)

Few interviewees had any recollections of receiving heat advice on official channels from the council or the national government. Those who did receive official guidance on keeping cool tended to have specific personal circumstances which would necessitate closer contact with the authorities, such as having adopted children, or working in a professional social care setting.

"On social media I didn't particularly see anything about it from the council or local authorities, [...] I thought for what I needed, I was given plenty of information, but I knew where to look for it in the first place."

(Bestwood resident, Woman, Age 35 – 44)

64%

found the advice they received to have been 'fairly' or 'very' useful.

Notably, there was some divergence between our interviewees and online survey participants on information sources commonly used during the 2022 heatwave. Among survey participants, we found that friends and colleagues were the most commonly reported source of health information during the heatwave, followed by television, and online and/or physical newspapers (Table 3). Survey participants indicated that they less frequently accessed health information from social media platforms, particularly TikTok, YouTube, and Twitter. It is possible that many people received information from friends and family via social media platforms, leading to a confounding of the two information sources. However, this overlap was not explicitly indicated in interviewees' accounts.

When we asked our online survey participants about specific organisations they received health-related advice from during mid-July 2022 (Table 4), the most indicated organisations were the NHS (38.6%), BBC (24.4%), and Met Office (18.8%). Most people (64%) found the advice they received to have been 'fairly' or 'very' useful.

Table 3. Sources of health information used by Nottingham residents (online survey participants) during the 2022 heatwave ranked in descending order of frequency of use.

How often did you access health-related advice and publicity from each of the following sources during mid-July 2022?

	Mean (SD)
Family, friends and/or colleagues	3.30 (1.10)
Television news and programmes	2.83 (1.13)
Online and/or physical newspapers	2.83 (1.24)
Radio news and programmes	2.49 (1.17)
Facebook	2.45 (1.36)
TikTok	2.02 (1.38)
YouTube	2.00 (1.28)
Twitter	1.91 (1.23)
Total N	500

Note: Responses to this question were recorded on a 5-point scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very often). Values presented in the table are average scores for each information source, with higher values representing greater frequency of access to information from the specified source.

Table 4. Organisations from which Nottingham residents remember receiving health-related information during the 2022 heatwave.

From which of the following organisations did you receive health-related advice and publicity during mid-July 2022?

	N	%
NHS	193	38.6
BBC	122	24.4
Met Office	94	18.8
Public Health England	28	5.6
Local Authority or Council	17	3.4
UK Health Security Agency (UKHSA)	8	1.6
Department of Health and Social Care	6	1.2
British Red Cross	4	0.8
Total N	500	100

Caring for others

Efforts made to look after others were also a key element of people's coping strategies during the heatwave. Interviewees described what they did to ensure the wellbeing of their pets, children, relatives and dependants, like purchasing cooling mats for pets, being extra vigilant to assist vulnerable people, encouraging elderly relatives to drink more water, and reminding people to take their medication.

"I got her [the dog] a blanket. It was like a cooling towel, like a cooling mat. She had extra water. She loves having a bath. So I brought her a little paddling pool, and she was in and out of that as and when she wanted to."

(Basford resident, Man, Age 35 – 44)

"So my mum is 76, 76 now so 75 then. ... she just, she'd moved home from her big house and moved into a flat..... it was very different, in her house. She had open doors at the back and you could go out in the garden or could just open the doors. Now she's in the flat that doesn't have a lot of windows [...] I ended up having to buy her a fan [....] because she wasn't coping well with it at all [...] I would take her bottles of water around, she doesn't like to drink the tap water. So, I would try and keep her hydrated as much as possible."

(Mapperley resident, Woman, Age 35 – 44)

"I spoke to school about what they were going to do about it, and they said, oh, you know, keeping them inside, which sounds like a wrong thing to do. [...] And I said what about, ice lollies and things like that? They said we haven't got the storage for them. I was like, can I buy you some and you give them out, and they said no, we just can't get them frozen. So, I ended up freezing just over a thousand ice lollies in three days in my freezer at home, putting as many as we could that were frozen into a bag, legging it to school and the school were giving them out across the classrooms for the three days that it was stupid temperatures. The kids thought it was fantastic for the ice lollies."

(Bestwood resident, Woman, Age 35 – 44)

People also talked about the concerns for the wellbeing of vulnerable people in the community, as well as things they did to support others and facilitate their coping.

"If you wandered around town, there wasn't drink stations or it's not, you know, other countries where you do get that. And I understand why we don't have it necessarily in this country, but at a time of crisis, if you want to call it that, there was nobody there with a Council little stall with drinks, handing them out, making sure that people, whether it be the homeless or the vulnerable or whatever, nobody was there doing anything to do with that."

(Basford resident, Woman, Age 45 – 54)

Coping evaluation

Across the study, most respondents broadly felt that they were able to cope well with the 2022 heatwave, despite highlighting the challenges and negative impacts they encountered. Most participants in the online survey (73%) reported that they coped 'fairly' or 'very' well (Table 5). Several interviewees described a 'grin and bear it' approach; describing how they felt able to cope with the heat by focusing on the fact that it would not last forever, while others acknowledged how they 'complained' frequently.

"It's just a case of, you know, it's gonna be uncomfortable for a couple of days and kind of like just make the best of it. And yeah, we will all feel groggy in the morning."

(Mapperley Park resident, Man, Age over 55)

"I think I coped okay with it, the only issue was the heat at nighttime when trying to get to sleep."

(City centre resident, Man, Age 35 – 44)

Table 5. Self-rated ability to cope with the impacts of the 2022 heatwave among survey participants.

During mid-July 2022, how well do you feel you were able to cope with the impacts of the hot weather?

	N	%
Not at all well	29	5.8
Not very well	105	21.0
Fairly well	284	56.8
Very well	81	16.2
Total N	500	100

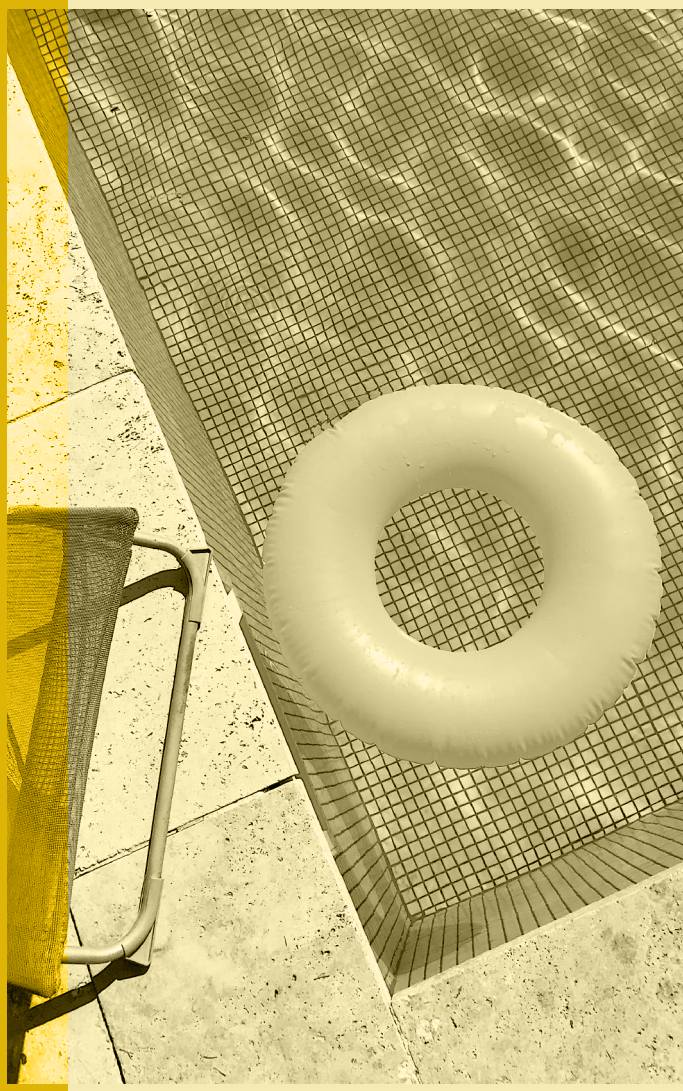
"As an adult, I coped relatively well. Like I wasn't on the floor like nooooo. But I probably was complaining a lot. You know when you're just like oh, it's so hot. [...] so I suppose I coped fine. I just complained a lot and couldn't wait for the day to end."

(Sherwood resident, Woman, 25 – 34)

Some participants who had spent significant time abroad; immigrated to the UK from, or had ancestral links to, countries with warmer climates described a greater resilience to the heat. They referenced knowing specific tips and tricks to cope better.

"We used to holiday in France. My grandparents spent their retirement money on a place in France and so that would regularly get over 30 degrees. So, there was a level that we've always been prepared for it. Like, I don't see 30 degrees somewhere and go, oh God, I'm gonna have an awful day. Yeah, but I go right, I've gotta prepare to stop myself being grumpy, like cold flannels and stuff like that...Swimming was always a really good one. Also siesta. So that was picked up from living in France. Like if you've got a hot day and sleep when you get to the hottest bit of the day [....], my friends noticed this as well. I was like the most prepared. I had the most ideas of things to do, shutting all the blinds and stuff like that"

(Sherwood resident, Man, Age 25 – 34)



Notably, cooling practices acquired from experiences in other geographical locations did not always translate effectively in the context of UK infrastructure. Some participants also described how they adapted or updated their understanding of effective practices for keeping their homes cool. For example, a participant narrated how she failed to cool her home effectively with practices she learned growing up in Vietnam, until her partner drew her attention to the fact that houses are designed to retain heat in the UK and required a different approach to cooling.

".....The houses in Vietnam, they're designed to let the heat out because it's really hot. But the houses here is (sic) designed to keep the heat in normally so it isn't as cold. Yes, I didn't know that. So, my boyfriend told me, erm, what we're going to do because these are the designs how it's supposed to be. So that's what you need to do to make the house cool because at the beginning, I thought oh I just need to open all the windows and I will be fine and then I leave it through the afternoon and I'm like, it's not really work, it got warmer."

(Mapperley resident, Woman, Age 25 – 34)

Some participants mentioned that their experiences, as well as adaptations they made, during the COVID pandemic made them better able to cope with the heatwave, specifically regarding familiarity with video-calling relatives and working from home. Furthermore, participants who described feeling prepared or organised for the heatwave also reported that they coped better.

"So during COVID, we were kind of prepped for it to be honest. Because during COVID what we did was we taught my parents, both of them, how to use Skype and FaceTime. So when it came to those summer nights when it was extremely hot, the kids were facetiming them. I was facetiming them. My sister, I've got a brother as well. We were all staying in touch with them."

(Basford resident, Man, Age 35 – 44)

Heatwave attributions

Climate change link

We asked participants in the interviews and online survey if they thought the 2022 heatwave was linked to climate change. Most participants made a connection between the heatwave and climate change (Figure 5). One interviewee reported that seeing the local park in an extremely dry state aggravated their low mood and feelings of climate anxiety.

"So do I [...] think there's a link between climate change and the heat wave? Yes. I think there's overwhelming evidence that global warming is happening, and I believe the more extremes we're seeing in terms of temperatures and weather is probably a direct link of us, of us messing up and messing up our ecosystems."

(Sneinton resident, Man, Age 25 – 34).

"The abiding memory is of the effect it had on the park because it was just baked and dry or getting on for being baked dry and had just lost its colour and it was quite alarming, but also not surprising and also a very, very real demonstration of if you like, just the way the world is coming at that point, you know, you're not look just looking at somewhere in Nottingham, you're looking at climate change."

(Basford resident, Man, Age over 55)

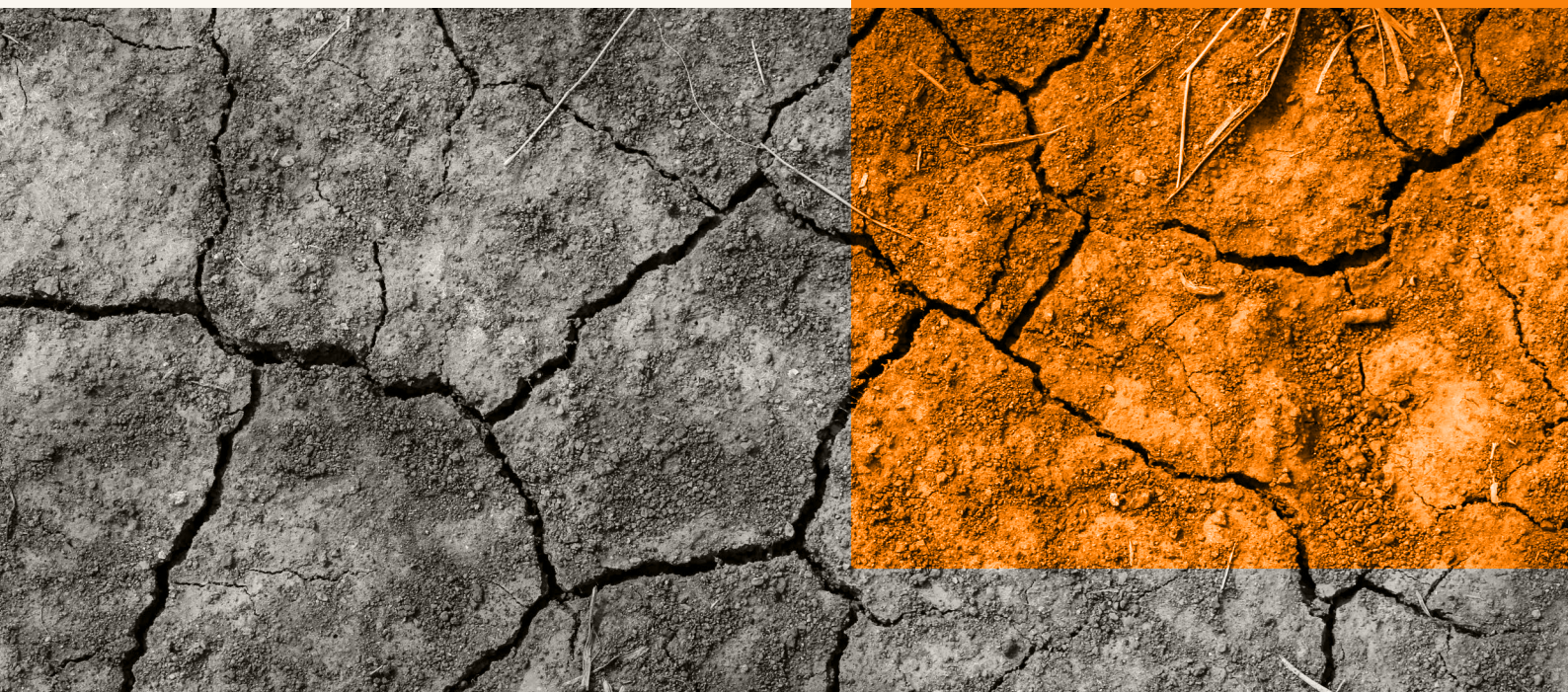


Figure 5. Distribution of survey respondents indicating agreement or disagreement with the notion that the 2022 heatwave was caused by climate change.

To what extent do you agree with the following statement about the heatwave that occurred in the UK in July 2022?

The heatwave was caused, in part, by climate change.

33.8%	39.4%	17.4%	6.0%	3.4%
Strongly agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**

Total N = 500

Climate change scepticism

A few participants commented that it is difficult to link one event to climate change although they accepted that increased heatwave probability was more reflective of an overall pattern of global warming.

Only a small minority outrightly rejected a link between climate change and the heatwave or were altogether sceptical about climate change.

"I think scientifically, you can't link one incident to climate change. You know what I mean. Climate change, I think, is the aggregation of everything that's happening. So yeah, I don't think you can say definitively the July heatwave was due to climate change, but it fits within a pattern of climate change overall, and I think it is more likely that we are going to see more extreme weather events as a result of climate change."

(Mapperley Park resident, Man, Age over 55)

Conclusions

The findings from this study provide insight into lived experiences of the summer 2022 heatwave among Nottingham residents. They offer a wide-ranging perspective on the many non-fatal and sub-clinical, yet significant ways, that the wellbeing and quality of life of people in Nottingham were affected by the heatwave. Importantly, our data on Nottingham residents' experiences of the 2022 heatwave tell a story that is not entirely limited to negative impacts and vulnerability. They also tell a story of resilience; of people responding to the heatwave adaptively and creatively, sharing vital information, and looking after one another.

Nottingham residents' lived experiences and perceptions of the 2022 heatwave were multi-faceted: typically comprising both positive and negative elements. In our interviews, it was common for a participant to begin their narrative with nostalgic recollections of taking time off work during the heatwave, spending time with family members, socialising with friends, or going on relaxing walks in nearby parks and woodlands. Further into the interview, the same participant would also recount their worries during the heatwave about vulnerable family members, experiences of discomfort caused by overheating, inability to concentrate or be productive at work, and constant tiredness due to sleep disruption.

> **Overall, people's evaluation of their subjective experience of the heatwave appeared to be shaped by factors like context (e.g., being at work versus being at home), duration (a couple of hot days versus protracted periods of high temperature), and temperature preference thresholds (some like it hot).**

Most of the heat-related impacts commonly reported by participants in this study, like sleep disruption, headaches, dehydration, low mood, irritability, demotivation, tiredness and lethargy; stress, feelings of isolation, anxiety, and worry, do not lend themselves readily to quantification. These impacts are not reflected in hospital admission or mortality statistics. Yet, they contributed significantly to lowering Nottingham residents' productivity, wellbeing, and quality of life during the 2022 heatwave. Furthermore, these impacts were not evenly distributed across different segments of the community. People with pre-existing conditions like asthma and diabetes, as well as menopausal or other hormone-related symptoms suffered more severe impacts.

> **Factors like the type of jobs people had, whether they were able to work from home, whether they were able to take paid time off work, the type of housing they lived in, all contributed significantly to the magnitude of impacts people experienced and how well they were able to cope during the heatwave.**

Many of our interviewees employed in the health, social care professions, and emergency services recounted experiences of increased public demand for health services, as well as difficulties with operating effectively during the heatwave. The impacts experienced by the vast majority if Nottingham residents we engaged in this study did not require formal medical care or attendance by the emergency services. However, this does not mean that our participants' reported experiences of the 2022 heatwave contradict the expectation of an increased demand for health and social care during periods of extreme heat. Rather, it points at a potential blind spot in our data. Approximately two-thirds of people we interviewed had completed a university degree; representation of older individuals, and people from ethnic minority backgrounds in our survey

is below their distribution in the Nottingham population. There is a strong likelihood that our sample is skewed toward people who might be more insulated from the worst impacts of the heatwave by their socioeconomic status.

> **Considering the limited representation of the most vulnerable groups in this study, participants' accounts of their lived experiences can be seen as only a tip of the iceberg compared with the full reality of the wellbeing impacts of the 2022 heatwave on people in Nottingham.**

Media coverage of hot weather in the UK is often polarised; ranging from sunny depictions of people cooling off by the seaside at one end (e.g., Powell, 2022) to fraught reporting of heat-related deaths and morbidity at the other (Thomas & Goodier, 2022; Bawden, 2023). This trend has prompted vexed responses in academic and policy circles (e.g., O'Neill, 2019; O'Neill et al., 2023), where the public health, social, and infrastructural risks associated with hot weather and climate change are a strong focus. Uncritical representations of heatwave experiences as mere 'fun in the sun' are undoubtedly problematic, but care must be taken not to over-correct with narratives that focus entirely on risk and vulnerability, as these could alienate the public. Negative impacts are only a fraction of the overall experiences that people have during heatwaves.

Across the contexts of home and work, adaptations made during the COVID pandemic were seen by many participants as significant facilitators of coping and adaptation during the 2022 heatwave. Based on the current data, we would suggest that a potentially fruitful direction for heatwave adaptation planning in Nottingham should include a review of living and working adaptations made by residents and organisations during the COVID pandemic, to identify arrangements that can be harnessed for mitigating future negative impacts from heatwaves and other extreme weather. For example, flexible workplace polices and working arrangements were identified as beneficial by many participants. Policies around paid time off work and/or mechanisms of financial support during periods of extreme heat would also mitigate disproportionate negative impacts on economically disadvantaged individuals (e.g., self-employed, precariously employed, and low-income earners).

Across the data, we saw evidence that many people's responses to the heatwave conveyed a strong sense of community and neighbourliness. People reported being extra vigilant about vulnerable people in their surroundings, taking steps to protect pets, children, and vulnerable adults. There is robust evidence for the role of mutual support and social networks as health-protective resources (Drageset, 2021; Yang et al., 2022). Adaptation planning for future heatwaves in Nottingham needs to prioritise strengthening community- and organisational-level resources for mutual support, especially when heatwaves are addressed within the context of policies like the CN28.

We recommend working with community members and community-based organisations to develop informational resources that help people in the community recognise, and provide effective support, when others around them are experiencing severe heat-related impacts on their wellbeing.

In an illustration of how practices 'travel' across geographic and cultural contexts (Maller & Strengers, 2013), we observed that people's experiences with cooling practices abroad contributed, in some instances, to helping them cope more effectively with the 2022 heatwave in Nottingham. However, it should not be taken for granted that knowledge of cooling and heat protection practices acquired in other geographic contexts will invariably make people less vulnerable to heat-related impacts in the UK. The effectiveness of such knowledge resources can be strongly dependent on how similar or dissimilar the origins of these practices are to the UK in terms of infrastructure. **Factors like differences in the design of buildings, or whether working practices allow people to take siesta or go for a swim during the hottest part of the day, are important considerations. It cannot simply be assumed that people with heritage links to hot countries, for instance, will automatically show greater resilience to heat in the UK.**

There is a great deal of focus on best practices for communication to help people respond more adaptively to heatwaves in the UK, although the existing evidence-base is scant (McLoughlin et al., 2023). Notably, there were little to no spontaneous references to official information sources when our research participants were describing their experiences of the 2022 heatwave. Friends, family, and colleagues, as well as social media, appeared to be the most common/salient sources of information regarding effective cooling and heat protection behaviours. Overall, most people felt that the information they received was useful even though some remarked that they only found relevant information because they knew where to look. We are unable to establish from the current data if relevant information necessarily reached the most vulnerable groups of people.

Participants advocated for provision of heat and health-related information in multiple languages and targeted delivery through local channels like community centres and local news and radio.

In previous research, factors like heat-related attitudes have been commonly addressed as important determinants of heat-related health protective behaviours (Lefevre et al. 2015; Erens et al., 2021; McLoughlin et al., 2023). Here, individual attitudes seemed to mostly play a role in determining people's preparedness for the heatwave; and people with greater preparedness for the heatwave generally coped better. However, structural factors, like housing type and employment status, came through more strongly in participants' accounts as having an important role in determining impacts, vulnerability, and capacity to cope during the heatwave.

Most participants in our interviews and online survey recognised that the 2022 heatwave was linked to climate change. This could prove valuable in at least two ways. Firstly, it could be leveraged to promote better preparedness for future heatwaves among Nottingham communities and organisations. In our data, we observed that people who prepared for the 2022 heatwave, either because they received advance warning or because could draw on previous experience, generally coped better. Given scientific projections for a higher likelihood and intensity of future heatwaves in the UK, recognising the role of climate change as a driver of heatwaves can help people shift from reacting to heatwaves when they are already occurring to incorporating heatwave preparedness into their long-term planning.

Secondly, public recognition of the link between heatwaves and climate change could be leveraged to curb escalation of unsustainable coping strategies like increased use of air-conditioning. For example, prior research shows that flood victims who explicitly attribute their flooding experience to climate change also show stronger support for climate policies and greater willingness on engage in pro-environmental actions (Ogunbode et al., 2019). Many respondents in this study indicated that they used air-conditioning during the 2022 heatwave as a coping strategy or reported intentions to acquire air-conditioning facilities as a way of coping with future heatwaves. Widespread use of air-conditioning during hot periods would place an unsustainable demand on UK energy infrastructure, increase carbon emissions, and contribute to further worsening of the climate crisis.

To combat of air-conditioning use, we recommend strengthening communications around how people can help themselves and/or others in the community during extreme heat events. Advice with health and wellbeing co-benefits such as drinking water, consuming fruits and vegetables to stay hydrated, and cooling down by visiting green or blue spaces could be promoted.

As with any research study, this one is not without limitations. The data collection was conducted approximately eight to ten months after the peak of the heatwave in July 2022. Therefore, we were dependent on participants' ability to accurately recall their experiences during the heatwave period. To address potential biases and gaps in participants' recollections, we encouraged them at the start of interviews

to review any images they had recorded on their phones or mobile devices during mid-July 2022 and describe their most salient memory from that period. Furthermore, our confidence in the accuracy of findings from this study is bolstered by the consistency with findings from a national study of people's experiences during the 2022 heatwave conducted by researchers at the University of Bath (Bawden, 2023), where data was gathered closer to the time of the heatwave occurring.

A second key limitation of the study relates to a lack of representativeness, particularly with respect to ethnic minorities and vulnerable groups within Nottingham communities such as people experiencing homelessness or those with a history of substance dependence. Ethnic minorities are potentially subject to elevated risks of adverse heat-related impacts, but there is insufficient primary data at local and national level to fully assess the nature and magnitude of these risks. Our capacity to explicitly target vulnerable groups when recruiting participants for this study was limited by the available funding. However, we advocate that pursuing a better understanding of how heatwaves are experienced by groups in Nottingham communities that are likely to suffer the worst impacts needs to be a top priority for future research. Relevant groups that were not addressed in this study include the demographics encompassed by inclusion health groups (e.g., people experiencing homelessness, those with substance dependence, Gypsy and Traveller communities, vulnerable migrants or refugees). These groups of people typically face multiple overlapping health risk factors and may have been most likely to experience severe negative impacts requiring institutional care during the heatwave.

Irrespective of the limitations, this study provides valuable insights into how the 2022 heatwave was subjectively experienced by people in Nottingham. It captures the range of physical, mental, and economic impacts that Nottingham residents endured during the heatwave, as well as how people coped with these impacts. Importantly, the study also provides a baseline upon which future research can build to support effective adaptation and strengthen community resilience to projected climate change impacts in the area.

We need narratives of heatwaves that chime with people's holistic experiences, especially stories that also represent and champion the diverse ways that our communities are showing resilience in the face of extreme weather and climate change.

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