



Enhancing Global Health System Resilience and Sustainability Post-COVID-19: A Grounded Theory Approach

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Abstract

Based on a grounded theory approach to healthcare professionals' experience, this study conducted a qualitative assessment of new opportunities and provided a conceptual justification of forward-looking trends of global health system efficiency improvement and resilience toward universal health in the post-COVID-19 era. The data were collected through semi-structured interviews, while theoretical saturation was reached after 20 interviews with international experts in Global Health System Resilience (psychologists, nurses, and community health consultants). The data were analyzed using four coding stages: initial, focused, axial, and theoretical. The results showed that to achieve global health system resilience toward universal health and safety coverage in the post-COVID-19 era, it is required to develop a strategy including the support of healthcare professionals, which allows coping with the emotional and psychological impact of the pandemic. Moreover, opportunities for professional development and collaboration can enhance their resilience and adaptability during and after crises. The findings suggest factors of global health system resilience ranked using the AHP method. The present research provides a valuable insight into the significance of telemedicine, remote care, and ensuring the safety of the healthcare industry and patients as the most crucial factors for enhancing health system sustainability. This article provides new policy recommendations to ensure the long-term effectiveness and sustainability of health systems.

Keywords:

Global Health System Resilience;
Health System Sustainability;
Public Health; Post-COVID-19 Era;
Health Management Efficiency;
Healthcare Technology;
Grounded Theory Approach.

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1- Introduction

Health systems are among the most important structures in our society. They are responsible for maintaining and improving people's health and preventing various diseases and epidemics [1]. Health system resilience is the "ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, adapt to, transform, and recover

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from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management” [2]. Thus, the ability to prevent, detect, respond to, and recover from public health threats and emergencies and agility in deploying resources to meet urgent needs and ensuring the continuity of essential health care are essential for health system resilience during crisis periods. Public health is key to the economic development of any country; this fact has been recognized since the seminal World Bank report of 1993: Investing in Health [3].

The COVID-19 pandemic highlighted the need to improve healthcare system sustainability and resilience for economic security, but restoring healthcare is overlooked in planning [4]. The pandemic revealed the link between health and economic sustainability. Sustained investment in emergency preparedness, public health capacities, and reforms is required to avoid panic cycles and build efficient, effective health systems supporting sustainability [5]. Reforms should integrate emergency response with universal healthcare access and marginalized population protection. Updated healthcare systems that are prepared for the next crisis are critical to avoiding higher expenses and casualties.

The OECD report [6] emphasizes that the COVID-19 pandemic has severed the existing weak spots in healthcare systems. Insufficient preparations and a lack of qualified personnel and investments were the reasons why existing systems failed to handle the crisis. The sustainability of healthcare systems is their ability to be prepared, adapt, and restore after serious shock [7]. However, the major challenge is perceived in the post-COVID-19 world, whereby the social, cultural, and emotional well-being of healthcare workers may be affected [8]. According to Greenberg et al. [9], post-trauma stressors are significant risk factors imposing long-term effects on mental health. It was well documented that healthcare professionals in the post-pandemic era after the SARS outbreak in 2003 sustained negative psychological symptoms, which continued for years. Not only this, but also the post-COVID-19 economic and social recession has impacted many healthcare workers with unemployment, followed by economic crises [10–12].

The extent of the issues reaches the point of showing the attributes of “psychological COVID-19 syndrome” that incorporate features of stress, anxiety, and depression [13, 14]. The HCW started to perceive social isolation fatigue as it emerged from lockdown measures for a longer period than expected [13]. Social isolation negatively impacts the socially linked quality of health, affecting social well-being [15]. The high risk of transmission may have compromised the motivation to work in a team-oriented environment. Also, the unequal distribution of resources among workers for the delivery of care is also conflicting. These challenges, which were persistent during a pandemic, may affect the quality of life in a post-pandemic era [16].

On the other hand, the emerging need for preparedness for future incidences has led to an inclusive paradigm shift in the field of medicine [16]. These paradigm shifts in practice result in cultural changes in the organization. For example, paradigm shifts in cardiac care, the concept of telemedicine in disease risk management, the introduction of virtual space in medicine, and the advancement of local healthcare systems have become recent spotlights in the field of medicinal research and practice [17–21]. The most important care objective is to provide person- or patient-centered care rather than focus on the system of care [22, 23]. In addition, health systems are integrating services to fulfill daily care needs and patient demands [24]. Therefore, a system with well-equipped resources and positive mental health among healthcare professionals is anticipated within the changing paradigm of the healthcare system.

Moosavi et al. [25] provided evidence of the high number of healthcare workers infected with COVID-19 worldwide, including in developed and underdeveloped countries. The study conducted in Qazvin, Iran, found that healthcare workers providing direct care for COVID-19 patients were at risk of infection [25]. Additionally, other studies on Ghanaian and Chinese healthcare workers also reported that these individuals were at low risk of infection with COVID-19 [26, 27]. These findings highlight the need to assess the clinical risk and exposure to the pathogen in healthcare workers to guide better management and planning for safe risk management.

On the other hand, there is ample evidence in the literature that healthcare workers have experienced increased levels of stress, anxiety, depression, and burnout during the pandemic [28]. The long-term consequences of these mental health challenges on healthcare workers' well-being and the need for interventions and support systems are areas that require further research.

Besides, the COVID-19 pandemic has underscored gaps in our understanding of healthcare system resilience. As Ambrose et al. [29] discuss, while past research has examined the resilience of healthcare systems and workers individually, there is limited knowledge on the resilience of healthcare systems as a unified team. The pandemic created an opportunity to study how healthcare teams' function and adapt as a cohesive unit during crisis situations. Similarly, Rajapaksha et al. [30] point to the need for more empirical research on health system resilience. Though interventions have been made to improve resilience, there is a crucial need to evaluate these strategies within existing frameworks. This can help identify management deficiencies and provide valuable recommendations based on the pandemic experience. Additionally, Vigoda-Gadot et al. [31] highlight the significance of public personnel management, trust, and social resilience during global crises like the pandemic. More research is required on how healthcare organizations and professionals can effectively manage crises and foster resilience despite unprecedented challenges.

The COVID-19 pandemic revealed gaps in knowledge on the resilience of healthcare systems as a unified entity, with limited research and application of resilience-building strategies. Further research is needed to examine how healthcare teams' function under crisis, identify management gaps, develop recommendations, and understand capabilities in public personnel management, trust, and social resilience during global emergencies. The literature affirms that these spaces require further investigation.

Comparing these studies revealed that the COVID-19 pandemic exposed crucial gaps in understanding healthcare workers' occupational exposure risks and long-term mental health impacts. Specifically, there is limited research on predictors of clinical vulnerability to guide enhanced safety protocols and a lack of knowledge on lasting mental health effects and tailored interventions. To address these gaps, the objectives of this article are threefold: 1) Analyze the impact of the COVID-19 pandemic on the mental, social, and cultural well-being of healthcare workers; 2) reflect on paradigm shifts in medicine due to the pandemic; and 3) develop strategies to ensure health system resilience and universal health coverage in the post-pandemic era. By exploring healthcare professionals' experiences using a grounded theory approach, this study aims to substantiate resilience strategies for health systems and elucidate challenges, opportunities, and shifts in the field of medicine resulting from the pandemic. The findings will help address the identified gaps and promote the well-being of healthcare workers in future health emergencies. The research also aims to highlight the challenges, opportunities, and paradigm shifts in the medical field due to the coronavirus pandemic. To study these impacts, the following research questions have been formulated:

- What impact did the COVID-19 pandemic have on mental, social and cultural well-being in general?
- What is the motivation and novelty of the study that determines its consequential benefits?

To answer the research questions efficiently, the following research objectives have been formulated:

- To analyze the impact of the COVID-19 pandemic on the mental, social and cultural well-being of healthcare workers;
- To reflect the paradigm shifts in the field of medicine due to the COVID-19 pandemic;
- To develop efficient measures for ensuring health system resilience toward universal health coverage and security in the post-COVID-19 era;
- To determine the motivation and novelty of the study for its consequential benefits.

This study can make several key contributions to the literature. First, it provides an in-depth understanding of the long-term mental health and wellbeing consequences of the COVID-19 pandemic on healthcare workers, helping address gaps in knowledge on lasting impacts. Second, by elucidating healthcare professionals' first-hand experiences, the study offers insights into paradigm shifts and innovations in medicine resulting from the pandemic, expanding the knowledge base. Third, the grounded theory approach generates substantive strategies to enhance health system resilience and progress towards universal health coverage based on stakeholders' perspectives, helping translate research to practice. Fourth, the findings can inform interventions and policies to better support healthcare worker wellbeing in future health emergencies. Finally, the study offers methodological value in applying an inductive, ground-up approach to develop actionable frameworks for health system preparedness and response.

2- Literature Review

2-1- Efficiency Improvement of the Health Systems

The health systems play a key role in protecting and promoting the health of communities. However, these systems often face numerous challenges that interfere with their ability to deliver services effectively [32]. One of the main challenges is the need to continually strive to improve efficiency.

Efficiency improvement in public health systems refers to the process of maximizing the use of resources while delivering high-quality healthcare services [33]. It involves streamlining processes, eliminating losses, and optimizing available resources to ensure that the maximum number of people receive the necessary care.

There are several key strategies [34] that can be implemented to improve the efficiency of public health systems.

1. **Technology usage:** electronic health records (EHR) and health information systems can significantly improve data management and coordination between healthcare providers. This not only reduces administrative workload, but also provides more accurate and timely access to patient data, resulting in improved diagnosis and treatment outcomes.
2. **Evidence-based practices:** by adopting scientifically proven methods and interventions, public health systems can ensure that resources are allocated to interventions with the greatest impact. This not only increases efficiency, but also reduces the risk of wasting resources on approaches that have limited or no benefit.

3. **Collaboration and partnerships:** public health systems must work together with other health care providers, community organizations and stakeholders to leverage their collective resources and expertise. By sharing knowledge, pooling resources and coordinating efforts, public health systems can streamline processes, reduce duplication of services and ultimately optimize the use of available resources.
4. **Workforce investment:** training and professional development opportunities for public health professionals can improve their skills and knowledge, enabling them to work more efficiently and effectively. By cultivating a competent and motivated workforce, public health systems improve their overall effectiveness and achieve better outcomes for the communities.
5. **Continuous monitoring and evaluation:** by regularly assessing performance, identifying weaknesses, and making data-driven decisions, public health systems can proactively address challenges and adapt their approaches to maximize effectiveness.

Improving efficiency is of high priority for public health systems to effectively fulfill their responsibilities to protect and promote public health. By mastering technology, adopting evidence-based practices, fostering collaboration, investing in workforce development, and continually evaluating efficiency, public health systems can optimize their resources and ensure the delivery of high-quality health services to those who need them. Improved efficiency not only benefits individuals, but also contributes to their overall well-being [35].

According to health index score, as of 2023, Singapore topped the health index rankings with an impressive score of 86.9. Trailing behind in second and third place were Japan and South Korea respectively. Figure 1 shows health system ranking in some countries (including Iraq, Russia, China, Taiwan, South Korea, Japan, and Singapore).

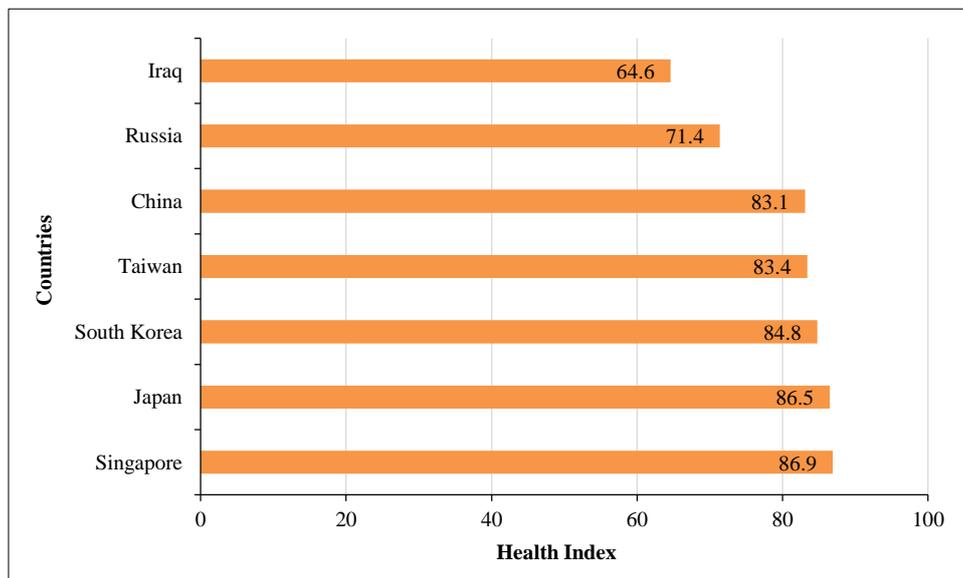


Figure 1. Ranking of countries by health index score in 2023 [36]

2-2- Health System Resilience Concept

Health system resilience is the ability of a health system to withstand shocks and stresses without compromising its ability to provide essential healthcare services. The COVID-19 pandemic has exposed weaknesses in many health systems around the world, highlighting the need for greater resilience in order to respond effectively to future pandemics or other crises.

One key aspect of health system resilience is preparedness. This includes having adequate supplies of personal protective equipment (PPE) and medical equipment, as well as sufficient staffing levels and surge capacity to handle an influx of patients during a crisis. It also involves having clear protocols and guidelines in place for responding to emergencies, as well as robust communication channels between different stakeholders.

Another important element of health system resilience is flexibility. Health systems must be able to adapt quickly to changing circumstances, such as shifting patterns of disease transmission or changes in patient needs. This requires willingness on the part of healthcare organizations and providers to innovate and experiment with new approaches, technologies, and care delivery models.

Equity is another critical factor in building resilient health systems. Ensuring that all individuals have access to high-quality healthcare services is essential not only for promoting population health, but also for ensuring that vulnerable populations are not disproportionately affected by emergencies or crises.

Finally, strong leadership at all levels is crucial for building resilient health systems that can respond effectively in times of crisis. Leaders must be able to inspire confidence among their staff, communicate clearly with patients and other stakeholders, make difficult decisions under pressure, and prioritize the interests of public health above all else. In conclusion, building resilient health systems will require concerted efforts from policymakers, healthcare leaders, providers, researchers, and community members alike. By focusing on preparedness, flexibility equity, and leadership as core principles guiding our responses moving forward, we can build stronger, more sustainable approaches towards tackling emerging challenges within our globalized society.

The concept of healthcare system sustainability is one of the most important matters that emerged after COVID-19 pandemic. The task of identifying and solving problems related to healthcare sustainability obtained the top priority on every social and government level. Healthcare systems across the world turned out to be unprepared for the COVID-19 scale. The traditional healthcare model was not able to solve such extreme challenges as infection spreading. Still, there is a potential for creating more sustainable healthcare systems. One of approaches assumes utilizing data and technologies for increasing the quality of services and developing new strategies of infection control.

One important matter is that creating new, more sustainable healthcare requires cooperation from all society. It can be achieved through information exchange among scientists, government bodies, social organizations and healthcare units. Integration of various healthcare system elements, such as developing infrastructure for quick diagnostic and treatment or using technologies for distant consulting and patients' condition monitoring, is another key factor in improving its sustainability. One more important task is leveling up the professional competence of healthcare workers. Training based on advanced techniques could help improve the qualifications of specialists and provide necessary skills for work under extreme conditions.

Overall, these strategies may help to create a more sustainable healthcare system after the COVID-19 pandemic. Despite they could require significant time and money investments, they appear necessary for the creation of more sustainable healthcare models. Also, they are expected to help society to prepare for future healthcare challenges and ensure accessibility of high-quality medical treatment in any conditions.

There are several directions for improving health system resilience presented in Figure 2.



Figure 2. Resilient populations for resilient health systems: tackling wider determinants of health

2-3-Mental Health/Psychological Well-Being as the Basis for Enhancing Resilient Health Systems

As substantiated in Hummel et al. [37], the psychological well-being of mental health workers is greatly affected. The clues of uncertainty among medical professionals and the amount of stress are highly concerning [38]. The deteriorating effects of burnout and stress among healthcare workers in the post-pandemic period while controlling the spread of the epidemic are emerging as a challenging trend in contemporary research [39]. Medical professionals have higher responsibilities in their delegated job roles and in protecting their families and themselves. However, the notified prevalence of psychological symptoms among medical professionals is showing opposite trends than what is expected [37]. In the post-pandemic period, these stressors may have been exacerbated with additional roles of managing resources and persisted long-lasting epidemic-related job stressors. The increased job demand during the peak period imposed sustained effects on the mental health of workers; hence, these effects must be studied from critical insight [39].

2-4-The Concept of Social Well-Being

The concept of social well-being revolves around the factor of maintaining healthy and meaningful relationships and terms with others [38]. Humans are social animals, which is why the part of the brain called the limbic system is responsible for feeling and needs to interact and be with others to have a sense of happiness and satisfaction [39]. Without the sustainable development and maintenance of one's social well-being, a person can have a sense of social isolation leading to physiological issues such as depression, anxiety, or lowliness disorders [39]. In contrast, cultural well-being can be defined as one of the bases for social interactions as it reflects the concept of sharing common beliefs, values, and identities with others [38].

2-5-Impact of the COVID-19 Pandemic on the Mental Health, Social and Cultural Well-Being of People

The COVID-19 outbreak has led to the imposition of several restrictions by different governments all over the world to restrict the spread of various infections. These impositions included lockdown and travel restrictions, which confronted people with being socially isolated in their homes [40]. This social isolation leads to several mental and psychological disorders among people, leading to depression, anxiety, suicidal thoughts, or aggressive behavior. In mid-March, WHO also published a report reflecting the facts of physiological disorders due to health emergencies imposed across the world [41]. However, no prominent measures were taken during the pandemic regarding the issue of mental illness of people, which is why reportedly, during and post-pandemic, people suffered from psychological disorders more than ever before [42]. This also leads to other major issues such as drug and improper social media usage and abusive behavior, especially among teenagers. Besides, the pandemic also served as the basis for other social issues such as increased crime rates, including robberies and stealing, as the lockdown created severe unemployment globally [43]. Hence, the COVID-19 outbreak led to several mental, social, and cultural issues.

As reported in Vera San Juan et al. [44], psychological tension among medical workers was reported before the peak of the pandemic in relation to knowing the difficult experiences in international frontline practices. This was a form of pre-peak anxiety among the medical staff. Not only this, but also an additional burden imposed caused the staff cognitive stress. These tensions revolved around setting, resources, morals, and barriers while performing the job. However, the study did not indicate the post-COVID retention of mental health stress [45].

One of the studies reported an excessive failure of mental and physical health during the times of the pandemic and indicated that these stresses have changed the situation at workplaces in the post-COVID era. For instance, the psychological preparation of workers before and after the pandemic in the workplace is disruptive in facing this challenge [35]. Another issue of xenophobia was discussed, stressing the fact that bad experiences of the pandemic are changing the perceptions and thinking of workers about colleagues and the social environment. This study was imperative in describing how mental health is affected in the post-COVID situation. However, it does not address the effects and behavior of medical staff, which would be submissive to find since they are frontline support. This can be well discussed in the findings of this study [35].

On the contrary, social life has been compromised. As reported in Billings et al. [46], even though healthcare workers substantiated the values of social media platforms as digital means to interact with colleagues and family. However, this has limited social gatherings and face-to-face communication outside the work environment. In other words, during the pandemic, the strong dependency on technological gadgets has produced a component of self-reliance while minimizing group activities. Changes in all layers of society were observed. In addition, a challenge is to ensure the acceptance of change under the effect of an individual's mental block levels. Studies of change management have also understood that for one to adopt a change or new norm, one must undergo the effect or live in an environment with change for readjustments [35]. However, there are very limited studies regarding the social effects. The previously defined studies have drawn one or two aspects of change in social well-being; however, there are many components to consider, such as consideration of colleagues, teamwork, and tensions in building social relationships.

Apart from this, cultural well-being is perceived as subjected to impact and control of practice changes. The effect of practice and policy reset for post-COVID-19 was studied in Billings et al. [47]. However, this discussion revealed a pool of "sludge" in the healthcare setting in relation to resources and practices. Many streamlined changes were expected in the administrative and medical practices for disease and risk management [47]. However, the study has not defined how and whether these changes were adopted by healthcare staff or if these can be successful in the post-COVID period. In addition, studies have also shared that the pandemic was a key source for bringing the culture of self-care to healthcare individuals. In this regard, healthcare leadership has a major contribution, but there were only indications and a call to action. Furthermore, it was also suggested that without these cultural practices of values and beliefs, there is a risk to manage the ongoing consequences [48]. Moreover, the cultural changes are not related to the practice of healthcare workers but also changes in the mindset and interactions with patients of different races and communities [49]. However, these studies are lacking in defining the effect of these values on culture. The change in mindset with a significant shift from the stressful environment to new adaptations in the post-COVID situation may change the perceptions of healthcare workers. For instance, how they interact with patients and ensure the successful delivery of care. Similarly, COVID-19

imposed social restrictions and introduced a culture of low contact, which may have affected people in the care setting. The present study, therefore, accounts for these factors in view and investigates the perceptions of healthcare workers regarding these changes, which will draw a comprehensive picture of the impact on cultural well-being.

2-5-1- Opportunities and Challenges the Medical Fields Experienced due to the Outbreak

Opportunities provided by the outbreak include the optimal application of digital technologies such as the application of telemedicine, which revolutionizes the healthcare sector in the provision of quality care, and the introduction of e-learning, which advances the research in the perspective of providing novel solutions to the problems [50]. The COVID-19 pandemic also posed serious challenges to the medical field, including absenteeism of proper management and supervision and lack of monetary incentives. The lack of coordination and proper management is lacking since the COVID-19 pandemic is quite new, and the knowledge to deal with such pandemics is very limited. Guidelines issued by the WHO and the government are changing continuously. Healthcare professionals suffered the most from the pandemic as they were doing shifts day and night, which was exasperating [51]. Along with this, they do not have the proper knowledge and training to deal with the pandemic situation. The lack of monetary incentives is also a big issue in this regard. Doctors are doing double to triple shifts, but do not receive many incentives. However, high authorities promised to provide treatment costs if they get infected and provide isolation rooms. However, none of these are applied in real time [51]. All these situations show the opportunities and challenges of a pandemic.

2-5-2- Work Paradigm Shift in the Medical Field due to the COVID-19 Pandemic

The COVID-19 pandemic has created a work paradigm shift in the medical field, leading to attention toward technical help and performance building the global that needs attention. Due to the pandemic, remote learning has gained importance and has a significant influence on the education and training of medical practitioners. Due to this, remote medical learning is gaining importance and evolving quickly. Many efforts have changed to virtualization, all due to technological advancement that creates online tools for learning and training. One is teleultrasound sessions, which gained importance in providing feedback during ultrasound scanning. It excludes the risk of diseases such as pneumothorax. It is also useful in poor resource units that can be run on solar power. Many article clubs and discussions have been shifted virtually due to the pandemic. Many online training platforms are available for medical staff training, and they are accessible globally. There are also online education series on toxicology, which the American College of Medical Toxicology supports to make advancements in the education and training regarding toxicology and train healthcare providers [16].

The practice has changed, e.g., in the mental healthcare sector with counseling. Psychotherapists adopted telepsychotherapy during the pandemic to avoid consequences such as social distancing [52]. The adoption of this practice started in the peak time of COVID-19 and accelerated the use of technology. The study has simultaneously reported challenges of low expertise, technological challenges, and miscommunication. However, this practice was rapidly adopted for learning lessons for the post-COVID era [36]. A similar example of change in practice with telemonitoring and telemedicine for medicine risk management was reported. The impact of telemedicine in diabetes risk management with glucose monitoring and periodic consultation reflected a strong paradigm change in the field of medicine. It is quite a facility for chronic diseases such as diabetes, which requires frequent monitoring and telehealth consultation [22]. All this showed paradigm shifts in the working environment of the medical field due to the COVID-19 pandemic. However, these were not the only changes; there is a significant consideration for the value of basic components, which facilitates the introduction of these changes into practice. For example, leadership, management, time, and values are basic components; however, no studies have discussed healthcare leadership, time, and value in response to COVID-19-related changes in the post-COVID era. Hence, this research will consider these components as well.

One of the main threats to healthcare system sustainability is a lack of medical workers. During the first two years of the pandemic, an increased number of excess mortalities was registered in OECD countries due to low number of medical workers and low social security per capita. Although the number of health workers in OECD countries has reached an all-time high, additional 3 million health and long-term care workers will be needed.

3- Materials and Methods

3-1- Research Design

This study applies a mixed research method (qualitative and quantitative methods) to prioritize the health system resilience factors in two phases. In the first phase, the constructivist grounded theory method, recommended by Charmaz [53], is used to identify the Health System Resilience factors, and in the second phase, these identified factors are ranked using the Analytic hierarchy process (AHP) method, which is a multi-criteria decision-making method, using the experts' opinion, in order to identify the importance of each of the elements of the resilience of the health system. The constructivist grounded theory method enabled us to generate a theory based on the data obtained from interviews with healthcare workers.

The study was designed and implemented based on philosophical principles that appear in the research stages. Ontology, epistemology, and methodology are the philosophical foundations of any study. In our study, the ontological assumption was based on relativism, which means that reality is subjective and varies from person to person. We used constructivism as our epistemological assumption, which involves the creation of a model by analyzing the interview.

3-2-Data Collection Method

To achieve the objectives of this study, a qualitative approach using the constructivist grounded theory method was employed. Detailed and semi-structured interviews were conducted with 20 healthcare professionals, including psychologists, nurses, and community health consultants, who had experience working in the COVID-19 unit. The interviews were conducted in primary care sectors and were scheduled on the basis of the participants' availability and willingness to participate. The data collection period lasted for two months, from December 2022 to February 2023. Participants were assured of the confidentiality of their responses, and informed consent was obtained from all participants prior to the interviews. The interviews were recorded, transcribed, and then analyzed using the constant comparative method to identify emerging themes and concepts related to the impact of COVID-19 on the work-life balance of healthcare professionals. Theoretical saturation was reached after the 14th interview, but to ensure that no new concepts emerged, additional six interviews were conducted. Here are examples of questions asked in interviews.

1. What challenges of fear and anxiety are you facing during COVID-19?
2. Do you have a feeling of isolation and burnout these days, and how has it been impacting your psychological health during the pandemic?
3. Who are your dearest relatives or friends, and how have you been interacting with them during the pandemic?
4. What are the negative components of social influence fostered in the present era of COVID-19?
5. How have COVID-19 containment strategies dealt with the situation of the pandemic, and what would be their consequences in the post-COVID era?
6. How is cultural well-being between doctors and patients affected by the paradigm shift during COVID-19?
7. How has the COVID-19 situation changed, and will it shift the paradigms of providing care to patients after lessons from the pandemic?
8. How do substance abuse and other psychiatric complications affect the service delivery of healthcare workers?
9. Do the actions of medical practitioners align with the ideology of utilitarianism? How can health workers develop these concepts for the happiness of most people living during and after COVID-19?
10. How are healthcare systems thriving in the extremes of the pandemic?

3-3-Sample Size and Sampling Technique

The sample size for two phases of this study consisted of 20 international experts in Global Health System Resilience (psychologists, nurses, and community health consultants) from Gimcheon, South Korea, Moscow, Russia, Hilla, Iraq, and Beijing, China. The authors selected participants from these cities and countries due to their own connections in these locations, which facilitated data collection and interview management. All the authors contributed to the data collection and managing the interviews. The participants were selected based on their professional roles and experience working in the COVID-19 unit. A convenience sampling technique was used to select the participants, as they were approached in the primary care sector and agreed to participate in the study.

The study reached theoretical saturation after the 14th interview, meaning that no new concepts emerged from the data analysis. However, to ensure the reliability and validity of the findings, an additional six interviews were conducted. These interviews confirmed that the concepts had been repeated, and no new themes had emerged, indicating that theoretical saturation had been achieved. The very same experts asked to participate in both phases of this study, i.e., grounded theory and AHP method phases.

3-4-Data Analysis

The data analysis in our study followed the principles of constructivist grounded theory. The analysis was performed simultaneously with the data collection using detailed and semi-structured interviews. The coding process, which is the first step in data analysis in grounded theory, involves four stages: initial coding, focused coding, axial coding, and theoretical coding [54]. The interviews were transcribed and analyzed using NVivo software. In the initial coding stage, we assigned titles related to the content of the interviews. In focused coding, we categorized and divided the titles extracted from the initial coding stage into separate sections and evaluated them in more detail to distinguish their

similarities and differences. We also assigned a label as a concept for each of these categories. The third step was axial coding, where we identified and examined the categories and defined the relationship between them. Finally, in theoretical coding, we determined the relations between the derived categories to form a theoretical model. We also reached theoretical saturation after the 14th interview but conducted additional six interviews to ensure that no new concept emerged. All concepts were repeated in these six interviews. The analysis was conducted through continuous interaction between the researcher and the interviewees.

The Analytic Hierarchy Process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology [55]. It uses a hierarchical structure to represent a decision problem, and then develops priorities for alternatives through pairwise comparisons of criteria and options [55]. A key advantage of AHP is that it helps break down a complex problem into smaller parts, allows for inconsistent judgments, and provides a structured way to evaluate tradeoffs [56]. By reducing complex decisions to a series of one-on-one comparisons, then synthesizing the results, AHP allows decision makers to arrive at the best decision based on both objective information and subjective opinions [57]. Overall, AHP is a flexible and powerful tool for multi-criteria decision-making. Figure 3 illustrates the comprehensive research design and methodology employed in this study.

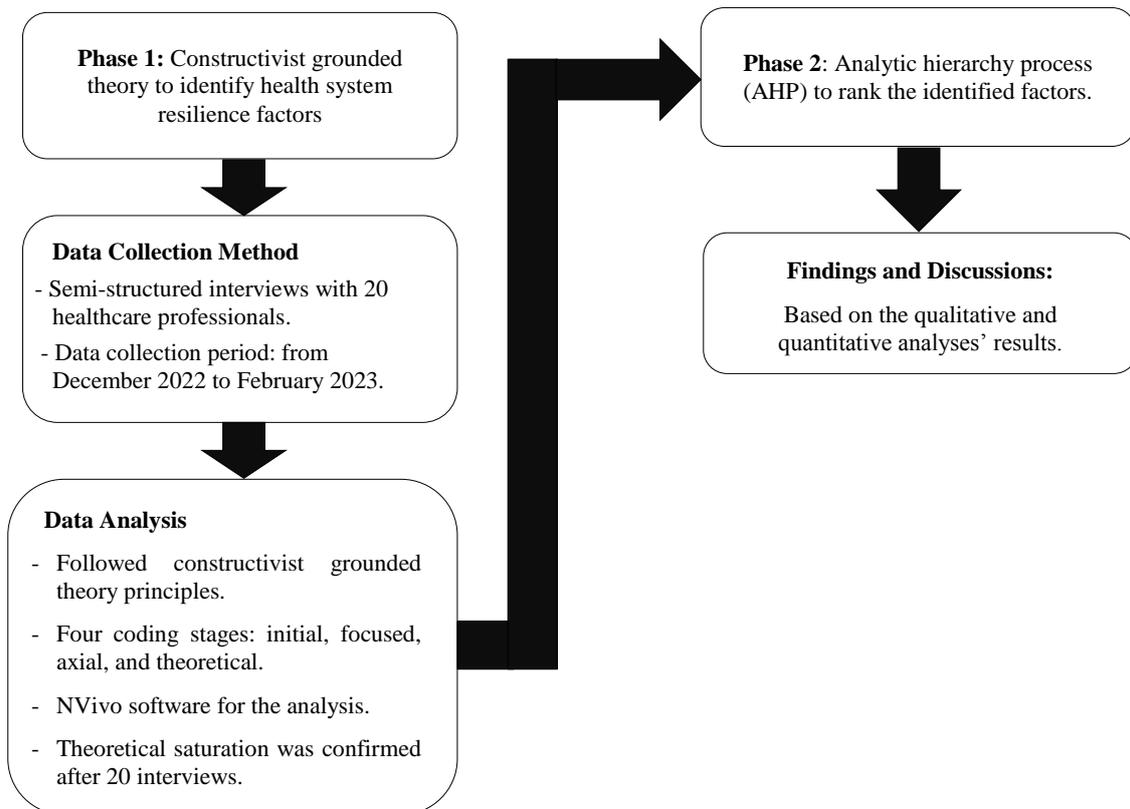


Figure 3. Methodology workflow: a visual representation of the research process

3-5-Ethical Considerations

The ethical considerations in the research methodology reflect the process of compliance with the moral and legal practices during the research. First, ethical approval was obtained via the Helsinki Declaration, and all the study components including methodology were within the scope of this declaration. Under the guidelines of Helsinki, human rights have been preserved, and patient safety was considered as a priority in sharing information [58]. Hence, the respondents were comfortable enough to share their experiences based on voluntary participation. The questions for the interview were shared with the respondents ahead of us to maintain transparency. Moreover, during the research, the study made sure to maintain the confidentiality of the respondents, and the results were generated and presented based on demographic and psychographic factors rather than the identity revelation of the respondents. Besides that, the respondents were previously informed of the field and niche. Their views or responses can be used while communicating the value their responses added to this study. Lastly, the respondents were not forced to share any personal information. Hence, the present research on mental health, social, and cultural well-being in the post-COVID-19 era and challenges, opportunities, and paradigm shifts in the field of medicine comprises all ethical considerations required.

4- Findings

The total number of respondents was 20 for the interview, including psychiatrists (n = 6), nurses (n = 10), and community health consultants (n = 4). The gender distribution was male 55% and female 45% of the total population. The average age of the participants was 45.9 years (SD = 2.02; ranging from 43 to 50 years old). The enrolled participants in the study had different levels of education and hierarchy in their reputable organizations. The education included a Bachelor's degree of a registered nurse, psychiatrist specialist, associate degree, certificate of a community health consultant, and Master's degree (Table 1). The demographic information of the participants can be a reflection of the appropriateness of the responses.

Table 1. The sample demographics and attributes

	n	%
Gender		
Male	11	55%
Female	9	45%
Age		
	<i>M</i> = 45.9 years old	<i>SD</i> = 2.02
Positions		
Psychiatrist	6	30%
Nurses	10	50%
Community Health Consultants	4	20%
Level of Education		
Psychiatrist MD	6	30%
BS registered nurse	7	35%
Community Health Consultants (Master's Degree)	4	20%
Nursing Associate Degree	3	15%
Location		
Gimcheon, Korea	5	25%
Moscow, Russia	5	25%
Hilla, Iraq	3	15%
Beijing, China	7	35%

During the initial coding phase, 697 crucial phrases were identified, followed by the discovery of 44 concepts during the focused coding stage and 13 subcategories during the axial coding stage. All subcategories were then consolidated into a primary category during the theoretical coding stage. The analysis led to the development of a theoretical model that showcases the relationships between different research elements. Table 2 provides instances of the initial codes.

Table 2. Examples of the initial codes

Initial Code	Interview Text	The Key Point
A10	"One of the biggest challenges we faced during the pandemic was the availability of essential medical supplies. We were constantly struggling to get enough personal protective equipment, such as masks and gowns, to keep ourselves and our patients safe. We also faced shortages of critical medications, which made it difficult to provide the best possible care to our patients. It was frustrating to see how the breakdowns in the medical supply chain were affecting our ability to do our jobs and keep people healthy"	Medical supply chain management
C27	"Two aspects of fear, including fear of isolation and fear of contamination, are serious challenges that lead to ultimate anxiety and depression. Healthcare workers are more stressed about the care of patients in a contaminated environment than suffering from the pandemic"	Fear and anxiety levels
E15	"There are also cultural variations such that I have seen differences in attitudes toward minority people working in a highly stressful environment."	Organizational culture

In the next stage of coding, known as focused coding, certain codes are given more importance as they appear more frequently or have greater relevance than others. Table 3 presents an example of the formation of these focused codes.

Table 3. Examples of the focused codes

Focused Code	Key Concepts	Related Initial Codes
AA14	Patient management	A10-A15-A27
AC27	Psychological well-being	C34-C23-C67

The third step in grounded theory is axial coding, where connections between categories and subcategories are made until theoretical saturation is reached. The latest new concept emerged during the 14th interview, and the emerging categories were completed to an acceptable level, however, we conducted another six interviews to make sure if any new concept appeared, which did not happen, and all the concepts inducted from these 6 interviews were already identified among the first 14 interviews. Examples of axial coding are presented in Table 4, and all axial codes resulting from the study are presented in Appendix I (Table A1).

Table 4. Examples of the axial coding

Main Category	Subcategories	Focused Codes
Challenges, Opportunities, and Paradigm Shifts in the Medical Field in Post-COVID Era	Patient management	Managing and treating COVID-19 patients
		Dealing with the backlog of non-COVID medical cases
		Ensuring the safety of healthcare workers and patients
		Addressing the mental health impacts of the pandemic
	Challenges	Medical supply chain management
		Hospital surge capacity
		Healthcare workforce preparedness
		COVID-19 variant response
		Treatment affordability
	Delayed medical care urgency	
	Availability of resources to address backlog	
	Potential for long-term health consequences	
	Impact on healthcare costs and resource allocation	
	Prioritization and triage strategies	
	Protection and infection control measures	
	Community transmission and exposure risk	
	Healthcare worker's psychological impact	
	COVID-19 testing and contact tracing capability	
	Safety compliance	
	Mental health impact	
	Availability of mental health resources	
	Mental health stigma and cultural barriers	
	Addressing social determinants of mental health	
	Mental health integration in healthcare delivery	

4-1-Challenges

Axial and theoretical coding resulted in the findings of two main challenges in the medical field in the post-COVID era, including patient management challenges and health worker well-being challenges (Figure 4).



Figure 4. Post-COVID healthcare challenges

Four categories of challenges were identified in the axial coding and grouped under the label “patient management challenges.” These categories include managing and treating COVID-19 patients, dealing with the backlog of non-COVID medical cases, ensuring the safety of healthcare workers and patients, and addressing the mental health impacts of the pandemic. Below, these findings are debated in detail.

4-1-1- Managing and Treating COVID-19 Patients

The grounded theory analysis revealed five main challenges in managing and treating patients with COVID-19, as reported by healthcare workers. These challenges included medical supply chain management, hospital surge capacity, healthcare workforce preparedness, COVID-19 variant response, and treatment affordability.

Medical supply chain management was identified as a significant challenge, with healthcare workers struggling to obtain essential medical supplies such as personal protective equipment and critical medications. One interviewee stated, *“One of the biggest challenges we faced during the pandemic was the availability of essential medical supplies. We were constantly struggling to get enough personal protective equipment, such as masks and gowns, to keep ourselves and our patients safe. We also faced shortages of critical medications, which made it difficult to provide the best possible care to our patients.”*

Another major challenge was hospital surge capacity, as healthcare workers feared the potential for hospitals to become overwhelmed with patients with COVID-19. In response, many healthcare institutions increased their hospital surge capacity by converting nontraditional spaces into makeshift hospitals. One interviewee reported, *“One of the concerns we had during the pandemic was the potential for hospitals to become overwhelmed with patients. We knew that if the number of COVID-19 cases continued to rise, we might not have enough beds or resources to treat everyone effectively. That is why we worked so hard to increase our hospital surge capacity.”*

Healthcare workforce preparedness was also identified as a challenge, with healthcare workers acknowledging that they were not initially prepared to manage patients with COVID-19 effectively. They reported shortages of supplies and equipment and a lack of appropriate training and expertise. However, many institutions have provided specialized training and education programs to improve healthcare workforce preparedness. One interviewee stated, *“We always knew that there was a risk of pandemics and outbreaks. But when COVID-19 hit, we quickly realized that we were not as prepared as we thought we were. We were short on supplies and equipment, and some of us didn’t have the appropriate training or expertise to manage patients with COVID-19 effectively. That’s why we had to quickly adapt and improve our healthcare workforce preparedness.”*

The emergence of new COVID-19 variants was also identified as a significant challenge. Healthcare workers expressed concerns about the potential impact of these variants on patient care, with some variants leading to more severe cases and hospitalizations. They also acknowledged the possibility of these variants being more resistant to current treatments and vaccines, prompting them to stay informed and ready to adapt quickly to any changes in the situation. One interviewee reported, *“I have been closely monitoring the emergence of new COVID-19 variants and their potential impact on patient care. We have already seen how some variants can lead to more severe cases and hospitalizations, which has forced us to adjust our treatment protocols. We are also concerned about the possibility of these variants being more resistant to current treatments and vaccines. This has prompted us to stay informed and ready to adapt quickly to any changes in the situation. We are continuously reviewing the latest research and recommendations from health authorities to ensure we are providing the best possible care to our patients.”*

Finally, treatment affordability was identified as a growing concern, particularly for patients without adequate health insurance coverage. Healthcare workers reported seeing many patients who were unable to pay for recommended treatments or medications, resulting in delays or forgone treatment. One interviewee stated, *“One of the biggest challenges that I come across is treating patients who cannot afford the cost of treatment. The issue of treatment affordability is a growing concern, especially for patients without adequate health insurance coverage. It is heartbreaking to see them struggle to access the care they need due to financial constraints. It is essential for us as healthcare workers to work with policymakers to find ways to make treatments more affordable and accessible to everyone, regardless of their financial situation.”*

4-1-2- Dealing with the Backlog of Non-COVID Medical Cases

Dealing with the backlog of non-COVID medical cases was identified as one of the major challenges faced by healthcare workers during the pandemic. Based on the interviews, we identified several aspects of this challenge.

First, healthcare workers reported a delay in medical care urgency among patients. Patients were hesitant to seek medical care because of the fear of contracting COVID-19, even if they had serious medical conditions. This resulted in patients’ delaying their medical care until their condition became critical, which put them at a greater risk of severe health outcomes. For example, one interviewee shared, *“I have seen patients with conditions like heart attacks and strokes who delayed seeking care until it was too late, which made their treatment more complicated and less effective. It was frustrating to see patients suffer due to the urgency of delayed medical care. As healthcare workers, we tried our best to raise awareness about the importance of seeking medical care promptly and safely, even during the pandemic.”*

Second, healthcare workers reported a need to address the backlog of cases that had been put on hold during the pandemic. This requires not only scheduling appointments and procedures, but also ensuring that sufficient resources are available to handle the increased demand. One interviewee stated, *“Now that things are starting to get back to normal, we are facing a new challenge: how to address the backlog of cases that we have put on hold. It is not just a matter of scheduling appointments and procedures – we also need to ensure we have the resources we must handle the increased demand. That means more staff, more equipment, and more supplies. It is a daunting task, but we are working hard to secure the resources we need so we can provide the care our patients need and deserve.”*

Third, healthcare workers expressed concern about the potential for long-term health consequences of COVID-19. While progress has been made in treating the acute symptoms of the disease, there is still much to learn about its long-term effects on the body. Patients who have recovered from COVID-19 may still experience lingering symptoms such as shortness of breath, fatigue, and difficulty concentrating. There is also uncertainty about the long-term effects of COVID-19 on other organs, such as the heart and lungs. As one interviewee stated, *“This is why it is so important for us to continue studying the disease and its effects on the body, so we can provide the best possible care for our patients and minimize the potential for long-term health consequences.”*

Fourth, healthcare workers reported an impact on healthcare costs and resource allocation due to the COVID-19 pandemic. The cost of personal protective equipment has increased, and hospitals and clinics have had to spend significant amounts of money to secure enough supplies to keep their staff and patients safe. This has put a strain on healthcare budgets and resources, which were already stretched thin before the pandemic. Additionally, the pandemic has created a backlog of non-COVID medical cases, which has further increased healthcare costs and resource allocation. One interviewee explained, *“We are seeing patients with more advanced diseases and illnesses due to delays in receiving care, which can require more expensive treatments and procedures. As healthcare workers, we are constantly thinking about how we can best allocate our resources to meet the needs of all our patients, especially during these challenging times.”*

Finally, healthcare workers reported the need to develop and implement prioritization and triage strategies to ensure that the patients in urgent need receive timely and appropriate care. This required making difficult decisions about which patients were most likely to benefit from treatment and which patients may need to be referred to other facilities or receive palliative care. Factors such as age, underlying health conditions, and available resources were considered when making these decisions. As one interviewee stated, *“it is difficult to make decisions about which patients to prioritize for treatment. With limited resources and an overwhelming number of patients needing care, we had to develop and implement triage strategies to ensure that those in the most urgent need received timely and appropriate care. This meant making difficult decisions about which patients were most likely to benefit from treatment and which patients may need to be referred to other facilities or receive palliative care. We also had to consider factors such as age, underlying health conditions, and available resources when making these decisions. It was a challenging and emotionally difficult process, but we knew that it was necessary to ensure the best possible outcomes for our patients.”*

4-1-3- Ensuring the Safety of Healthcare Workers and Patients

The interviews conducted highlighted several challenges in ensuring the safety of healthcare workers and patients during the COVID-19 pandemic. The first challenge identified was the importance of protection and infection control measures. A healthcare worker stated, *“We’ve had to adapt to new protocols and guidelines to ensure the safety of both our patients and ourselves. This includes wearing personal protective equipment such as masks, gowns, and gloves and implementing strict hand hygiene practices. We also had to make adjustments to our work environment, such as implementing social distancing measures and increasing cleaning and disinfection procedures.”*

The second challenge identified was the risk of community transmission and exposure. A healthcare worker acknowledged this by saying, *“We have seen firsthand how easily the virus can spread, even among those who are asymptomatic. This is why we have implemented strict protocols to protect ourselves and our patients, including regular testing, wearing personal protective equipment, and practicing social distancing. However, despite our best efforts, there is still a risk of exposure, especially in areas with high rates of community transmission.”*

The third challenge identified was the psychological impact on healthcare workers. One healthcare worker stated, *“The sheer scale of the pandemic, combined with the uncertainty and fear surrounding the disease, has taken a significant toll on our mental health and well-being. We have been working long hours, dealing with critically ill patients and constantly worrying about our own health and the health of our loved ones.”*

The fourth challenge identified was the need for COVID-19 testing and contact tracing capability. A healthcare worker emphasized, *“Testing and contact tracing have been crucial in our efforts to control the spread of COVID-19. We were able to identify positive cases quickly and isolate them to prevent further transmission. The challenge has been keeping up with the demand for testing and contact tracing.”*

Finally, the fifth challenge identified was safety compliance. A healthcare worker highlighted the importance of following safety guidelines and protocols by saying, *“As a team, we hold each other accountable for compliance with these safety measures to protect both ourselves and our patients. It can be challenging at times, especially when we have long shifts or when we are short-staffed, but we know that safety compliance is non-negotiable.”*

4-1-4- Addressing the Mental Health Impacts of the Pandemic

After conducting interviews with healthcare workers, several challenges related to addressing the mental health impacts of the pandemic have been identified. One of the most significant challenges is the mental health impact on healthcare workers. As one interviewee stated, *“the mental health impact of COVID-19 has been immense. We are constantly dealing with critically ill patients and the fear of exposure to the virus. The stress of the pandemic has made it difficult to separate work from personal life, leading to feelings of burnout and exhaustion.”* Healthcare organizations should prioritize the mental health and well-being of their staff and provide resources for support and self-care.

Another important aspect is the availability of mental health resources. Healthcare workers need access to mental health resources during the pandemic. One interviewee pointed out, *“My hospital has been great about providing resources, like counseling services and support groups, to help us cope with the mental health challenges we are facing. They also provide regular wellness activities such as yoga and meditation to help us relax and de-stress.”* These resources can make a significant difference in maintaining the mental health of healthcare workers during this challenging time.

Mental health stigma and cultural barriers are also significant challenges that prevent individuals from seeking the help they need. As one interviewee stated, *“in some cultures, mental health is not discussed openly, and there is a stigma associated with seeking mental health treatment. This can make it difficult for individuals to access the support they need, even when they are struggling with mental health issues.”* Healthcare workers should be sensitive to cultural barriers and provide culturally sensitive care to help break down these stigmas.

Addressing social determinants of mental health is another critical aspect of addressing the mental health impacts of the pandemic. As one interviewee stated, *“factors such as poverty, lack of access to education and healthcare, and social isolation can all contribute to poor mental health outcomes. While we can provide treatment and support for mental health conditions, it is important to also address the underlying social determinants that may contribute to the problem.”* Healthcare providers, community organizations, and policymakers need to work together to address these social determinants to improve the overall health and well-being of communities and reduce the burden of mental illness.

Lastly, mental health integration in healthcare delivery is essential for providing comprehensive care. As one interviewee stated, *“mental health issues are often interconnected with physical health conditions, and addressing both together can lead to better outcomes for patients.”* Integrating mental health services into healthcare delivery can help identify and address mental health concerns early on, preventing them from escalating into more serious conditions. By integrating mental health providers into primary care clinics, patients can easily access mental health services without having to go to a separate location, leading to positive outcomes in terms of improved mental health and overall health outcomes.

Two categories of challenges were identified in the axial coding and grouped under the label “Health Worker Well-Being.” These categories include social and cultural well-being and psychological stress. Below, these findings are presented.

4-1-5- Social and Cultural Well-Being

Social and cultural well-being was identified as a significant challenge among healthcare workers in our interviews. This challenge encompassed various aspects, including organizational culture, diversity and inclusion, workload and job demands, and access to resources.

According to one interviewee, organizational culture plays a crucial role in the social and cultural well-being of health workers. This includes the values and beliefs of the organization, which can impact job satisfaction and overall well-being. The interviewee stated, *“It’s important for healthcare organizations to prioritize the well-being of their staff and create a positive work environment that supports the social and cultural well-being of their employees.”*

Another important aspect of social and cultural well-being is diversity and inclusion. Interviewees emphasized the importance of promoting diversity, equity, and inclusion in healthcare organizations to support the well-being of health workers from underrepresented groups. One interviewee noted that *“when healthcare organizations prioritize diversity, equity and inclusion, it sends a message that all employees are valued and respected, regardless of their background or identity. This creates a more positive work environment, where everyone feels included and supported.”*

Workload and job demands were also identified as significant challenges for healthcare workers’ social and cultural well-being. Interviewees noted that the demanding workload can leave little time or energy for social and cultural activities outside of work, making it difficult for workers to balance work and personal life. One interviewee stated that *“it’s important for healthcare organizations to recognize the impact that workload and job demands can have on their staff’s social and cultural well-being and to take steps to mitigate that impact.”*

Finally, access to resources such as mental health support, social networks, and cultural events was identified as critical for healthcare workers’ social and cultural well-being. Interviewees emphasized the importance of having access to resources that can help manage work-related stress and promote social interaction and cultural understanding. One

interviewee noted that *“having access to counseling services and peer support groups has been helpful in promoting emotional support and discussing work-related challenges.”*

4-1-6- Psychological Stress

Interviews conducted with healthcare workers revealed that psychological stress is a significant challenge during the COVID-19 pandemic. One aspect of this stress is fear and anxiety levels. As one interviewee stated, *“the fear of isolation and contamination has contributed to high levels of anxiety and fear among our patients. This fear and anxiety can manifest in physical symptoms, such as rapid heartbeat and sweating, and can even lead to panic attacks.”* The interviewee emphasized the importance of healthcare organizations providing resources and support to help patients manage their anxiety and fear during this challenging time.

Emotional exhaustion was another aspect of psychological stress identified in the interviews. Healthcare workers are constantly dealing with critically ill patients, long hours, and their own fears, and anxieties about the virus. As one interviewee explained, *“the emotional toll of caring for patients with COVID-19 is significant, and it can be difficult to separate work from personal life.”* Burnout can result in emotional exhaustion, feelings of depersonalization, and a reduced sense of personal accomplishment. The interviewee stressed the need for healthcare organizations to recognize the emotional toll on their staff and provide resources for support and self-care.

Job demands are also a significant contributor to psychological stress of healthcare workers during the pandemic. High-stakes decision-making and long working hours *cause burnout or other mental health issues because of these demands.* Healthcare organizations should recognize that high workload can be physically and emotionally exhausting. As one interviewee stated, *“it is not uncommon for healthcare workers to experience”* all that these job demands can take on their staff and take steps to mitigate the impact. This could include providing mental health resources and adjusting workload and staffing levels.

Social support was the final aspect of psychological stress identified in the interviews. As one interviewee explained, *“having support from colleagues and family can make a huge difference.”* Social support can come in the form of colleagues to talk to and debrief with after challenging cases or family members who understand the challenges of the job and are there to listen when needed. The interviewee emphasized the importance of having this social support network to manage the emotional toll of the job and maintain mental health during this difficult time.

4-2- Opportunities

Through the process of axial and theoretical coding, two main areas of “opportunities” in the medical field emerged in the post-COVID era. These include opportunities related to technology and innovation and those related to public health and policy (Figure 5).

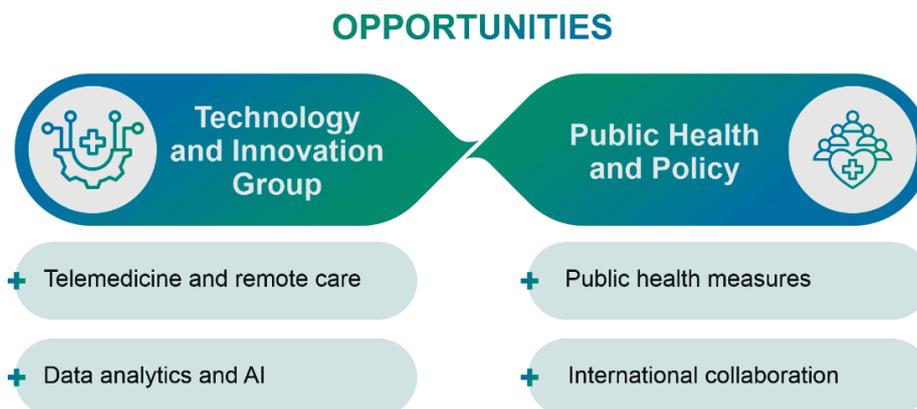


Figure 5. Opportunities in healthcare in the post-COVID era

4-2-1- Telemedicine and Remote Care

During the interviews conducted with healthcare providers and workers, two main opportunities were identified in the post-COVID era in the medical field, including technological equity in healthcare and reliable telecommunication infrastructure. These opportunities were found to be critical in ensuring that patients have equal access to high-quality healthcare.

The first opportunity, technological equity in healthcare, emphasizes the importance of ensuring that patients have access to the technology and internet connectivity necessary for receiving high-quality healthcare. One interviewee stated, *“Access to technology is essential for receiving high-quality healthcare, but unfortunately, many patients do not*

have access to the necessary devices or internet connectivity.” This issue is particularly prevalent in underserved areas, where low-income patients may not have the financial means to purchase devices or reliable internet connectivity. To address this, the interviewee suggested expanding broadband access in rural areas, providing low-cost devices to low-income patients, or offering training and support to patients who may be less comfortable using technology.

The second opportunity identified, reliable telecommunication infrastructure, emphasizes the importance of having high-speed internet and reliable telecommunication infrastructure to support telemedicine and remote patient monitoring. As one interviewee stated, *“with the rise of telemedicine and remote patient monitoring, it is crucial for healthcare organizations to have access to high-speed internet and reliable telecommunication infrastructure.”* The lack of reliable telecommunication infrastructure can limit patients’ ability to receive quality healthcare, particularly in rural or underserved areas. The interviewees emphasized the importance of investing in reliable telecommunication infrastructure to ensure that all patients have equal access to high-quality care, regardless of their location or socioeconomic status.

4-2-2- Data Analytics and Artificial Intelligence (AI)

Opportunities identified in the medical field during the post-COVID Era include data availability and accuracy and AI integration in healthcare decision-making.

During the interviews, participants highlighted the importance of data availability and accuracy in delivering quality care. According to one healthcare provider, *“electronic health records and disease surveillance systems are essential sources of information for healthcare providers, allowing us to track patient health and identify trends in disease prevalence.”* Ensuring that healthcare data is both available and accurate can improve patient outcomes and make more informed decisions about healthcare policy and practice.

Participants also identified AI integration in healthcare decision-making as an opportunity in the era. According to a healthcare provider, *“integrating data analytics and AI into healthcare decision-making can help us predict patient outcomes, identify at-risk populations, and even suggest treatment plans tailored to each patient’s unique needs.”* However, it is important to note that AI should not replace human expertise and judgment. Healthcare providers should work closely with AI technologies to ensure that the insights generated are clinically relevant and appropriate for each patient.

4-2-3- Public Health Measures

Our study revealed that the post-COVID era presented several opportunities in the medical field. Through interviews with healthcare providers, we identified three main opportunities: public health education for prevention, vaccine access and availability, and public health funding and resources.

Regarding public health education for prevention, one interviewee noted, *“There were all sorts of campaigns and outreach efforts aimed at promoting vaccination, hygiene, and social distancing. It was not just about providing information; it was about ensuring that everyone had access to the resources and support they needed to follow through on those recommendations.”* This highlights the importance of education and outreach efforts to promote public health measures, especially in times of crisis.

The importance of vaccine access and availability was also highlighted in our interviews. Another healthcare provider shared, *“Thanks to the rapid development and deployment of COVID-19 vaccines, we now have an opportunity to protect millions of people from this devastating disease. However, there are still challenges to overcome in terms of vaccine access and distribution, particularly in underserved areas.”* This highlights the need for an equitable distribution of vaccines to ensure that everyone has access to protection from infectious diseases.

Finally, our interviews revealed that the COVID-19 pandemic led to a massive influx of public funds directed toward public health initiatives. As one interviewee noted, *“it has allowed us to expand our testing and treatment capabilities, to train more healthcare professionals, and to develop new technologies and therapies that have the potential to revolutionize healthcare.”* This highlights the importance of continued investment in public health to ensure that we are prepared to respond to future health crises.

4-2-4- International Collaboration

The interviews conducted for this study highlighted the importance of international collaboration and coordination in healthcare during the COVID-19 pandemic. Participants pointed out that the pandemic has demonstrated the interconnectedness of our world and the need for global cooperation to address health challenges. Two major opportunities were identified: global healthcare collaboration and coordination and global integration of medical research and treatment protocols.

The first opportunity identified was global healthcare collaboration and coordination. Healthcare organizations, governments, and researchers across different countries and regions came together to provide education and resources,

share knowledge, and provide support and assistance during the pandemic. Participants noted that this level of collaboration and coordination has accelerated the development and approval of COVID-19 treatments and vaccines. They believe that this type of collaboration and coordination will continue to be important beyond the pandemic to address other global health challenges.

One interviewee stated, *“The COVID-19 pandemic has been a stark reminder of the interconnectedness of our world and the need for global collaboration and coordination in healthcare.”* Another interviewee commented, *“By working together, we can achieve more than we ever could alone.”*

The second opportunity identified was the global integration of medical research and treatment protocols. The participants noted that the pandemic has shown the importance of collaboration and integration in medical research and treatment protocols in different healthcare systems and populations. They highlighted the remarkable progress in the development of vaccines and treatments for COVID-19 in a short time, thanks to the global effort of healthcare organizations, governments, and researchers. Participants believe that continuing this kind of collaboration and integration will be essential to address future global health challenges. One interviewee remarked, *“COVID-19 has shown us the importance of collaboration and integration in medical research and treatment protocols across different healthcare systems and populations. Moving forward, it will be essential to continue this kind of collaboration and integration to address other global health challenges.”*

4-3-Paradigm Shifts

Through the process of axial and theoretical coding, two main paradigm shifts were identified in the medical field in the post-COVID era: healthcare delivery models and health promotion and prevention (Figure 6).

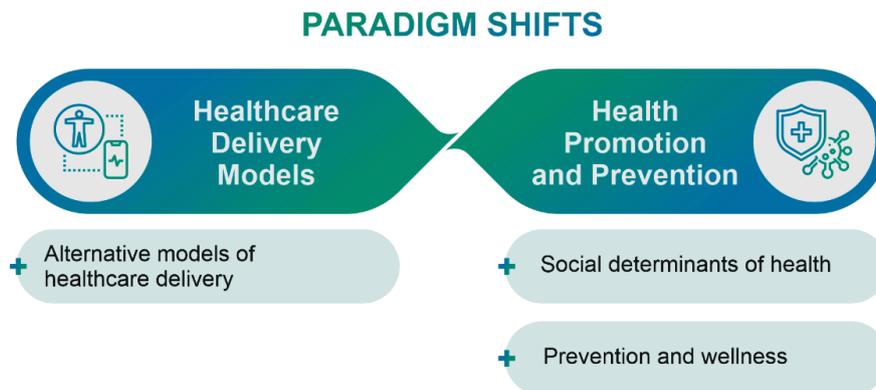


Figure 6. Paradigm shifts in healthcare

4-3-1- Alternative Models of Healthcare Delivery

The interviews revealed three paradigm shifts in healthcare delivery in the post-COVID era. First, there is a need for accessible and affordable alternative healthcare models such as home-based care and community health clinics. As one interviewee stated, *“the COVID-19 pandemic has shown us that there is a great need for alternative healthcare models that are both accessible and affordable, such as home-based care and community health clinics.”* The pandemic has highlighted the limitations of traditional healthcare settings, especially in terms of accessibility and safety. Alternative models of healthcare delivery can provide essential healthcare services in a safe and convenient manner while also being cost-effective.

Second, resource sufficiency is crucial for alternative healthcare delivery models. *“The pandemic has highlighted the importance of resource sufficiency for alternative healthcare delivery models. We should ensure that these models have adequate resources and staff to provide high-quality care to patients,”* said an interviewee. This is especially important in underserved areas, where alternative healthcare delivery models can be a viable solution to improve access to care. Investing in these models can create a more resilient and sustainable healthcare system that can better handle future challenges.

Third, there is a need for legal and regulatory frameworks to support alternative models of healthcare delivery. *“The COVID-19 pandemic has brought attention to the need for legal and regulatory frameworks to support alternative models of healthcare delivery,”* said an interviewee. Regulations must ensure patient safety and quality of care while still allowing for innovation in healthcare delivery. The pandemic has shown that more flexibility in regulatory environments is necessary to allow for the use of alternative healthcare delivery models such as telemedicine and home-based care. Ongoing review and updating of the regulatory frameworks will ensure that they support the use of alternative healthcare models.

4-3-2- Social Determinants of Health

The interviews conducted revealed that the post-COVID era has brought about paradigm shifts in the medical field. One of these paradigm shifts is the increased focus on social determinants of health. This shift includes two aspects that emerged from the interviews: social determinants of health programs and resources and collaboration for addressing social determinants of health.

The first aspect, social determinants of health programs and resources, emphasizes the importance of the availability and accessibility of resources and programs to address social determinants of health. As one interviewee stated, *“the pandemic has exposed the existing health disparities in our communities, which are often rooted in social and economic factors such as poverty, education, and access to healthy food and safe housing.”* The interviewee also noted the development of new programs and resources, such as community health workers who connect patients with social services and partnerships between healthcare organizations and community-based organizations. This underscores the recognition by healthcare providers of the significance of addressing social determinants of health to improve health outcomes and reduce healthcare costs.

The second aspect, collaboration for addressing social determinants of health, emphasizes the importance of collaboration and coordination among healthcare organizations, government agencies, and community-based organizations to address social determinants of health. According to one interviewee, *“the pandemic has made it clear that we need to work together to address the social determinants of health.”* The interviewee stressed the importance of collaboration in providing resources and support to those who are most vulnerable, including addressing factors such as poverty, access to healthy food, and safe living environments. This highlights the recognition of the critical role that social determinants play in overall health and well-being and the need for collaboration to address them effectively.

4-3-3- Prevention and Wellness

The interviews conducted revealed that the post-COVID era has brought about paradigm shifts in the healthcare sector. One of the significant shifts is the focus on prevention and wellness. The interviewee stated, *“We have seen an increase in resources and programs aimed at educating patients on how to prevent illness and maintain good health. This includes things like virtual health classes and workshops and more access to preventive care services like vaccinations and routine check-ups.”* This emphasizes the importance of promoting prevention and wellness to improve overall health outcomes and reduce the burden on the healthcare system.

Another paradigm shift identified is the integration of health promotion and education into the healthcare system. The interviewee stated, *“Healthcare providers are not only treating illnesses, but also focusing on promoting health and wellness among their patients. For example, we have started to see more emphasis on preventative care, such as routine check-ups and screenings. Additionally, patient education has become an integral part of healthcare delivery, with healthcare providers taking the time to explain the importance of healthy habits and lifestyle choices.”* This indicates that healthcare providers are recognizing the significance of patient education in promoting health and wellness and are integrating it into their overall healthcare system planning and implementation.

4-4- Health System Resilience

The resilience of a health system refers to its ability to withstand and effectively respond to various challenges, shocks, and disruptions while maintaining essential healthcare services and minimizing negative impacts on population health [59]. It involves the capacity of the health system to adapt, absorb, and recover from unexpected events, such as pandemics, natural disasters, or other emergencies, while ensuring the continuity of care, protecting the well-being of healthcare workers, and meeting the evolving needs of the population [60]. A resilient health system recognizes the importance of an appropriately distributed and motivated workforce [58]. This involves having adequate human and physical resources, including diagnostics, primary and specialist care facilities, pharmaceuticals, vaccines, and medical equipment [61, 62]. It also entails the ability to increase the capacity of services and healthcare professionals to cope with sudden surges in demand [63]. Prioritizing health worker well-being, providing support mechanisms, and ensuring their safety are critical for maintaining a resilient health system, as a motivated and well-supported workforce is essential in responding effectively to incidents like pandemics [64, 65]. The resilience of a health system refers to its capacity to withstand, adapt, and recover from shocks and challenges while continuing to provide essential healthcare services. The necessities for a resilient health system encompass preparedness and response planning, coordination among stakeholders, an organizational learning culture, effective information systems, surveillance capabilities, sufficient financial resources, comprehensive health coverage, and a motivated workforce.

By prioritizing these elements, health systems can enhance their resilience and better protect population health in the face of incidents such as the COVID-19 pandemic. Therefore, all the factors identified in the first phase of this study (i.e., the output of the grounded theory phase) as challenges, opportunities, and paradigm shifts in the medical field in the post-COVID era should be considered to evaluate the resilience of a health system. In other words, this study

considers the following factors as the health system resilience factors: managing and treating COVID-19 patients (medical supply chain management, hospital surge capacity, healthcare workforce preparedness, COVID-19 variant response, treatment affordability), dealing with the backlog of non-COVID medical cases (delayed medical care urgency, availability of resources to address the backlog, potential for long-term health consequences, impact on healthcare costs and resource allocation, prioritization and triage strategies), ensuring the safety of healthcare workers and patients (protection and infection control measures, community transmission and exposure risk, psychological impact on healthcare workers, COVID-19 testing and contact tracing capability, safety compliance), addressing the mental health impacts of the pandemic (mental health impact, availability of mental health resources, mental health stigma, cultural barriers, addressing social determinants of mental health, mental health integration into healthcare delivery), psychological stress (fear and anxiety levels, emotional exhaustion, job demands, social support), social and cultural well-being (organization, culture, diversity, inclusion, workload, job demand, access to resources), telemedicine and remote care (technological equity in healthcare, reliable telecommunication infrastructure), data analytics and AI (data availability and accuracy, AI integration into healthcare decision-making), public health measures (public health education for prevention, vaccine access and availability, public health funding and resources), international collaboration (global healthcare collaboration and coordination, global integration of medical research and treatment protocols), alternative models of healthcare delivery (accessibility and affordability of alternative healthcare models, resource sufficiency for alternative healthcare delivery, regulations for alternative healthcare delivery), social determinants of health (social determinants of health programs and resources, collaboration for addressing social determinants of health), prevention and wellness (promotion of prevention and wellness, integration of health promotion and education into healthcare system).

The analytic hierarchy process (AHP) was used to rank the importance of factors contributing to health system resilience, and the findings are summarized in Table 5. Subcategories and focused codes in Table A1 are considered respectively as the main factors and sub-factors to evaluate health system resilience. The third column of Table 5 reflects the weights of factors and sub-factors of health system resilience, obtained from the AHP approach. The weight of the main factors of health system resilience are bold and also depicted in Figure 7 which presents the overall scores or weights assigned to the main factors contributing to health system resilience as determined by the AHP. These weights indicate the relative importance of each factor in evaluating health system resilience. Among the main factors, telemedicine and remote care received the highest weight of 0.0978, indicating its significant role in building a resilient health system. Ensuring the safety of healthcare workers and patients followed closely with a weight of 0.0904, emphasizing the importance of protecting the well-being of those involved in healthcare delivery. Alternative models of healthcare delivery (weight: 0.0828), social and cultural well-being (weight: 0.0816), and data analytics and AI (weight: 0.0815) were also identified as key factors in enhancing health system resilience. Psychological stress (weight: 0.0804), social determinants of health (weight: 0.0787), and addressing the mental health impacts of the pandemic (weight: 0.0742) were other significant factors to consider. Dealing with the backlog of non-COVID medical cases (weight: 0.0694), public health measures (weight: 0.0685), international collaboration (weight: 0.0673), managing and treating COVID-19 patients (weight: 0.0662), and prevention and wellness (weight: 0.0612) were also found to contribute to health system resilience, albeit with relatively lower weights compared to the top-ranking factors. These results provide valuable insights into the prioritization of factors in strengthening health system resilience. Policymakers, healthcare leaders, and stakeholders can utilize this information to focus their efforts on the most critical areas for building resilient health systems capable of effectively responding to challenges and ensuring the well-being of populations.

Table 5. Weighted scores of all the factors and sub-factors in health system resilience using AHP

Factors	Sub-factors	Weights	Weighted scores
<i>Managing and treating COVID-19 patients:</i>		0.0662	
	Medical supply chain management	0.1735	0.011486
	Hospital surge capacity	0.2176	0.014405
	Healthcare workforce preparedness	0.1902	0.012591
	COVID-19 variant response	0.1906	0.012618
	Treatment affordability	0.2281	0.0151
<i>Dealing with the backlog of non-COVID medical cases:</i>		0.0694	
	Delayed Medical Care Urgency	0.206	0.014296
	Availability of resources to address backlog	0.2221	0.015414
	Potential for long-term health consequences	0.1834	0.012728
	Impact on healthcare costs and resource allocation	0.1404	0.009744
	Prioritization and triage strategies	0.2481	0.017218

<i>Ensuring the safety of healthcare workers and patients:</i>	0.0904	
Protection and infection control measures	0.1908	0.017248
Community Transmission and Exposure Risk	0.2356	0.021298
Healthcare worker's psychological impact	0.1753	0.015847
COVID-19 Testing and Contact Tracing Capability	0.1871	0.016914
Safety Compliance	0.2112	0.019092
<i>Addressing the mental health impacts of the pandemic:</i>	0.0742	
Mental Health Impact	0.2173	0.016124
Availability of Mental Health Resources	0.196	0.014543
Mental Health Stigma and Cultural Barriers	0.1753	0.013007
Addressing social determinants of mental health	0.1765	0.013096
Mental health integration in healthcare delivery	0.2349	0.01743
<i>Psychological Stress:</i>	0.0804	
Fear and anxiety levels	0.2761	0.022198
Emotional exhaustion	0.2539	0.020414
Job demands	0.2383	0.019159
Social support	0.2317	0.018629
<i>Social and cultural well-being:</i>	0.0816	
Organizational culture	0.2445	0.019951
Diversity and inclusion	0.2213	0.018058
Workload and job demand	0.2738	0.022342
Access to resources	0.2604	0.021249
<i>Telemedicine and remote care:</i>	0.0978	
Technological equity in healthcare	0.7235	0.070758
Reliable telecommunication infrastructure	0.2765	0.027042
<i>Data analytics and AI:</i>	0.0815	
Data availability and accuracy	0.6944	0.056594
AI integration in healthcare decision-making	0.3056	0.024906
<i>Public health measures:</i>	0.0685	
Public health education for prevention	0.4212	0.028852
Vaccine access and availability	0.3445	0.023598
Public health funding and resources	0.2343	0.01605
<i>International collaboration:</i>	0.0673	
Global healthcare collaboration and coordination	0.5983	0.040266
Global integration of medical research and treatment protocols	0.4017	0.027034
<i>Alternative models of healthcare delivery:</i>	0.0828	
Accessibility and affordability of alternative healthcare models	0.2982	0.024691
Resource sufficiency for alternative healthcare delivery	0.3239	0.026819
Regulations for alternative healthcare delivery	0.3779	0.03129
<i>Social determinants of health:</i>	0.0787	
Social determinants of health programs and resources	0.4121	0.032432
Collaboration for addressing social determinants of health	0.5879	0.046268
<i>Prevention and wellness:</i>	0.0612	
Promotion of Prevention and Wellness	0.6729	0.041181
Integration of health promotion and education into healthcare system	0.3271	0.020019

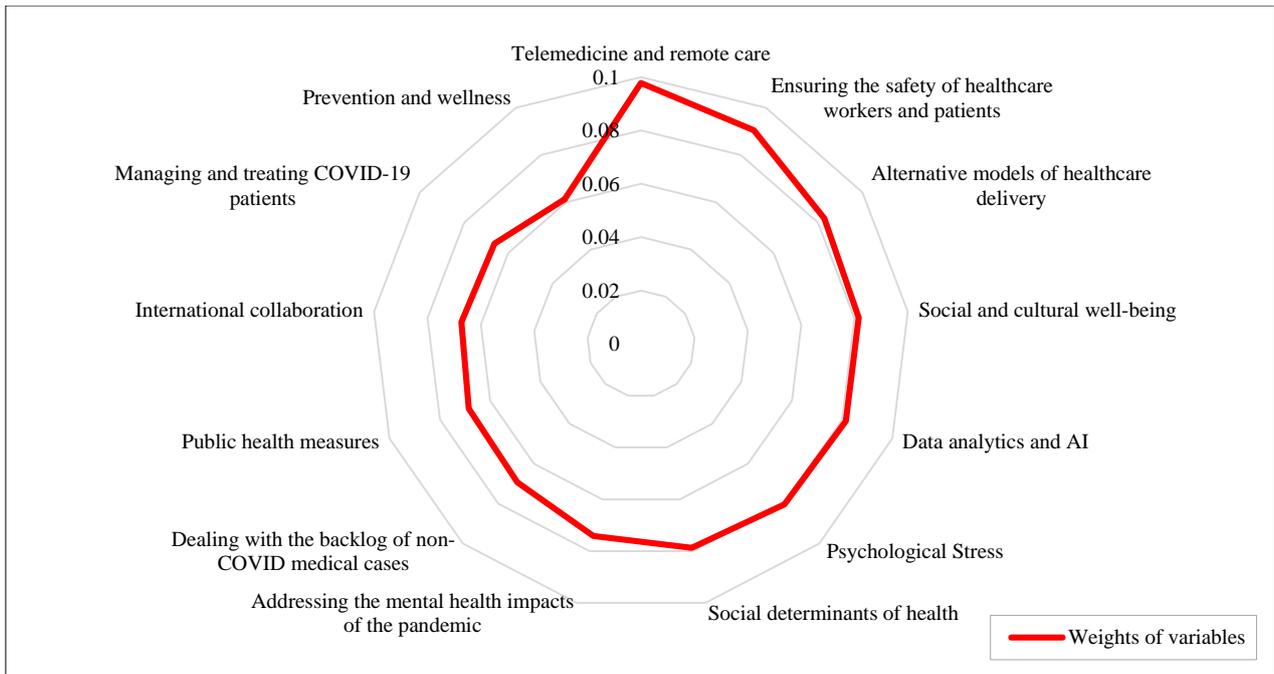


Figure 7. Overall scores of the main factors in health system resilience using AHP

The fourth column of the table shows weighted scores of the sub-factors obtained by multiplying the weight of each sub-factor by the weight of the main factor.

5- Discussion

The results of this study provide valuable insights into the challenges, opportunities, and paradigm shifts in the medical field during the post-COVID era, as well as key factors contributing to health system resilience. The challenges identified highlight issues around managing COVID-19 treatment, addressing backlogs of non-COVID care, ensuring healthcare safety, and supporting mental health. This aligns with existing literature documenting the strains on healthcare systems during the pandemic [66-68]. The findings emphasize the need for continued vigilance around COVID-19, while also expanding access and managing deferred care. Supporting healthcare worker wellbeing is also underscored as an urgent priority.

At the same time, opportunities around technology, data analytics, public health, and global collaboration emerged from the pandemic. The acceleration of telemedicine, investments in public health infrastructure, and breakthroughs in vaccine development underscore how crises can catalyze innovation. This reflects discussions in the literature around potential lasting benefits from the pandemic response [69, 70]. However, realizing these opportunities requires addressing access barriers and health disparities.

The study also revealed paradigm shifts toward prevention, social determinants of health, and alternative care models. This indicates a growing awareness of the need for more holistic, equitable and proactive healthcare. The literature similarly points to these shifts representing a changing philosophy in healthcare [71, 72]. However, implementing these philosophical shifts in practice remains challenging.

Using AHP, this study identified key factors in health system resilience, including workforce protection, remote care capabilities, data analytics, and mental healthcare. This prioritization provides guidance to policymakers on targeting investments to strengthen resilience. The factors align with characteristics of resilience highlighted in existing frameworks [73]. However, there are opportunities for further research on weighting resilience factors across different contexts.

This study makes important contributions by eliciting and analyzing perspectives from frontline healthcare professionals to develop an empirically-grounded understanding of the post-COVID healthcare landscape. The research identifies key challenges, opportunities, paradigm shifts, and priorities for health system resilience based on the lived experiences of those providing care during the pandemic. These insights can inform policies and investments aimed at strengthening healthcare systems, supporting healthcare workers, managing care backlogs, improving public health capabilities, harnessing technology, and fostering global collaboration. This study provides a foundation for further research while generating timely practical recommendations to guide healthcare leaders and policymakers during this critical window. Most significantly, it gives voice to the first-hand accounts of healthcare workers, honoring their indispensable service and benefiting from their hard-won wisdom.

5-1-Theoretical Contributions

The findings of this study have significant theoretical contributions to the field of healthcare, particularly in the post-COVID era. First, the identification of challenges faced by the healthcare system in the post-COVID era offers a theoretical contribution in terms of understanding the complex interplay between healthcare, public health, and policy. It highlights the importance of ensuring healthcare workforce preparedness, managing the medical supply chain, addressing the backlog of non-COVID medical cases, ensuring the safety of healthcare workers and patients, and addressing the mental health impacts of the pandemic.

Moreover, the identification of opportunities presented by technology, innovation, and public health measures offers theoretical contributions in terms of understanding the potential for technological equity in healthcare, reliable telecommunication infrastructure, AI integration in healthcare decision-making, global healthcare collaboration and coordination, and vaccine access and availability.

Furthermore, the identification of paradigm shifts in healthcare highlights the importance of focusing on prevention, wellness, and patient education, as well as integrating these elements into overall healthcare system planning and implementation. This paradigm shift can contribute to a more proactive approach to healthcare, leading to improved health outcomes and reduced burden on the healthcare system. These theoretical contributions provide insights into potential avenues for future research and practice in healthcare, and the potential for innovation and collaboration to improve healthcare outcomes.

5-2-Practical Implementations

Based on the findings of this study, there are several practical implications for the medical field in the post-COVID era.

First, there is a need for healthcare providers to prioritize prevention and wellness promotion in their practice and to integrate patient education into their delivery of care. This can be achieved by offering more virtual health classes and workshops and by ensuring patients have greater access to preventive care services such as vaccinations and routine check-ups.

Second, healthcare systems should prioritize the integration of prevention, wellness, and patient education into overall healthcare system planning and implementation. This can be achieved by developing more comprehensive health promotion programs and ensuring that healthcare providers have the necessary resources and training to effectively promote and educate patients on healthy habits and lifestyle choices.

Third, healthcare systems should focus on addressing the challenges and opportunities identified in this study. This includes managing and treating COVID-19 patients, dealing with the backlog of non-COVID medical cases, ensuring the safety of healthcare workers and patients, addressing the mental health impacts of the pandemic, and promoting the well-being of healthcare workers.

Finally, there is a need for investment in technology and innovation, including telemedicine and remote care, data analytics and AI, and reliable telecommunication infrastructure. There is also a need for increased funding and resources for public health measures, including public health education for prevention, vaccine access and availability, and global healthcare collaboration and coordination.

By implementing these practical recommendations, healthcare providers and systems can effectively respond to the challenges and opportunities presented by the post-COVID era and ensure that they are well-prepared to provide high-quality care to their patients. The COVID-19 pandemic showed the vulnerability of the global healthcare system and the necessity to increase its sustainability. Based on analysis of past pandemics and modern experience of fighting against COVID-19, several recommendations for improving the sustainability of the global healthcare system can be given.

1. *Reinforcing local healthcare systems:* Local healthcare systems are the first line of defense against epidemics; hence, they must be equipped with all necessary resources for quick and efficient reaction to potential threats. This means investments are needed in developing medical infrastructure, personnel training, purchasing medical equipment and drugs.
2. *Creation of global pandemic fund:* Establishing a global pandemic fund could be an important step for improving the sustainability of the global healthcare system. This fund is supposed to be used for quick reaction to alarms, buying necessary medical assets and training personnel.
3. *Reinforcing international cooperation:* COVID-19 demonstrated that epidemics are not held by borders, so only strong international cooperation can be effective against them, which requires creation of mechanisms for international action coordination, experience and information exchange, and developing the unified strategy for fighting against potential threats.
4. *Investing in scientific research:* Scientific research is the key factor in improving global healthcare system sustainability. They help to reveal new threats, develop methods of disease prevention and treatment, and optimize the work of healthcare systems.

5. *Raising public awareness:* The population must be aware of potential threats to its health and of proper reaction. Propaganda campaigns of healthy lifestyle, diseases prevention and proper use of medical resources must become an important part of the strategy for improving global healthcare system sustainability.

In general, improving the sustainability of the global healthcare system after the COVID-19 pandemic requires a complex approach and cooperation between all parties involved. The main areas of action are reinforcing local health systems, creating a global pandemic fund, reinforcing international cooperation, investing in research, and raising public awareness.

6- Conclusion

This constructivist grounded theory study offers invaluable insights into the landscape of healthcare in the post-COVID era, grounded in the perspectives of frontline healthcare workers who experienced the pandemic firsthand. The findings shed light on the multifaceted challenges faced by healthcare systems, including struggles to manage COVID-19 treatment, address backlogs of non-COVID care, ensure healthcare safety, and support mental health. However, the results also reveal opportunities sparked by the pandemic to leverage technology, data analytics, public health infrastructure, and global collaboration to innovate healthcare. Notably, the study indicates paradigm shifts toward prevention, social determinants of health, and alternative care models, reflecting changing philosophies and priorities in healthcare delivery. Analyzing these results through the lens of health system resilience reveals key priorities such as protecting the healthcare workforce, building remote care capabilities, harnessing data analytics, and investing in public health and mental healthcare. The study makes important theoretical contributions around promoting prevention and wellness, integrating health education into care, and embracing technology and innovation to overcome challenges. Practical implications call for investments in prevention programs, integrating health promotion into planning, and leveraging telemedicine, data analytics, and global partnerships. This timely research elucidates the perspectives of healthcare workers, honoring their service while generating actionable recommendations to guide policymakers and leaders in building more sustainable, equitable, and resilient health systems ready to respond to future crises.

The study provides a foundation for further research while delivering urgently needed insights to inform healthcare in the post-pandemic era as the field continues to evolve. Further exploration of healthcare workers' experiences using qualitative approaches could provide richer insights into the long-term impacts of the pandemic. Quantitative studies assessing factors like workforce retention and mental health outcomes could supplement the qualitative data. Research might also focus on specific resilience strategies and innovations that emerged during the pandemic using case study approaches. Evaluative studies could then assess the implementation and effectiveness of these strategies. Finally, future research should examine the generalizability of the findings to different cultural contexts and low-resource settings.

7- Declarations

7-1- Author Contributions

Conceptualization, D.D. and Z.R.G.; methodology, M.V.M. and D.D.; software, M.E.K.; validation, M.V.V. and M.V.M.; formal analysis, Z.R.G. and Z.H.A.Q.; investigation, E.V.K. and Z.R.G.; resources, M.E.K.; data curation, D.D.; writing—original draft preparation, M.V.M., Z.H.A.Q., and M.E.K.; writing—review and editing, D.D., M.V.V., Z.R.G., and E.V.K.; visualization, M.E.K.; supervision, D.D.; project administration, D.D.; funding acquisition, M.V.V. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available in the present article

7-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-4- Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki. Under the guidelines of Helsinki, human rights have been preserved and participants' safety was considered as a priority for sharing information. During the research, the study made sure to maintain the confidentiality of the respondents, and the results were generated and presented based on demographic and psychographic factors rather than the identity revelation of the respondents. The respondents were not forced to share any personal information.

7-5- Informed Consent Statement

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

7-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

8- References

- [1] W.H.O. (2021). Building Health Systems Resilience for Universal Health Coverage and Health Security during the COVID-19 Pandemic and Beyond: A Brief on the WHO Position. World Health Organization (WHO), Geneva, Switzerland. Available online: <https://www.who.int/publications/i/item/WHO-UHL-PHC-SP-2021.01> (accessed on November 2023).
- [2] W.H.O. (2020). Glossary of Health Emergency and Disaster Risk Management Terminology. World Health Organization (WHO), Geneva, Switzerland. Available online: <https://www.who.int/publications/i/item/9789240003699> (accessed on November 2023).
- [3] Preston, S. H., & Bank, W. (1994). World Development Report 1993: Investing in Health. *Population and Development Review*, 20(2), 464. doi:10.2307/2137529.
- [4] W.H.O. (2005). International Health Regulations (3rd Ed.). World Health Organization (WHO), Geneva, Switzerland. Available online: <https://www.who.int/publications/i/item/9789241580496> (accessed on November 2023).
- [5] Wenham, C., Katz, R., Birungi, C., Boden, L., Eccleston-Turner, M., Gostin, L., Guinto, R., Hellowell, M., Onarheim, K. H., Hutton, J., Kapilashrami, A., Mendenhall, E., Phelan, A., Tichenor, M., & Sridhar, D. (2019). Global health security and universal health coverage: From a marriage of convenience to a strategic, effective partnership. *BMJ Global Health*, 4(1), 1145. doi:10.1136/bmjgh-2018-001145.
- [6] OECD. (2023). Ready for the Next Crisis? Investing in Health System Resilience. Organisation for Economic Cooperation and Development, OECD Publishing, Paris, France. doi:10.1787/1e53cf80-en.
- [7] Donskikh, O. A. (2021). Moral and Ideological Consequences of Pandemic. *The Beacon: Journal for Studying Ideologies and Mental Dimensions*, 3(2), 020510125. doi:10.55269/thebeacon.3.020510125.
- [8] Sokolov, E. V., & Kostyrin, E. V. (2022). Social Financial Technologies for the Development of Large-Scale Healthcare Systems and the Russian Economy. 2022 15th International Conference Management of Large-Scale System Development (MLSD). doi:10.1109/mlsd55143.2022.9934748.
- [9] Greenberg, N., Brooks, S. K., Wessely, S., & Tracy, D. K. (2020). How might the NHS protect the mental health of health-care workers after the COVID-19 crisis? *The Lancet Psychiatry*, 7(9), 733–734. doi:10.1016/S2215-0366(20)30224-8.
- [10] Kathirvel, N. (2020). Post COVID-19 pandemic mental health challenges. *Asian Journal of Psychiatry*, 53, 102430. doi:10.1016/j.ajp.2020.102430.
- [11] Banerjee, D., Vaishnav, M., Sathyanarayana Rao, T. S., Raju, M. S. V. K., Dalal, P. K., Javed, A., Saha, G., Mishra, K. K., Kumar, V., & Jagiwal, M. P. (2020). Impact of the COVID-19 pandemic on psychosocial health and well-being in South-Asian (World Psychiatric Association zone 16) countries: A systematic and advocacy review from the Indian Psychiatric Society. *Indian Journal of Psychiatry*, 62(9), S343–S353. doi:10.4103/psychiatry.IndianJPsychiatry_1002_20.
- [12] Wang, X., Wong, Y. D., & Yuen, K. F. (2021). Rise of ‘lonely’ consumers in the post-covid-19 era: A synthesised review on psychological, commercial and social implications. *International Journal of Environmental Research and Public Health*, 18(2). doi:10.3390/ijerph18020404.
- [13] Filindassi, V., Pedrini, C., Sabadini, C., Duradoni, M., & Guazzini, A. (2022). Impact of COVID-19 First Wave on Psychological and Psychosocial Dimensions: A Systematic Review. *Covid*, 2(3), 273–340. doi:10.3390/covid2030022.
- [14] Sohn, J. N. (2021). Impact of Covid-19 Pandemic on Mental Health and Associated Risk Factors. *Journal of Southwest Jiaotong University*, 56(5), 213–224. doi:10.35741/issn.0258-2724.56.5.20.
- [15] Moskovkin, V. M. (2020). Do We Need a Great Reset? COVID-19, Black Revolution, Inequality and Common Good. *The Beacon: Journal for Studying Ideologies and Mental Dimensions*, 3(1), 011310115. doi:10.55269/thebeacon.3.011310115.
- [16] Mamelund, S. E., & Dimka, J. (2021). Not the great equalizers: Covid-19, 1918–20 influenza, and the need for a paradigm shift in pandemic preparedness. *Population Studies*, 75(S1), 179–199. doi:10.1080/00324728.2021.1959630.
- [17] Rao, G., Singh, A., Gandhotra, P., Meraj, P., Jauhar, S., Kuvin, J., Epstein, L., Naidu, S., Arora, R., Kaplan, B., & Jauhar, R. (2021). Paradigm Shifts in Cardiac Care: Lessons Learned From COVID-19 at a Large New York Health System. *Current Problems in Cardiology*, 46(3), 100675. doi:10.1016/j.cpcardiol.2020.100675.
- [18] Danne, T., Limbert, C., Puig Domingo, M., Del Prato, S., Renard, E., Choudhary, P., & Seibold, A. (2021). Telemonitoring, Telemedicine and Time in Range During the Pandemic: Paradigm Change for Diabetes Risk Management in the Post-COVID Future. *Diabetes Therapy*, 12(9), 2289–2310. doi:10.1007/s13300-021-01114-x.

- [19] Guzoňová, V., & Bočková, K. (2022). Color Preferences for Morning and Evening Chronotypes. *Emerging Science Journal*, 6(4), 798-816. doi:10.28991/ESJ-2022-06-04-010.
- [20] Tatarcanov, A. A. B., Alexandrov, I. A., & Olejnik, A. V. (2020). Evaluation of the contact surface parameters at knurling finned heat-exchanging surface by knurls at ring blanks. *Periodico Tche Quimica*, 17(36), 372–389.
- [21] Oleinik, A., Kapitanov, A., Alexandrov, I., & Tatarcanov, A. (2020). Calculation methodology for geometrical characteristics of the forming tool for rib cold rolling. *Journal of Applied Engineering Science*, 18(2), 292–300. doi:10.5937/jaes18-25211.
- [22] Kartashova, E. A., & Sarvilina, I. V. (2019). About the prognostic role of fibulin-5 protein in the progression of pathological vascular remodeling in patients with isolated systolic arterial hypertension. *Advances in Gerontology*, 32(6), 1003–1010.
- [23] Kartashova, E. A., & Sarvilina, I. V. (2018). The influence of cytoflavin on molecular mechanisms of myocardial and vascular wall remodeling in patients with systolic arterial hypertension. *Cardiology and Cardiovascular Surgery*, 11(5), 40–46. doi:10.17116/kardio20181105140.
- [24] Reyes, J. A., Bates, A., & Gadaleta, D. (2021). Raising the Standard: Extending Patient-centered Care via Digital Healthcare. *Bariatric Times*, 18(5), 14–15
- [25] Moosavi, S., Namdar, P., Moghaddam Zeabadi, S., Akbari Shahrestanaki, Y., Ghalenoei, M., Amerzadeh, M., & Kalhor, R. (2023). Healthcare workers exposure risk assessment in the context of the COVID-19: a survey among frontline workers in Qazvin, Iran. *BMC Health Services Research*, 23(1), 155. doi:10.1186/s12913-023-09160-w.
- [26] Ashinyo, M. E., Dubik, S. D., Duti, V., Amegah, K. E., Ashinyo, A., Larsen-Reindorf, R., Kaba Akoriyea, S., & Kuma-Aboagye, P. (2020). Healthcare Workers Exposure Risk Assessment: A Survey among Frontline Workers in Designated COVID-19 Treatment Centers in Ghana. *Journal of Primary Care & Community Health*, 11. doi:10.1177/2150132720969483.
- [27] Wang, J., Zhou, M., & Liu, F. (2020). Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. *Journal of Hospital Infection*, 105(1), 100–101. doi:10.1016/j.jhin.2020.03.002.
- [28] Talae, N., Varahram, M., Jamaati, H., Salimi, A., Attarchi, M., Kazempour dizaji, M., Sadr, M., Hassani, S., Farzanegan, B., Monjazebi, F., & Seyedmehdi, S. M. (2022). Stress and burnout in health care workers during COVID-19 pandemic: validation of a questionnaire. *Journal of Public Health (Germany)*, 30(3), 531–536. doi:10.1007/s10389-020-01313-z.
- [29] Ambrose, J., Catchpole, K., Evans, H., Nemeth, L., Layne, D., & Michelle, N. (2023). Healthcare Team Resilience During COVID-19: A Qualitative Study. doi:10.21203/rs.3.rs-2626478/v1.
- [30] Rajapaksha, R. M. N. U., Khatri, R. B., Abeysena, C., Wijesinghe, M. S. D., Endalamaw, A., Thomas, T. K., Perera, N., Rambukwella, R., De Silva, G., Fernando, M., & Alemu, Y. A. (2022). Success and challenges of health systems resilience-enhancing strategies for managing Public Health Emergencies of International Concerns (PHEIC): A systematic review protocol. *BMJ Open*, 12(11), e067829. doi:10.1136/bmjopen-2022-067829.
- [31] Vigoda-Gadot, E., Cohen, N., & Mizrahi, S. (2022). Battling COVID-19: Public Personnel Management, Trust, and Social Resilience During a Global Crisis. *Review of Public Personnel Administration*, 43(3), 583–613. doi:10.1177/0734371x221111479.
- [32] Lee, B. W. (2020). A study on the awareness of community public health project among the employees in the public health center. *Medico-Legal Update*, 20(1), 1614–1620. doi:10.37506/v20/i1/2020/mlu/194533.
- [33] Lee, B. W. (2023). A Study to Establish Local Healthcare Projects in the with-COVID-19 Age: Based on Health Recognition of Local Residents in the Korea. *Journal of Survey in Fisheries Sciences*, 10(4S), 472-483. doi:10.17762/sfs.v10i4S.740.
- [34] Walters, J. K., Sharma, A., & Harrison, R. (2023). Efficiency Improvement Strategies for Public Health Systems: Developing and Evaluating a Taxonomy in the Australian Healthcare System. *Healthcare (Switzerland)*, 11(15), 2177. doi:10.3390/healthcare11152177.
- [35] Vasiljeva, M., Neskorodieva, I., Ponkratov, V., Kuznetsov, N., Ivlev, V., Ivleva, M., Maramygin, M., & Zekiy, A. (2020). A predictive model for assessing the impact of the COVID-19 pandemic on the economies of some Eastern European Countries. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(3), 92. doi:10.3390/JOITMC6030092.
- [36] Vankar, P. (2023). Health and health systems ranking of countries worldwide in 2023, by health index score, Statista. Available online: <https://rb.gy/jf6h0> (accessed on May 2023).
- [37] Hummel, S., Oetjen, N., Du, J., Posenato, E., Resende de Almeida, R. M., Losada, R., Ribeiro, O., Frisardi, V., Hopper, L., Rashid, A., Nasser, H., König, A., Rudofsky, G., Weidt, S., Zafar, A., Gronewold, N., Mayer, G., & Schultz, J.-H. (2021). Mental Health Among Medical Professionals During the COVID-19 Pandemic in Eight European Countries: Cross-sectional Survey Study. *Journal of Medical Internet Research*, 23(1), e24983. doi:10.2196/24983.
- [38] Hernández-Torrano, D., Ibrayeva, L., Sparks, J., Lim, N., Clementi, A., Almukhambetova, A., Nurtayev, Y., & Muratkyzy, A. (2020). Mental Health and Well-Being of University Students: A Bibliometric Mapping of the Literature. *Frontiers in Psychology*, 11, 1226. doi:10.3389/fpsyg.2020.01226.

- [39] Zhou, T., Xu, C., Wang, C., Sha, S., Wang, Z., Zhou, Y., Zhang, X., Hu, D., Liu, Y., Tian, T., Liang, S., Zhou, L., & Wang, Q. (2022). Burnout and well-being of healthcare workers in the post-pandemic period of COVID-19: a perspective from the job demands-resources model. *BMC Health Services Research*, 22(1), 284. doi:10.1186/s12913-022-07608-z.
- [40] Ualiyeva, R. (2023). Functional Role of Vitelline Glands and Mehlis Gland in the Process of Resistant Egg Shell Formation in Trematodes. *OnLine Journal of Biological Sciences*, 23(2), 124–132. doi:10.3844/ojbsci.2023.124.132.
- [41] Ellison, M. L., Belanger, L. K., Niles, B. L., Evans, L. C., & Bauer, M. S. (2018). Explication and Definition of Mental Health Recovery: A Systematic Review. *Administration and Policy in Mental Health and Mental Health Services Research*, 45(1), 91–102. doi:10.1007/s10488-016-0767-9.
- [42] Dhar, G., & Dash, S. P. (2022). A Systematic Literature Review on the Impact of Open Spaces on Human Physiological and Mental Well-Being in Post-Pandemic Housing in Urban Context. *ECS Transactions*, 107(1), 7723–7747. doi:10.1149/10701.7723ecst.
- [43] Bostock, S., Crosswell, A. D., Prather, A. A., & Steptoe, A. (2019). Mindfulness on-the-go: Effects of a mindfulness meditation app on work stress and well-being. *Journal of Occupational Health Psychology*, 24(1), 127–138. doi:10.1037/ocp0000118.
- [44] Kubzansky, L. D., Huffman, J. C., Boehm, J. K., Hernandez, R., Kim, E. S., Koga, H. K., Feig, E. H., Lloyd-Jones, D. M., Seligman, M. E. P., & Labarthe, D. R. (2018). Positive Psychological Well-Being and Cardiovascular Disease: JACC Health Promotion Series. *Journal of the American College of Cardiology*, 72(12), 1382–1396. doi:10.1016/j.jacc.2018.07.042.
- [45] Vera San Juan, N., Aceituno, D., Djellouli, N., Sumray, K., Regenold, N., Syversen, A., Mulcahy Symmons, S., Dowrick, A., Mitchinson, L., Singleton, G., & Vindrola-Padros, C. (2021). Mental health and well-being of healthcare workers during the COVID-19 pandemic in the UK: contrasting guidelines with experiences in practice. *BJPsych Open*, 7(1), 15. doi:10.1192/bjo.2020.148.
- [46] Makhbul, Z. K. M., & Rawshdeh, Z. A. (2021). Mental stress post-COVID-19. *International Journal of Public Health Science*, 10(1), 194–201. doi:10.11591/ijphs.v10i1.20497.
- [47] Billings, J., Ching, B. C. F., Gkofa, V., Greene, T., & Bloomfield, M. (2021). Experiences of frontline healthcare workers and their views about support during COVID-19 and previous pandemics: a systematic review and qualitative meta-synthesis. *BMC Health Services Research*, 21(1), 923. doi:10.1186/s12913-021-06917-z.
- [48] Sinsky, C., & Linzer, M. (2020). Practice and policy reset post-covid-19: Reversion, transition, or transformation? *Health Affairs*, 39(8), 1405–1411. doi:10.1377/hlthaff.2020.00612.
- [49] Park, B., Steckler, N., Ey, S., Wiser, A. L., & DeVoe, J. E. (2020). Co-creating a thriving human-centered health system in the post-COVID-19 era. *NEJM Catalyst Innovations in Care Delivery*, 1(3), 1-9. doi:10.1056/CAT.20.0247.
- [50] Talmage, C. A., Allgood, B., Ashdown, B. K., Brennan, A., Hill, S., Trevan, E., & Waugh, J. (2022). Tethering Natural Capital and Cultural Capital for a More Sustainable Post-COVID-19 World. *International Journal of Community Well-Being*, 5(3), 657–678. doi:10.1007/s42413-021-00151-5.
- [51] Ibarra, F., Baez, M., Cernuzzi, L., & Casati, F. (2020). A Systematic Review on Technology-Supported Interventions to Improve Old-Age Social Wellbeing: Loneliness, Social Isolation, and Connectedness. *Journal of Healthcare Engineering*, 2020, 2036842. doi:10.1155/2020/2036842.
- [52] van Zyl, L. E. (2021). Social Study Resources and Social Wellbeing Before and During the Intelligent COVID-19 Lockdown in The Netherlands. *Social Indicators Research*, 157(1), 393–415. doi:10.1007/s11205-021-02654-2.
- [53] Charmaz, K. (2014). *Constructing grounded theory*. SAGE Publication, Newcastle upon Tyne, United Kingdom.
- [54] Glaser, B. G. (2007). *Constructivist grounded theory?*. *Historical Social Research*. Supplement, 93-105.
- [55] Ishizaka, A., & Labib, A. (2011). Review of the main developments in the analytic hierarchy process. *Expert Systems with Applications*, 38(11), 14336–14345. doi:10.1016/j.eswa.2011.04.143.
- [56] Dyer, R. F., & Forman, E. H. (1992). Group decision support with the Analytic Hierarchy Process. *Decision Support Systems*, 8(2), 99–124. doi:10.1016/0167-9236(92)90003-8.
- [57] Wallenius, J., Dyer, J. S., Fishburn, P. C., Steuer, R. E., Zionts, S., & Deb, K. (2008). Multiple criteria decision making, multiattribute utility theory: Recent accomplishments and what lies ahead. *Management Science*, 54(7), 1336–1349. doi:10.1287/mnsc.1070.0838.
- [58] Wang, G. Y. (2022). Churn Prediction for High-Value Players in Freemium Mobile Games: Using Random Under-Sampling. *Statistika*, 102(4), 443–453. doi:10.54694/STAT.2022.18.
- [59] Fridell, M., Edwin, S., von Schreeb, J., & Saulnier, D. D. (2019). Health System Resilience: What Are We Talking About? A Scoping Review Mapping Characteristics and Keywords. *International Journal of Health Policy and Management*, 9(1), 6–16. doi:10.15171/ijhpm.2019.71.

- [60] Biddle, L., Wahedi, K., & Bozorgmehr, K. (2020). Health system resilience: A literature review of empirical research. *Health Policy and Planning*, 35(8), 1084–1109. doi:10.1093/heapol/czaa032.
- [61] Khayrutdinov, M. M., Golik, V. I., Aleksakhin, A. V., Trushina, E. V., Lazareva, N. V., & Aleksakhina, Y. V. (2022). Proposal of an Algorithm for Choice of a Development System for Operational and Environmental Safety in Mining. *Resources*, 11(10), 88. doi:10.3390/resources11100088.
- [62] Xiang, H., Lu, J., Kosov, M. E., Volkova, M. V., Ponkratov, V. V., Masterov, A. I., Elyakova, I. D., Popkov, S. Y., Taburov, D. Y., Lazareva, N. V., Muda, I., Vasiljeva, M. V., & Zekiy, A. O. (2023). Sustainable Development of Employee Lifecycle Management in the Age of Global Challenges: Evidence from China, Russia, and Indonesia. *Sustainability (Switzerland)*, 15(6), 4987. doi:10.3390/su15064987.
- [63] Mukataeva, Z., Dinmukhamedova, A., Kabieva, S., Baidalinova, B., Khamzina, S., Zekenova, L., & Aizman, R. (2023). Comparative characteristics of developing morphofunctional features of schoolchildren from different climatic and geographical regions. *Journal of Pediatric Endocrinology and Metabolism*, 36(2), 158–166. doi:10.1515/jpem-2022-0474.
- [64] Davletova, A. H., Tolganbaiuly, T., Tazhigulova, A. I., Smagulova, L. A., Kasymova, A. H., & Baigozhanova, D. S. (2019). Project-oriented training experience in micro-robot programming in college and its features. *Option: Journal of Human and Social Sciences*, (22), 292-307.
- [65] Nurbekova, Z. K., Mukhamediyeva, K. M., Davletova, A. H., & Kasymova, A. H. (2018). Methodological system of educational robotics training: Systematic literature review. *Espacios*, 39(15), 28.
- [66] Findling, M. G., Blendon, R. J., & Benson, J. M. (2020). Delayed Care with Harmful Health Consequences - Reported Experiences from National Surveys during Coronavirus Disease 2019. *JAMA Health Forum*, 1(12), 201463. doi:10.1001/jamahealthforum.2020.1463.
- [67] de Joode, K., Dumoulin, D. W., Engelen, V., Bloemendal, H. J., Verheij, M., van Laarhoven, H. W. M., Dingemans, I. H., Dingemans, A. C., & van der Veldt, A. A. M. (2020). Impact of the coronavirus disease 2019 pandemic on cancer treatment: the patients' perspective. *European Journal of Cancer*, 136, 132–139. doi:10.1016/j.ejca.2020.06.019.
- [68] Zainun, N. Y., Ajman, N. N., Sulaiman, N., & Khahro, S. H. (2022). Challenges Faced in Managing Covid-19 Pandemic Case Study: Malaysia. *Advances in Engineering Research*. doi:10.2991/aer.k.220131.043.
- [69] Adam, O., Sayibu, M., Oloji, S., Akintunde, I., & Yinka, T. (2022). Technology Infrastructure in Public Health System: Mediating Role of Public Trust in Government Disaster Preparedness. *Public Policy and Administration Research*, 12(5), 27–40. doi:10.7176/ppar/12-5-03.
- [70] Hincapié, M. A., Gallego, J. C., Gempeler, A., Piñeros, J. A., Nasner, D., & Escobar, M. F. (2020). Implementation and Usefulness of Telemedicine During the COVID-19 Pandemic: A Scoping Review. *Journal of Primary Care and Community Health*, 11. doi:10.1177/2150132720980612.
- [71] Odusola, F., Smith, J. L., Bisaga, A., Grbic, J. T., Fine, J. B., Granger, K. E., Hu, M. C., & Levin, F. R. (2020). Innovations in pre-doctoral dental education: Influencing attitudes and opinions about patients with substance use disorder. *Journal of Dental Education*, 84(5), 578–585. doi:10.1002/jdd.12048.
- [72] Majnarić, L. T., Babič, F., O'Sullivan, S., & Holzinger, A. (2021). AI and Big Data in Healthcare: Towards a More Comprehensive Research Framework for Multimorbidity. *Journal of Clinical Medicine*, 10(4), 766. doi:10.3390/jcm10040766.
- [73] Kuhlmann, E., Brînzac, M. G., Burau, V., Correia, T., & Ungureanu, M. I. (2021). Health workforce protection and preparedness during the covid-19 pandemic: A tool for the rapid assessment of EU health systems. *European Journal of Public Health*, 31(Supplement_4), IV14–IV20. doi:10.1093/eurpub/ckab152.

Appendix I

Table A-1. Axial coding

Main Category	Subcategories	Focused Codes	
Challenges, Opportunities, and Paradigm Shifts in the Medical Field in Post-COVID Era	Managing and treating COVID-19 patients	Medical supply chain management	
		Hospital surge capacity	
	Patient management	Dealing with the backlog of non-COVID medical cases	Healthcare workforce preparedness
			COVID-19 variant response
		Ensuring the safety of healthcare workers and patients	Treatment affordability
			Delayed medical care urgency
	Addressing the mental health impacts of the pandemic	Availability of resources to address backlog	Potential for long-term health consequences
			Impact on healthcare costs and resource allocation
	Psychological Stress	Mental health impact	Prioritization and triage strategies
			Protection and infection control measures
Health Worker Well-being	Social and cultural well-being	Community transmission and exposure risk	
		Healthcare worker's psychological impact	
Opportunities	Telemedicine and remote care	COVID-19 testing and contact tracing capability	
		Safety compliance	
	Data analytics and AI	Fear and anxiety levels	Addressing social determinants of mental health
			Mental health integration in healthcare delivery
Public Health and Policy	Public health measures	Emotional exhaustion	
		Job demands	
Healthcare Delivery Models	Alternative models of healthcare delivery	Social support	
		Organizational culture	
Paradigm Shifts	Social determinants of health	Diversity and inclusion	
		Workload and job demand	
Prevention and wellness	Prevention and wellness	Access to resources	
		Integration of health promotion and education into healthcare system	
Technology and Innovation Group	International collaboration	Technological equity in healthcare	
		Reliable telecommunication infrastructure	
Public Health and Policy	Public health measures	Data availability and accuracy	
		AI integration in healthcare decision-making	
Healthcare Delivery Models	Alternative models of healthcare delivery	Public health education for prevention	
		Vaccine access and availability	
Paradigm Shifts	Social determinants of health	Public health funding and resources	
		Global healthcare collaboration and coordination	
Prevention and wellness	Prevention and wellness	Global integration of medical research and treatment protocols	
		Accessibility and affordability of alternative healthcare models	
Healthcare Delivery Models	Alternative models of healthcare delivery	Resource sufficiency for alternative healthcare delivery	
		Regulations for alternative healthcare delivery	
Paradigm Shifts	Social determinants of health	Social determinants of health programs and resources	
		Collaboration for addressing social determinants of health	
Prevention and wellness	Prevention and wellness	Promotion of prevention and wellness	
		Integration of health promotion and education into healthcare system	