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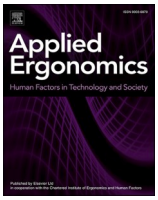

Exploring the nature of adaptive capacity for resilience in healthcare across different healthcare contexts; a metasynthesis of narratives

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ABSTRACT

Adaptive capacity has been described as instrumental for the development of resilience in healthcare. Yet, our theoretical understanding of adaptive capacity remains relatively underdeveloped. This research therefore aims at developing a new understanding of the nature of adaptive capacity by exploring the following research questions: 1. What constitutes adaptive capacity across different healthcare contexts? and 2. What type of enabling factors support adaptive capacity across different healthcare contexts? The study used a novel combination of qualitative methods featuring a metasynthesis of narratives based on empirical research to contribute understanding of adaptive capacity across different healthcare contexts. The findings show that adaptive capacity was found to include four forms: reframing, aligning, coping, and innovating. A framework illustrating the relatedness between the identified forms, in terms of resources, change and enablers, is provided. Based on these findings, a new definition of adaptive capacity for resilience in healthcare is proposed.

1. Introduction

Resilience in healthcare has been a priority topic for almost a decade, and there is broad consensus among scholars that resilience of healthcare systems needs to be strengthened (Blanchet et al., 2017). A system's capacity to adapt has been described as a foundation for the development of resilience in the healthcare sector (Anderson et al., 2020; Wiig et al., 2020; Aase et al., 2020) but, despite the instrumental role of adaptive capacity in developing resilience, the nature and enablers of adaptive capacity have yet to be fully understood. Adaptive capacity is described in safety environmental studies as "the ability of systems and individuals to adjust to potential damage, to take advantage of opportunities, or to cope with the consequences" (Shirali et al., 2012, p. 84). However, in a study of disaster resilience, Parsons et al. (2016) divide coping abilities from adaptive capabilities, where coping capabilities refers to the use of existing resources, skills, and opportunities to keep up operations and adaptive abilities refers to adjustments through learning, adaptation, and transformation to ensure resilient performance. For the resilience in healthcare field a new definition of adaptive capacity is needed to combine different understandings stemming from different domains.

In healthcare, adaptations are often found to be of an unofficial and informal character, both because they often cannot be easily specified and described in advance, and because the healthcare system tends to privilege rationalized models of clinical work which rarely acknowledge the need for ongoing adaptation (Perry and Wears, 2012). However, in order to successfully facilitate resilience in healthcare systems, it is crucial to understand the adaptive capacity of the organization (Nemeth, 2012). Moreover, resilience and adaptive capacity are not restricted to the organisational front-line, and therefore also offers a useful lens for understanding quality improvements at all healthcare levels, including micro, meso, and macro-level (Anderson et al., 2020; Øyri et al., 2020).

Several calls for future research have been raised by researchers to deepen our understanding of adaptive capacity for resilience in healthcare. In particular, new studies are needed that explore adaptive capacity across different levels (micro, meso, and macro) and across different healthcare settings, studies that develop new methodologies to understand adaptive capacity, and studies that develop new frameworks for describing the factors that underpin adaptive capacity (Anderson et al., 2020; Berg et al., 2018; Ellis et al., 2019; Iflaifel et al., 2020).

Abbreviations: RiH, Resilience in Healthcare; SHARE, Centre for Resilience in Healthcare in Norway.

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Furthermore, there is, to date, also a lack of understanding of resilience and adaptive capacity in relation to quality of care (Anderson et al., 2020).

The aim of this research is therefore to contribute to new understanding of adaptive capacity for resilience in healthcare by exploring the following research questions: 1. What constitutes adaptive capacity across different healthcare contexts, and 2., What type of enabling factors support adaptive capacity across different healthcare contexts?

2. Research method

2.1. Design and sample selection

This paper is part of the Resilience in Healthcare (RiH) research programme which applies a collaborative interactive research design aiming to develop a comprehensive RiH framework, including theoretical and practical outcomes (2018–2023) (for more details see Aase et al. (2020)). The RiH research programme consists of two main phases – an explorative phase and an intervention phase, where this paper reports from the exploratory phase (Aase et al., 2020, p. 4–5).

In this exploratory part of the study, data from multiple empirical healthcare contexts and levels (micro, meso, macro) are used. The data is sampled from a number of former and ongoing research projects involving researchers from the Centre for Resilience in Healthcare in Norway. The selection process for included projects, involved screening a total of 50 research projects (research projects, post-doctoral projects, and PhD projects) in accordance with an established screening protocol (Aase et al., 2020) and a Quality and Resilience Trigger Tool (Aase et al., 2020). The screening process was used to establish the extent to which the projects related to resilience and healthcare quality.

The screening process resulted in a sample of 25 projects for inclusion, all of which stemmed from a diverse range of different empirical healthcare settings (e.g. homecare, nursing homes, hospital, prehospital critical care), stakeholders (e.g. next of kin, patients, users, healthcare professionals, managers, regulators), quality dimensions (patient safety, clinical effectiveness, patient centredness, coordination), and levels (individual, team, unit, organisational, larger system) (Aase et al., 2020, p. 5). The screening for appropriate projects was performed and agreed upon by all authors involved in this study. In order to ensure that the written materials of the projects had produced empirical results (published articles, PhD thesis, book chapters, project reports) that could be used as data material for the analysis, the 25 projects were subjected to a secondary selection process, where 14 out of 25 projects were deemed fit for further analysis (see overview of the 14 included projects in Attachment 1).

2.2. Data collection

The 14 research projects included in this article covers 22 published articles and book chapters and 6 PhD theses (each thesis includes 3–5 articles and a synopsis). For full details of included projects, see Attachment 1. The text produced in the publications comprise our data and was collected from the journal web sites, databases, or from the publicly available database over Norwegian PhD thesis. The data collection took place from February 2020–September 2020.

2.3. Data analysis

The analytical process consisted of two parts, performed in sequence. The first part constituted a metasynthesis of narratives, narrative inquiry methodology, from the 14 projects. All narratives were developed in pairs of researchers, in accordance with a predefined template. All researchers studied the articles or PhD thesis and further developed a narrative that covered the following dimensions based on Macrae & Wiig (2019).

Defining the phenomena of resilience (approximately 150–200 words on each question):

- Resilience for what: what type of goals and objectives are resilience supporting?
- Resilience to what: what were the triggers to resilience?
- Resilience of what: what materials and resources facilitate resilience?
- Resilience through what: what type of mechanisms, activities and interactions enact resilience?

Furthermore, the narratives included detailed descriptions of the respective healthcare settings, system levels, stakeholders involved, professions, and contextual conditions of where the projects took place. Each narrative resulted in 4-7 pages for each project, making for a data set of a total of 70 pages. As such, the narrative inquiry methodology allowed for a synthesis of a comprehensive dataset, giving emphasis to contextual factors (Lal et al., 2012; Sandelowski and Barroso, 2006).

The second analytical part included an inductive analysis in accordance with grounded theory as described by Gioia et al. (2013). The initial coding, comprising the 1st order concepts, consisted of concepts emerging directly from the data. These initial 1st order concepts were further aggregated into 2nd order themes and 3rd dimensions, where the aggregation process included informing theory and abstraction. First-order codes were coded by the first author. Even though two or more coders have been found valuable for measuring inter-related reliability in various qualitative analysis (Miles and Huberman, 1994), it is of less value in grounded theory analysis (Ryan and Bernard, 2000). This is due to the inductive process of letting codes emerge from the data in the first round of coding. Armstrong, Gosling, Weinman, and Marteau (1997) found that grounded theory researchers name first-order codes differently, thereby producing low inter-related reliability, but a clear consensus of thematic meaning was still found between the researchers. Validity in grounded theory therefore relies on the researchers agreeing on the higher-order meanings and abstractions that are built on first-order codes. As such, to support this generation of higher-order intersubjective meaning, all authors met regularly to agree on concepts, themes, and dimensions and to discuss the aggregation process for this study.

The inductive analysis (no predefined codes from theory) was performed in the following steps: Firstly, 1st order codes inductively emerged directly from the data, in total 296 different 1st order codes. In addressing RQ1, 12 different 1st order codes (adapting practices, practice flexibility, self-organization, aligning interests, aligning to patient needs, aligning to target context, balancing demands from different stakeholders, negotiating interests, coping with external demands, handling the unexpected, innovative solutions, improvising), totalling 189 instances, were found related to adaptive capacity and further aggregated into the following 2nd order themes: *Reframing* practices, *Aligning* different interests, *Coping* with demands, and *Innovating* which describe the nature of adaptive capacity across healthcare contexts. The 2nd order theme *Reframing* included 1st order concepts like *adapting practices, practice flexibility, and self-organization*. *Aligning* included the following 1st order concepts; *aligning interests, aligning to patient needs, aligning to target context, balancing demands from different stakeholders, and negotiating interests*. *Coping* included 1st order concepts: *coping with external demands and handling the unexpected*. The *Innovating* theme included *improvisation and innovative solutions*. The distribution of instances across these 2nd order themes was found to differ; *Reframing* accounted for 78 instances in the dataset, *Aligning* accounted for 56 instances in the dataset, *Coping* accounted for 47 instances, and *Innovating* was found at 8 instances, making up a total of 189 instances of the 3rd order adaptive capacity dimensions. Fig. 1 illustrates the inductive data analysis and the aggregation process.

Having identified the themes constituting adaptive capacity across different healthcare contexts, focus was shifted towards the identification of factors acting as enablers for adaptive capacity. In addressing

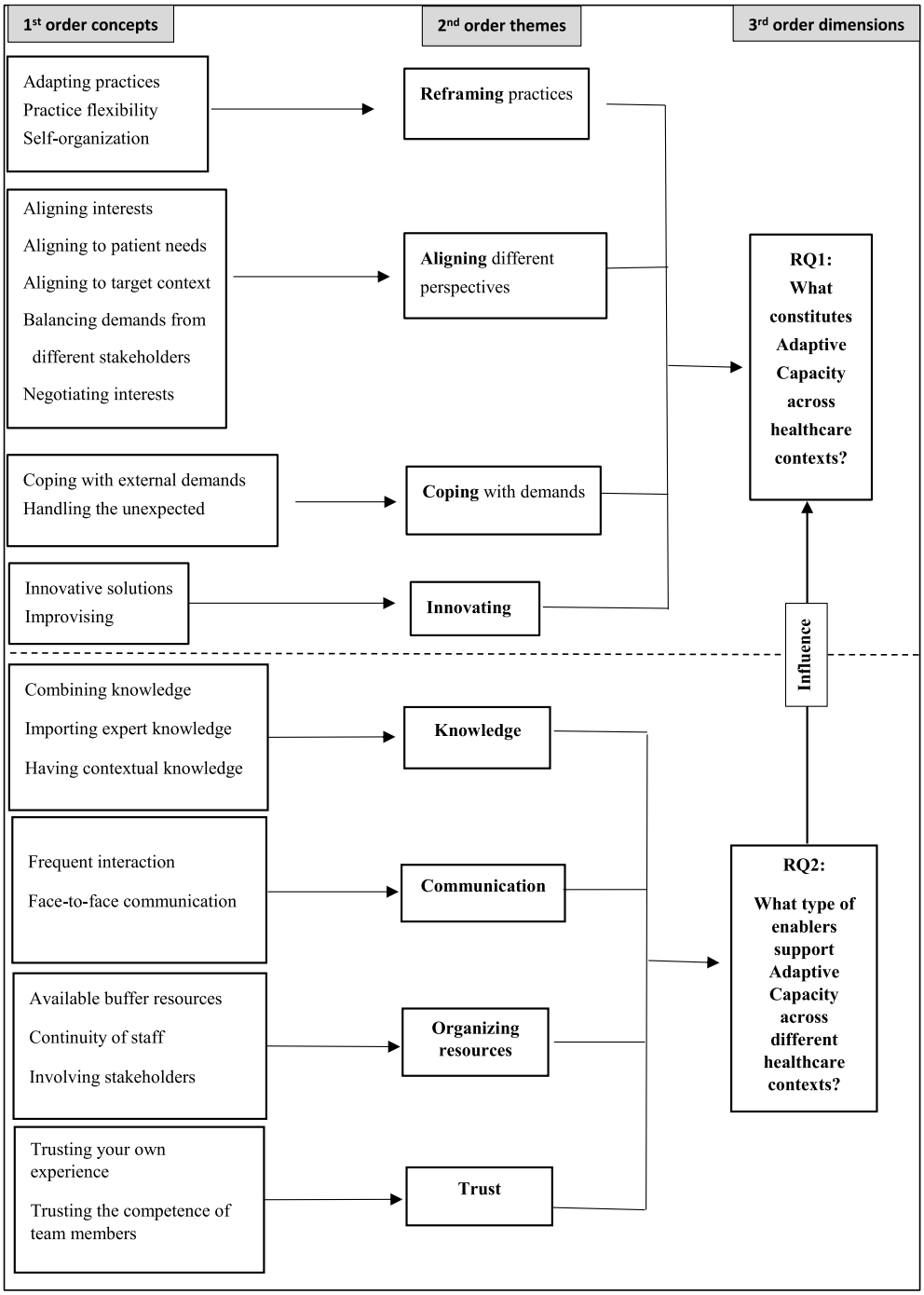

Fig. 1. Data structure model based on the Gioia et al. (2013) framework.

RQ2, with the aim of identifying types of enablers for adaptive capacity, a second inductive process was introduced of re-coding all content within the 2nd order themes constituting the adaptive capacity dimension, see Fig. 1. Even though the second analysis searched for enabling factors, there were no preset concepts of what these enablers would be like, hence an inductive coding approach was needed. 1st order concepts *Combining knowledge, Importing expert knowledge, and Having contextual knowledge* formed the *Knowledge* 2nd order theme. *Frequent interaction and Face-to-face communication* made up the *Communication* theme. The 2nd order theme *Organizing resources* included the 1st order concepts: *Available buffer resources, Continuity of staff and the Involvement of stakeholders*. And finally, the 2nd order theme *Trust* was formed based on the following 1st order concepts: *Trusting your own experience* and by *Trusting the competence of team members*. The definitions described in the result section of the different 3rd order adaptive capacity dimensions and enabling factors are formed based on the empirical content, the literature, and dictionary definitions after the inductive analysis was completed.

3. Theory

Scholars have used a variety of concepts for describing adaptive capacity, where adaptations have been described to encompass activities like self-organization, reconciliation of conflicting goals, the re-evaluation of priorities, innovation and coping with external demands (Foster et al., 2019; Reiman et al., 2015). Hale and Borys (2013)

furthermore describe the tacit acceptance of rule violation and the stretching of boundaries as adaptative acts for safety performance. Woods and Wreathall (2008) distinguish two types of adaptive capacity: 1st order and 2nd order adaptive capacity. First-order adaptive capacity is when existing and predetermined planning and capabilities are used to restore normal operation. Second-order adaptive capacity refers to situations where the organization needs to develop new solutions and capabilities in response to demands outside their predetermined planning.

Other approaches have taken a process view. Frick, Fletcher, Ramsay, and Bedwell (2018) describe adaptations in teams as a process consisting of four phases: recognize, reframe, respond, and reflect. These concepts share similarities with Hollnagel's (2018) broader model that defines four potentials of resilient performance: anticipate, monitor, respond, and learn, and the interconnections between these concepts is instructive. In Frick et al.'s (2018) first 'recognize' phase the team members use cues and information from internal and external sources to identify a change in need of adaptation. This aligns with the anticipation potential described by Hollnagel (2018), focusing on identifying a risk, signal, or disruption.

In the second phase, 'reframe', team members change their cognitive approach towards the present situation and start to prepare for a response. It is during this second phase that an adaptative response is developed. The third phase, 'respond', is when the planned response is put into action (Frick et al., 2018; Hollnagel, 2018). Without the reframing phase, the resulting response will strictly follow existing and predetermined plans—which is what Woods and Wreathall (2008) define as first-order adaptive capacity. However, if the response results from reframing, it will be a second-order adaptation and introduce novelty to the situation. As such, in this model the reframing phase is the heart of the adaptative process. Finally, the 'reflect' phase allows for reflections of the outcome of the adaptation, and thereby a process of learning from what took place. This is in line with the learning described as a resilience potential by Hollnagel (2018). However, even though adaptive capacity is often described by dividing the performance and process into components, the various phases are integrated and should not be considered in isolation (Hollnagel, 2018).

Adaptive capacity in healthcare has also been explained in terms of the capacity to absorb, adapt, and transform in response to shocks and crises, while still being in control and able to function (Blanchet et al., 2017). According to Blanchet et al. (2017) absorbing refers to the health system's capacity to deliver the same level of care to the patients with the same level of resources. Such absorbing capacity is present in situations where both the level of change and the impact of the crisis is low. When the impact level and the level of change are raised to a medium level in a crisis, the health care system needs to perform services with fewer and different types of resources, thus making it necessary for the organization to adapt their practices and processes. If the level of change and impact of the crisis continues to increase, the system must rely on its transformative capacity. This refers to the ability to transform functions and structures, which are highly intrusive organizational changes. As such, the intensity of the crisis and the level of change needed provides a hierarchy for adaptive behaviour in healthcare organizations.

A final central aspect of adaptive capacity includes improvisation and creative solutions to cope with demands. Some of these may be short cuts and improvisation due to a lack of relevant procedures, malfunctioning procedures, ignorance, or because work arounds are more effective. Others can take the form of new and innovative processes, practices, organization of resources, and products (Foster et al., 2019). Innovative solutions may be formed on the basis of demand 'pull', where present and unsolved needs drive the innovation development (such as developing a vaccine to combat a global pandemic), or by a technology 'push', where existing technology can be used for solving new problems (like using telecare and GPS technology in homecare) (Di Stefano, Gambardella and Verona, 2012). However, for new solutions to be successfully integrated into an organization, they need to fit the contextual needs of the users.

Resilience in healthcare is not the only theoretical approach that highlights adaptations in complex socio-technical systems to ensure quality and patient safety (Holden et al., 2013; Odberg, 2020; Scanlon and Karsh, 2010; Wilson, 2014). Adaptations also hold a prominent role in the human factors engineering/ergonomics literature. In a human factors framework (SEIPS) by Holden et al. (2013) adaptations are described as being either anticipated or unanticipated, short-term or long-term, and intermittent or regular. The different adaptations are seen as efforts to reduce the gap between work as imagined and work as done, which is a similar perspective of adaptations as that found in the resilience in healthcare literature (Anderson et al., 2020; Fairbanks et al., 2014; Holden et al., 2013; Hollnagel, 2014; C. Nemeth, Wears, Woods, Hollnagel and Cook, 2011; Odberg, 2020). However, as adaptive capacity for resilience in healthcare is an under-researched area, this study is grounded in the resilience literature even though our findings share strong connections to the ergonomics literature (Anderson et al., 2020; Berg et al., 2018; Ellis et al., 2019; Hassall et al., 2014; Iflaifel et al., 2020).

4. Results

Adaptive capacity across different healthcare contexts was found to take the following forms: *Reframing* practices, *Aligning* different perspectives, *Coping* with demands, and *Innovating*. Enablers for adaptive capacity across healthcare contexts were found to be: knowledge, communication, organizing resources, and trust.

4.1. Describing adaptive capacity

4.1.1. Reframing

Reframing can be defined as efforts to change the way something is expressed, considered, or performed, thereby resulting in a transformation of perspectives and procedures. Reframing was found to be the most frequent tactic for handling variability and complexity across all healthcare contexts (78 instances), a finding which emphasizes the practice-focused nature of adaptive capacity. This was found to include the following 1st order concepts; *Adaptation of practices, Practice flexibility, and Self-organization*.

Adaptation of practices included situations where practices needed to be adapted to the situation and thus contribute to a better fit between practices and the situation at hand. This is exemplified in the dataset in a situation where managers in nursing homes adapted to external needs (requests from next-of-kin to buy new furniture for one department) by relocating financial resources across departments. By doing so managers improved quality within their department without having to wait for new budgets. Furthermore, using available resources across different departments was a way of optimizing the use of resources and the quality for the overall system (example from project 3, see Attachment 1).

Secondly, the reframing of practices also relied on *flexibility* within the system to be successful. Healthcare professionals were found to be in a constant need of prioritizing the urgency of various work tasks. Flexibility within the system therefore allowed healthcare professionals to adjust their practices to the severity of the different situations. This was demonstrated in peak situations, where the staff had to prioritize medication administration to those patients needing it most, while stable patients received less attention (example from project 14).

And third, if present practices and guidelines were inappropriate to solve the situational challenge, healthcare professionals *self-organized* in order to ensure quality care for patients. An example from a mental health ward, illustrates how healthcare professionals did their outmost to ensure a feeling of safety for the patient, where a patient managed to gradually improve through treatment by using sedatives during acute phases and the presence of healthcare professionals who stayed with her in the bathroom in the dark, as this made her feel safe because no one

could find her. Staying in a dark bathroom with the patient is not a treatment described in any guidelines, but a tactic found helpful for this particular patient, and a situation where healthcare professionals self-organized to make it happen (example from project 8).

Reframing practices included both *adjustments* (1/3 of the instances), which referred to short-term and minor alterations of existing practices (e.g. taking on extra responsibilities, re-prioritizing in peak situations), and *re-organization* (2/3 of the instances), which referred to more radical and/or long-term solutions (e. g. organizing for flexibility in the system so that healthcare professionals could step aside from forms and checklists and use their competence when forming decisions).

4.1.2. Aligning

Aligning refers to efforts to converge views, meanings, and practices to form a shared outcome. Aligning accounted for 56 instances within the dataset. Healthcare professionals at both the micro - level (nurses and physicians) and the meso-level (managers) often found themselves subject to pressure from different stakeholders, and in need of *negotiating different interests* to arrive at decisions. This can be exemplified in a radiology context, where pressure from different stakeholders resulted in different agendas among the actors involved, leading to a lack of compliance with the macro-level guidelines of reducing the number of referrals. The radiologists felt under pressure to quickly complete assessments of their numerous referrals, while GPs often experienced a lack of time to properly relay information and to discuss with their patients during consultations, and instead ended up making excessive referrals (example from project 11).

Different stakeholders, like patients, next-of-kin, physicians, nurses, often possessed different perspectives of the situation and the way forward. Accordingly, to obtain a holistic understanding of the situation, it was advantageous to bring all the different voices to the table. This was evident in regulatory investigations of adverse events, where the inclusion of the voices and perspectives of next-of-kin were key when seeking information and understanding of the event. Next-of-kin, through their familiarity of the patient, could offer insights not documented in health records and thereby provide new understanding for the regulatory investigation (example from project 2).

This advocacy between patients, next-of-kin, and different healthcare professionals, to *balance the demands of the stakeholders*, was found more of a challenge for unexperienced actors, who found themselves more often inclined to give in for the stakeholders' requests. This can be exemplified by a GP who wanted to keep an old patient at the nursing home for palliative care. But after extreme pressure from the next-of-kin, the inexperienced GP gave in to the pressure. The patient was placed in an ambulance and sadly passed away during the transport to the hospital (example from project 10).

Healthcare professionals also needed to *align their practices to the specific patient's need and to the context*. In addition to the different interests of the actors involved, availability of resources was found as a contributing factor for physicians when forming their decisions. For example, if rooms were available on the ward, and the patient was anxious to leave the hospital, then physicians were more permissive to prolong the hospital stay for the patient. This indicates a trade-off in prioritizing between a finite amount of resources or the needs of the patient, and the context. (example from project 10).

4.1.3. Coping

Coping can be defined as "the fact of dealing successfully with problems or difficult situations" (Cambridge Online Dictionary, 2022). Coping was found to include 47 instances in the data. Organizations, teams, managers, and individuals providing health care services are all subject to demands from both external and internal sources. Internal demands were found to be associated with a lack of resources, such as the lack of staff or requisite competence. The ability to *cope with unexpected challenges* can be exemplified at a rural maternity ward where a particular situation requiring a higher level of competence, than what the ward was set up for, took place. The guidelines, from the macro-level, was to transfer patients with health-related issues to the more advanced maternity ward at the city hospital. However, when the patient arrived at the rural maternity ward, short-winded with heavy asthma and allergies, there was no time for transfer, and healthcare professionals had to adapt and cope with the unexpected situation at hand (example from project 1).

Budget cuts and regulatory demands from the municipality and national health authorities formed *external demands that triggered adaptations*. For managers, having responsibilities for ensuring compliance with external demands, this required the development and implementation of new work practices, in order to cope with the demands. However, external demands did not only introduce strains at the sharp-end. If the regulations and guidelines included specified applications in accordance with the target context, healthcare professionals coped by using the regulations to advocate their situation to actors at the macro-level, in charge of their budget (example from project 3).

4.1.4. Innovating

Innovation is defined as something that is perceived as "new by a proportion of key stakeholders" (Hartley, 2005, p. 27, p. 27). *Innovative solutions* were scarce within this dataset, and only accounted for 8 instances. This does not mean that there was a lack of ideas and reframed practices which possessed a potential as input for innovations, but rather a situation where resources were not allocated to the process of developing innovations.

Innovative solutions can be exemplified with a surgeon who developed a procedure for ensuring quality and patient safety. The innovative solution included the use of a hollow pen to mark the needle entrance in order to ensure that if a swelling occurred the mark was still going to be visible. Instead of the surgeon having to "feel" his way to the artery, the access was now marked and easily identifiable. This innovative procedure could very well be developed into a product innovation, instead of using a hollow pen (example from project 6).

In situations where formal guidelines and procedures did not provide the sufficient support to ensure high quality care, healthcare professionals needed to *improvise* in their practices. This was exemplified at a mental health ward, where healthcare professionals improvised care to the patients' needs and the given situation, instead of strictly conforming to formal guidelines (example from project 8).

4.2. Enablers for adaptive capacity

Addressing the second research question of identifying enablers supporting adaptive capacity across different healthcare contexts, resulted in four 2nd order themes (*knowledge*, *communication, organizing resources* and *trust*).

4.2.1. Knowledge

Knowledge was found to act as a key enabler for adaptive capacity. Knowledge refers in our study to information that is infused with human values, experiences, insight, consequences, comparisons, and prior knowledge (Davenport and Prusak, 1998). In particular, three types of knowledge were valuable as enablers across healthcare contexts in this dataset. Firstly, *contextual knowledge*, which relates to knowledge based on practical and local experiences in particular healthcare settings, provided an ability to coordinate practices in a good way. As such, healthcare professionals could set aside forms and checklists and instead prioritize to trust their competence and experiences. Furthermore, *Contextual knowledge* was found to provide an overview of the situation and an understanding of what the adaptation put into the situation may result in. Possessing contextual knowledge and experience, therefore, provided healthcare professionals with an ability to verify and evaluate adaptations in a proactive manner.

When knowledge from actors familiar with the situation and/or the patient was needed, healthcare professionals were found to *import*

knowledge from these "expert sources", whether or not the actor with the "expert knowledge" was a part of the organization or not, or was a healthcare professional or not (e.g. a patient/next-of-kin). An example was where physicians at a nursing home called hospital physicians to discuss the treatment of a patient. The nursing home physicians' therefore imported knowledge from hospital physicians and as such increased their situated knowledge and competence (example from project 10). Likewise, by including and *combining knowledge* from different stakeholders, healthcare professionals increased their overview of the situation and were given an understanding of new and often unfamiliar perspectives. An example of this is from cancer care, where key information sometimes was omitted in the patient records, or where descriptions in the formal documentation were found to be inaccurate, next-of-kin could provide valuable corrections and fill in the blanks (example from project 9).

4.2.2. Communication

Communication refers to the transmission of thoughts, messages and/or information between individuals. *Frequent interaction* and *face-to-face communication* were emphasized to clarify ambiguity in language and knowledge between different actors. Healthcare professionals emphasized the need for frequent interaction with both colleagues (e.g. for learning and training in emergency situations in project 1, and for information exchange and shared reflection in project 14) as well as with the patients and next-of-kin. Even though frequent interaction could be facilitated by the use of technology (like telecare in project 5) the need for face-to-face communication with patients was important as it allowed for individual assessments of patients (e.g. in regards to suicide risk in project 8) and for the development of situational awareness of healthcare professionals.

4.2.3. Organizing resources

The *organisation of resources* includes processes of planning, structuring, and prioritizing of resources for quality in care. The appointment of targeted coordinating roles was found to be a valuable way of organizing resources and further was found to introduce flexibility to the system. The appointment of a member of staff to a coordination-role at a maternity ward, who had no assigned patients and instead stepped in were needed in peak situations, functioned as a buffer resource for the system (example from project 1). Having available buffer resources (i.e. knowledge, staff, rooms, technology), provided healthcare professionals with a flexibility to adapt to a given situation.

The complexity inherent in socio-technical systems, like healthcare, requires actors to cope with uncertainty and to form decisions without full understanding of the situation. Organizing for *staff continuity* was a type of resource-based enabler found to be valuable for healthcare professionals to cope with demands. The appointment of, for instance, surgical personnel to specific units are decisions taken by managers at the meso-level, while the results gained by this enabler of adaptive capacity are seen at the micro-level. The rewards gained by the individual micro-level actors included an increased level of trust, confidence, efficiency, and problem solving (example from project 6).

4.2.4. Trust

Trust is to be understood as having firm beliefs that something/someone is safe and reliable (Cambridge Online Dictionary, 2022). Healthcare professionals are used to facing complex situations, where decisions need to be made at a fast pace and with only partial knowledge to hand. Healthcare professionals performing adaptations therefore had to trust their own contextual competence and skills when forming decisions, like when physicians at a hospital violated discharge guidelines and allowed some patients to extend their stay at the hospital to ease their situation (example from project 10).

Furthermore, in challenging situations, it was also found facilitative to trust the competence and skills of team members, leaving each member to take responsibility for their speciality, revealing a source for multidisciplinary efficiency in healthcare practices. An example of such trusted multidisciplinary collaboration was seen in surgical teams, where quality of care relied upon the collective efforts performed by the different professions. The different professions held different roles and performed different functions, and therefore needed to trust each other's competence to work efficiently (example from project 6).

Trust between healthcare professionals and patients was also found an enabler for adaptive capacity. When healthcare professionals had established a trusted relationship with the patient, the adaptation of care to the specific patient needs was eased. This was of high importance in the assessment and monitoring of suicidal patients at mental healthcare wards. A trustful relationship between healthcare professionals and patients relied upon patients to trust the healthcare professionals to act in accordance with their own interests (example from project 8).

5. Discussion

The aim for this study was to develop a new understanding of the nature of adaptive capacity across different healthcare contexts and to identify factors enabling adaptive capacity. Findings showed that adaptive capacity has four main aspects to it: Reframing, Aligning, Coping, and Innovating. The enabling factors that supported adaptive capacity in healthcare took the form of knowledge, communication, trust, and the organization of resources.

The findings reported above, combined with theoretical contributions by Blanchet et al. (2017), Frick et al. (2018), and from the innovation literature (e.g. Bessant and Tidd, 2007), allow the development of a new conceptual framework of adaptive capacity, see Fig. 2, which characterises the different forms of adaptive capacity which each involve different levels of change and resource.

Blanchet et al. (2017) describe governance for resilient healthcare in crises to consist of three levels: absorption, adaptation, and transformation, where the degree of change and the level of stress are determining factors for which level to conform to. Absorption is highly related to the *Coping* aspect identified in our research, in which healthcare professionals need to cope with and absorb internal and external demands and unexpected situations. Parsons et al. (2016) describe coping capacities and adaptive capacities as different abilities

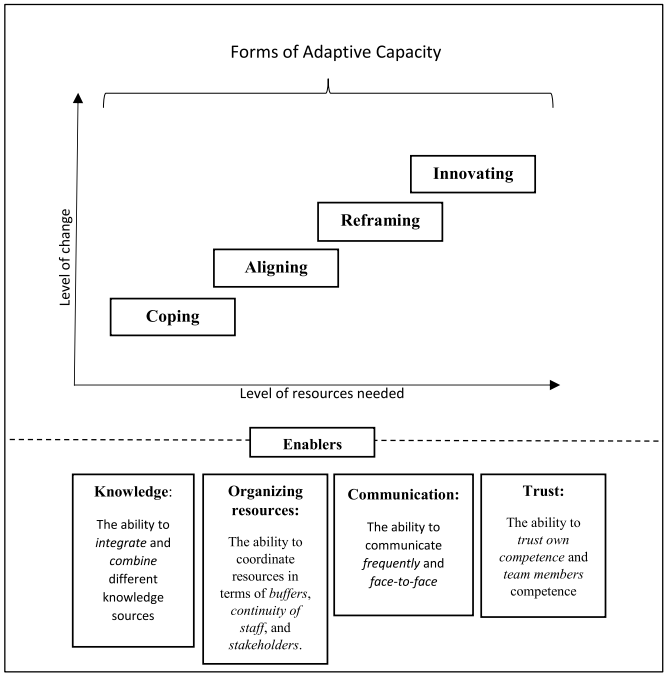

Fig. 2. Framework illustrating forms of adaptive capacity in terms of change, resources, and enablers.

needed to form disaster resilience, and thereby highlighting the importance of coping for resilience. Shirali et al. (2012) describe the ability to cope as part of adaptive capacity. In our study *coping* is viewed as an adaptive response, which is generally an appropriate reaction in situations where the level of possible change is relatively low. Coping can be exemplified in our study by an example from a rural maternity ward, (see section 4.1.3), where the healthcare professionals needed to cope with a patient having serious health-related issues. According to the guidelines, this patient should have been taking care of at the city hospital where appropriate resources for such health-related issues are at hand. The healthcare professionals in the rural maternity ward were trained as midwifes, and since it was impossible to transfer the patient at this stage, they just had to cope with this unexpected event and to the increased level of risk.

Aligning is at the next level of the framework and refers to healthcare professionals having to converge and combine differing needs, demands, interest, and goals. *Aligning* is therefore a more resource-demanding activity as it introduces new actors and perspectives, making it necessary to include a converging process. Furthermore, the level of change is raised due to the introduction of new perspectives in how to solve challenges. This was noted in the example from the regulatory investigations of adverse events, where the knowledge from next-of-kin allowed for a new and deeper understanding of the event, which changed the investigation outcome (see section 4.1.2).

As the level of change further increases, a *Reframing* of practices is necessary. However, allowing for increased changes also increases the level of resources needed to perform the changes. *Reframing* took place as the form of adjustments (short-term adaptations) or transformations of practices (long-term adaptations) based on the level of re-organization (Lyng et al., 2021; Macrae and Draycott, 2019). Reframing as short-term adaptations refers to what Woods and Wreathall (2008) defined as 1st order adaptive capacity. At this level existing and pre-determined responses were used to restore normal operation, e.g. when re-prioritizing resources in medication administration in peak situations (see section 4.1.1). *Reframing* as long-term adaptations corresponds with 2nd order adaptive capacity, where responses are based on new solutions and capabilities. 2nd order adaptive capacity thereby introduces novelty through acts like improvisation and creativity when reframing practices. Correspondingly, the level of change and resources are greater in long-term adaptations compared to short-term adaptations. It may therefore be attractive to initiate short-term efforts. However, short-term adaptations may result in unexpected and adverse outcomes at other healthcare system levels, and in relation to long-term planning, since short-term adaptations rarely involve the systemic approaches that are at the core of the field of ergonomics and the resilience literature (Hignett and Lang, 2018; Lyng et al., 2021).

Innovation was found to be the aspect with the lowest number of instances within this dataset. Based on the four forms of adaptive capacity, *innovation* is the most resource demanding, but also the form that holds the highest potential for change. The high level of resources needed for developing innovations, are because innovations depend upon a full process, from idea to implementation to be successful (Bessant and Tidd, 2007). The high potential for change has two causes. Firstly, a key part of the innovation process is to spread innovations to other organizations, and as such change can take place across many different organizations (Lyng et al., 2021). Secondly, innovations are based on re-combinations of already existing knowledge (Schumpeter, 1934) and the introduction of new knowledge provides a potential for more radical solutions (Hacklin and Wallin, 2013; Lyng and Brun, 2020). Adaptations and workarounds may introduce creative inputs that lead to innovations, if these are explored in a positive way (Hignett and Lang, 2018; Lyng et al., 2021; Dul et al., 2012; Patterson, 2018).

While adaptive capacity has been found to be instrumental for resilience in healthcare (Anderson et al., 2020), there are always at least two sides of the story. Shirali et al. (2012) argue that systems which solely depend on the adaptive capacity of front-line actors, do not achieve resilience unless adaptive capacity is coupled together with constructed and controlled organizational factors. This is echoed in Lyng et al.'s (2021) study where adaptations were classified into short-term and long-term adaptations. Short-term adaptations were often seen as adjustments by individuals to upcoming challenges at the frontline. However, these sort of band-aid solutions, even though essential in some situations, were also found to mask system deficiencies by not being internalized into the organization. Long-term adaptations, on the other hand, included an organizational re-organization of practices and resources and therefore acted as an enabler for adaptive capacity.

Enablers found in this study to facilitate adaptive capacity were knowledge, communication, the organization of resources, and trust. These enablers indicate similarities and interconnections with other existing studies. Several studies have emphasized the need for feedback and learning to ensure resilient performance (Della Torre et al., 2021; Haraldseid-Driftland et al., 2021; Parsons et al., 2016; Salehi and Veitch, 2020; Salehi et al., 2020; Shirali et al., 2012; Aase et al., 2020). This is echoed in the findings in this study of knowledge and communication as enabling factors. In terms of communication, Scanlon and Karsh (2010) state that there is no "ideal" type of communication, suitable for all situations and contexts, however for emergency contexts in hospitals there is a need for closed loop communication. In our cross-contextual study frequent communication and face-to-face communication were emphasized, therefore being co-located or having frequent meeting arenas were facilitative for adaptive capacity.

Our study found that the organization of resources was enabling for adaptive capacity. This is also reflected in the literature. Shirali et al. (2012) state that adaptive capacity needs to be coupled with constructed safeguards and organizational factors. Furthermore Grote et al. (2018); Salehi and Veitch (2020) and Salehi et al. (2020) all emphasize the need for aligning flexibility and stability to build adaptive capacity. Trust as an enabler for adaptive capacity in complex socio-technical systems has previously been found to be an important factor for collaborating in situations of high uncertainty (Davenport et al., 1998), such as in healthcare. Furthermore, Della Torre et al. (2021) emphasize leaders' responsibility for building trust between colleagues. As such, the enablers found in this study share similarities with those seen in the existing literature, yet this study extends the analysis of how these enablers are important for ensuring adaptive capacity and resilience across different healthcare contexts and practices. In terms of the ergonomics literature, Fig. 2 provides an illustration of how familiar ergonomics factors (knowledge, organizational resources, communication and trust) play roles as enablers for adaptive capacity for resilience in healthcare (Hignett and Lang, 2018). As such, a bridge between ergonomics and resilience literature is illustrated.

The conceptualizing of adaptive capacity into different forms, and the development of a conceptual framework, provides a comprehensive understanding of the phenomenon. However, the different adaptive capacity forms (coping, aligning, reframing, and innovating) are interrelated and should not be considered strictly in isolation (Hollnagel, 2018).

Based on the findings from this research, we propose the following understanding as a definition of adaptive capacity in healthcare; *Adaptive capacity in healthcare constitutes adaptations based on reframing, aligning, coping and innovating, in response to external and internal demands from different organizational levels, in order to ensure quality of care.*

5.1. Strengths and limitations

Combining qualitative methodologies for data analysis has been found to be a valuable strategy in an increasing number of studies (Lal et al., 2012). However, the combination of a narrative inquiry methodology and grounded theory is still scarce. Lal et al. (2012) found narrative inquiry and grounded theory to be a valuable combination which provided complementary understanding to the data analysis. Narrative inquiry methodology contributes a way of synthesizing and

converging a large dataset, while still maintaining rich descriptions of contextual factors. Grounded theory allows the comparison of important aspects across different contexts and is therefore found valuable for theory development (Lee et al., 2013; Welch et al., 2011).

A limitation of this study may be the inclusion in the sample of only Norwegian projects from the SHARE (Centre for Resilience in Healthcare) research centre. However, even though the data for this study is limited to studies from a single research centre in Norway, it is a strength of this study that the data represent varied contextual settings in primary care, secondary care, and transitional care, different system levels, and from different geographical locations in Norway. Future research should nevertheless seek to undertake cross-country studies of adaptive capacity for resilience in healthcare, to expand our knowledge of the influence of cultural contexts.

Moreover, this study of adaptive capacity is theoretically largely based on resilience in healthcare literature. However, as the human factors and ergonomics literature share similarities in how adaptation is conceptualised, the results from this study extend and contribute to this broader ergonomics literature—as indicated previously, where the impacts of the different forms of adaptive capacity (as shown in Fig. 2) are discussed in terms of both ergonomics and resilience literature. However, the specific objective here was to explore adaptive capacity for resilience in healthcare, and this study accordingly examined the specific nature of adaptive capacity in terms of resilience. It would therefore be valuable for future studies to further explore and elaborate in more depth the interlinkages between the human factors/ergonomics literature (e.g. Carayon et al., 2020) and the resilience literature in terms of adaptive capacity which is fundamental for both fields.

6. Conclusion

A rich dataset of projects from Centre of Resilience in Healthcare (SHARE) in Norway provided understanding of adaptive capacity for resilience in healthcare across a variety of healthcare settings. To analyse the dataset a novel combination of qualitative methods was used, which allowed for complementary cross-contextual understanding of adaptative capacity and provided a response to the call for new methodologies in studies of adaptive capacity in healthcare.

Adaptive capacity was found to include the following forms: *coping, aligning, reframing, and innovating*. Based on their potential for change and their need for resources, a framework of the relationship between these forms of adaptive capacity is provided. The conceptual framework provides a response to the call for new studies to develop framework of occurring factors of importance for adaptive capacity.

Factors enabling adaptive capacity across healthcare settings are *knowledge, communication, trust* and *the organization of resources*. Based on the findings a new definition and framework for adaptive capacity across healthcare context are provided: *Adaptive capacity in healthcare constitutes adaptations based on reframing, aligning, coping and innovating, in response to external and internal demands from different organizational levels, in order to ensure quality of care.* However, both the new definition and the new framework need further testing and verification in larger and international studies from additional healthcare contexts.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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