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REVIEW ARTICLE

Impact of climate change on health workers: a scoping review

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Abstract

Aim Climate change is the most pressing global challenge of the twenty-first century and has recently been declared as a public health emergency due to its widespread environmental, social, economic, and health impacts. This scoping review aims to map existing evidence on the impact of climate change on health workers.

Subject and methods We followed the JBI guidelines for scoping reviews and the PRISMA-ScR protocol. Systematic searches were conducted in databases including PubMed, MEDLINE, ProQuest, SCOPUS, Web of Science, EMBASE, CINAHL and PsycINFO. Peer-reviewed articles published between 01 January 2014 and 03 May 2024 were included. The findings were presented numerically and thematically, and a narrative synthesis summarised the evidence.

Results We analysed 23 studies from different regions and identified four main areas of climate change impacts: physical health impacts, mental health impacts, occupational safety impacts, and impacts on the capacity and resilience of health workers. This review also identified barriers and challenges to health workers' ability to respond to climate change, including time constraints, gaps in knowledge and training, strains on infrastructure and supply chains, difficulties in resource allocation, and coordination challenges between organisations.

Conclusion The review highlights the substantial physical health, mental health, and occupational safety impacts of climate change on health workers. These effects undermine the resilience of health workers and the operational integrity of health services. To increase health workers' resilience to climate change impacts, it is essential to implement a comprehensive strategy that includes targeted training, infrastructure upgrades, policy updates, and improved inter-agency coordination.

Keywords Climate change · Occupational health · Health services · Health workers · Scoping review

Introduction

Climate change has recently been declared a public health emergency (Costello et al. 2009) and is emerging as the most serious global health threat of the twenty-first century, posing significant environmental, social, economic, and public health challenges (Masson-Delmotte et al. 2021; Berg et al. 2021; Dasandi et al. 2021). It is characterised by long-term alterations in average weather patterns, including temperature, precipitation, and atmospheric conditions (Collins et al. 2013). Human activities, such as burning fossil fuels, deforestation, and industrial processes, primarily drive these changes by releasing greenhouse gases into the atmosphere (Haines et al. 2006). The resultant increase in greenhouse gas concentrations induces the greenhouse effect, which traps heat in the Earth's atmosphere and contributes to global warming (METMalaysia 2024; Mikhaylov et al. 2020). This temperature rise initiates a cascade of impacts, including elevated sea levels, intensified weather events, and shifts in disease patterns (Reid and Gamble 2009; De Sario et al. 2013; Ramadani et al. 2023), thereby threatening physical, biological, and ecological systems crucial for human health (McMichael et al. 2007). These changes can exacerbate existing health challenges and introduce new

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pandemic risks, such as heat-related illnesses, respiratory complaints, increased susceptibility to infectious diseases (Patz and Olson 2006; Paavola 2017; Woodward et al. 2014), and mental health problems (Dos Santos et al. 2023).

Rapid environmental change exacerbates health inequalities, especially among vulnerable populations (Parmesan et al. 2022; Sorensen and Fried 2024). Marginalised communities, low-income countries, and regions with limited health infrastructure are disproportionately affected (Benevolenza and DeRigne 2019; Khine and Langkulsen 2023; Jessel et al. 2019). Recognising the urgency needed to address this issue, global health organisations such as the World Health Organisation (WHO) (World Health Organization 2019, the United Nations Environment Programme (2019) , the United Nations Development Programme (2015), and UNICEF (2019) prioritise addressing climate change's physical and mental health impacts. The United Arab Emirates Declaration on Climate and Health, endorsed by over 120 countries at COP28 in 2023, signifies a pivotal step in safeguarding human health amidst a changing climate (World Health Organization 2023). This global consensus emphasises the imperative for urgent, coordinated action across mitigation, adaptation, and preparedness strategies to effectively mitigate the health consequences of climate change and promote equity.

A robust and resilient health workforce is fundamental to any functioning health system (Burau et al. 2022). Health workers are critical in addressing and responding to climate-related challenges (Kreslake et al. 2018; Sorensen and Fried 2024; Roberts and Stott 2010) and are the backbone of health systems worldwide (Anyangwe and Mtonga 2007). They are essential for promoting health, preventing and managing disease, and ensuring a robust response to health emergencies (World Health Organization 2016; Sharkiya 2023; Oo 2024). However, the escalating threat of climate change poses a significant challenge to the resilience and capacity of health workers. Climate change can affect the capacity and well-being of health workers in many ways, jeopardising the delivery of health services in a changing climate (Nicholas and Breakey 2017; Wuersch et al. 2023).

Extreme weather events such as bushfires, cyclones, floods and heatwaves can cause significant damage to health infrastructure, affecting the ability of health workers to provide essential services and reach communities in need (Behera et al. 2020; Pedersen et al. 2021). Changes in the geographic distribution and prevalence of infectious diseases due to climate change also impose additional demands on health workers, necessitating diagnosing, treating, and managing a broader spectrum of diseases such as malaria, dengue fever, Lyme disease (Caminade et al. 2019), COVID-19 (Wahaj et al. 2022), and others (Barrett et al. 2015). Climate-related events can lead to increased numbers of patients requiring urgent medical care, trauma treatment, and mental health support, straining health systems and putting additional pressure on health workers (Xu et al. 2023; Nicholas et al. 2020; Søvold et al. 2021). The impact of climate change on health workers goes beyond their physical health (Pendrey et al. 2021). The cumulative effect of rising climate-related diseases and disaster exposure undermines workforce resilience (Padhy et al. 2015; Wuersch et al. 2023). Witnessing suffering and emotional stress leads to burnout and distress, reducing job satisfaction and making health workers less equipped to deal with the growing health challenges posed by climate-change conditions (Gupta et al. 2021; Berry et al. 2010).

Understanding the impact of climate change on health workers is critical to developing effective adaptation and mitigation strategies and ensuring a resilient health system (Ramanathan and Haines 2016). While the broader health impacts of climate change are increasingly recognised, a specific focus on health workers is lacking. Existing literature often overlooks the impact of climate change on health workers and the challenges they face in preparing for and responding to its effects, which have not been fully explored. This scoping review addresses this gap by systematically mapping the existing evidence. By synthesising and consolidating relevant research, this scoping review aims to examine the impact of climate change specifically within acute and community-based healthcare settings, identify research gaps, and highlight areas for further investigation.

While long-term care facilities and home-care nursing visits present distinct challenges, our focused examination of acute and community contexts allows for a comprehensive understanding of the immediate impacts on healthcare workers. By identifying the specific challenges faced in these environments, this study seeks to inform policy development aimed at enhancing the resilience of health systems and ensuring that healthcare workers receive the necessary support as they adapt to a changing climate. The results of this research will contribute to and support the development of strategies that strengthen the capacity of health systems to withstand climate-related stresses, ultimately safeguarding the health and well-being of workers and the communities they serve. The results of this study will also provide valuable guidance to policy makers, researchers, and health professionals in developing evidence-based interventions and strategies to strengthen the resilience of health workers, which is critical to protecting public health in a changing climate.

Research/review questions

- **Research question one**: what are the documented impacts of climate change on health workers?

- **Research question two**: what challenges do health workers face in preparing for and responding to the impacts of climate change?

Materials and methods

This scoping review followed the Joanna Briggs Institute (JBI) guidelines for scoping reviews (Peters et al. 2020). Using the JBI framework ensures a systematic and rigorous approach throughout the review process. We adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist to ensure transparent reporting (see S1 File) (Tricco et al. 2018). The research questions were formulated using the population/concept/context (PCC) framework (Peters et al. 2015), as outlined in item 4 of the PRISMA-ScR extension (Tricco et al. 2018). This framework, recommended by the JBI, was employed to identify the key concepts underpinning the primary review questions. The PCC framework facilitated the conceptualisation of the review objectives and guided the development of a comprehensive search strategy, detailed in Table 1. A protocol for this scoping review was pre-registered with the Open Science Framework (OSF) (link: https://osf.io/enpjd).

Eligibility criteria

The eligibility criteria for this scoping review were developed to guide the selection of studies examining climate change's impacts on health workers. These criteria were informed by the PCC framework and were as follows:

Population

Health workers are the target population or participants of interest for this review. These individuals encompass those involved in the provision of healthcare, covering both clinical and non-clinical roles within the healthcare system, such as doctors, nurses, midwives, allied health professionals (e.g., therapists, nutritionists, pharmacists), technicians (e.g., radiology, dental), public health professionals, and community health workers engaged in healthcare delivery (Australian Government Department of Health and Aged Care, n.d.). They form the backbone of the health system and play an integral role in providing essential care to populations worldwide. Recognising the diversity of these professions is critical, as each group brings unique perspectives and experiences related to the impacts of climate change. This diversity will be crucial in ensuring that health workers remain strong and resilient to climate change in the future.

Concept

In this review, the concept of climate change encompasses a wide range of phenomena including global warming, climate variability, the climate crisis, climate disruption, the greenhouse effect, environmental change, and climate instability. The focus is on how these aspects of climate change specifically affect health workers within the health sector. The articles included in this review discuss the effects of climate change on health workers, such as extreme weather events (e.g., heat waves, floods, droughts, cyclones, wildfires, sea level rise, extreme cold). Understanding this multifaceted nature of climate change is critical for developing adaptation strategies, mitigating risks, and strengthening the resilience of health workers globally.

Table 1 Search terms for the scoping review on the impacts of climate change on health workers, 2024

Key concepts	Keywords
Impact	(impact OR effect* OR problem* OR consequence OR outcome* OR influence OR disruption OR disturbance)
	AND
Climate change	("climate change" OR "global warm*" OR "global heat*" OR "climate variability" OR "climate crisis" OR "climate disruption" OR "climate issue*" OR "climate vulnerabilit*" OR "climate emergenc*" OR "greenhouse effect" OR "environmental change" OR "climate instability" OR "extreme weather" OR "extreme heat*" OR "extreme cold" OR heatwave OR "heat wave" OR "sea level ris*" OR storm* OR cyclone* OR hurricane* OR flood* OR drought* OR wildfire* OR bushfire*) AND
	AND
Health workers	("health worker" OR "healthcare worker" OR "health workforce" OR "healthcare workforce" OR "health professional*" OR "healthcare professional*" OR "health practitioner*" OR "healthcare practitioner*" OR "health personnel*" OR "healthcare provider*" OR "medical workforce" OR "medical practitioner*" OR "medical personnel" OR "medical doctor*" OR "general practitioner*" OR "nursing workforce" OR "allied health workforce" OR "allied health worker*" OR "allied health practitioner*" OR "allied health professional*" OR "public health workforce" OR "public health professional*" OR "public health worker*" OR "community health worker*" OR "community nurs*" OR "nursing personnel" OR "midwifery personnel" OR "dentistry personnel" OR physician* OR nurs* OR midwife OR midwives OR dentist* OR "dental technician" OR psychiatrist OR "clinical staff" OR pharmacist)

Context

This review considered studies conducted in various health settings, including hospitals, clinics, community health centres, and other relevant environments, ranging from primary care to hospitalisation and care in emergency departments. Studies from all geographical regions and contexts were included because climate change is a global issue affecting all countries to varying degrees. This global perspective is crucial for guiding practice and policy, as it enables the identification of best practices and lessons learned for improving the resilience of health workers to climate change.

Types of evidence sources

To ensure a focus on the most relevant and current literature, we established the following inclusion criteria: 1) full-text articles published in peer-reviewed journals between 01 January 2014 and 03 May 2024, 2) original research studies (e.g., cross-sectional, case–control, cohort, or experimental designs), 3) studies reporting on the challenges faced by health workers in addressing the impacts of climate change, such as gaps in knowledge and awareness, and 4) studies published in English.

Exclusion criteria

The eligibility criteria for this scoping review excluded the following publication types: expert commentaries, perspective papers, letters to the editor, supplements, and short communications, Grey literature sources available in the public domain were also excluded, such as dissertations, reports, process documentation, and national survey data. These types of publications were omitted because they present methodological challenges and reduced reproducibility compared to peer-reviewed original research articles.

Search strategy

A preliminary search of the Medline (Ovid) database was conducted to identify text terms (keywords) using the PCC approach (Arksey and Omalley 2005). This step helps to develop a comprehensive search strategy to identify relevant studies across different databases. Synonyms for 'impact', 'climate change', and 'health workers' were utilised to identify relevant keywords. By incorporating these synonyms and related terms with truncation in the search strategy, a wide array of relevant articles was retrieved from the databases; ensuring that the scoping review encompassed a broad spectrum of literature concerning the impact of climate change on health workers. The search strategy was devised based on the keywords outlined in Table 1.

Terms related to concepts were combined using the Boolean operator OR, while the operator AND was employed to combine different concepts. The research team (AHT, JP, and EM) developed the search strategy with a professional librarian. A final systematic search was conducted across several electronic databases, including PubMed, MEDLINE, ProQuest, SCOPUS, Web of Science, EMBASE, CINAHL, and PsycINFO. The search was limited to peer-reviewed articles published in English in the last 10 years to ensure the relevance of the findings in the current context. English serves as a predominant language for scientific communication in academia. The example search strategy for the Medline (Ovid) databases is detailed in the S2 File and the S3 File. Citation chaining was employed to identify additional relevant articles by examining the reference lists (bibliographies) of included articles to find studies that met the inclusion criteria.

Study selection

The study selection process adhered to a rigorous methodology to ensure the inclusion of relevant and high-quality articles. We utilised EndNote version 21 software for citation management. Citations were subsequently imported into Covidence®, a systematic review management tool, which facilitated the removal of duplicate articles and the screening of evidence. ATH conducted initial screening based on title and abstract to identify potentially eligible studies. Full-text articles were downloaded and screened by ATH, with EM independently verifying 20% of studies for reliability before final inclusion in the review. Disagreements were resolved through discussion until consensus was reached, with adjudication by a third reviewer (JP) in cases of unresolved disagreement. Articles not meeting the inclusion criteria were excluded, and reasons for exclusion were documented. This systematic and transparent approach ensures the robustness and reliability of the selected studies, enhancing the credibility and validity of our review findings.

Data charting and quality assurance

We employed Covidence® to ensure a meticulous and reliable data extraction process. After uploading the full text of all eligible articles, one reviewer (ATH) extracted relevant data using a standardised form developed within Covidence®. Another reviewer (EM) independently extracted data from a random sample of 20% of the studies to ensure inter-rater reliability. These checks ensured consistency and minimized the risk of bias in data extraction. Any discrepancies were resolved through discussion and consensus, with

a third reviewer (JP) available for adjudication if necessary. No differences were observed between reviewers in article screening and data extraction. The data extraction form captured key information for each study, including study characteristics (e.g., first author, year, design), population characteristics (e.g., types of health workers included), and the challenges health workers face in preparing for and responding to the impact of climate change. This rigorous approach, supported by robust quality assurance measures, enhances the trustworthiness and credibility of the extracted data presented in this scoping review.

Results presentation and synthesis

We employed a multifaceted approach to comprehensively present and synthesise the findings of this review. First, a quantitative summary presents the main characteristics of the included studies. This includes the total number of studies, study designs, geographical location, and other relevant measures. This numerical summary provides a concise overview of the characteristics of the included studies and allows for grasping the scope and breadth of research in this area. Second, a narrative review synthesizes the findings across all the included studies. This synthesis summarises the main themes and key findings identified from the collective body of evidence, offering a deeper understanding of the impact of climate change on health workers. Tables were developed to summarise key information extracted from the included studies, encompassing details such as climate change impacts, type of health workers, observed outcomes on health workers, and challenges encountered by the health workers in responding to the impacts of climate change. During the reporting process, an iterative review, refinement, and feedback process among the authors was carried out until a final agreement was reached to ensure accuracy, completeness, and the overall quality of the review.

Results

Searching and studies selection process

Using a systematic search strategy in electronic databases, we identified 3646 studies. In addition, citation chaining of the included studies identified nine additional eligible articles. After removing 1613 duplicate records, 2039 unique citations were subjected to title and abstract screening. A total of 1978 records were excluded as they did not meet the eligibility criteria. The remaining 61 reports were then retrieved for full-text review. A further 38 studies were excluded due to a lack of relevance to the impact of climate change on health workers or insufficient data. The study selection process is summarised in the PRISMA- ScR flow diagram (Fig. 1).

Characteristics of the included studies

The 23 studies included in this scoping review were published between January 2016 and February 28, 2024, with the majority (15 studies) published in the last 3 years. Geographically, the included studies spanned several world regions including: North America (six studies) (Bell et al. 2020; Byron and Akerlof 2021; Callen and Clay 2024; Harris-Glenville and Cloos 2024; Mash et al. 2023; Rempel et al. 2024), Asia (six studies) (Al-Wathinani et al. 2021; Buriro et al. 2018; Hugelius et al. 2017; Ediz and Uzun 2024; Rattanakanlaya et al. 2018; Fertelli 2023), Europe (four studies) (Brooks et al. 2023; Litke et al. 2022; Wibowo et al. 2024; Albrecht et al. 2023), Australia (five studies) (Hurst et al. 2024; Mak and Singleton 2017; Mohtady Ali et al. 2022; Scrymgeour et al. 2020; Stilita and Charlson 2024), South America (one study) (Arias et al. 2023), and Africa (one study) (Samba et al. 2023). In terms of study design, 17 studies (Brooks et al. 2023; Buriro et al. 2018; Byron and Akerlof 2021; Ediz and Uzun 2024; Fertelli 2023; Harris-Glenville and Cloos 2024; Hugelius et al. 2017; Litke et al. 2022; Mak and Singleton 2017; Mohtady Ali et al. 2022; Rattanakanlaya et al. 2018; Rempel et al. 2024; Samba et al. 2023; Scrymgeour et al. 2020; Stilita and Charlson 2024; Albrecht et al. 2023) employed cross-sectional quantitative or qualitative methods, two studies (Callen and Clay 2024; Hurst et al. 2024) utilised a mixed-methods approach, two studies (Wibowo et al. 2024; Bell et al. 2020) were experimental, and one study (Mash et al. 2023) was a prospective cohort study. The sample sizes of the studies ranged from seven to 681 participants from different groups of health professionals, including nurses, doctors, psychologists, pharmacists, public health workers, and other health workers. The specific impacts of climate change events examined in these studies include heatwaves (Brooks et al. 2023; Buriro et al. 2018; Litke et al. 2022; Wibowo et al. 2024), sea level rise (Ediz and Uzun 2024), floods (Al-Wathinani et al. 2021; Buriro et al. 2018; Byron and Akerlof 2021; Callen and Clay 2024; Litke et al. 2022; Mohtady Ali et al. 2022; Rattanakanlaya et al. 2018; Samba et al. 2023), hurricanes (Bell et al. 2020; Callen and Clay 2024; Harris-Glenville and Cloos 2024; Mash et al. 2023), bushfires (Hurst et al. 2024; Mak and Singleton 2017; Mohtady Ali et al. 2022; Scrymgeour et al. 2020), extreme precipitation (Arias et al. 2023; Byron and Akerlof 2021), storms (Litke et al. 2022), droughts (Arias et al. 2023; Byron and Akerlof 2021), and cold temperatures (Callen and Clay 2024). The majority, 14 (60.9%) of the studies focused on nurses, followed by doctors, eight (34.8%) (Fig. 2). The main characteristics and findings of the 23 included studies are summarised in Table 2.

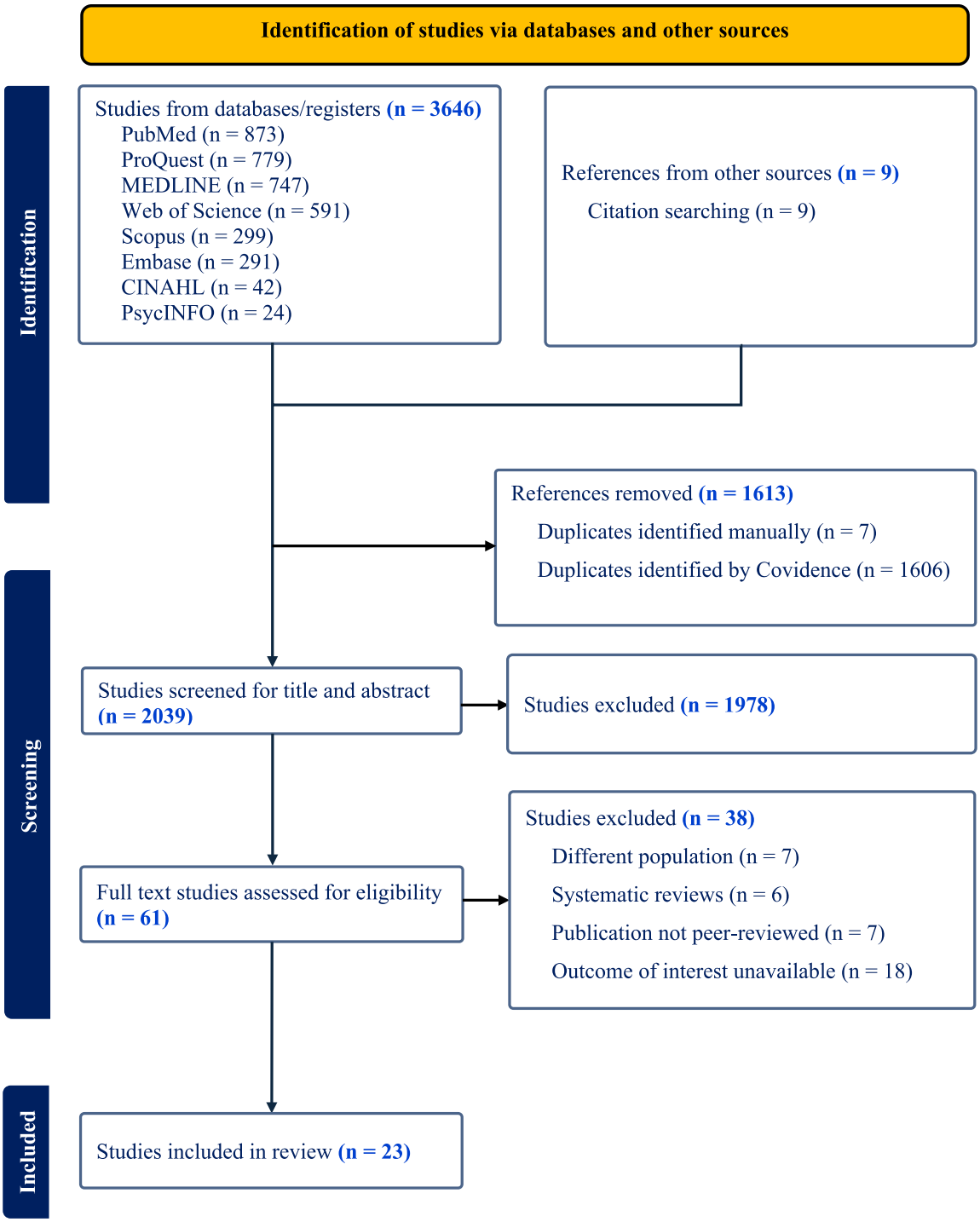

Fig. 1 PRISMA-ScR flow diagram of study selection for this scoping review ($n = 23$)

Climate change impacts on health workers

In addressing research question one, 19 of the included articles examined the various impacts of climate change on health workers. This review identified four key categories of these impacts: physical health impacts, mental health impacts, occupational safety impacts, and impacts on health worker capacity and resilience of health workers. These health impacts occur both within the workplace and outside the workplace. Within the workplace, health workers face increased risks from extreme temperatures, poor air quality, and the physical demands of responding to climate-related

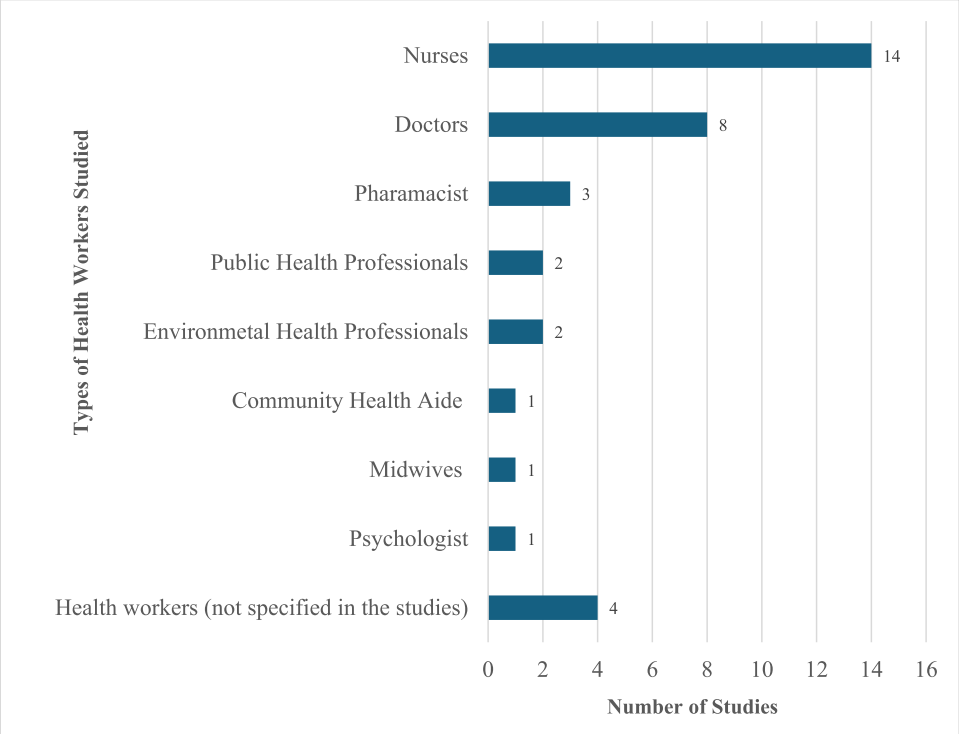

Fig. 2 Types of health workers studied in the included articles ($n = 23$)

health emergencies, which can lead to heat-related illnesses, respiratory problems, and higher stress levels. Outside the workplace, health workers are vulnerable to the wider environmental and social impacts of climate change, such as increased prevalence and incidence of vector-borne diseases, displacement due to natural disasters, and psychological stress caused by witnessing the negative impacts of climate change on communities. This dual exposure underscores the broad scope of climate change's impacts on health workers, affecting both their professional and personal well-being (Fig. 3).

Physical health impacts

Among the included articles, 50.5% ($n = 11$) (Arias et al. 2023; Brooks et al. 2023; Buriro et al. 2018; Callen and Clay 2024; Harris-Glenville and Cloos 2024; Ediz and Uzun 2024; Mash et al. 2023; Rempel et al. 2024; Samba et al. 2023; Wibowo et al. 2024; Albrecht et al. 2023) report that climate change is affecting the physical well-being of health workers worldwide, with varying impacts across different regions. Nurses and physicians in Germany reported respiratory symptoms, heat stress, heat stroke, and increased allergies (Albrecht et al. 2023). In Pakistan, nurses faced health issues related to flooding, heatwaves, and various infectious diseases, including vector-borne, food-borne, water-borne, and airborne diseases (Buriro et al. 2018). Health workers in the United States have experienced personal injuries from hurricanes (Mash et al. 2023) and respiratory problems from extreme weather events such as snow, thunderstorms, floods, hurricanes, and wildfires (Callen and Clay 2024). Nurses in Turkey reported an increase in infectious diseases tied to flooding, drought, and sea level rise (Ediz and Uzun 2024).

Mental health and well-being impacts

A study in England found that doctors reported feeling uncomfortable, tired, stressed, and unable to cope during heatwaves, which negatively affected their efficiency and ability to provide care (Brooks et al. 2023). Similarly, nurses in Turkey expressed feelings of worry and hopelessness about flooding, drought, and sea level rise (Fertelli 2023). Health professionals in the Philippines experienced worse overall health and higher frequencies of mental health issues following a typhoon (Hugelius et al. 2017). In Australia, bushfires led to burnout, staff turnover, surging workloads, anxiety, fear of being overwhelmed, and sadness among health workers (Hurst et al. 2024). Physicians and medical assistants in Germany described experiencing fear, stress, desperation, a feeling of losing control, insecurity, and helplessness due to heatwaves and extreme weather events (Litke et al. 2022). Health workers in other countries, such as the United States (Callen and Clay 2024; Mash et al. 2023), Canada (Rempel et al. 2024), and Australia (Scrymgeour et al. 2020; Mohtady Ali et al. 2022), also reported similar mental health challenges, including fear, anxiety, and emotional distress, in response to climate change impacts.

Table 2 Characteristics of studies included in the scoping review on the impact of climate change on health workers ($n = 23$)

Author/s and publication year	Geographic location	Study design	Methods of data collection	Sample size	Health workers studied	Climate change impacts	Impacts on health worker
Albrecht et al. 2023	Europe (Germany)	Cross-sectional	Interviews	142	Nurses and Doctors	Not mentioned	• Respiratory symptoms, • Heat stress, heat stroke • Increased allergies • Mental health issues
Al-Wathinani et al. 2021	Asia (Saudi Arabia)	Cross-sectional	Survey	227	Nurses, Doctors, Pharmacist, and Other (not mentioned)	Flood	• Increased absenteeism of workers
Arias et al. 2023	South America (Colombia)	Not mentioned	Interviews	NM	Nurses	High precipitation and drought	• Increased occurrence of food-borne diseases and acute diarrhoeal diseases
Bell et al. 2020	North America (USA: Louisiana and New Jersey)	Quasi-experimental	Secondary data (datasets from 2001–2017)	NM	Doctors and nurses	Hurricanes and Sandy	• Availability of health workers decreased
Brooks et al. 2023	Europe (England)	Qualitative	Survey	13	Doctors and professional staff	Heatwaves	• Staff and patients overheating in healthcare buildings • Staff feeling uncomfortable, tired, stressed, unable to cope, less efficient and observing distress in patients • Increased workload (increase in-patient admissions on hot days)
Buriro et al. 2018	Asia (Pakistan)	Cross-sectional	Interviews	105	Nurses	Flooding, heat waves	• Vector-borne, food-borne, water-borne, and air-borne diseases
Byron and Akerlof 2021	North America (USA:Montana)	Cross-sectional	Interviews	185	Public health and Environmental health professionals	Drought, flooding, forest fire, and extreme precipitation	• Their general health was affected by climate impacts
Callen and Clay 2024	North America (USA)	Mixed	Interviews	62	Doctors	Snow, thunderstorm, flooding, hurricane, wildfire, cold	• Respiratory difficulties • mental health problems
Fertelli 2023	Asia (Turkey)	Cross-sectional	Interviews	NM	Nurses		• Worry, hopelessness

Table 2 (continued)

Author/s and publication year	Geographic location	Study design	Methods of data collection	Sample size	Health workers studied	Climate change impacts	Impacts on health worker
Harris-Glenville and Cloos 2024	North America (Dominica, Caribbean)	Qualitative	Interviews	59	Community health aides, Nurses, Environmental health officers, Doctors, Pharmacists, and Midwives	Hurricane, flood, landslide	• Rise in new conditions (high blood pressure and diabetes and stroke) • Mental health problems (anxiety and depression) • Loss of property and loved ones, loss of livelihoods and other social problems
Hugelius et al. 2017	Asia (Philippines)	Cross-sectional	Survey	73	Health workers	Typhoon	• Mental health problems (worse health and higher frequency of affected mental health)
Hurst et al. 2024	Australia (NSW)	Mixed	NM	NM	Health workers	Bushfires	• Burnout, staff turnover, surging workloads, anxiety, fear of being overwhelmed and sadness
Ediz and Uzun 2024	Asia (Turkey)	Qualitative	NM	35	Nurses	Flood, drought, sea level rise	• Increase in infectious diseases, depression • Anxiety disorders, reluctance to work in overpopulated areas • Experiencing crises, increased workload • Increased air pollution, water pollution, migration, vector-borne diseases
Litke et al. 2022	Europe (Germany)	Qualitative	Interviews	40	Doctors and Nurses	Heatwaves, extremely high temperature, floods, storms	• Increased fear, stress, desperation, • Feeling of losing control, insecurity, helplessness, overload
Mak and Singleton 2017	Australia (Tasmania)	Qualitative	Interviews	7	Pharmacists	Bushfires	• Pharmacists were emotionally challenged during this time

Table 2 (continued)

Author/s and publication year	Geographic location	Study design	Methods of data collection	Sample size	Health workers studied	Climate change impacts	Impacts on health worker
Mash et al. 2023	North America (USA: Maryland)	Prospective cohort	Survey	681	Public health workers	Hurricane	• Personal injury • Lower work productivity • Increased negative emotional response
Mohtady Ali et al. 2022	Australia (Queensland)	Qualitative	Interviews	30	Health workers	Bushfires, floods,	• Mental health problems (fear)
Rattanakanlaya et al. 2018	Asia (Thailand)	Qualitative	Interviews	15	Doctor and Nurses	Flooding	• Stress
Rempel et al. 2024	North America (Canada)	Qualitative	Interviews	12	Nurses	Heat dome, drought, forest fires dome	• Physical problems • Emotional problems/ mental health problems • Lack of stability and safety
Samba et al. 2023	Africa (Ethiopia, Uganda, South Africa, Ghana, Cameroon, and Nigeria)	Qualitative	Interviews	7	Nurses	Flooding, warming	• Increased allergens • Increased air pollution • Decreased quality of water supplies, • Power disruptions
Scrymgeour et al. 2020	Australasia (Australia and New Zealand)	Qualitative	Interviews	15	Nurses	Earthquakes and bushfires	• Emotional impact
Wibowo et al. 2024	Europe (Germany)	Experimental (crossover trial)	Experimental	18	Nurses	Heatwave	• Heat strain, heat stress • Physiological effects • Productivity losses
Stilita and Charlson 2024	Australia	Mixed	Survey	59	Psychologist	Bushfires smoke, Heat, Flooding, Storms	• Experience frustration • Worry and anxiety

NM = not mentioned

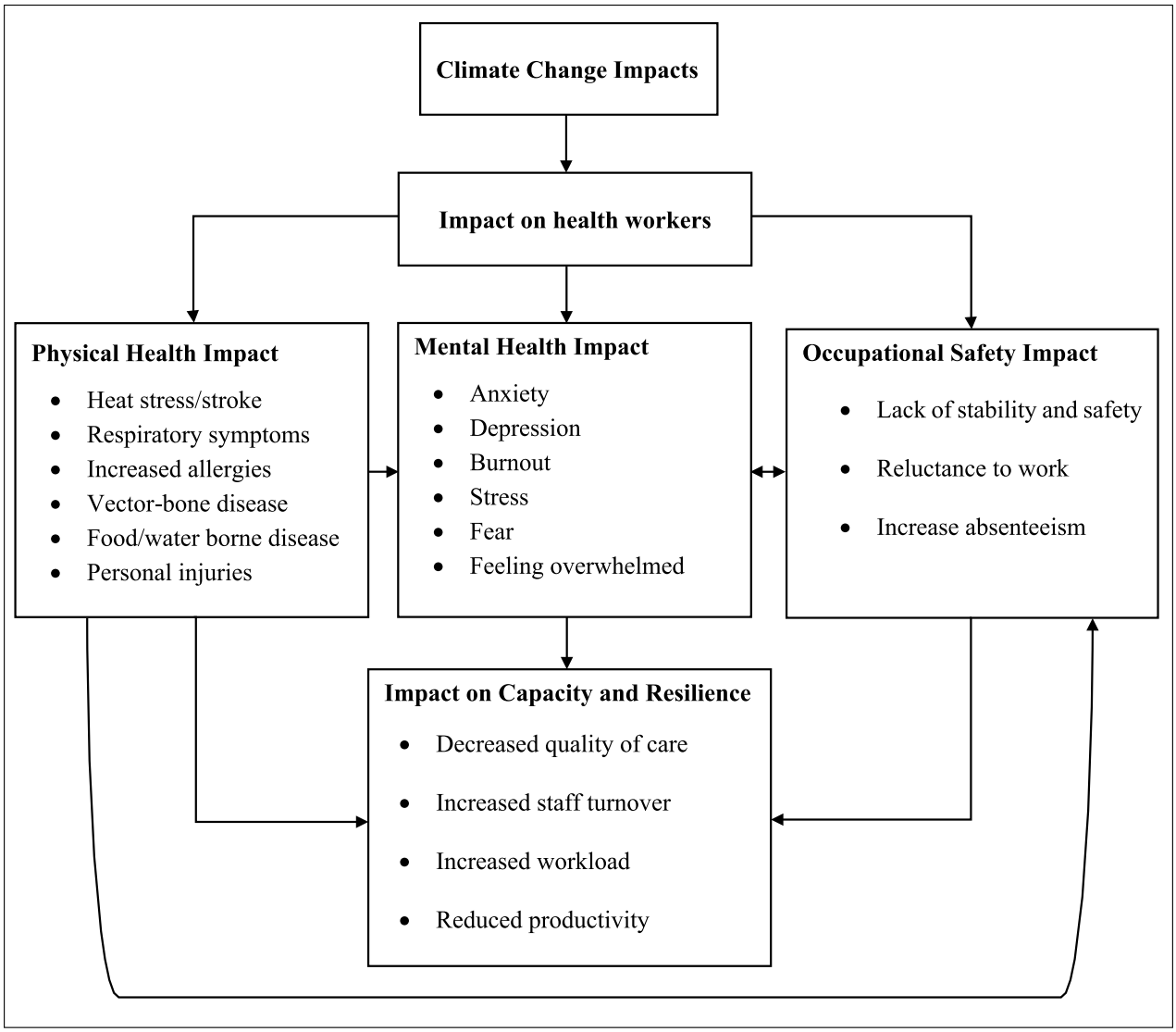

Fig. 3 Diagrammatic representation of the impacts of climate change on health workers ($n = 23$)

Occupational safety impacts

Four studies reported that climate-change impacts threaten the safety and working conditions of health workers. Occupational factors related to climate change, such as power outages, infrastructure damage, and supply chain disruptions, were reported to compromise the safety and stability of healthcare facilities, putting workers at risk. For instance, the study by Al-Wathinani et al. in Saudi Arabia found increased absenteeism among health workers due to flood events (Al-Wathinani et al. 2021). Similarly, the study by Ediz et al. in Turkey noted health workers' reluctance to work in overpopulated areas affected by climate impacts such as floods, droughts, and sea level rise (Ediz and Uzun 2024). In addition, studies by Litke et al. in Germany and Rempel et al. in Canada describe how health workers experience a lack of stability, safety, and insecurity due to climate-related events such as heat waves, floods, and wildfires (Litke et al. 2022; Rempel et al. 2024).

Impacts on health workers capacity and resilience

Seven of the included studies reported the compounding effects of climate change on the capacity and resilience of health workers. The physical and mental health challenges, combined with the impact on occupational safety during extreme weather events such as heat waves, floods, cyclones, bushfires, and droughts, contributed to absenteeism, staff turnover, and reduced availability of health workers (Al-Wathinani et al. 2021; Litke et al.

2022; Ediz and Uzun 2024; Bell et al. 2020; Hurst et al. 2024). Health workers reported feeling overwhelmed, less effective, and in crisis because of these climate-related disruptions (Brooks et al. 2023; Hurst et al. 2024).

Challenges faced by the health workers

Addressing research question two, seven of the included articles described 16 critical challenges that hinder the ability of health workers to prepare for and respond to the impacts of climate change. These challenges can be broadly categorized into five key issues: capacity and resource constraints, knowledge and awareness gaps, infrastructure and organisational barriers, limitations in vulnerability assessment and response, and challenges in rural and disaster-affected areas (Table 3).

Capacity and resource constraints

Of the seven articles included in Table 3, all reported various challenges that health workers face in addressing the impacts of climate change and implementing effective climate action strategies (Brooks et al. 2023; Harris-Glenville and Cloos 2024; Hurst et al. 2024; Rattanakanlaya et al. 2018; Samba et al. 2023; Stilita and Charlson 2024; Albrecht et al. 2023). Three articles identified a lack of time due to heavy workloads and insufficient resources available to health workers and healthcare organisations as a fundamental obstacle (Brooks et al. 2023; Stilita and Charlson 2024; Albrecht et al. 2023). Four articles reported that shortages of materials and funding inhibit the ability of the health workers to carry out necessary climate-related measures (Brooks et al. 2023; Hurst et al. 2024; Stilita and Charlson 2024; Albrecht et al. 2023).

Table 3 Challenges health workers face in preparing for and responding to climate change impacts ($n=7$)

Challenge theme	Key issues	Authors
Capacity and resource constraints	• Lack of time and capacity to respond to high temperatures due to competing priorities • Shortage of materials, funding, and other resources needed for climate action/climate adaptation measures	Albrecht et al. 2023 Stilita and Charlson 2024 Brooks et al. 2023 Harris-Glenville and Cloos 2024 Hurst et al. 2024
Knowledge and awareness gaps	• Lack of awareness of relevant climate adaptation and mitigation measures and early warning systems • Limited access to data and information required for vulnerability assessment and response	Harris-Glenville and Cloos 2024 Stilita and Charlson 2024 Brooks et al. 2023 Hurst et al. 2024 Rattanakanlaya et al. 2018
Infrastructural and organisational barriers	• Challenges in managing indoor temperatures due to building design • Disruption to medical equipment and facilities, including the failure of medication storage facilities, refrigeration services, air conditioning, and the overheating of server rooms affecting IT systems • Restrictive infection prevention and control policies on the use of electric fans and air conditioning in wards • Fragmented coordination and limited data sharing between departments • Political will	Brooks et al. 2023 Harris-Glenville and Cloos 2024 Stilita and Charlson 2024 Rattanakanlaya et al. 2018
Limitations in vulnerability assessment and response	• It is not clear how the organisation can tackle climate change • Unclear processes for assessing the vulnerability of different patient populations • It is not a priority • Narrow focus on biomedical factors, with limited consideration of social determinants and mental health • Lack of feedback loops and limited use of monitoring/surveillance data for decision-making	Stilita and Charlson 2024 Hurst et al. 2024 Harris-Glenville and Cloos 2024
Challenges in rural and disaster-affected areas	• Geographical isolation and lack of resources faced by rural health workers • Need to address the emotional and mental health needs of staff and patients in disaster-affected areas • Lack of coordination and preparedness planning between health facilities and local authorities	Samba et al. 2023 Hurst et al. 2024 Rattanakanlaya et al. 2018

Knowledge and awareness gaps

Another challenge identified by five of the articles (Brooks et al. 2023; Hurst et al. 2024; Rattanakanlaya et al. 2018; Stilita and Charlson 2024; Albrecht et al. 2023) was the lack of knowledge and awareness among health workers. Lack of familiarity with relevant climate action plans, early warning systems and the data needed to assess the vulnerability to climate change events were among the challenges identified by health workers in the included articles (Harris-Glenville and Cloos 2024; Rattanakanlaya et al. 2018; Hurst et al. 2024). This lack of information limits their ability to make informed decisions and implement appropriate adaptation and mitigation strategies (Rattanakanlaya et al. 2018).

Infrastructural and organisational barriers

Infrastructural and organisational barriers further compound the difficulties faced by the health workers. Issues with the design and insulation of healthcare facilities, political will, restrictive infection control policies, and fragmented coordination between departments all serve to undermine the effectiveness of climate-related measures (Harris-Glenville and Cloos 2024; Rattanakanlaya et al. 2018; Stilita and Charlson 2024).

Limitations in vulnerability assessment

There are also challenges in assessing climate-related vulnerability. A study in Dominica reported that health organisations often focus narrowly on biomedical factors, overlooking the social determinants of health and the importance of mental health considerations. In addition, two articles reported that health workers were unclear about how their organisation could address climate change, were unaware of climate change policies within the health system, and noted limited consideration of health-sector involvement at the central level (Rattanakanlaya et al. 2018; Stilita and Charlson 2024). The limited use of monitoring and surveillance data for policy purposes also hinders informed policy and decision making (Hurst et al. 2024; Harris-Glenville and Cloos 2024; Rattanakanlaya et al. 2018).

Hurst et al. (2024) recommend the importance of continuous monitoring of resource allocation and longitudinal assessment of health worker capacity in rural areas, arguing that tracking the use of resources over time and the outcomes in terms of health worker resilience is crucial for refining policies aimed at strengthening rural health systems in times of crisis. Harris-Glenville and Cloos (2024) recommend comprehensive, real-time monitoring systems that systematically track resource allocation, workforce performance, and health outcomes, integrating data on health worker resilience and access to care to inform policy adjustments. Rattanakanlaya et al. (2018) recommend a systematic monitoring framework to assess disaster preparedness and response capacity in health facilities, highlighting the need to track the effectiveness of training, availability of resources, and response times during flood events. By collecting and analysing these data, health systems can identify gaps in preparedness, inform policy adjustments, and improve decision-making to increase resilience during disasters.

Challenges in rural and disaster-affected areas

An article by Hurst et al. found that rural and disaster-affected health workers face unique challenges, including geographic isolation, resource constraints, and the need to address the emotional and psychological impact on staff and patients (Hurst et al. 2024). In addition, a lack of coordination and preparedness planning between health facilities and local authorities has led to delays and gaps in response to climate change-related disasters (Samba et al. 2023; Hurst et al. 2024; Rattanakanlaya et al. 2018).

Discussion

This scoping review examines the literature on the impacts of climate change on health workers, highlighting the effects on physical and mental health, occupational safety, and broader capacity and resilience. Challenges identified for health workers in preparing for and responding to the impacts of climate change include gaps in knowledge and training on climate-related health threats, strains on infrastructure and supply chains due to extreme weather events, difficulties in resource allocation, coordination challenges between organizations, and disproportionate impacts on vulnerable populations. These findings underscore the urgent need for targeted interventions and policies to build the resilience of health workers. Prioritising this agenda is essential to protect the health and well-being of health workers and patients in the face of accelerating climate change impacts (Mosadeghrad et al. 2023; Sorensen and Fried 2024).

The results of this review indicate that climate change is affecting the physical health of health workers. The increased risk of heat illnesses and injuries, such as heat exhaustion and heat stroke, demands immediate attention, especially in resource-limited settings where cooling infrastructure and heat protection measures are inadequate (Samba et al. 2023; Wibowo et al. 2024; Conaty et al. 2023; Mash et al. 2023). Addressing these vulnerabilities is essential to safeguarding the well-being of health workers, who often operate in physically demanding environments with elevated body temperatures (Smith 2020; Wibowo et al. 2024). Furthermore, the review highlights the heightened

respiratory health risks faced by health workers, driven by worsening air pollution, increased aeroallergen levels, and the spread of airborne infectious diseases (Buriro et al. 2018; Callen and Clay 2024; Nassikas and Gold 2023). Exposure to wildfire smoke, dust storms, and other climate-related air quality challenges may exacerbate pre-existing respiratory conditions and introduce new breathing difficulties for workers, particularly in emergency response and long-term care settings (Jagals and Ebi 2021; Levy and Roelofs 2019). Increasing the availability and use of appropriate personal protective equipment and improving indoor air quality in health facilities can help reduce these escalating physical health risks (Patel et al. 2022).

The findings of this review also underscore the growing threat of vector-borne diseases, which are expanding their geographic range and transmission seasons as the climate changes (Arias et al. 2023; Buriro et al. 2018). This puts health workers at increased risk of contracting diseases such as malaria, dengue, Lyme disease, and Zika virus, especially in regions where surveillance and prevention measures are inadequate (Campbell-Lendrum et al. 2015; Scott et al. 2024). Strengthening disease surveillance, vector control programs, and worker education and training will be critical to safeguarding the health of the health workers (Scott et al. 2024; Liu 2021; Al-Wathinani et al. 2021). In addition, the findings highlight the risks posed by climate-fuelled extreme weather events, which can compromise health infrastructure and supply chains (Litke et al. 2022; Mak and Singleton 2017). Damage to facilities and disruptions to the availability of personal protective equipment, medical countermeasures, and other essential resources can jeopardise the safety and well-being of health workers responding to these climate-related emergencies (Rattanakanlaya et al. 2018; Hurst et al. 2024; Brooks et al. 2023; Albrecht et al. 2023). Enhancing the resilience of health systems to withstand such climate shocks is vital to protecting frontline staff.

This review also found that climate change is impacting the mental well-being of health workers. Across diverse geographical contexts, health workers report increased levels of stress, anxiety, burnout, and other negative mental health outcomes in response to climate change events such as heatwaves, floods, hurricanes, and bushfires (Brooks et al. 2023; Hurst et al. 2024; Ediz and Uzun 2024; Rattanakanlaya et al. 2018). This is particularly concerning, as compromised mental health can undermine health workers' resilience, productivity, and capacity to deliver high-quality patient care during emergencies and crises (Hugelius et al. 2017; Mash et al. 2023; Brooks et al. 2023). The mental health burden experienced by health workers is probably exacerbated by feelings of helplessness, loss of control, and fears for their safety and that of their families and communities (Litke et al. 2022; Rempel et al. 2024). Furthermore, the indirect social and economic disruptions caused by climate change, such as displacement, supply-chain issues, and strain on health systems, may compound the mental health challenges facing health workers (Litke et al. 2022; Harris-Glenville and Cloos 2024; Hurst et al. 2024). These findings align with a growing body of academic literature demonstrating the significant psychological distress experienced by frontline health workers in the context of climate change and environmental disasters. Studies have shown that exposure to extreme weather events, resource scarcity, and disruptions to healthcare infrastructure can lead to heightened rates of post-traumatic stress disorder, depression, and moral injury among health workers (Dodgen et al. 2016; Cianconi et al. 2020). Chronic stress associated with climate change has also been linked to increased burnout and intention to leave the profession, further straining the capacity of the health workforce needed to respond to the escalating impacts of a changing climate (Albrecht et al. 2007; Stanke et al. 2012).

The findings of this review underscore the profound occupational safety challenges that health workers face globally due to the impacts of climate change. Disruptions to healthcare infrastructure, power outages, supply chain breakdowns, and other operational disruptions stemming from extreme weather events can jeopardise health workers' safety and working conditions (Samba et al. 2023; Mak and Singleton 2017; Brooks et al. 2023). This assertion is well-supported by literature, which has consistently demonstrated how extreme weather events, environmental degradation, and associated social and economic disruptions can compromise the structural integrity of health facilities, interrupt supply chains, and pose risks to the safety and security of health workers (McMichael 2020). In addition, factors such as insufficient and appropriate PPE, unreliable access to electricity and water, and compromised transportation and communication channels further exacerbate these challenges (Paavola 2017; Lapão 2016). These factors collectively undermine the ability of health workers to safely deliver care, presenting a heightened occupational risk that not only threatens the well-being of individual providers but also has significant implications for the resilience and continuity of health service delivery, particularly in resource-constrained settings (Samba et al. 2023).

The findings of this review highlight the compounding effects of climate change on the well-being of health workers, threatening their capacity and resilience. This is supported by studies demonstrating the adverse effects of climate-related disruptions, such as heatwaves, floods, cyclones, bushfires, and droughts, on health workers (McMichael 2020; Paavola 2017; Lapão 2016; Cianconi et al. 2020). One study reported a direct correlation between extreme weather conditions and increased absenteeism among health workers, which directly impacts workforce availability (McMichael 2020). Research also indicates occupational safety concerns during these events contribute

to staff turnover, compromising workforce capacity (Paavola 2017; Lapão 2016). Furthermore, studies reveal the mental health toll on healthcare workers in crises, leading to feeling overwhelmed and less effective in care delivery (Cianconi et al. 2020; Albrecht et al. 2007). This evidence underscores the need to address these workforce challenges. The compounding effects of climate-related disruptions on workforce capacity and productivity are well-documented, with studies pointing to reduced efficiency and effectiveness in healthcare delivery, particularly in resource-limited settings (Watts et al. 2021). Moreover, research has highlighted the link between health workers challenges and decreased quality of care, emphasizing the critical role of workforce resilience in maintaining healthcare standards during climate crises (Warsini et al. 2014). Therefore, addressing these challenges is essential for the well-being of health workers and the overall resilience of health systems.

The review identifies several challenges that hinder the ability of health workers to effectively respond to climate-change impacts. A fundamental obstacle is the lack of time and resources, as heavy workloads and funding shortages inhibit climate-related action (Brooks et al. 2023; Albrecht et al. 2023). The issue is most acute in resource-limited settings, where overburdened health systems cannot invest in climate adaptation and mitigation (Samba et al. 2023). Another key challenge is the knowledge and awareness gaps among practitioners, as many lack familiarity with climate plans and warning systems (Brooks et al. 2023; Hurst et al. 2024; Rattanakanlaya et al. 2018; Albrecht et al. 2023). This information deficit may limit their ability to make informed decisions and deploy appropriate adaptation and mitigation strategies, thereby undermining the effectiveness of the health sector's response to climate change. Infrastructural and organisational barriers compound difficulties for the health workforce. Issues with facilities, policies, and coordination undermine climate-resilient measures (Harris-Glenville and Cloos 2024; Rattanakanlaya et al. 2018). A narrow focus on biomedical factors in vulnerability assessments hampers informed policymaking (Harris-Glenville and Cloos 2024). Rural and disaster-affected practitioners face isolation, resource constraints, and emotional impacts (Hurst et al. 2024). A lack of coordination delays disaster response (Hurst et al. 2024; Harris-Glenville and Cloos 2024; Rattanakanlaya et al. 2018), further compromising health workers in preparing for and responding to the impacts of climate change.

In addition, the impact of climate change events on medical equipment and facilities, including failures in medication storage, refrigeration services, air conditioning, and server room overheating, poses challenges that undermine the ability of healthcare workers to effectively prepare for and respond to climate-related impacts (Seervai et al. 2022; Al-Marwani 2023). Failures in drug storage facilities can lead to the loss of drug potency and an increased risk of contamination, rendering medications unsafe and disrupting supply chains (National Academies of Sciences, Engineering, and Medicine 2022). This complicates medication management and hinders health workers' efforts to ensure patient safety and continuity of care amidst climate-related disruptions (Ansah et al. 2021). Similarly, disruptions to refrigeration services threaten vaccine integrity, jeopardise the preservation of biological samples, and spoil nutritional supplies essential for patient care (Brooks et al. 2023; Thakur et al. 2024). As a result, health workers may be forced to seek alternative solutions and manage potential shortages, straining their resources and further complicating their response to climate-related emergencies (Sorensen and Fried 2024).

Furthermore, restrictive infection prevention and control (IPC) policies on the use of electric fans and air conditioning in wards aim to control airborne infections by preventing pathogen spread (Standard, Quality Improvement Guide 2012). However, these measures can increase discomfort and heat stress, especially for critically ill patients sensitive to temperature extremes. This complicates health workers' ability to respond to the impacts of climate change. As climate change leads to more frequent and severe heatwaves, inadequate cooling in healthcare settings can heighten heat-related risks for staff, impair their performance, and hinder patient care (Brooks et al. 2023). Therefore, healthcare facilities must adopt flexible IPC policies that address both infection control and climate resilience. Essential measures include implementing advanced air filtration systems, maintaining cooling infrastructure, and incorporating innovative cooling solutions. Training health workers to deal with climate-related impacts is crucial and will require collaboration between infection-control experts, climate scientists, and health administrators to protect both patients and staff in a changing climate (Clinical Excellence Commission 2016; Elliott et al. 2017).

Research gaps

The review identified several research gaps. First, there is a geographical disparity, with most studies focusing on high-income countries, leaving a significant gap in understanding the challenges faced by health workers in low- and middle-income countries (LMICs), where health systems are often less equipped to cope with climate-related stressors. Second, while much of the research focuses on doctors and nurses, other key groups such as community health workers (CHWs) and allied health professionals are under-represented. These groups, particularly in rural and underserved regions, may experience unique climate-related impacts that remain unexplored. Third, the impact of climate change on occupational safety, particularly with regard to disruptions to health infrastructure, is under-researched. The impact of extreme

weather events on facility security, power outages and supply chain disruptions require further research. Finally, there is a lack of research on interventions to strengthen the resilience of health workers to climate change. Although resilience is critical, few studies evaluate effective strategies to increase their adaptive capacity. Addressing these gaps is essential to ensure that health workers are adequately supported in the face of climate change.

Implications and call to action

The findings of this review underscore the urgent need for global action on climate change mitigation and adaptation strategies within healthcare. Addressing knowledge gaps among healthcare practitioners is crucial, and providing comprehensive training on climate-related health risks and integrating action plans can empower health workers to respond effectively to emerging challenges (Mosadeghrad et al. 2023). To enhance resilience, healthcare facilities should revise facilities, update policies, and foster interdepartmental coordination, with special attention given to rural and disaster-affected areas to support healthcare workers facing unique challenges. Establishing mental health programs is imperative to mitigate the psychological burden on health workers exacerbated by climate-related stressors. In addition, developing robust, regularly updated disaster-preparedness plans is essential for maintaining healthcare services during climate events (Sandifer and Walker 2018; Mosadeghrad et al. 2023). Promoting interdisciplinary collaboration and securing funding for research, infrastructure improvements, and workforce development are necessary for effective climate adaptation in healthcare. Successful funding strategies that support recovery and include professional development have demonstrated significant benefits in bolstering healthcare resilience (Mosadeghrad et al. 2023; Hurst et al. 2024). Furthermore, collaboration between healthcare organizations, policymakers, and authorities is essential to strengthen preparedness planning, communication strategies, and resource allocation, enhancing the long-term sustainability and effectiveness of healthcare systems (Mosadeghrad et al. 2023; Lugten and Hariharan 2022). By focusing on these actions, stakeholders can work together to mitigate the impact of climate change on health workers and ensure the resilience of healthcare systems worldwide.

Limitations and future research directions

This scoping review has several limitations. The search strategy focused on peer-reviewed literature, which may introduce bias in the selection of studies. In addition, the review's scope is limited to articles published in English, potentially excluding significant findings from non-English language sources. Furthermore, we did not assess the methodological quality of the included studies, a common drawback of scoping reviews. Another notable limitation is that the abstracts were screened by only one reviewer, and 80% of the full texts were also screened by a single reviewer. This approach may increase the risk of bias in the selection process and could affect the comprehensiveness of the review findings. To mitigate this, regular consultations were held with co-authors to discuss difficult decisions and ensure consistency in the application of inclusion criteria.

Future research should focus on the challenges faced by health workers in LMICs, where health systems are often less resilient to climate-related stressors. Studies must also include community health workers (CHWs) and allied health professionals, particularly in rural and underserved areas, to address their specific needs. Evaluation of interventions to strengthen the resilience of health workers is essential, including assessment of the effectiveness of adaptation strategies and organisational policies. Finally, longitudinal studies needed to understand the long-term impacts of climate change on health workers, tracking changes in workload, mental health, and occupational safety over time.

Conclusion

This scoping review outlines the multiple impacts of climate change on health workers globally, including physical health risks, mental health challenges, and occupational safety impacts. These compounding effects threaten the capacity and resilience of health workers, jeopardising health services and patient outcomes, particularly in vulnerable settings. The review highlights the urgency of a multi-pronged approach to building resilience in the health workers through targeted training, reviewing facility infrastructure, updating policies, providing mental health support, and promoting interdepartmental coordination. Policymakers must prioritise the well-being of health workers and advocate for policies that prioritise climate resilience in the health sector. Prioritising climate resilience in health policy and fostering collaboration between stakeholders is critical to building a sustainable and effective health system in the face of climate change. Communicating the impacts of climate change to different stakeholders such as governments, communities including individuals, NGOs, businesses, international organisations, and risk communicators will help minimise further impacts and address the challenges of building resilient health workers in a changing climate.

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Data availability Not applicable.

Declarations

Ethics approval This study was a review of previous evidence. Therefore, ethics approval was not required.

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