

BMJ Open Resilience perspective on healthcare professionals' adaptations to changes and challenges resulting from the COVID-19 pandemic: a meta-synthesis

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ABSTRACT

Objective To identify, review and synthesise qualitative literature on healthcare professionals' adaptations to changes and challenges resulting from the COVID-19 pandemic.

Design Systematic review with meta-synthesis.

Data sources Academic Search Elite, CINAHL, MEDLINE, PubMed, Science Direct and Scopus.

Eligibility criteria Qualitative or mixed-methods studies published between 2019 and 2021 investigating healthcare professionals' adaptations to changes and challenges resulting from the COVID-19 pandemic.

Data extraction and synthesis Data were extracted using a predesigned data extraction form that included details about publication (eg, authors, setting, participants, adaptations and outcomes). Data were analysed using thematic analysis.

Results Forty-seven studies were included. A range of adaptations crucial to maintaining healthcare delivery during the COVID-19 pandemic were found, including taking on new roles, conducting self and peer education and reorganising workspaces. Triggers for adaptations included unclear workflows, lack of guidelines, increased workload and transition to digital solutions. As challenges arose, many health professionals reported increased collaboration across wards, healthcare teams, hierarchies and healthcare services.

Conclusion Healthcare professionals demonstrated significant adaptive capacity when faced with challenges imposed by the COVID-19 pandemic. Several adaptations were identified as beneficial for future organisational healthcare service changes, while others exposed weaknesses in healthcare system designs and capacity, leading to dysfunctional adaptations. Healthcare professionals' experiences working during the COVID-19 pandemic present a unique opportunity to learn how healthcare systems rapidly respond to changes, and how resilient healthcare services can be built globally.

BACKGROUND

On 12 March 2020, WHO announced the novel coronavirus disease (COVID-19) as a pandemic.^{1 2} The pandemic caused serious challenges for healthcare systems worldwide,³ including resource limitations (eg, a lack of

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This review protocol was registered at the Open Science Framework and followed the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols guidelines.
- ⇒ A comprehensive search strategy was employed to identify studies focusing on healthcare professional's adaptations to changes and challenges resulting from the COVID-19 pandemic.
- ⇒ To ensure inclusion of relevant studies, we used the *RiH Quality and Resilience Trigger* tool to capture resilience elements in studies not directly focusing on resilience in healthcare.
- ⇒ The inclusion of articles and analysis were limited to qualitative results, and do not include data on patients, next of kin or employees without a healthcare professional background.
- ⇒ The quality appraisal indicated that 18 out of the 48 included studies were considered low quality.

equipment, workforce and physical space), surges in the number of patients needing healthcare services and rapid introduction of infection control procedures.⁴⁻⁶ Decisions had to be made faster than most systems were accustomed to. New work tasks and routines, as well as mastery of new equipment and new technical procedures, were rapidly developed and implemented.⁷ In response to these challenges, healthcare professionals were forced to adapt to ensure that healthcare service delivery was sustained.

Resilience in Healthcare (RiH) is a subset of the Safety-II perspective within patient safety theory. In addition to focusing on the absence of unwanted outcomes (Safety-I), Safety-II focuses on the things that go well because of healthcare professionals' ability to adjust their work to match current working conditions.⁸ RiH is about maintaining stability in the face of expected or unexpected changes, and the system or the individual's

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ability to adjust or adapt to these changes or disturbances and return to a stable state.⁹ In healthcare, workers and leaders adjust work performance to situations as they arise to minimise the impact of system challenges on care delivery and patient outcomes. This ability to adjust or adapt is called performance variability and is described as ‘adjustments that are the basis for safety and productivity’.¹⁰ Healthcare professional’s capability to respond and evolve is called adaptive capacity, and is defined as ‘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’.¹¹ RiH argues that performance variability is crucial to ensure system performance and patient safety in the context of a complex and ever-changing healthcare system.^{8 12}

Previous research

There has been a significant amount of research on different aspects of the COVID-19 pandemic, including research on healthcare professionals’ experiences during the pandemic,^{13–15} infection control and implications for healthcare quality,^{16 17} recommended and executed measures related to the pandemic (eg, how to reorganise care, how to apply telehealth/telecare)^{18–20} and physical and psychological outcomes of COVID-19 on patients.^{21–23} However, there is limited research examining health professionals’ adaptations (cf RiH) to the changes caused by the COVID-19 pandemic. RiH seeks to identify and understand behaviours contributing to a system’s ability to respond to the unexpected.²⁴ An increased understanding of adaptive human behaviour can contribute to improvements in current approaches to patient safety.²⁵

Aim and research questions

This study aimed to identify, review and synthesise qualitative literature on healthcare professionals’ adaptations to changes and challenges resulting from the COVID-19 pandemic (cf RiH). Specifically, the study aimed to identify what adaptations were executed and why, from the perspectives of healthcare professionals.²⁵ Using the PICO model (table 1), the review addressed the following research questions:

1. What kinds of adaptations were required from healthcare professionals during the COVID-19 pandemic (cf RiH), and why were they necessary?
2. What kind of performance variation did healthcare professionals experience as a result of these adaptations?

METHODS AND DESIGN

Protocol and reporting

A review protocol was developed following the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 guidelines (online supplemental file 1).²⁶ The protocol (online supplemental file 2) is registered with the Open Science Framework (OSF) register (<https://osf.io/pnhby>).²⁷

Eligibility criteria/study selection

The selection criteria are presented in table 2. The review was limited to qualitative research (including qualitative components of mixed-methods studies), as we sought to identify rich, in-depth information about health professionals’ experiences, perceptions and opinions which are best captured through qualitative approaches.²⁸ In addition, qualitative research allows for identifying data concerning performance variability and adaptive capacity in study foci (eg, other than RiH).^{11 28} Research published in 2020 or later was included to capture studies about COVID-19. Grey literature, reviews, commentaries, editorials and other non-empirical publications were not included. Eligible study populations included healthcare professionals, as defined in table 2. Studies investigating health professionals not providing direct formal care (eg, policymakers, hospital managers), other personnel working in hospitals/the primary healthcare service (eg, porters or cleaning staff) and patients and their next of kin were not included in this review as this was beyond the study’s scope. Only studies published in English or Scandinavian languages were included, as these are the native languages of the author team.

The RiH Quality and Resilience Trigger tool developed by Aase *et al*²⁹ to screen research projects for RiH relevance was used to guide the conceptualisation of RiH in the study selection. The RiH triggers are listed in table 3 and were particularly useful in identifying resilience elements in studies not focusing on RiH specifically.

Data sources, search terms and search strategy

Scoping searches were conducted from March to June 2021 using the academic databases: Academic Search Elite, CINAHL, MEDLINE, PubMed, Science Direct and Scopus. The main search was carried out on 21 May 2021 in all databases. A search string was developed using keywords from five clusters related to the review topic: COVID-19, patient/patient safety, healthcare/health professionals, resilience and qualitative research, including related MeSH terms and synonyms.

Table 1 The PICO model²⁷

Participants	Healthcare professionals (definition provided in <i>Clarification of central concepts</i>)
Interventions/exposures	The COVID-19 pandemic
Comparators	Performance variation before the pandemic
Outcomes	Healthcare professionals’ experience of performance variations during the COVID-19 pandemic

Table 2 Selection criteria

Criteria grouping	Inclusion criteria	Exclusion criteria
Participants/context	Studies involving healthcare professionals (as defined below) in somatic clinical settings, for example, hospitals, home care services, nursing homes and general practitioner (GP) offices. A healthcare professional was defined as a person who maintains humans' health by applying evidence-based principles and procedures of medicine and caring through formal paid services (WHO, 2013). ¹⁰⁸ For example, nurses, hospital physicians, GPs, certified nurse assistants (CNA), healthcare assistants/care assistants, auxiliary nurses, personal care workers, nursing home physicians, pharmacists, physiotherapists, licensed practical nurses (LPNs), bioengineers, occupational therapists, health secretaries, midwives, clinical nutritionists and radiographers (Health Personnel Act, 1999, §48). ¹⁰⁹ Although healthcare personnel working in psychiatric healthcare services are included in WHO's definition of healthcare professionals, they were not included in this review as the focus here was on somatic settings.	Studies involving psychiatric or psychological wards or services. Studies involving healthcare professionals not providing direct formal care (eg, hospital management, policymakers, ward leaders). Studies involving non-healthcare personnel working in healthcare settings (eg, porters, cleaning staff). Patients, aged care residents, service users (eg, people receiving home care services), their next of kin or other informal caregivers (family, neighbours, friends).
Exposure	Studies investigating the COVID-19 pandemic.	Studies not concerning the COVID-19 pandemic. Studies investigating previous pandemics/epidemics (eg, H1N1, Ebola, Zika).
Outcome	Studies including resilience triggers on a microlevel, for example, individual capacity (knowledge, competence, learning, behavioural strategies) and team/unit capacity (communication, collaboration and learning), or triggers on the macrolevel, for example, organisational capacity (resources, organisation, culture).	Studies investigating larger systems' adaptation capacity (infrastructure, regulation, framework). Psychological (individual) resilience or lack of resilience. This includes psychological or physical difficulties experienced by healthcare personnel (eg, sleep deprivation, tiredness, difficulties with protective gear), or healthcare personnel's professional identity. Medical perspectives, such as COVID-19 treatment regimes. Studies not involving adaptive capacity, for example, studies only focusing on barriers and challenges (not solutions).
Language	English, Norwegian, Danish or Swedish.	Languages other than English, Norwegian, Danish or Swedish.
Year of publication	Studies published between 2019 and 2021.	Studies published before 2019.
Methods	<ul style="list-style-type: none"> ► Studies applying qualitative methods, including qualitative data from mixed-methods studies. ► Studies published in peer-reviewed scientific journals. ► Case studies where adaptation to standard practices was discussed. 	Studies applying quantitative methods only.
Publication type	Peer-reviewed journal articles comprising empirical primary research.	Grey literature, for example, editorials, government reports, comments, non-scientific publications, conference abstracts, theses/dissertations.

Multiple test searches using different search combinations in the selected databases combined with multiple team discussions resulted in the establishment of the

search string. The final search string was run in the included databases (online supplemental file 3: overview of searches).

Table 3 Resilience triggers

<ul style="list-style-type: none"> ► Adaptation ► Variation ► Trade-offs ► Improvisation ► Response ► Complexity ► Individual capacity (knowledge, competence, learning, personal characteristics, cognitive, behavioural strategies) 	<ul style="list-style-type: none"> ► Team/unit capacity (communication, collaboration, learning) ► Organisational capacity (resources, organisation, culture) ► Larger system capacity (infrastructure, regulation, framework conditions) 	<ul style="list-style-type: none"> ► Development ► Improvement ► Success ► Enhancement ► Growth ► Recovery ► Transformation ► Collaborative learning ► Work practice ► Problem solving ► Interaction 	<ul style="list-style-type: none"> ► Stakeholder actions ► Knowledge brokering ► Cocreation ► Contribution ► Information ► Engagement ► Teamwork ► Changes ► Challenges ► Disruption
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Selection of eligible studies

The identified publications (n=3139) were downloaded and managed in EndNote V.20. Duplicates were removed (n=705) and the remaining references were uploaded into Rayyan QCRI, an online mobile and web-based application for abstract and title review.³⁰ Abstracts underwent a three-step blinded screening process. First, a random 10% excerpt of publications was independently screened by all reviewers (MKG, KL and EEA) to ensure that the application of inclusion and exclusion criteria was consistent. After multiple conflicts arose, a group discussion, including a thorough clarification of the selection criteria, was conducted. Second, a new random 10% sample of publications was independently screened by reviewers (MKG, KL and EEA), giving more uniform results with some discrepancies. These were resolved through a second round of discussion and clarifications of criteria. A title and abstract review of remaining publications was carried out by two pairs of independent researchers (MKG, KL and EEA), where MKG reviewed all abstracts, resulting in 171 records undergoing full-text screening. If there was ambiguity about whether a publication met the inclusion criteria, it was progressed to the full-text review (eg, if the methods were unclear in the abstract).

All full texts were evenly and randomly distributed among the two pairs of independent reviewers (MKG screened all publications and KL and EEA screened 50% each). Inclusion/exclusion decisions and notes supporting the decisions were entered into a predesigned data extraction form using Microsoft Excel (designed by KL). The resilience triggers (table 3) were used as decision support when the resilience perspective was unclear. Any disagreement on inclusion decisions was discussed by each screening pair. If a consensus could not be reached between a pair, the third screener acted as arbitrator.³¹ Two more additional researchers were available for consultation if disagreements were unresolved (SW and DWB) (see online supplemental file 4 for an overview of excluded articles and reasons for exclusion).

Quality assessment

All included studies underwent a blinded quality appraisal using the Clinical Appraisal Skills Program (CASP) for qualitative studies.³² The CASP enabled a systematic assessment of the trustworthiness, relevance and results of published qualitative articles.³² The quality of the included studies was appraised by two pairs of independent researchers (with MKG appraising all studies). If articles had several methodological weaknesses, such as a poorly described research design in combination with a poorly described recruitment strategy and ethical considerations, they were deemed low quality. Disagreements were discussed by the pairs of reviewers after the blinded appraisal. The CASP tool does not include a scoring system of exclusion cut-offs,³³ and therefore, the 18 articles considered low quality were not excluded but were given less weight in the write-up of results.³³

Data extraction and analysis

Data were extracted and quality assessments were conducted simultaneously by one reviewer (MKG), while a sample of the data extraction was validated by the coreviewers (KL and EEA).³⁴ The predesigned data extraction form included publication details, setting, participants, adaptations and outcomes. All data relevant to the research questions were extracted, including quotes (inclusive approach).³⁴ The analysis was guided by Thomas and Harden's³⁵ three stages of analysis. Stages 1 and 2 consisted of openly coding text and developing descriptive themes (conducted by MKG). Contrary to Thomas and Harden's³⁵ suggestion regarding coding, we first extracted the text relevant to the research question (as suggested in other thematic analysis literature, eg, Braun and Clarke³⁶), before conducting line-by-line coding. Free codes without hierarchical structure were developed, and new codes were added if necessary. This process is referred to as the *translation of concepts between studies*.³⁵ After the coding process was finalised, the codes were reviewed to check for consistency in interpretation and to consider the need for additional coding levels. During this process, 34 codes were identified. Differences and similarities between the semantics of codes guided the grouping of codes into a *hierarchical tree structure*.³⁵ To capture patterns in the data, similar codes were grouped to form *descriptive* themes (see figure 1: example of analysis theme 1, steps 1–3). The five identified themes were reviewed by the research team. Stage 3 consisted of generating *analytical* themes, aiming to 'go beyond the findings of the primary studies, and generate additional concepts, understandings and hypotheses'.³⁵ This was conducted as a cyclic process where theme suggestions were processed and refined in multiple rounds. Finally, two main themes and five subthemes were identified and approved by the research team.

Patient and public involvement

No patients, patients' next of kin or healthcare professionals participated in this study.

RESULTS

The review resulted in the inclusion of 47 articles (see figure 2: PRISMA flow diagram and online supplemental file 5: overview of included studies and quality assessment). The analysis resulted in two main themes with five affiliated subthemes. The results are presented according to identified themes and subthemes.

COVID-19 has driven an increased need for individual and team capacity to handle extreme changes in working conditions

The first theme demonstrated an intensified need for health professionals to handle increased responsibilities. At the same time, they were adjusting to constant changes in the organisation and adapting existing collaborations,



Figure 1 Example of analysis theme 1, steps 1–3.

as well as creating new collaborations, to handle changing needs.

Handling increased responsibilities on an individual level

Multiple studies highlighted how roles abruptly changed or expanded due to the pandemic and described the required adaptations that followed.^{37–45} For example, several studies found that health professionals' educational roles had become intensified.^{42 43 45} This included an increased need to educate and inform patients about necessary precautions to reduce infection risk^{42 45} and increased responsibility in conveying information from local or nationwide authorities.⁴³

Similarly, other studies^{40 46} reported that health professionals functioned as *the patients' lifelines to the outside world* and were filling in the gap of absent relatives by comforting end-of-life patients. One study found that newly educated nurses suddenly had to function as the senior professionals, even though they were having their first care experiences with patients with COVID-19.⁴⁷ Nurses also reported that they adapted to changing work conditions by taking on multiple roles, for example, as dietitians (delivering meals), respiratory therapists (administering nebulisers) and environmental services (emptying trash bins), because the primary groups normally responsible for these tasks visited patient rooms less often during the pandemic.⁴⁴ Pharmacists joined the

hospital's infection disease team, previously only staffed by physicians, to provide expert opinion and guidance on the use of potential treatments for COVID-19.³⁸

These changes in health professionals' roles were closely linked to increased professional role identity⁴⁸ as they now, to a much larger degree, had to function as independent decision-makers.^{40 48} Many healthcare teams had to reorganise themselves to handle the pressure that originated in the healthcare service.^{37 39 44 49–54} This was found to be the case for hospital wards, general practitioner (GP) offices/clinics, specific treatment teams (eg, diabetes teams), nursing groups and pharmacies. *Self-reorganisation* consisted of forming specific teams caring for patients with COVID-19 only,⁴⁹ taking responsibility for task distribution,⁴⁹ developing appropriate nursing plans for patients with COVID-19, holding regular case-based seminars⁵¹ and rearranging facilities to improve infection control.⁵³ *Self-reorganisation* was reportedly needed as the new workflow was unclear,⁵² strategies to care provision were inefficient,⁴⁴ there was a lack of guidelines on how to act and respond⁵⁰ and the work environment became unstructured and difficult to handle.³⁹

As health professionals had often not received formal training for many roles (including the expansion of roles), they organised their own education to handle new challenges related to caring for patients with COVID-19.

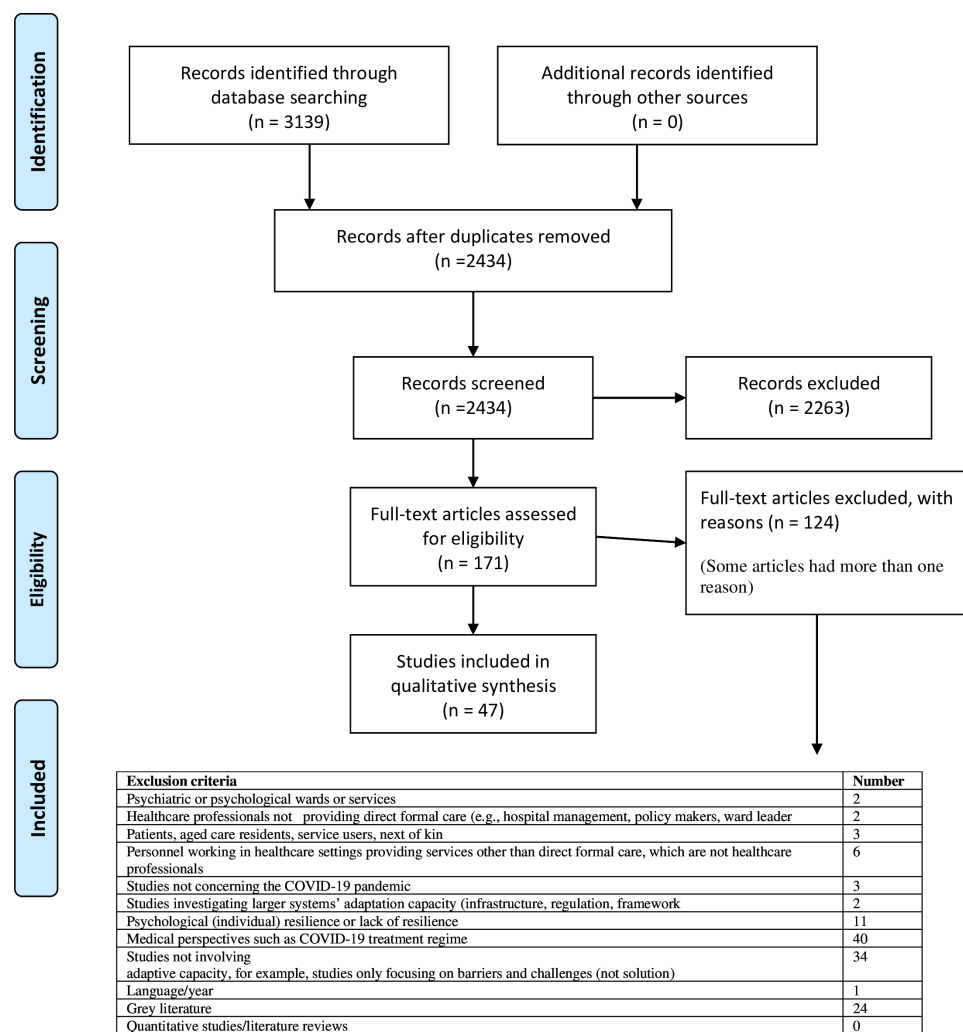


Figure 2 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.

They held training sessions on correct personal protective equipment (PPE) use, shared their acquired knowledge with other health professionals (sometimes acquired from trying and failing), discussed clinical cases with each other and shared knowledge via social media or by sharing self-produced informational videos.^{47 50 55 56} They also searched for knowledge by watching YouTube videos and seeking online courses and scientific articles,^{48 55} reportedly leading to a steep learning curve during COVID-19.^{37 47 48 51 57}

The literature frequently reported limited staffing and resources during the pandemic.^{47 58} Consequently, health professionals were required to handle both expected and unexpected forms of resource limitations, including rationing supplies such as PPE and disinfectants, and redistributing tasks between nurses.^{53 59 60} Several studies reported that health professionals turned to non-traditional alternatives to cope with staffing and resource limitations.^{44 50 52 53 55 59 61} For example, some washed and reused face masks, while others purchased their own masks because they lacked equipment at work. Some healthcare professionals made their own equipment out of uncertified materials, used painters' masks,

printed face shields or obtained missing equipment through social contacts.^{55 59 61} One study reported that physicians used unorthodox therapies or non-traditional approaches to care delivery that could be suboptimal or potentially harmful to avoid having to deny treatment to some patients.⁵⁹

Adapting to constant organisational changes

Closely related to changes in roles, several studies found that health professionals experienced an increased workload; a changed work scope; changes in workflows, guidelines and work tasks; and had to familiarise themselves with new equipment. The increased workload was a consequence of rising patient numbers, reduced staff and/or the absence of new hires to reflect the increased workload. For example, staff quarantine requirements forced other staff to take on additional workloads which again required additional work in managing new settings or redeployed staff.^{40 62} Additionally, health professionals were forced to handle unfamiliar tasks that would normally be done by other health professionals.^{63 64} For example, surgical nurses became medical nurses,⁵¹ and nurses were transferred from other hospitals and wards

with new guidelines and routines.⁴⁸ One study described that a teacher in a medical school was forcefully assigned to treat patients with COVID-19 without having the practical knowledge of doing so.⁵⁵ Changes in work tasks led to feelings of uncertainty and frustration.⁴³ For example, GPs described how their treatment focus had changed towards acute illness and the likely manifestations of COVID-19 infections, while monitoring chronic conditions was seen as less of a priority.⁶⁵

Constant changes in guidelines caused confusion and insecurity.⁵⁰ There were descriptions of frequent protocol changes, lack of consistency in protocols between healthcare services and sometimes contradictory indications, leaving health professionals uncertain of what their tasks were.^{38 50 60} Some healthcare professionals adapted to this uncertainty by starting every day carefully reading emails to check for changes in protocols and procedures.⁴⁷

Adapting collaboration to changing needs

The new challenges that arose in the tide of COVID-19 were reported to lead to better collaboration between healthcare professionals as well as improved collaboration across healthcare services. Growth of personal relationships and trust, a general willingness to take on other tasks and responsibilities, increased solidarity, creation of common protocols across hospitals and clear agreements on the distribution of care were some of the mentioned benefits.^{37 43 66} Moreover, new non-traditional team compositions were created with different departments and health professionals collaborating in unusual ways (eg, collaboration between physicians, caregivers, physiologists, housekeepers, janitors and technicians). Some studies reported that the feeling of working towards a common goal blurred the hierarchy between the different professions, fostering new relationships and strengthening existing work relationships.^{44 47 62 67} Other studies reported the opposite,^{42 43 56} for example, home palliative care professionals⁶⁸ felt that the connection between healthcare services was lost as their affiliated hospital had been turned into a COVID-19-only hospital.

COVID-19 has led to changes in healthcare organisations which better support health professionals' need to implement adaptations

The second theme described major organisational adaptations to handle the challenges of COVID-19. Consequently, health professionals had to adapt to these changes, including managing increased use of technology to provide healthcare.

Overall organisational efforts to handle COVID-19 challenges

Many studies reported that health professionals experienced rapid changes at their workplace as organisations adapted to COVID-19 challenges. Organisations found alternative ways of triaging and assessing patient needs^{58 69} and reorganised their physical space to reduce the risk of infection (eg, rearranging waiting rooms or removing unnecessary

materials in consultation rooms to prevent contamination).⁴³ Several studies reported transitioning to digital solutions to provide patient care and minimise staff exposures to the virus.^{65 68–71} In a methadone clinic, health professionals described telemedicine as a 'game changer' and the 'future of medicine'.⁶⁹ In a maternity ward, the rapid development of telehealth increased healthcare access for many women, although they depended on reliable access to a phone, video and the internet.⁷¹ Pharmacists expressed that virtual witnessing and assessing of medication could decrease delays and reduce travelling for both patients and providers.⁶⁸ In one study, midwives started practising case loading (one designated midwife caring for one woman throughout the childbearing continuum) which facilitated meeting women's needs and resulted in a positive professional experience.⁷¹ Similarly, in one study, nursing home staff implemented a primary nursing model which enabled them to provide all-around care for residents. This had previously been impossible because of unfavourable nurse-to-patient ratios.⁴⁸ A further example was the introduction of a differentiated labour practice model, which enabled pharmacy technicians to pivot rapidly away from multitasking, thereby enhancing resilience and improving workplace conditions for staff.⁷²

Several studies described that COVID-19 had paved the way for changes in healthcare, which previously had been thought impossible,^{54 68 71} including larger organisational changes; for example, leadership modification,⁶¹ conversion of hospital wards to COVID wards,^{37 73} development of new protocols and triage algorithms⁴¹ and the introduction of mobile consultation services.⁷⁴ Although these measures were deemed necessary to cope with the COVID-19 outbreak, they sometimes created confusion, frustration and logistical challenges for healthcare professionals.^{50 71 72}

Managing new and increased use of technology to provide healthcare

Several studies highlighted a spike in the use of different technologies to enable the provision of patient care in different settings.^{38 45 53 54 57 58 68 71 74–77} Dunleavy and colleagues⁵⁴ described the adoption of new technology to manage diabetes care during the pandemic such as the use of web-linked glucometers, electronic patient records, online referral systems and videoconferencing tools. These technologies enabled diabetes teams to identify and consult on patient needs more rapidly and enabled remote consultation.⁵⁴ As previously stated, telehealth was used by health professionals to continue patient treatment and support patient care teams.^{38 53} For example, pharmacists³⁸ and physiotherapists⁷⁵ made instructional videos to support their patients. One nursing home used Zoom to carry out multidisciplinary rounds/mortality rounds and opened a WhatsApp messaging group to effectively exchange information



among health professionals.⁵⁴ They also conducted a virtual *saying goodbye* for patients with terminal illness using open-source videoconferencing software.⁵⁴ Several other studies described the use of digital tools to maintain patients' social care when patients were not allowed visitors.^{40 46 48 60 78}

DISCUSSION

This systematic review demonstrated how COVID-19 triggered multiple adaptations by health professionals to ensure continued provision of healthcare services during the pandemic. Health professionals adopted new roles, were given increased organisational responsibilities and coped with resource limitations. Consequently, health professionals' workload increased, their work scopes and workflow changed and they learnt to use new equipment, while guidelines constantly changed. There were reports of silver linings, for example, increased collaboration between healthcare professionals within and across organisations, as well as changes in the healthcare system to better support healthcare workers' needs.

The resilient healthcare service: adaptations and preparedness

Adaptions identified in this review^{37 38 44 46 50 63 79} were crucial in maintaining healthcare service delivery during the pandemic, for example, covering shifts due to staff shortages, allowing existing personnel to fill necessary roles, handling new procedures and reorganising workspaces to reduce the spread of the virus. Many healthcare systems were able to adjust to a somewhat stable state during the pandemic due to the extensive adaptations by staff, teams and organisations to the new demands, with some systems adapting more effectively than others. This supports Hollnagel's assertion that performance variability is crucial to ensure system performance and patient safety in changing work systems.⁸

According to RiH theory,⁸⁰ adaptations can be triggered by different factors in the system. These factors may be both internal (eg, resources, staffing, competence) and external (eg, budget cuts, regulatory demands).⁸⁰ Our review identified examples of adaptations triggered by both internal and external factors with health professionals experiencing a lack of competence, resources, staffing, equipment, information and guidelines.^{38 47 50 55 63 71 79} These factors forced health professionals to seek new ways of coping to be able to sustain required performance.⁸⁰

Health professionals' adaptive capacity was found to significantly contribute to healthcare systems' resilience. However, system preparedness is also critical for system resilience. The included studies reported varying degrees of preparedness across different healthcare services. Some health professionals spoke positively about how they had managed to 'come

Box 1 Resilience potentials

- ⇒ Knowing what to do (how to *respond* to disruptions and disturbances by adjusting normal functioning).
- ⇒ Knowing what to look for (*monitor* what are or could be future threats).
- ⇒ Knowing what to expect (how to *anticipate* developments of threats and threats further into the future).
- ⇒ Knowing what has happened (how to *learn* from experience, particularly the right lessons from the right experiences).⁸⁰

together and make things work',^{39 47 78} while others spoke of extreme resource shortages and being overworked.^{41 53 60} In this context, variations in how different countries were affected by the pandemic should be considered, for example, the rate of spread of infection in a population, differences in population size, proportion of older adults in the population, population density and how well-developed a country's healthcare system was to begin with. That being said, according to Hollnagel,⁸¹ a system must have some sort of readiness if something unexpected happens (eg, resource allocation to match the needs of the expected event) to be considered resilient.⁸¹ A resilient system should further cover four resilience potentials (responding, monitoring, anticipation, learning) (box 1).⁸¹

Reported experiences of healthcare professionals grappling with ever-changing guidelines and procedures, as well as limited resources (ie, staffing and equipment), suggest that most healthcare systems did not have the capacity (eg, a large enough PPE storage or back-up staffing), or the right measures in place (eg, adequate contingency plans), to respond adequately to the disturbance (COVID-19). Similar descriptions have been found in related reviews and quantitative studies.^{82–85} Despite the lack of preparedness of the system, the literature reported significant amounts of adaptive capacity among healthcare professionals, supporting Wears'⁸⁶ claim that people are the most adaptable element in any complex work system. The adaptations needed to cope with the COVID-19 pandemic, such as greater freedom for healthcare professionals to incorporate their adaptive capacity in patient care and a stronger focus on changing the organisation of healthcare based on health professionals' suggestions and needs, should be used for learning and preparation for near and future threats.⁸¹ As we are still learning from this pandemic, it is important to understand adaptations that have worked well⁸¹ to ensure more resilient healthcare services when encountering future disturbances including pandemics.⁸⁷

Adaptations: the good, the bad and the ugly

Some adaptations are effective solutions that can function long term, thus strengthening the healthcare service and in some instances, resulting in innovations.⁸⁰ This aligns with RiH characteristic of *learning from what goes well*.⁸ Although the distinction between long-term adaptations

and sustainable innovations was somewhat unclear in the included literature, several of the measures set in place as a response to the pandemic were deemed helpful by health professionals. For example, the introduction of telemedicine and other assistive technology were particularly viewed positively,^{59 68 71 88} as well as new care models, new procedures, new systems and new working models.^{45 48 72} Overall, the focus on innovation development in healthcare had to increase rapidly in response to the COVID-19 pandemic,^{89–92} despite the challenges that innovations in healthcare have met in the past.⁹³ Successful targeted innovations can, in the long run, contribute to more effective, more cost-effective and safer healthcare services.^{94 95} Learning from the ‘good’ adaptations and innovations resulting from COVID-19 is therefore of great interest to improve healthcare services into the future.

However, adaptations set in place as survival mechanisms—so-called ‘fire-fighting’⁹⁶—were also identified by included studies (eg, reuse of PPE).^{41 50 55 61} These types of adaptations are often short-term solutions and may have negative impacts on both the healthcare system and healthcare professionals.⁸⁰ Firefighting adaptations can create a false impression of success because it gives the illusion that a system is performing better than it is.⁸⁶ Conversely, continuous adaptations to poorly functioning systems can be exhausting for the people working within them,^{50 52 71} resulting in inefficient and potentially hazardous systems, as well as threats to patient safety and healthcare quality.⁸⁶

According to Woods,⁹⁷ all systems have a range of how much they can adapt to unexpected events based on the resources they hold and the already existing variation in the system. When a system is pushed towards, or over its range of performance, the system can either adapt and expand its performance beyond its range, or it can result in a rapid fall in performance. Woods calls these opposites *graceful extensibility* and *brittleness*, where brittleness is the opposite of resilience. A resilient system will handle unexpected changes with graceful extensibility and be able to expand its adaptive capacity when unexpected events happen, while non-resilient systems will not be able to handle being pushed past their performance range, and experience a system collapse (brittleness).⁹⁷ The distinction between brittleness and graceful extensibility depends on the general preparedness of a healthcare system and is a reminder of the need to prepare healthcare systems for future crises.

How did rapid changes become possible?

The path to becoming a more functional and prepared healthcare system includes system-level changes. However, introducing sustainable changes into a system (eg, delivering care in line with new evidence) has proven difficult in the past.⁹⁸ However, some included studies found that changes that had previously been impossible due to rigid systems became possible in the wake of the pandemic.^{48 54 68 71} The pandemic created a window of

possibility to explore how rapid changes in healthcare systems can be made possible.

Nilsen *et al*⁹⁹ identified three characteristics of successful change: (1) having the opportunity to influence change, (2) being prepared for the change and (3) valuing the change. Many of the adaptations identified in this review were introduced by frontline health professionals. Opportunities to influence change came when personnel experienced pressure to find novel solutions and adopt high-responsibility roles. Additionally, existing hierarchies in healthcare systems were described to have vanished as health professionals worked towards a common goal.^{44 47 62 78} The blurring of hierarchy and the development of new collaborations lead to breaches of organisational silos,^{39 49 74} as well as closer collaboration within existing teams.^{37 42 56 78} There were reports of new team mixes, new collaborations between health professionals from different hospitals,³⁹ and strengthened relationships, collaborations, solidarity and trust within existing teams.^{37 44 78} These changes were found to be valued by healthcare professionals, with increased opportunities to discuss problems across hierarchies and find solutions more openly. The experience of partnership is a crucial factor when making changes or improvements in healthcare systems.¹⁰⁰ This is supported by Gergerich and colleagues¹⁰¹ who described the need to work as a team outside the normal hierarchy to successfully make transformation or change, and is in line with research findings showing that humans who experience acute social stress engage in more prosocial behaviour such as trust, trustworthiness and sharing.¹⁰² Overall, the COVID-19 pandemic created the context for partnerships between health professionals to develop through a common goal, and demonstrated that increased collaboration, cooperation and inclusion across and within professions, roles and hierarchies were crucial to effectively introduce changes into the healthcare system.

Implications for policy and practice

This review demonstrated that adaptive capacity among healthcare professionals played a major part in keeping healthcare services running during the extreme conditions that the COVID-19 pandemic induced. The study findings indicate the benefits of giving health professionals greater freedom in adapting their work when handling the complexities and changing systems of healthcare services. At the same time, awareness is needed to identify and address maladaptations resulting from poor system designs. Previously, poorly functioning system designs in healthcare have proven difficult to change.⁹⁸ However, this review found that during the pandemic, healthcare services changed rapidly and often for the benefit of patients and workflows. The changes described in this review were often initiated or suggested by healthcare professionals, or based on their needs, once again highlighting the need to involve health professionals in organising and restructuring healthcare services to a greater extent than has previously been done.

Implications for research

The organisational changes executed during the pandemic have created an opportunity to explore how rapid changes in healthcare systems can be possible. Changes in healthcare systems are needed to improve patient safety, quality of care and efficiency. However, it is becoming more difficult to redesign systems with the increasing complexity of healthcare services. It is therefore pivotal to seize the opportunity to learn about health system change in the aftermath of the pandemic peak. Moreover, this study revealed skills in cooperation across healthcare institutions, healthcare professionals and other professional groups. Health professionals' ability to cross healthcare silos to deliver care should be further investigated. Lastly, to improve healthcare systems' preparedness and resilience, it would be useful to further investigate what factors in healthcare systems facilitate positive adaptations and innovations and what factors result in poorly functioning adaptations.

Strengths and limitations

This review protocol was registered at the OSF and followed the PRISMA-P guidelines. A comprehensive search strategy was employed to identify studies focusing on healthcare professionals' adaptations to changes and challenges resulting from the COVID-19 pandemic.

Limitations of the current study stem from our pragmatic choices to not include grey literature and not rerun the search before publication. That said, there are arguments that a more purposeful sampling approach aiming to provide a holistic description of a phenomenon, rather than to identify all eligible studies, might be more appropriate in qualitative literature reviews.¹⁰³ Moreover, the search strategy was developed by a committee of subject matter experts and not a database search specialist. The committee consisted of three researchers with experience in search strategy development, and the strategy was later reviewed by two independent researchers with broad experience within the researched field. It is possible that the search strategy could have been strengthened by an expert in database search strategies (eg, a clinical librarian). In addition, published literature examining adaptations made by health professionals may be shaped by publication bias, with negative results less likely to be published.

CONCLUSION

The COVID-19 pandemic created tremendous disturbances in healthcare systems worldwide, demanding rapid adaption to comprehensive changes. COVID-19 triggered the rapid reorganisation of healthcare services, and through these changes, healthcare systems and health professionals demonstrated significant adaptive capacity. Many of the changes driven by the pandemic led to positive and useful alterations to the healthcare system, potentially creating foundations for healthcare innovation and sustainable change. The pandemic also exposed

weaknesses in healthcare system design and capacity,^{104 105} forcing health professionals to make dysfunctional and potentially harmful adaptations. Crucially, few healthcare systems were properly prepared for a pandemic event, which does not align with characteristics of a resilient healthcare system. Healthcare professionals' experiences of the COVID-19 pandemic represent an opportunity to learn about how healthcare systems respond to unexpected challenges that linger, and how we might build resilient health systems globally.^{106 107}

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