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Healthcare Workforce Management Strategies During Health Crises: A Scoping Review

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KEYWORDS

health workforce, healthcare workers, health crisis, health emergency, pandemic, disaster

ABSTRACT:

Introduction: Health crises have exposed critical weaknesses in healthcare systems worldwide, particularly in terms of workforce management.

Objectives: This review aimed to identify management strategies implemented globally to strengthen the healthcare workforce (HCWF) capacity during health crises.

Methods: Literature was searched in four databases—ProQuest, Science Direct, Scopus and PubMed—from January 1, 2020, to October 25, 2024. Studies were included if they described healthcare management interventions aimed at improving HCWF capacity during health crises. Identified strategies were categorised into four domains: individual-level support, capacity building and role optimisation, organisational-level interventions, and system-wide workforce enablers.

Results: Seventeen studies were included. The most frequently implemented domain was interventions to strengthen and optimise the HCWF role, followed by strategies targeting workforce enablers at the system-wide level. The least prioritised were those supporting and protecting healthcare workers at the individual level. Key strategies across domains included infection prevention and control, mental health support, remuneration, capacity building, and intersectoral collaboration. Gaps identified included the lack of comprehensive healthcare worker information systems and inadequate workforce planning. Digital tools were identified as critical enablers for resource allocation and decision making.

Conclusions: This review emphasises the importance of leveraging digital tools, strengthening workforce policies, and integrating continuous training for public health leaders to enhance HCWF preparedness for future crises. Improving workforce information systems and HCWF planning is paramount for building resilient and sustainable health systems..

1. Introduction

The healthcare workforce (HCWF) is a critical component of World Health Organization's (WHO) health system building blocks, especially during health crises (1). Health crises are significant events that pose a serious threat to the health and safety of a population and often require urgent intervention and coordinated responses, leading to substantial impacts on social, economic, and population health (2-4). Health crises encompass a wide range of situations, including infectious disease outbreaks, natural disasters, conflicts, and large-scale public health emergencies, affecting vulnerable populations such as women, children, and the elderly (3-4). Health crises impose significant pressure on health systems, necessitating swift and strategic

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allocation of resources, along with a flexible and robust healthcare workforce (5). Public health leadership plays a vital role in the efficient management of the healthcare workforce, particularly in times of health crises, as effective leadership ensures that healthcare personnel are present in sufficient numbers and are equipped, protected, and supported to respond efficiently to the demands of the crisis (6).

Health crises such as the COVID-19 pandemic have highlighted critical issues in healthcare workforce management, including shortages, burnout, and the necessity for swift redeployment and cross-training (7). Healthcare workforce management is a critical component of healthcare systems, focusing on strategic planning, development, and administration of healthcare personnel to ensure quality and effective service delivery (8). It involves human resource management, addressing challenges such as workforce shortages, skill mismatches, and the need for continuous training and coordination among healthcare workers (8-9). Effective workforce management strategies are paramount for sustaining workforce morale, guaranteeing occupational safety, and enacting policies that foster mental health and resilience (6). In the event of a health crisis, rapid decision-making involving the healthcare workforce is vital to prevent the collapse of healthcare systems and ensure the continuity of essential health services.

Various workforce management strategies have been applied worldwide to optimise the responses to health crises. These interventions encompass individual-level support for protecting healthcare workers (HCWs), capacity building, organisational adjustments to increase HCWs availability, and system-wide policy reforms (10). Leaders also responded to shifting needs, improve work schedules, staff redistribution between facilities, the use of technologies such as telehealth for remote consultations, and the recruitment of additional or retiring professionals to augment HCWs capacity (11).

Therefore, this scoping review seeks to explore and synthesise the existing literature on the workforce management strategies employed by public health leaders during health crises. It highlights and analyses key interventions to provide a comprehensive understanding of how effective workforce strategies can enhance resilience, support healthcare delivery, and improve outcomes during emergencies. It is imperative to consolidate existing knowledge and effective workforce practices implemented by health leaders to guide future preparedness and response initiatives during crises (12).

2. Methods

This scoping review follows the methodological framework outlined by Arksey and O'Malley (13). This approach ensures a systematic and transparent process to map the evidence on workforce management strategies during health crises. This review included five key stages namely identifying the research question, identifying relevant studies, study selection, data charting/ extraction, collating, summarising, and reporting the results. The methodology aligns with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (14) to ensure transparency and rigor in the review process.

Identifying the Research Question

The central question guiding this review is "what are the management strategies implemented by healthcare institutions across countries to improve healthcare workforce capacity during health crises"? This scoping review aimed to systematically identify the various workforce management strategies of health systems implemented in selected countries during health crises, to categorise workforce management strategies implemented, and identify gaps in the current literature to suggest areas for future research.

Identifying Relevant Studies

A comprehensive search strategy was developed to ensure the coverage of relevant studies. Four electronic databases were searched to identify high-quality peer-reviewed journal articles. The databases included ProQuest, Scopus, Science Direct, and PubMed. The search strategy used a combination of keywords as portrayed in **Table 1**.

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Table 1. Search strategy of scoping review

Database	Search Term	Number of Articles
ProQuest	(management OR strategy) AND (short) AND (“medical staff” OR “health workforce” OR “healthcare workers”) AND (“health Crisis” OR “health emergency”)	3299
Scopus	(management OR strategy) AND (short OR gap) AND (“medical staff” OR “health workforce” OR “healthcare workers”) AND (“health crisis” OR “health emergency” OR pandemic OR epidemic OR disaster)	29
Science Direct	(management OR strategy) AND (short OR gap) AND (“medical staff” OR “health workforce” OR “healthcare workers”) AND (“health Crisis” OR “health emergency”)	236
PubMed	(management OR strategy) AND (short OR gap) AND (“medical staff” OR “health workforce” OR “healthcare workers”) AND (“health crisis” OR “health emergency” OR pandemic OR epidemic OR disaster)	8

Study Selection

Microsoft Excel Version 16.93 (Microsoft Corporation, 2024) was used to collect, organise and manage references retrieved from the searches and to remove duplicates. Once this phase was completed, the articles were screened based on the eligibility criteria. The screening process involved title and abstract screening and full-text review. Screening was performed independently by six reviewers to exclude irrelevant studies. After title and abstract screening, full-text review was conducted based on eligibility criteria for the final inclusion of study. Articles that did not meet the eligibility criteria were excluded. Any discrepancies between reviewers were resolved through discussion. **Table 2** presents the inclusion and exclusion criteria for this review. The inclusion process is described in **Figure 1** as recommended by PRISMA (14).

Table 2. Inclusion and exclusion criteria for scoping review

	Aspects	Inclusion Criteria
Inclusion Criteria	Population	Study involving any healthcare workers (including physicians, nurses, allied health professionals, administrators, managers and support staff) working in any healthcare setting (including hospitals, primary care clinics, and community health centers)
	Concept	Study documenting any type of healthcare workforce management strategies that were taken to support the shortage of healthcare workers
	Context	Study discussing any type of health crises or health emergencies including disease outbreaks such as COVID-19, post-conflict recovery and disaster. It also includes situation with critical shortage of workforce
	Publication date	Published from 1st January 2020-25th October 2024
	Publication type	Published in English language; Peer-reviewed; Available in full text; Free articles
Exclusion Criteria	Study design	Review paper; Editorial and opinion article; Case study/ reports; Clinical trial

Data Charting/ Extraction

Data from the selected articles were collected and gathered using Microsoft Excel Version 16.93. Six investigators independently extracted data from the included studies and disagreements were resolved through discussion. A table containing key information from the included studies was created to capture the following variables:

i. Publication details (author and year)
ii. Article title
iii. Study location, study period, study population, study design and data collection method
iv. Health crises/ Event involved

Collating, Summarizing, and Reporting Results

Descriptions of workforce strategies or interventions were synthesised and categorised into four predefined intervention domains based on the WHO’s interim guidance on Healthcare Workforce policy and management in the context of COVID-19 as shown in **Table 3**.

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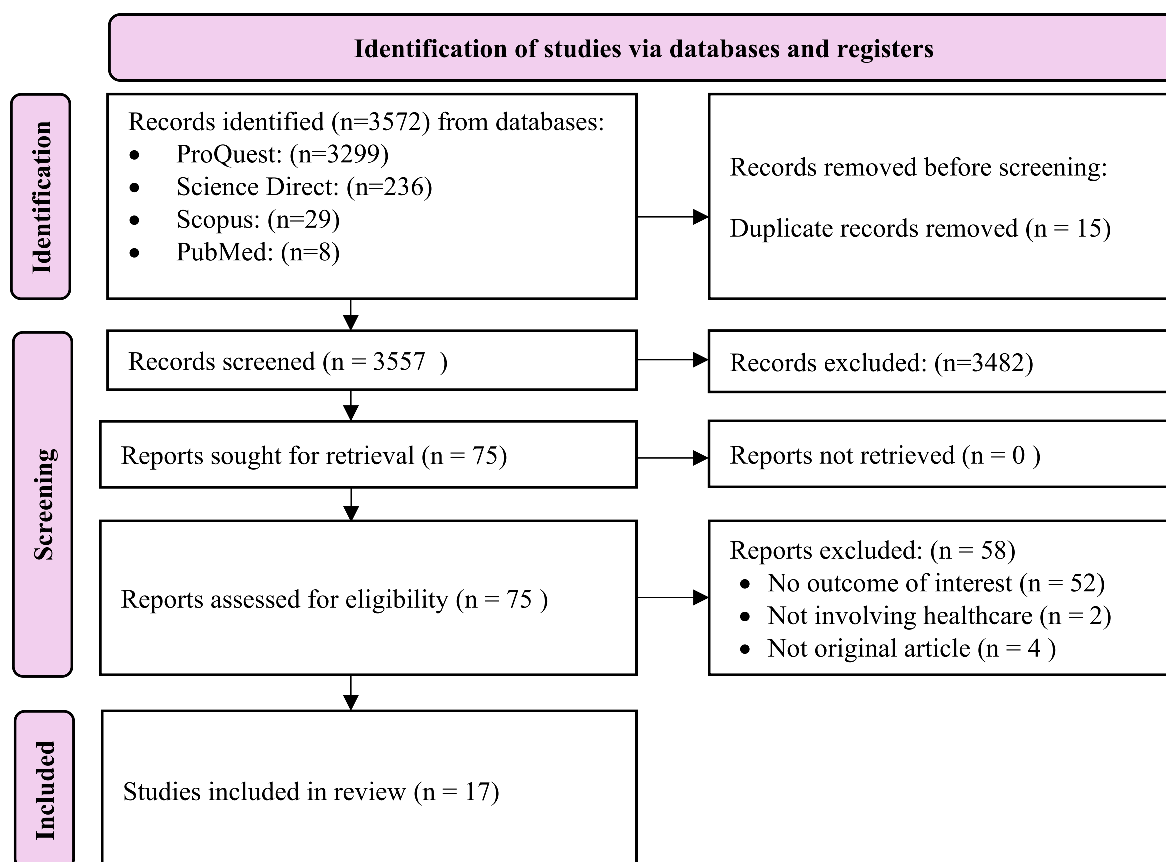

Figure 1. Flow chart of the selection process based on PRISMA (14)

Table 3. Domains and areas of interventions presented at the interim guidance on Healthcare Workforce Policy

Domains	Areas of interventions
Interventions to support and protect healthcare workers at individual level	i. Infection prevention and control ii. Decent working conditions iii. Mental health of HCWs iv. Remuneration and incentives
Interventions to strengthen and optimise the role of healthcare workforce teams at management level	i. Building competencies through education and training ii. Optimising roles iii. Leveraging community-based HCWs
Interventions to increase capacity and strategic healthcare workers deployment at oranisational level	i. Improving health worker availability ii. Rationalizing the HCWF distribution iii. Supportive work environment and manageable workload
Interventions targeting workforce enablers at system-wide level	i. Strengthening governance and intersectoral collaboration mechanisms ii. Improving HCWF information systems iii. Assessment, planning of HCWF needs iv. Licensing and regulation

Source: (WHO, 2020) (10)

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3. Results

A total of 3572 records were identified from the four databases, and 17 were selected and included in the review.

Characteristics of Reviewed Articles

The general information on the reviewed articles is presented in Table 4. Of the 17 articles included in the review, (n=10) were conducted mostly in developing countries (15-24), followed by developed countries (n=6) (25-30), and under-developed country (n=1) (31). Two studies were conducted in China (20, 23), while the other (n=15) were conducted in regions or countries such as Australia (25), Ireland (30), Iran (17), Switzerland (29), England (26), Baltic countries (27), Finland (28), Nigeria (16), Tanzania (22), Ethiopia (18), the Eastern Mediterranean region (19), Arab countries (24), Thailand (21), and Sub-Saharan Africa (31). Most of the studies (n=16) were conducted during the COVID-19 era in 2020 to 2023 (15-21, 23-31) meanwhile only (n=1) study was conducted in the pre-COVID-19 period from 2015 to 2016 (22). Data were collected predominantly via interviews (15-19. 22, 25-26, 28-29, 31) In terms of health crises, the majority of the studies involved COVID-19 (n=14), (n=1) was due to the post-conflict period, (n=1) faced a critical workforce shortage and (n=1) was secondary to an infectious disease outbreak.

Table 4. Characteristics of articles included in scoping review

Ref.; Year of Publication; Country; Study Period	Study Population	Study Design; Data Collection Method	Event Involved
(25); 2024; Australia; Sept. 2021 – Dec. 2021	33 rural health service leaders in executive, clinical, and administrative roles	Qualitative design; Interviews	COVID-19 pandemic
(15); 2024; Democratic Republic of Congo (DRC), Nigeria, Senegal, Uganda; Nov. 2020 – March 2021	60 health managers, policymakers, and health workers)	Qualitative design; Interviews	COVID-19 pandemic
(16); 2024 ; Nigeria; During COVID-19 pandemic	22 Health Directors, Assistant Directors, heads of programmes from State Ministries of Health and State Primary Health Care Development Agencies	Qualitative design; Interviews	COVID-19 pandemic
(17); 2024; Iran; Dec. 2022 – Aug. 2023	20 hospital staff and health managers, specialists and managers at the level of the Ministry of Health, universities and hospitals	Qualitative design; Interviews	Infectious disease outbreaks
(26); 2024; England; June 2021 – March 2022	20 local health protection staff	Qualitative design; Interviews	COVID-19 pandemic
(27); 2024; Baltic Countries (Estonia, Latvia, Lithuania); Feb. 2020 – Aug. 2020	Healthcare system administrators and policymakers	Cross-sectional; Secondary data and document analysis	COVID-19 pandemic
(28); 2023; Finland; March 2021 – June 2021	14 city managers, directors of joint municipal health care and social service authorities, heads of social and health services in municipalities directors of health services and administrative head nurse	Qualitative design; Interviews	COVID-19 pandemic

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Ref.; Year of Publication; Country; Study Period	Study Population	Study Design; Data Collection Method	Event Involved
(18); 2023; Ethiopia; Sept. 2020 – Oct. 2020	59 healthcare professionals and administrators	Qualitative design; Interviews	COVID-19 pandemic
(19); 2022; Eastern Mediterranean Region (22 countries); May 2020 – Oct. 2020	185 hospital staff, hospital managers, and policymakers)	Mixed-methods; Online survey and key informant interviews (KIIs)	COVID-19 pandemic
(20); 2022; China; During COVID-19 pandemic	Health system workers	Cross-sectional; Secondary data and document analysis	COVID-19 pandemic
(21); 2021; Thailand; During COVID-19 pandemic	Healthcare workers and administrators	Cross-sectional; Secondary data and document analysis	COVID-19 pandemic
(22); 2021; Tanzania; 2015 - 2016	38 members supervising health workers' retention scheme at district level and Health Facility Governing Committees (HFGCs)	Qualitative design; Key informant interviews (KIIs) and focus group discussions (FGDs)	Critical shortage of workforce
(31); 2021; Four sub-Saharan African countries: June 2020 – Feb. 2021	9 pharmacy workforces	Qualitative design; Interviews	Post-Conflict Recovery
(23); 2021; China; Jan. 2020 – March 2020	Public health administration and policy experts	Cross-sectional	COVID-19 pandemic
(24); 2021; Arab countries; During COVID-19 pandemic	Healthcare workers from health systems and legal responses	Cross-sectional	COVID-19 pandemic
(29); 2021; Switzerland; During COVID-19 pandemic	4773 healthcare staff, support staff, administrative staff of a university hospital, educators at institution for disabled persons, caregivers from a regional hospital, nursing students and in-house instructors	Mixed-methods design, combining qualitative and quantitative approaches	COVID-19 pandemic
(30); 2020; Ireland; Feb. 2020 – July 2020	Health system workers	Cross-sectional	COVID-19 pandemic

Workforce Management Strategies Implemented By Countries

Table 5 presented a summary of the extracted workforce management strategies implemented across countries. At least one of the four domains of the intervention was implemented in each study. The highest domain implemented by the countries under review was ‘Interventions to strengthen and optimise the role of healthcare workforce teams at management level’ amounting to 88.2%, followed by ‘Interventions targeting workforce enablers at the system-wide level, with 82.4%. The least domain was ‘Interventions to support and protect healthcare workers at individual level’ scoring only 64.7% (**Figure 2**).

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Table 5. Summary of the workforce management strategies across countries identified by domain and area of intervention

Domains	Areas of intervention	Interventions	Number of study (References)
Intervention to support and protect healthcare workers at individual level	Infection prevention and control	Personal protective equipment's (PPE) provision and sanitisers	Seven (15, 16, 17, 19, 20, 23, 27)
		Infection prevention and control protocol	Two (16, 29)
	Decent working conditions	Priority COVID-19 testing for health workers including family members	Two (15, 19)
		Vaccination	Two (15, 16)
	Mental health of healthcare workers	Psychosocial support/counseling including hotline platform	Five (15, 19, 25, 29, 30)
		Peer support for sharing the workload, solidarity among employees	Three (17, 25, 29)
	Remuneration and incentives (Financial incentives)	Salary increment (Latvia introduced a 20–50% salary bonus, Estonia increased salaries 1.5 or 2 times, Lithuania raised salaries 60–100% for doctors, health professionals, health workers and pharmacists combating COVID-19 during early phase)	Four (15, 16, 22, 27)
		Provision of allowances- Risk/hazard, Overtime, Activity specific (e.g. contact tracing and testing)	Four (15, 16, 19, 22)
		Prize giving to the best performer of the year	One (22)
		Temporary tax exemptions	One (15)
	Remuneration and incentives (Non-financial incentives)	Treatment (medical care), including to family members infected	Two(15, 19)
		Food/ meals eg. In China, vitamins were included in their daily diet to strengthen their immune system in case they contract the virus, grocery delivery at home in Switzerland	Five (15, 16, 19, 20, 29)
		Transport: ambulances, movement support document, free parking	Four (15, 16, 19, 29)
		Accommodation	Four (15, 16, 19, 29)
		Recognition	Two (15, 19)
	Remuneration and incentives (Financial compensation)	Health insurance	Two (15, 19)
Intervention to strengthen and optimise the role of healthcare workforce teams at management level	Building competencies through education and training	Training and education to improve essential skills eg.intubation and pharmacy staff training	Five (16, 20, 22, 25, 31)
		Training on COVID-19 programmes such as surveillance, RRT, best practice sharing and coaching new healthcare workers with COVID-19 manuals eg. Multilingual epidemic control manuals for COVID-19, Protocol for Prevention and Control of COVID-19 Cases, Diagnosis and Treatment Protocol for COVID-19, Guidelines for Investigations and Management of Close Contact	Nine (16, 18, 19, 20, 22, 23, 25, 29, 31)
		Training on infection prevention and control and PPE	Five (16, 17, 18, 19, 26)
		Training e.g., telemedicine training, supervision, mentorship at group and individual levels and workshops	One (15)
		Cross training of healthcare workers where needed, for example e.g. theatre nurses to be ICU nurses	One (30)
		Active headhunting of graduating students in health training institution	One (22)

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Domains	Areas of intervention	Interventions	Number of study (References)
	Optimising roles	Altered scope of practice, task shifting strategy implemented to share task/ increase flexibility	Six (16, 19, 24, 25, 26, 29)
	Leveraging community-based HCWs	Community health workers/ Health extension workers in Ethiopia; volunteers who were already engaged in community education, mobilisation and prevention activities, Village health volunteers (VHVs) in Thailand were individuals chosen by villagers to receive basic medical training	Five (15, 16, 18, 21, 31)
Intervention to increase capacity and strategic healthcare workers deployment at organisational level	Improving health worker availability	Employment of under-graduate nursing students/ medical students/ university students/ faculty members	Four (17, 20, 25, 30)
		Bringing forward exams for final year medical students to enable them to join the workforce	One (30)
		Recruitment of additional staff eg. doctors and nurses such as “Be on call for Ireland”; international recruitment campaign to encourage healthcare professionals at home and abroad to come and work in the public health service including retiree, Easier re-registration for former healthcare workers and former members of the defense force	Nine (15, 16, 18, 19, 20, 24, 26, 29, 30)
		Employment of adhoc workers	One (16)
		Redeployment of experienced staff to COVID-19 programmes, health workers were redeployed to work at facilities near to their residence, reallocation of staff, adding responsibilities to the existing workforce, health professionals from hospitals and health centres were redeployed to isolation and treatment centers, rapid response teams (RRT), and care teams for patients in home-based isolation. Reassignment of healthcare workers from private sector, and other external staffing supports on a needs basis.	Eight (17, 18, 19, 25, 27, 29, 30, 23).
		Recruiting junior staff for ICU, hiring international staff for surge, recruiting volunteers, retirees, and fresh medical graduates	One (19)
		The use of volunteer labor	Three (15, 17, 20)
		Increase working hours; many teams moved from providing a 9-5, 5-day-a-week service to a 7-day-a-week service, overtime up to 60 hours per week	Four (26, 27, 29, 30)
		Two-week rotation in staff to reduce risk of cross-infections	One (19)
		Temporary annual leave was prohibited to all professionals, except emergency case eg. pregnant and lactating women and providers with chronic conditions	One (18)
		Encouraging those on career break to return early	One (30)
	Rationalising the HCWF distribution	Reduction of non-essential services	One (25)
		Telehealth, GPs have been providing the majority of their consultations over the phone or via video link	Four (16, 24, 25, 30)
	Supportive work environment and manageable workload	Working from home	One (29)
		Annual leave	One (25)

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Domains	Areas of intervention	Interventions	Number of study (References)
Intervention targeting workforce enablers at system-wide level	Strengthening governance and intersectoral collaboration mechanisms	Coordination across levels of the health systems including manpower, collaboration with private hospitals	Eight (16, 17, 19, 23, 25, 26, 29, 30).
		Collaboration of healthcare with municipalities in many public health activities, such as public communication, monitoring of case numbers, mitigation measures, quarantines, and isolation, as well as individual health needs (e.g., diagnosis, patient information, treatment of mild cases, and vaccination)	One (28)
		Collaboration with local government leaders	Five (17, 22, 23, 28, 31)
		Collaborations with national/ international NGOs, academic institutions, professional associations, private sector and military	Two (18, 19)
	Improving HCWF information systems	Estonia created inactive health workers database who could volunteer in a case of need	One (27)
	Assessment, planning of HCWF needs	Strategic planning for dangerous diseases, preparedness plans at the operational level, predict future trends portrayed by the virus and to make informed decisions regarding the policy procedures	Three (17, 20, 28)
	Licensing and regulation	Relaxing health professional licensing rules	One (24)

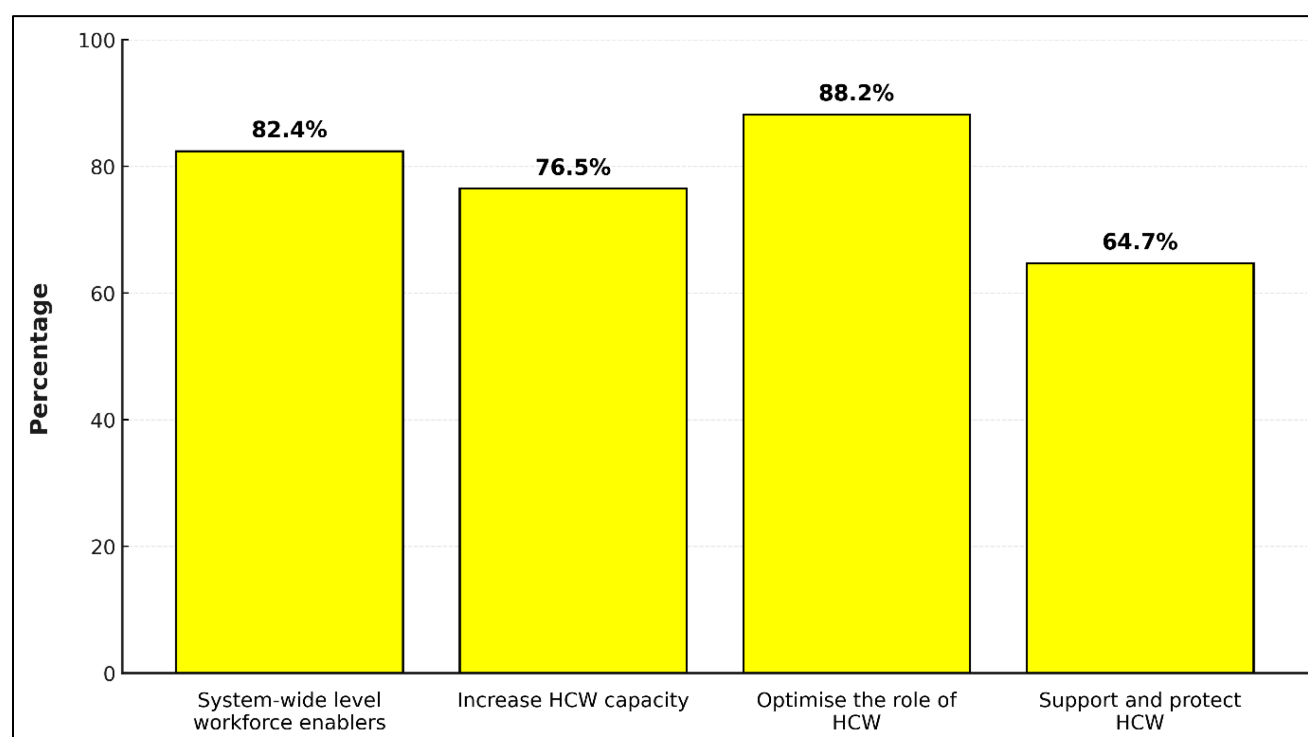

Figure 2. Domains of workforce management interventions in each study

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With regard to domains of interventions according to countries, developed and developing countries were able to implement all (n=4) domains, while under-developed countries were only able to cater to (n=2) domains, which were ‘Interventions to strengthen and optimise the role of healthcare workforce teams at the management level’, and ‘Interventions targeting workforce enablers at the system-wide level’ (**Figure 3**).

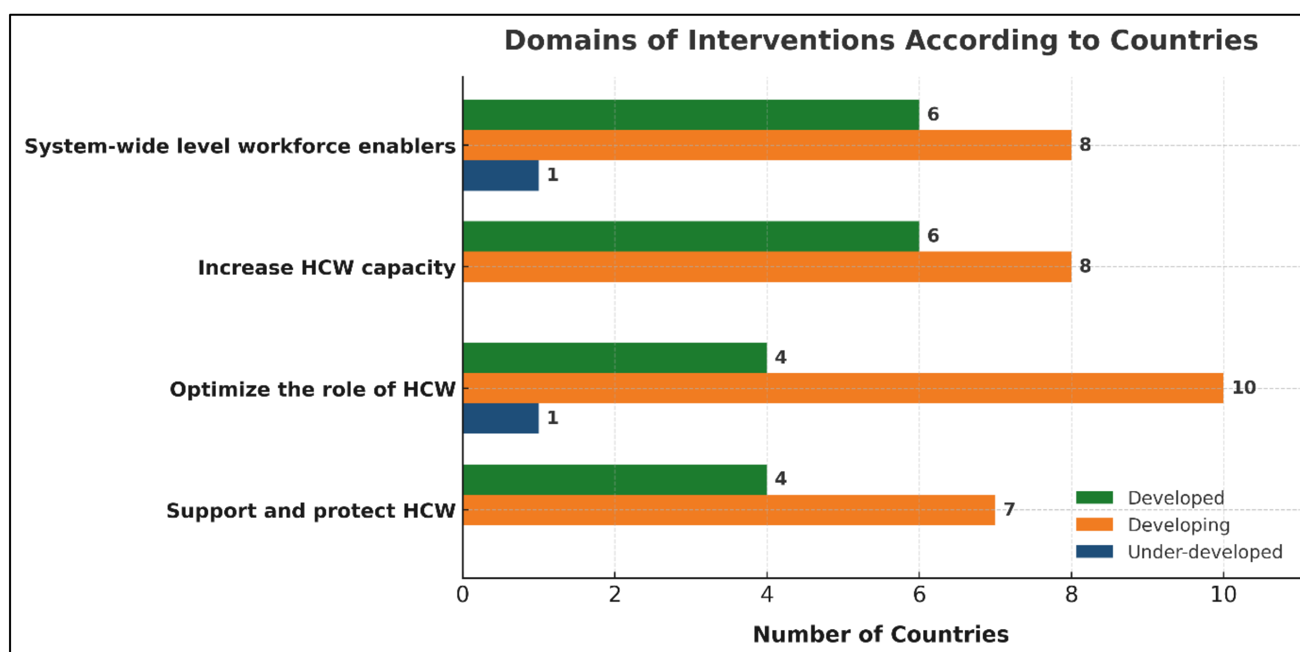

Figure 3. Domains of Interventions According to Countries

Figure 4 depicts the percentage of studies mentioning each intervention area within each domain, and shows that each study may cover more than one domain or intervention area. Generally, out of the (n=14) intervention areas, there were (n=5) areas with the least priority namely decent working conditions, supportive work environment and manageable workload, improving HCWF information systems, planning of HCWF needs and licensing and regulation.

Domain 1: Interventions to support and protect healthcare workers at individual level

This was the least prioritized domain (64.7%) in most studies. Of the 11 studies containing this domain, most countries prioritised infection prevention and control programs (72.7%), followed by more than half of the studies focusing on mental health support (54.5%) and remuneration (54.5%). Interventions were mainly based on personal protective equipments (PPE) provisions including sanitisers (15-16). Psychosocial support and counseling have been provided to protect the mental health of healthcare workers, including mental health support hotlines (15, 19, 25, 29-30). Financial and non-financial incentives were provided to attract and sustain the healthcare workforce during health crises. Financial incentives are disbursed in the form of salary increments, provision of allowances, namely risk/hazard allowances, overtime, and activity-specific allowances, primarily for workers involved in high-demand activities, such as contact tracing and COVID-19 testing (15-16. 22, 27). Interestingly, non-financial incentives were quite prominent, primarily in the form of food. For instance, in China, vitamins were included in their daily diet to strengthen their immune system in case they contracted the virus and grocery delivery services at home in Switzerland (20, 29). In addition, transportation and accommodation were provided to assist their daily lives while working as front-liners, including ambulances, movement support documents, free parking, and nearby accommodations from their workplace (15-16, 19, 29). Least focus was given to decent working conditions with only (27.3%) to protect healthcare workers, and the strategies included COVID-19 testing and vaccination of healthcare workers.

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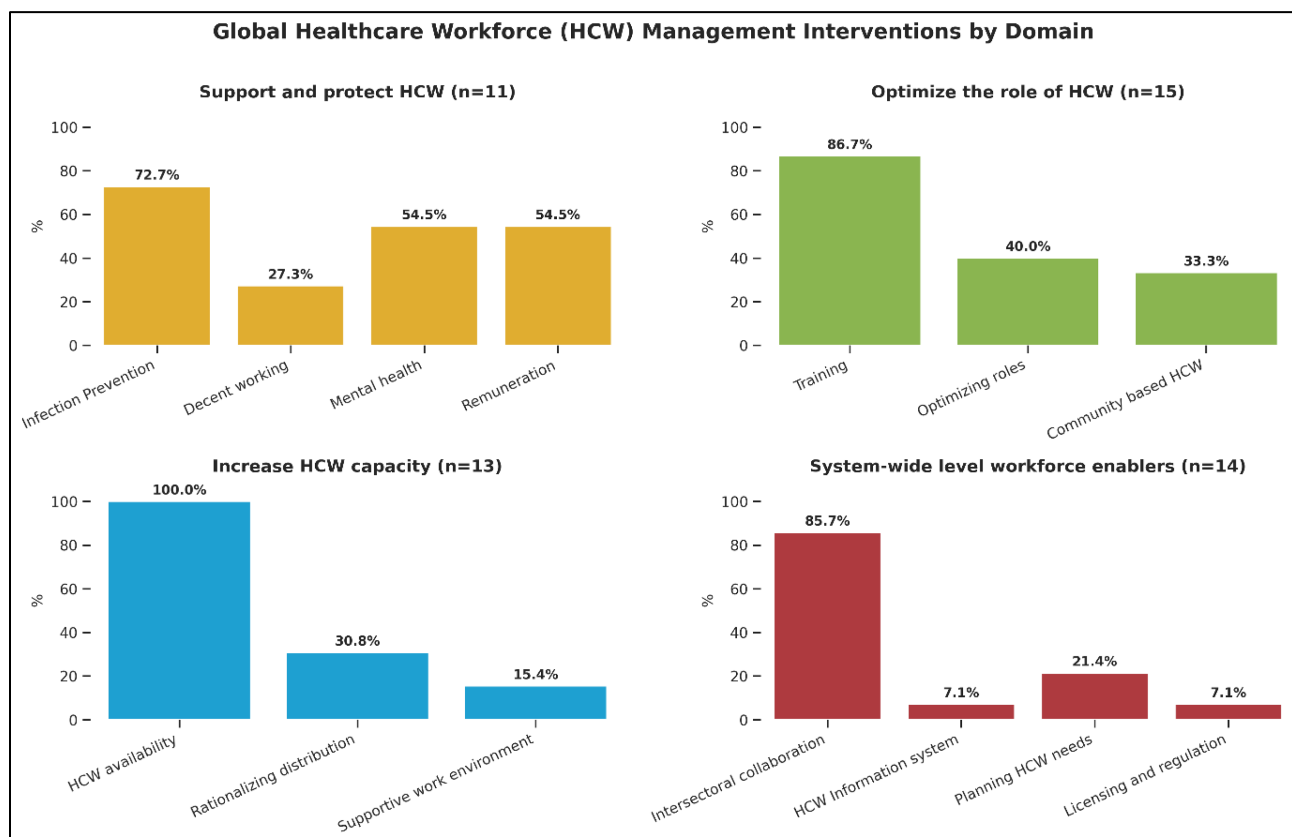

Figure 4. Percentage of studies mentioning each intervention area within each domain. Each study may cover more than one domain or intervention area.

Domain 2: Interventions to strengthen and optimise the role of healthcare workforce teams at management level

This was the highest domain (88.2%) covered by the included studies. Of the 15 studies that mentioned this domain, building competencies through education and training constituted the highest intervention area (86.7%). Optimising roles and community-based healthcare workers were almost equally distributed, at (40%) and (33.3%) respectively. Training employed in various studies consisted of training and education to improve essential skills for the management of COVID-19, such as intubation, pharmacy-based training, training on surveillance, rapid response team (RRT), and COVID-19 control manual training, namely Multilingual Epidemic Control Manuals for COVID-19, Protocol for Prevention and Control of COVID-19 Cases, Diagnosis and Treatment, Protocol for COVID-19, Guidelines for Investigations and Management of Close Contacts and Training on Infection Prevention and Control, and PPE (16, 18-20, 22-23, 25, 29, 31). With regard to optimising roles, many healthcare workers have undergone altered scope of practice and task shifting to increase shared tasks and flexibility, so they could assist in managing COVID-19 in addition to their routine work that mostly ceased due to the pandemic (16, 19, 24-26, 29).

Domain 3: Interventions to increase capacity and strategic healthcare workers deployment at organisational level

Of the thirteen studies mentioning this domain, all targeted improving health worker availability to increase deployment at the organisational level. Among prevalent strategies implemented were employment of under-graduate students and faculty members from nursing and medical faculties, bringing forward exams for final year medical students to enable them to join the workforce, recruitment of additional doctors and nurses through international recruitment campaign, for instance “Be on call for Ireland” to encourage healthcare professionals at home and abroad to come and work in the public health

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service including retiree and easier re-registration for former health care workers and former members of the defense force to join healthcare team fighting COVID-19 infection (15-16, 18-20, 24, 26, 29-30). Many studies have also utilised interventions such as redeployment of experienced staff to COVID-19 programmes, health workers being redeployed to work at facilities near their residences, reallocation of staff, adding responsibilities to the existing workforce, redeploying health professionals from hospitals and health centres to isolation and treatment centres, joining rapid response teams (RRT), and care teams for patients in home-based isolation (15-16, 18-20, 24, 26, 29-30). Reassignment of healthcare workers from the private sector and other external staffing support on a needs basis were employed to increase workforce capacity. Some countries also increased working hours, whereby many teams moved from providing a 9-5, 5-day-a-week service to a 7-day-a-week service and overtime up to 60 hours per week (26-27, 29-30). Supportive workplaces were the least discussed (15.4%), covering strategies such as working from home and providing annual leave.

Domain 4: Interventions targeting workforce enablers at systemwide level

Fourteen included studies mentioned this domain, and a vast majority (85.7%) focused on strengthening governance and intersectoral collaboration mechanisms. Interventions include manpower coordination across levels of health systems and collaboration with private hospitals and local government leaders. Other collaborations include national and international NGOs, academic institutions, professional associations, the private sector, the military, and municipalities in many public health activities, such as public communication, monitoring of case numbers, mitigation measures, quarantines, and isolation (16-17, 23, 25-26, 28-30). Of all four domains, the two least described areas of intervention were licensing and regulation, and improving HCWF information systems (7.1% for each study). Estonia created an inactive health worker database that could volunteer in case of need to improve HCWF information systems (27). Only a few strategies revolved around the assessment planning of HCWF needs, such as, strategic planning for dangerous diseases, preparedness plans at the operational level, predicting future trends portrayed by the virus, and making informed decisions regarding policy procedures (17, 20, 28). In terms of licensing, strategies used was relaxing health professional licensing rules and bypassing standard licensing procedures (24).

4. Discussion

This scoping review synthesises various workforce management strategies implemented during health crises, with a primary focus on the COVID-19 pandemic. Interventions were categorized into four main areas; support for individual health workers, capacity building and role optimisation, organisational-level interventions, and system-wide enablers. Any kind of health crisis highlights workforce challenges. Emergency situations often compromise human resource planning and execution of response processes during events. As a result, most interventions are taken merely to fill the gap in services and sometimes involve trial and error. Many interventions are short-term solutions without plans for long-term sustainability, raising concerns about their lasting impact (32-33).

Developing and developed countries have the resources to implement comprehensive interventions across various domains, unlike under-developed countries, which often focus on limited domains owing to resource constraints. The lack of resources in these countries hampers their ability to provide comprehensive and effective healthcare services (34). In struggle to meet the demand for healthcare, less developed countries often adopt low cost, limited-resource healthcare service to cater to their population’s need (35).

Interventions to support and protect healthcare workers at individual level

Thirty-seven percent of healthcare workers experienced depression and 39% experienced anxiety, indicating a widespread mental health crisis experienced by HCWs during health crisis (36-37). However, amid health crisis chaos, interventions to support and protect healthcare workers at the individual level have been neglected, possibly because of the absence or inadequacy of such interventions, even before health crises arise. Moreover, a lack of organisational culture prioritising individual needs and mental health within health organisations, fail to integrate mental health considerations into their crisis response, ultimately impacting the well-being of healthcare workers and their ability to provide quality

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care during challenging times (38-39). Moreover, organisational strategies often prioritize broad systemic changes over individual needs, which can lead to oversight of personal support mechanisms. This neglect stemmed from the overwhelming focus on patient care, increased workloads, resource shortages, and the urgency of the health crisis, which prioritised immediate operational responses over individual mental health needs. This intervention should be prioritised, as it determines the viability and sustainability of any healthcare service during or after a health crisis (40).

Lack can also be seen primarily in providing decent working conditions, such as infection prevention and control protocols, priority COVID-19 testing and treatment for health workers, including family members, and vaccination. This could be attributed to resource constraints and a lack of preparedness (41). However, these strategies are paramount for mitigating the spread of the virus and protecting both healthcare workers and patients (41).

Financial and non-financial incentives such as hazard pay, housing, and transport allowances are undoubtedly important for maintaining morale, enhancing the quality of care, increasing staff determination, and retaining health workers (42). Monetary incentives can effectively motivate behaviour, however their design must be carefully considered to avoid negative impacts on intrinsic motivation and professional value (43-44). Disparities in resource availability have led to variations in the effectiveness of these interventions across regions. Poorly implemented incentives can lead to discontent, owing to perceived unfairness and favouritism (45). Therefore, they must be carefully designed and executed to avoid negative impacts (15).

Interventions to strengthen and optimise the role of healthcare workforce teams at management level

Upskilling and task shifting are common strategies for addressing workforce shortages to meet surge demands and increase the flexibility of the healthcare workforce during health crises (10). It involves reallocating responsibilities from highly specialised workers to those with fewer qualifications (46). Targeted training programs must be implemented to ensure that HCWs receive adequate guidance and supervision to perform new tasks (47). This is important to ensure safe delivery of care beyond competencies and skills (48). Despite the benefits of task shifting/ redistribution, these strategies face challenges such as resistance to role changes, concerns about the quality of care and potential service disruptions (46). Ensuring adequate training, clear communication and coordination regarding role expectations is essential to mitigate these issues. Implementing these interventions also requires strong and strategic leadership and a supportive organisational culture (46). Organisations with hierarchical structures or limited autonomy face difficulties in adopting flexible deployment strategies. Cultural and organisations resistance impedes the adoption of new roles and responsibilities among health workers (46).

Interventions to increase capacity and strategic healthcare workers deployment at organisational level

England's response to the COVID-19 pandemic included asking retired staff and final-year medical students to return to work, resulting in over 20,000 former staff members rejoining the healthcare force (26). Employment of under-graduate nursing students, medical students, university students and faculty members in the workforce has led to an increase in healthcare workforce capacity in China and Ireland (20, 30). Increasing the number of health workers during health crises contributes to a surge in capacity, rapid workforce expansion to meet unprecedented demands and resilient health systems (5). Additionally, the rapid influx of new staff may strain existing systems and protocols, potentially leading to miscommunication and inefficiencies (49-50). Therefore, in situations involving massive or external recruitment, seamless cooperation and transition are crucial. Key strategies such as transferring essential knowledge, fostering open communication, strategic task assignment, and implementing graded learning and responsibility to ensure effective integration of new team members must be adhered (2, 50).

Only a few studies have implemented supportive approaches to the work environment as part of their workforce management strategies (25, 29). This is probably due to the reluctance to allow the absence of HCWs from the workplace, for example, for annual leave or working from home, owing to overstretched work demands and possible disruptions in delivery. However, supportive leadership and supportive management

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practice is important in maintaining organisational resilience, workers retention and well-being (51).

Interventions targeting workforce enablers at systemwide level

Most studies have focused on intersectoral collaboration among health fraternities, municipalities, local government leaders, Non-Governmental Organisations (NGOs), academic institutions, professional associations, private sector and military teams (15-20, 22-23, 25-26, 28-31). This collaboration is beneficial in enhancing resource mobilisation, fostering partnerships, improving problem-solving capabilities, and leading to a more sustainable and effective response to public health emergencies (52).

While intersectoral collaboration offers significant advantages, challenges remain among diverse stakeholders, such as effective communication and coordination, lack of trust, cultural issues towards collaboration and inadequate availability of resources. Hence, strong commitment, regular communication among stakeholders, trust, positive beliefs and organisational culture towards intersectoral collaboration and establishment of accountability frameworks can overcome these barriers (53-54). Effective leadership and command systems are equally important for successful collaboration (53-54).

However, to increase preparedness for future health emergencies, countries should also focus on improving HCWF information systems and assessing HCWF needs. Healthcare workforce planning is crucial for preventing excessive workloads during health crises (15). The World Health Organization (WHO) projects a significant shortfall of 18 million health workers by 2030, predominantly affecting low-income countries. This shortage is driven by various factors, including inadequate healthcare workforce planning and fiscal constraints. The implications of this shortfall are profound, potentially leaving millions without adequate healthcare (55).

Therefore, implementation of digital tool technologies for HCWF assessment and planning enables real-time workforce tracking and forecasting, allocation and timely decision-making (56). One of the biggest challenges in the healthcare workforce is to ensure sustainable workforce management. Hence, with data-driven allocation of resources, such as staff and equipment, this can assist in the strategic planning of resources. Nevertheless, the effectiveness of digital tool technologies depends on the existing technological infrastructure and digital literacy. Therefore, training programs based on these technologies can enhance the digital literacy of healthcare workers, enabling them to fully leverage digital technologies (57).

Policy innovation also plays a crucial role in sustaining the healthcare workforce. In the wake of COVID-19, the development of resilient national policies for workforce distribution and crisis management will ensure a coordinated and resilient response (10).

Strength

This scoping review has several strengths. A systematic approach ensured a comprehensive search and analysis from relevant databases. By including both quantitative and qualitative studies, the review provides a broad perspective and a deeper understanding of workforce management from the perspective of healthcare workers. Covering broad regions, the findings can be applied to both developed and developing countries. Interventions were systematically categorised for clarity and practical application for policymakers. This review's focus on workforce management during the COVID-19 pandemic adds timeliness and relevance to the current situation.

Limitations

This review has several limitations. The inclusion of English-language articles may have excluded relevant findings in other languages. Many studies have relied on cross-sectional designs, limiting their ability to determine causal relationships between interventions and outcomes. Data collection through interviews can potentially introduce information biases that can affect reliability. Most studies have focused on developed and developing countries, making these findings less applicable to underdeveloped nations. Moreover, workforce management strategies differ across countries due to variations in socioeconomic conditions, political status, health policies, and available resources, necessitating cautious interpretation of the findings. Additionally, workforce management responses often vary depending on the pandemic or health crisis phase.

Implications

This review identifies gaps and practices to guide future responses and improve workforce preparedness. It can assist the development of public health policies and budget priorities for future health emergencies, helping policymakers and health administrators strengthen health systems and build resilience in crises.

5. Conclusion

Globally, health crises have compelled countries to develop strategies to manage healthcare workforce strain. Less developed nations focus on optimising roles and mobilising resources to meet urgent needs. Key interventions implemented by most countries during health crises include infection prevention and control, mental health support, remuneration, capacity building, increasing workforce availability, and fostering intersectoral collaboration. However, gaps in implementing HCW information systems and planning HCWF needs hinder effective workforce planning and resource allocation (58). Leveraging digital tools for workforce management can track workforce requirements, guide resource allocation and improve real-time decision making (56, 58). Utilising real-time epidemiological data can further guide workforce planning and policy decisions (59). In the event of a health crisis, each country should develop tailored responses to address its unique challenges and ensure successful implementation of workforce strategies (60). Integrating effective leadership into these efforts can create adaptable and resilient health systems capable of managing future crises (61). Longitudinal research is required to evaluate the sustainability and effectiveness of workforce interventions, to guide the development of more efficient health systems (62). Similarly, evaluating the integration of digital tools can help optimise their impact on workforce management during health emergencies (63).

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Ethics Of Study

As this scoping review involved synthesis of publicly available data, ethical approval was not required. However, adherence to ethical research practices, including proper citation and acknowledgment of sources, were maintained throughout the study.

Conflicts of Interests

The authors have no conflicts of interest to declare.

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Authors' Contributions

Conceptualization and design: ND, VG, SAP, MHAH, NA, HGJ, MFMF, ARR; Analysis and interpretation of data: ND, VG, SAP, MHAH, NA, HGJ; Drafting of the article: ND, VG, SAP, MHAH, NA, HGJ; Critical revision of the article for important intellectual content: ND, VG, SAP, MHAH, NA, HGJ; Final approval of the article: ND, VG, SAP, MHAH, NA, HGJ, MFMF, ARR; Provision of study materials or patients: ND, VG, SAP, MHAH, NA, HGJ; Administrative, technical, or logistic support: MFMF, ARR; Collection and assembly of data: ND, VG, SAP, MHAH, NA, HGJ. All authors read and approved the final manuscript.

References

1. World Health Organization. *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies*; World Health Organization: Geneva, 2010. Available at: www.iniscommunication.com (accessed Nov 9, 2025).
2. Dow, A. W.; Dipiro, J. T.; Giddens, J.; Buckley, P.; Santen, S. A. Emerging from the COVID-19 Crisis with a Stronger Health Care Workforce. **Acad. Med. 2020**, *95*, 1823–1826. DOI: 10.1097/ACM.0000000000003656.
3. Khatri, R. B.; Endalamaw, A.; Erku, D.; Wolka, E.; Zewdie, A.; Assefa, Y. Preparedness, Impacts, and Responses of Public Health Emergencies towards Health Security: Qualitative Synthesis of Evidence. **Arch. Public Health 2023**, *81*, 58. DOI: 10.1186/s13690-023-01223-y.
4. Naik, R.; Maxwell, N.; Jones, T.; Dopson, S. A. Public Health Emergency Preparedness: Qualitative Analysis of After-Action Reports. **Disaster Med.**

Public Health Prep. 2023, *17*, e201. DOI: 10.1017/DMP.2023.201.

5. Organisation for Economic Co-operation and Development. *Ready for the Next Crisis? Investing in Health System Resilience*; OECD Publishing: Paris, 2023. Available at: 1e53cf80-en (accessed Nov 9, 2025).
6. Mosadeghrad, A. M.; Afshari, M.; Isfahani, P.; Ezzati, F.; Abbasi, M.; Farahani, S. A. Strategies to Strengthen the Resilience of Primary Health Care in the COVID-19 Pandemic: A Scoping Review. **BMC Health Serv. Res. 2024**, *24*, 32. DOI: 10.1186/S12913-024-11278-4.
7. Poortaghi, S.; Shahmari, M.; Ghobadi, A. Exploring Nursing Managers' Perceptions of Nursing Workforce Management during the Outbreak of COVID-19: A Content Analysis Study. **BMC Nurs. 2021**, *20*, 102. DOI: 10.1186/s12912-021-00546-x.
8. Cometto, G.; Buchan, J.; Dussault, G. Developing the Health Workforce for Universal Health Coverage. **Bull. World Health Organ. 2019**, *98*, 109. DOI: 10.2471/BLT.19.234138.
9. Stanimirović, D.; Pribaković Brinovec, R. Management of Health Care Workforce: Conceptualizing a Structural Model of Human Resource Planning in Healthcare in Slovenia. **J. Contemp. Manag. Issues 2023**, *28*, 45–59. DOI: 10.30924/mjcmi.28.1.3.
10. World Health Organization. *Health Workforce Policy and Management in the Context of the COVID-19 Pandemic Response: Interim Guidance*; World Health Organization: Geneva, 2020. Available at: hlh-docs/health-workforce-policy-and-management-COVID-19 (accessed Nov 9, 2025).
11. Chimed-Ochir, O.; Amarsanaa, J.; Ghotbi, N.; Yumiya, Y.; Kayano, R.; Van Trimpont, F. Impact of COVID-19 on Health Emergency and Disaster Risk Management System: A Scoping Review of Healthcare Workforce Management in COVID-19. **Sustainability 2023**, *15*, 11668. DOI: 10.3390/su151511668.
12. Gocke, D.; Johnston-Webber, C.; McGuire, A.; Wharton, G. *Building Sustainable and Resilient Health Systems: Key Findings from Country Reports*; PHSSR: London, 2023. Available at: www.phssr.org (accessed Nov 9, 2025).
13. Arksey, H.; O'Malley, L. Scoping Studies: Towards a Methodological Framework. **Int. J. Soc. Res. Methodol. 2005**, *8*, 19–32. DOI: 10.1080/1364557032000119616.
14. Page, M. J.; McKenzie, J. E.; Bossuyt, P. M.; Boutron, I.; Hoffmann, T. C.; Mulrow, C. D.; Shamseer, L.; Tetzlaff, J. M.; Akl, E. A.; Brennan, S. E.; Chou, R.; Glanville, J.; Grimshaw, J. M.; Hróbjartsson, A.; Lalu, M. M.; Li, T.; Loder, E. W.; Mayo-Wilson, E.; McDonald, S.; McGuinness, L. A.; Stewart, L. A.; Thomas, J.; Tricco, A. C.; Welch, V. A.; Whiting, P.; Moher, D. The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews. **BMJ 2021**, *372*, n71. DOI: 10.1136/bmj.n71.
15. Kiwanuka, S. N.; Babirye, Z.; Kabwama, S. N.; Tusubira, A. K.; Kizito, S.; Ndejjo, R.; Tumusiime, D. K.; Okello, E.; Wanyenze, R. K. Health Workforce Incentives and Disincentives during the COVID-19 Pandemic: Experiences from Democratic Republic of Congo, Nigeria, Senegal, and Uganda. **BMC Health Serv. Res. 2024**, *24*, 10822. DOI: 10.1186/s12913-024-10822-6.
16. Bello, S.; Neill, R.; Jegede, A. S.; Bamgboye, E. A.; Salawu, M. M.; Afolabi, R. F.; Nwaozuzu, U.; Ihekweazu, C.; Adeyemi, O.; Oduyebo, O. Health Systems Challenges, Mitigation Strategies and Adaptations to Maintain Essential Health Services during the COVID-19 Pandemic: Learnings from the Six Geopolitical Regions in Nigeria. **BMC Health Serv. Res. 2024**, *24*, 11072. DOI: 10.1186/s12913-024-11072-2.
17. Mahmoudjanlou, S.; Mahmoudi, G.; Jahani, M. A. Hospital Crisis Management in the Epidemic: A Qualitative Study. **Health Sci. Rep. 2024**, *7*, e70059. DOI: 10.1002/hsr2.70059.
18. Mitike, G.; Nigatu, F.; Wolka, E.; Defar, A.; Tessema, M.; Nigussie, T. Health System Response to COVID-19 among Primary Health Care Units in Ethiopia: A Qualitative Study. **PLoS One 2023**, *18*, e0281628. DOI: 10.1371/journal.pone.0281628.
19. Ravaghi, H.; Naidoo, V.; Mataria, A.; Khalil, M. Hospitals' Early Challenges and Interventions Combatting COVID-19 in the Eastern Mediterranean Region. **PLoS One 2022**, *17*, e0268386. DOI: 10.1371/journal.pone.0268386.
20. Kayani, F. N. A Resilient China amid COVID-19 Pandemic Crisis: Innovative Lessons for Other Countries. **Int. J. Econ. Financ. Issues 2022**, *12*, 135–142. DOI: 10.32479/ijefi.13400.
21. Marome, W.; Shaw, R. COVID-19 Response in Thailand and Its Implications on Future Preparedness. **Int. J. Environ. Res. Public Health 2021**, *18*, 1089. DOI: 10.3390/ijerph18031089.
22. Sirili, N.; Simba, D. It Is beyond Remuneration: Bottom-Up Health Workers' Retention Strategies at the Primary Health Care System in Tanzania. **PLoS One 2021**, *16*, e0246262. DOI: 10.1371/journal.pone.0246262.
23. Yu, E. An Analysis of China's Strategy in Combating the Coronavirus Pandemic with the 3H Framework. **Public Adm. Policy 2021**, *24*, 76–91. DOI: 10.1108/PAP-12-2020-0055.

24. Hasan, H. F. Legal and Health Response to COVID-19 in the Arab Countries. **Risk Manag. Healthc. Policy 2021**, *14*, 1141–1154. DOI: 10.2147/RMHP.S297565.
25. Watkins, V. J.; Shee, A. W.; Field, M.; Alston, L.; Hills, D.; Albrecht, S. L.; O'Connor, M.; Bell, E.; Morris, R.; Dickinson, H. Rural Healthcare Workforce Preparation, Response, and Work during the COVID-19 Pandemic in Australia: Lessons Learned from In-Depth Interviews with Rural Health Service Leaders. **Health Policy 2024**, *145*, 105085. DOI: 10.1016/j.healthpol.2024.105085.
26. Rotheram, S.; Clayton, S.; Buchan, I.; Ghebrehewet, S.; Barr, B. 'A System That Is Struggling': Understanding Health Protection Resilience in England during the COVID-19 Pandemic through the Experiences of Local Health Protection Responders. **BMC Health Serv. Res. 2024**, *24*, 10651. DOI: 10.1186/s12913-024-10651-7.
27. Webb, E.; Winkelmann, J.; Scarpetti, G.; Behmane, D.; Habicht, T.; Kahur, K.; Murauskiene, L.; Karanikolos, M. Lessons Learned from the Baltic Countries' Response to the First Wave of COVID-19. **Health Policy 2024**, *126*, 438–445. DOI: 10.1016/j.healthpol.2021.12.003.
28. Karreinen, S.; Paananen, H.; Kihlström, L.; Janhonen, K.; Huhtakangas, M.; Viita-aho, M.; Kinnunen, J.; Seppänen, K. Living through Uncertainty: A Qualitative Study on Leadership and Resilience in Primary Healthcare during COVID-19. **BMC Health Serv. Res. 2023**, *23*, 9223. DOI: 10.1186/s12913-023-09223-y.
29. Juvet, T. M.; Corbaz-Kurth, S.; Roos, P.; Benzakour, L.; Cereghetti, S.; Moullec, G.; Suard, J.-C.; Voirol, P.; Piquard, F.; Mombelli, M.; Pantet, O.; Broers, B.; Haller, D. M. Adapting to the Unexpected: Problematic Work Situations and Resilience Strategies in Healthcare Institutions during the COVID-19 Pandemic's First Wave. **Saf. Sci. 2021**, *139*, 105277. DOI: 10.1016/j.ssci.2021.105277.
30. Kennelly, B.; O'Callaghan, M.; Coughlan, D.; Cullinan, J.; Doherty, E.; Glynn, L.; Moloney, E.; Queally, M. The COVID-19 Pandemic in Ireland: An Overview of the Health Service and Economic Policy Response. **Health Policy Technol. 2020**, *9*, 419–429. DOI: 10.1016/j.hlpt.2020.08.021.
31. Wong, A.; Hung, K. K. C.; Mabhala, M.; Tenney, J. W.; Graham, C. A. Filling the Gaps in the Pharmacy Workforce in Post-Conflict Areas: Experience from Four Countries in Sub-Saharan Africa. **Int. J. Environ. Res. Public Health 2021**, *18*, 8132. DOI: 10.3390/ijerph18158132.
32. Channa, N. A.; Shah, S. M. M.; Ghumro, N. H. Uncovering the Link between Strategic Human Resource Management and Crisis Management: Mediating Role of Organizational Resilience. **Ann. Contemp. Dev. Manag. HR 2019**, *1*, 15–27. DOI: 10.33166/acdmhr.2019.02.003.
33. Edvardsson, I. R.; Durst, S. Human Resource Management in Crisis Situations: A Systematic Literature Review. **Sustainability 2021**, *13*, 12406. DOI: 10.3390/su132212406.
34. Das, S. K.; Twanabasu, S. A Story to Tell or Not, a Glimpse of Emergency Setting in the Low Economic Country: Experience Sharing and Review. **J. Gen. Pract. Emerg. Med. Nepal 2023**, *10*, 24–26. DOI: 10.59284/JGPEMAN218.
35. Arifin, B. Economic Evaluation—Do Limited-Resource Hospitals Improve Medical Care Utilization in Underdeveloped Areas: Evidence from Mobile Hospitals in Indonesia. **Value Health Reg. Issues 2022**, *30*, 67–75. DOI: 10.1016/j.vhri.2021.12.002.
36. Morgan, R.; Tan, H. L.; Oveisi, N.; Memmott, C.; Korzuchowski, A.; Hawkins, K.; Smith, J. Women Health-Care Workers' Experiences during COVID-19 and Other Crises: A Scoping Review. **Int. J. Nurs. Stud. Adv. 2022**, *4*, 100066. DOI: 10.1016/J.IJNSA.2022.100066.
37. Narapaka, P. K.; Katikala, K.; Ponnala, V. R.; Meenakshi, S.; Viswas, G.; Singh, M.; Reddy, M. S.; Reddy, B. K.; Nair, S. Psychological Health among Health-Care Professionals during COVID-19 Pandemic: An Updated Meta-Analysis. **Indian J. Psychiatry 2024**, *66*, 413–420. DOI: 10.4103/indianjpsychiatry.indianjpsychiatry_173_23.
38. Maple, J. L.; Whiteside, M.; Smallwood, N.; Putland, M.; Baldwin, P.; Bismark, M.; Willis, K.; Lewis, S. Culture, Conditions and Care Support Mental Health of Health-Care Workers during Crises. **Occup. Med. (Oxf.) 2024**, *74*, 211–217. DOI: 10.1093/OCCMED/KQAE002.
39. Maple, J.-L.; Willis, K.; Lewis, S.; Putland, M.; Baldwin, P.; Bismark, M.; Whiteside, M.; Smallwood, N. Health-Care Workers' Perceptions of Strategies Supportive of Their Mental Health. **J. Med. Surg. Public Health 2024**, *2*, 100049. DOI: 10.1016/J.GLMEDI.2024.100049.
40. Halms, T.; Strasser, M.; Papazova, I.; Reicherts, P.; Zerbini, G.; Grundey, S.; Wingenfeld, K.; Schäfer, I. What Do Health-Care Workers Need? A Qualitative Study on Support Strategies to Protect Mental Health of Health-Care Workers during the SARS-CoV-2 Pandemic. **BMC Psychiatry 2023**, *23*, 86. DOI: 10.1186/S12888-023-04686-Z.
41. Denisov, E. I.; Prokonenko, L. V.; Pfaf, V. F. Issues of Occupational Health of Health-Care Workers and Pandemic COVID-19. **Med. Tr. Prom. Ekol. 2021**,

61, 49–61. DOI: 10.31089/1026-9428-2021-61-1-49-61.

42. Ahmat, A.; Okoroafor, S. C.; Asamani, J. A.; Jean, M.; Mourtala, A. I.; Nyoni, J.; Mwinga, K. Health Workforce Strategies during COVID-19 Response: Insights from 15 Countries in the WHO Africa Region. **BMC Health Serv. Res. 2024**, *24*, 10942. DOI: 10.1186/S12913-024-10942-Z.
43. Korlén, S.; Essén, A.; Lindgren, P.; Amer-Wåhlin, I.; von Thiele Schwarz, U. Managerial Strategies to Make Incentives Meaningful and Motivating. **J. Health Organ. Manag. 2017**, *31*, 126–139. DOI: 10.1108/JHOM-06-2016-0122.
44. Millar, R.; Chen, Y.; Wang, M.; Fang, L.; Liu, J.; Xuan, Z.; Li, X.; Li, Z. It's All about the Money? **Int. J. Equity Health 2017**, *16*, 120. DOI: 10.1186/s12939-017-0616-9.
45. Okyere, E.; Ward, P. R.; Marfoh, K.; Mwanri, L. Incentives Management among Health Workers in Primary Health-Care Facilities: Addressing Important Issues in Rural Ghana. **J. Health Organ. Manag. 2022**, *36*, 712–733. DOI: 10.1108/JHOM-08-2021-0322.
46. Dasid, S.; Grantid, L.; Fernandes, G. Task Shifting Health-Care Services in the Post-COVID World: A Scoping Review. **PLoS Glob. Public Health 2023**, *3*, e0001712. DOI: 10.1371/journal.pgph.0001712.
47. Pedersen, G. A.; Shrestha, P.; Akellot, J.; Sepulveda, A.; Luitel, N. P.; Kasujja, R.; Kigozi, F.; Kohrt, B. A.; Jordans, M. J. D.; Thornicroft, G. A Mixed Methods Evaluation of a WHO Competency-Based Training Package for Foundational Helping Skills among Pre-Service and In-Service Health Workers in Nepal, Peru and Uganda. **Cambridge Prisms Glob. Ment. Health 2023**, *10*, 43. DOI: 10.1017/gmh.2023.43.
48. Yankam, B. M.; Adeagbo, O.; Amu, H.; Dowou, R. K.; Nyamen, B. G. M.; Ubechu, S. C.; Boadi, C.; Sombie, I.; Chatio, S.; Titi-Ofei, R.; Gachuhi, A. Task Shifting and Task Sharing in the Health Sector in Sub-Saharan Africa: Evidence, Success Indicators, Challenges and Opportunities. **Pan Afr. Med. J. 2023**, *46*, 11. DOI: 10.11604/pamj.2023.46.11.40984.
49. Johol, E.; Dato, Z. Post-Pandemic Transition and the Way Forward: A Narrative Literature Review of Onboarding. **Int. J. Acad. Res. Bus. Soc. Sci. 2023**, *13*, 599–615. DOI: 10.6007/IJARBSS/v13-i7/17427.
50. Goyal, M.; Kromm, J.; Ganesh, A.; Wira, C.; Southerland, A.; Sheth, K. N.; Jadhav, A. P.; Jovin, T. G.; Levy, E. I.; Mocco, J.; Saver, J. L.; Albers, G. W.; Smith, W. S.; Lansberg, M. G. Integrating New Staff into Endovascular Stroke-Treatment Workflows in the COVID-19 Pandemic. **Am. J. Neuroradiol. 2021**, *42*, 22–27. DOI: 10.3174/AJNR.A6854.
51. Skogsberg, M.; Jarl, G.; Matérne, M. The Association of Broadband Internet Access and Telemedicine Utilization in Rural Western Tennessee: An Observational Study. **BMC Health Serv. Res. 2022**, *22*, 1563. DOI: 10.1186/s12913-022-08937-9.
52. Yasobant, S.; Lekha, K. S.; Thacker, H.; Solanki, B.; Bruchhausen, W.; Saxena, D. Intersectoral Collaboration and Health System Resilience during COVID-19: Learnings from Ahmedabad, India. **Health Policy Plan. 2024**, *39*, i29–i38. DOI: 10.1093/HEAPOL/CZAE045.
53. Bradley, E. H. Intersectoral Collaboration: What Works and What Doesn't. **Int. J. Health Policy Manag. 2023**, *12*, 8090. DOI: 10.34172/IJHPM.2023.8090.
54. Mirzania, M.; Shakibazadeh, E.; Ashoorkhani, M. Challenges for Implementation of Inter-Sectoral Efforts to Improve Outbreak Response Using the Consolidated Framework for Implementation Research: Iran's COVID-19 Experience. **BMC Health Serv. Res. 2021**, *22*, 1118. DOI: 10.1186/s12913-022-08510-4.
55. World Health Organization. *Health Workforce*; World Health Organization: Geneva, 2024. Available at: maternal-health/about/health-workforce (accessed Nov 9, 2025).
56. Saini, A. How Is Workforce Management Empowering Health-Care? **J. Eng. Appl. Sci. Technol. 2023**, *5*, E131. DOI: 10.47363/JEAST/2023(5)E131.
57. Saigí-Rubió, F.; Romeu, T.; Hernández, E.; Guitert, M.; Andrés, E.; Reixach, E. Design, Implementation and Analysis of an Assessment and Accreditation Model to Evaluate a Digital Competence Framework for Health Professionals: Mixed Methods Study. **JMIR Med. Educ. 2024**, *10*, 53462. DOI: 10.2196/53462.
58. Wang, A. Advancing Organizational Effectiveness through Strategic Workforce Planning and Technology Integration. **Adv. Econ. Manag. Polit. Sci. 2024**, *121*, 107–112. DOI: 10.54254/2754-1169/121/20242362.
59. Haw, D. J.; Biggerstaff, M.; Prasad, P.; Walker, J.; Grenfell, B.; Arinaminpathy, N. Using Real-Time Data to Guide Decision-Making during an Influenza Pandemic: A Modelling Analysis. **PLoS Comput. Biol. 2023**, *19*, e1010893. DOI: 10.1371/journal.pcbi.1010893.
60. Kokashvili, N.; Sosanidze, M.; Osadze, L. Human Resource Management Strategies: Analysis and Evaluation. **Grail Sci. 2024**, *43*, 184–193. DOI: 10.36074/GRAIL-OF-SCIENCE.06.09.2024.021.

61. Nzinga, J.; Boga, M.; Kagwanja, N.; Waithaka, D.; Barasa, E.; Tsofa, B.; English, M.; Scott, J.; Molyneux, S. An Innovative Leadership Development Initiative to Support Building Everyday Resilience in Health Systems. **Health Policy Plan. 2021**, *36*, 1023–1035. DOI: 10.1093/heapol/czab056.
62. Malik, M. M. U. D.; Lamghare, P. K.; Khanna, V.; Saraf, A. Addressing the Health-Care Workforce Shortage in India: Strategies for Recruitment and Retention. **South East Eur. J. Public Health 2024**, *24*, 934–943. DOI: 10.70135/SEEJPH.VI.1571.
63. Cavalcante de Oliveira, A. P.; Galante, M. L.; Maia, L. S.; Craveiro, I.; da Silva, A. P.; Fronteira, I.; Ferrinho, P. Implementation of Policy and Management Interventions to Improve Health and Care Workforce Capacity to Address the COVID-19 Pandemic Response: A Systematic Review. **Hum. Resour. Health 2023**, *21*, 856. DOI: 10.1186/S12960-023-00856-Y