



Midwives' preparedness for climate change impacts on maternal and child health: A scoping review

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ABSTRACT

Background: Midwives are frontline healthcare providers for pregnant women, yet gaps in their knowledge and training on extreme heat and air pollution limit their ability to provide effective care during these climate-related challenges.

Objective: This scoping review aimed to explore midwives' knowledge, adaptation, and preparedness for caring for pregnant women during climate change-related events, with a focus on extreme heat and air pollution.

Method: A scoping review was conducted using the Joanna Briggs Institute (JBI) methodology. A total of 272 articles were retrieved from multiple databases, of which five studies met the inclusion criteria. The included studies comprised qualitative, quantitative, mixed-method, case study, and review designs.

Findings: The review revealed two key areas. First, midwives demonstrated varying levels of knowledge and preparedness regarding climate change-related events, particularly extreme heat and air pollution, with implications for maternal and child health. Second, barriers and enablers were identified: limited training, weak institutional support, and inadequate policies hindered practice, whereas professional development initiatives and supportive leadership acted as enablers.

Conclusion: The findings highlight an urgent need to integrate education on such climate change-related events into midwifery training. Strengthening midwives' knowledge and preparedness is essential to empower them in safeguarding maternal and child health amidst growing climate-related challenges.

Statement of Significance

Problem or Issue

Midwives are frontline providers for pregnant women, yet climate change-related events expose gaps in their knowledge and training, limiting their ability to deliver effective care.

What is Already Known

Climate change-related events impact maternal and child health, but both evidence and education for midwives in this area remain limited, leaving their preparedness and adaptive capacity largely unexamined.

What this Paper Adds

This review highlights knowledge and training gaps, identifying

barriers and enablers to effective practice. It underscores the urgent need for education on climate change-related events in midwifery training, alongside ongoing professional development to strengthen preparedness among both current and future midwives.

Introduction

The world is facing a climate crisis. Anthropogenic activities are driving prolonged heatwaves and drier conditions causing bushfires, which are posing significant challenges to public health due to heightened levels of air pollution [1]. One of the most vulnerable populations experiencing exposure to these environmental hazards are pregnant women [2]. Research has consistently shown that exposure to these

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conditions can lead to severe health outcomes such as preterm births, low birth weights, and stillbirths [3]. For instance, Bekkar et al. (2020) found a 16 % increase in preterm births during heatwaves, which they defined as periods when temperatures exceed the 90th percentile for at least two consecutive days [4]. This finding is a significant concern, as preterm births are associated with increased risks of infant mortality and long-term developmental disabilities [5]. Furthermore, studies indicate that low birth weight, another outcome linked to maternal exposure to extreme heat, can lead to chronic health issues such as hypertension, diabetes, and cardiovascular diseases later in life [6–8].

Despite efforts to mitigate these healthcare impacts, current studies by Bonell (2024) and Rise (2022) have highlighted a critical gap in preparedness and response to climate change-related events, as well as in the evaluation of action plans for healthcare professionals managing vulnerable populations, including maternal and childcare, during extreme climatic events [9,10]. The lack of an existing action plan in current clinical practice for healthcare professionals has a profound negative financial impact on both the healthcare system and individual families.

For example, preterm births and related complications often require extensive neonatal care, which places a considerable burden on both healthcare systems and families. In Australia, the mean annual cost of hospitalisation for a preterm infant was \$182,312 in the first year and \$9958 in the second [11]. Families faced additional out-of-pocket expenses of approximately \$2212 in the first year and \$121 in the second [11]. These figures likely underestimate the true burden, as they exclude long-term costs of ongoing medical care and special educational needs. Thus, the intersection of climate change-related events and maternal health presents both medical and economic challenges.

Addressing these challenges requires strengthening the maternal health workforce, particularly midwives, who are pivotal in protecting maternal and newborn health during climate change-related events. Midwives, as the primary provider of woman-centred care during pregnancy, birth, and the postpartum period, are uniquely positioned to safeguard maternal and newborn health in the context of climate change-related events [12]. Midwives often act as the first and sometimes only point of contact for women, especially in low-resource or rural settings, and their role extends beyond clinical care to include education, advocacy, and community leadership [13,14].

Despite this pivotal role, studies highlight critical gaps in midwives' preparedness to respond to climate-related health risks, largely due to limited training, resource constraints, and inadequate institutional support [15,16]. For example, a survey of Australian and New Zealand midwifery educators reported low levels of confidence and limited teaching on planetary health topics [17], underscoring the urgent need for education and professional development initiatives. Without targeted initiatives, midwives remain underprepared to support women during extreme weather events, heightening maternal and neonatal health risks [18]. Strengthening midwives' capacity to respond effectively to climate-related risks is therefore essential for both health outcomes and health system resilience [19,20].

Recognising this, global and national policy documents have emphasised midwives' responsibility and central role in climate adaptation and resilient healthcare systems. Global policy and position documents have stressed this responsibility. The World Health Organisation (WHO) has called for the global expansion of midwifery-led models of care, highlighting their role in delivering high-quality, person-centred, and efficient maternal and newborn services within resilient health systems [21,22]. Similarly, the International Confederation of Midwives (ICM) has issued a *Position Statement on the Impact of Climate Change* and its *Interlocked: Midwives and the Climate Crisis* report, both of which identify midwives as essential actors in climate adaptation strategies, disaster preparedness, and sustainable service provision [23,24]. At the national level, the Australian Nursing and Midwifery Federation (ANMF) has issued a position statement calling for urgent climate action, urging the inclusion of environmental health, climate

change-related events and sustainable healthcare practices in midwifery education, workplace protocols, emergency preparedness, and procurement strategies [25].

Conceptual framing has also been advanced through scholarly discourse. O'Connell and colleagues (2024) emphasised the urgent need to strengthen midwifery practices in response to the global climate crisis, positioning midwives as central to protecting maternal and newborn health [20]. The authors argue that midwives have both a professional and ethical duty to engage in climate action, with climate resilience embedded as a core component of woman-centred care. Broader global health literature has further documented the impacts of climate change-related events on reproductive and perinatal health, including systematic reviews and evidence gap maps that point to urgent research and training needs [26,27]. Together, these policy statements and research contributions provide a strong rationale for assessing midwives' current knowledge and preparedness.

Considering these challenges, this scoping review aims to summarise the existing evidence on midwives' knowledge, their adaptation and preparedness for caring for pregnancy during climate change-related events. By synthesising this evidence, the study seeks to identify gaps in education and training and highlight areas where improvements are most urgently needed.

Methods

Study design

This scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) guidelines for scoping review [19]. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [28] was also used to ensure a systematic and comprehensive approach to reporting. The Protocol registration for scoping review is DOI: <https://doi.org/10.17605/OSF.IO/YX6D2>.

Review question(s)

The overarching aim of this scoping review is to examine midwives' knowledge and preparedness in responding to the impacts of climate change-related events on pregnancy care. To address this aim, the review explored two research questions:

- How well are midwives prepared to support pregnant women during climate change-related events, particularly extreme heat and air pollution
- How knowledgeable are midwives in supporting pregnant women to remain safe during extreme heat related and air pollution events?

Information sources and search strategy

A comprehensive search was conducted in June 2024 and reviewed search in August 2025 across several databases, including MEDLINE (EBSCOhost), CINAHL (EBSCOhost), Scopus, and PubMed. The PICO framework was applied to guide the development of key search terms. The search terms are presented in Table 1.

Eligible criteria

The search limit included documents published in English from 2014 to include current evidence published in past 10 years. The inclusion criteria focused on midwives, extreme heat and air pollution. Any articles that included healthcare professionals other than midwives and any climate change-related events that were not related to extreme heat and air pollution were excluded from the search. See Table 2 inclusion and exclusion criteria.

Table 1
Search terms for the search strategy.

P (Population)	Midwi* OR maternity care provider* OR obstetric nurse* OR Obstetric healthcare provider* OR Prenatal care nurse* OR Perinatal nurse* OR midwifery practitioner* OR Registered Midwives, OR RM OR Doulas
I (Interest)	Knowledge OR understanding OR training OR preparedness OR awareness, education, skill* OR competenc*
C (context)	extreme heat OR Air pollution OR climatic event* OR heatwave* OR high temperature* OR severe weather condition* OR environmental pollution OR heat stress OR climate change*
O (outcomes of interest)	preparedness OR knowledge* OR skill* OR competenc* OR train* Care quality OR pregnancy outcomes OR maternal health OR birth outcome*, Maternal morbidit* OR pregnancy complication* OR maternal mortalit* OR sustainabl* centri*

Table 2
Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Population	midwives	Healthcare professionals other than midwives
Intervention/ Exposure	Studies discuss participants' knowledge, understanding, training, preparedness, awareness, education, skills, and competency	Studies that do not discuss participants' knowledge and awareness.
Context	Studies discuss extreme heat, air pollution, climate events, heatwaves, high temperatures, severe weather conditions, environmental pollution, and heat stress.	other climate change factors not related to heat and air pollution.
Outcome	Outcomes relate to pregnancy and birth outcomes, including but not limited to care quality, pregnancy outcomes, maternal health, birth outcomes, maternal morbidity, pregnancy complications and maternal mortality.	Outcomes unrelated to pregnancy and birth outcomes.

Study/sources of evidence selection

Following the search, all identified records were compiled and uploaded into Covidence [29], with duplicates removed. Two researchers independently screened the titles and abstracts of all identified articles. Potentially eligible articles proceeded to full-text screening, where two reviewers independently assessed them against the inclusion and exclusion criteria. Any conflicts were resolved by a third researcher. Consistent with JBI guidance for scoping reviews, critical appraisal of included studies was not undertaken [30].

Data extraction and synthesis

Two team members independently extracted data from the included full-text papers. Where available, the following data were extracted from each of the included studies: 1) study characteristics; 2) characteristics of the study participants; 3) main outcome that is the level of understanding and preparedness of midwives in caring for pregnant women during climate change-related events, with a focus on extreme heat and air pollution; 4) other key findings and recommendations highlighted by each article and relevant to the aim of this review; and 5) study limitations. For the narrative synthesis, findings from the included studies were analysed using a thematic approach. Data were first coded inductively to identify patterns and key concepts across studies. Codes were then grouped into broader categories and themes that reflected the commonalities and differences in midwives' understanding and preparedness for extreme climate events. This process was iterative, with

themes refined through discussion between the two team members. Where consensus could not be reached, a third team member was consulted. The themes were further reviewed by the remaining author group, and discrepancies were resolved through discussion for finalising the themes. Nvivo (Version 12) was used to extract relevant information from included studies, facilitate coding, and supporting the grouping of findings into themes [31]. Characteristics of the included studies and their main findings were summarised narratively using descriptive analysis and presented in a tabular format to provide a comprehensive overview.

Findings

The original search identified 269 records, and an additional three articles were identified through ancestry searching of reference lists from relevant articles (Fig. 1). After removing 28 duplicates, 244 articles had remained for screening, of which 5 articles met the inclusion criteria. Although Baharav et al. (2023) does not present empirical data on midwives' preparedness, it was included because it provides explicit practice recommendations for midwives and other perinatal care providers during extreme heat events, which aligns with the concept criterion of our review (preparedness, knowledge, and practice guidance). Our inclusion criteria allowed for guidelines, protocols, and recommendation papers that inform midwifery practice in the context of climate-related hazards. This decision was discussed and agreed upon by the review team to ensure that relevant evidence informing preparedness strategies was captured. The article selection followed Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist for reporting.

Characteristics of studies and study participants

The included studies demonstrated variation in the type of publication, data collection methods, country of origin, study participants, and the level of understanding and preparedness of midwives in caring for pregnant women during extreme climate events (See supplementary file 1 and 2). The country of origin included Uganda (n = 2), United States (n = 1), Turkey (n = 1), and not identified (n = 1). Included studies were published recently, with publication years ranging from 2019 to 2024. The type of studies included were qualitative study, quantitative study, mixed-method study, case study and review. The majority of the studies (n = 4) incorporated a qualitative component. Most study participants in the included studies held bachelor's degrees or higher and were working in health and birthing centres.

Synthesis of the result

Main outcome

Level of knowledge and preparedness. The findings from the included studies highlight the multifaceted role of midwives in responding to the health challenges associated with climate change-related events. Midwives are increasingly recognised not only as care providers but also as educators and advocates for public health interventions aimed at managing the impacts of environmental risks on pregnant women. For instance, the study by Nantanda et al. (2019) in Uganda demonstrated that midwives played a crucial role in developing and delivering educational programs that significantly improved the knowledge and behaviours of pregnant women regarding biomass smoke exposure [32]. Similarly, the study by Cartwright et al. (2022) illustrated that midwives continued to implement educational strategies beyond the formal conclusion of the intervention, thereby reflecting their commitment to ongoing health promotion [33].

Furthermore, the research by Baharav et al. (2023) also supported that midwives value the importance of being knowledgeable about

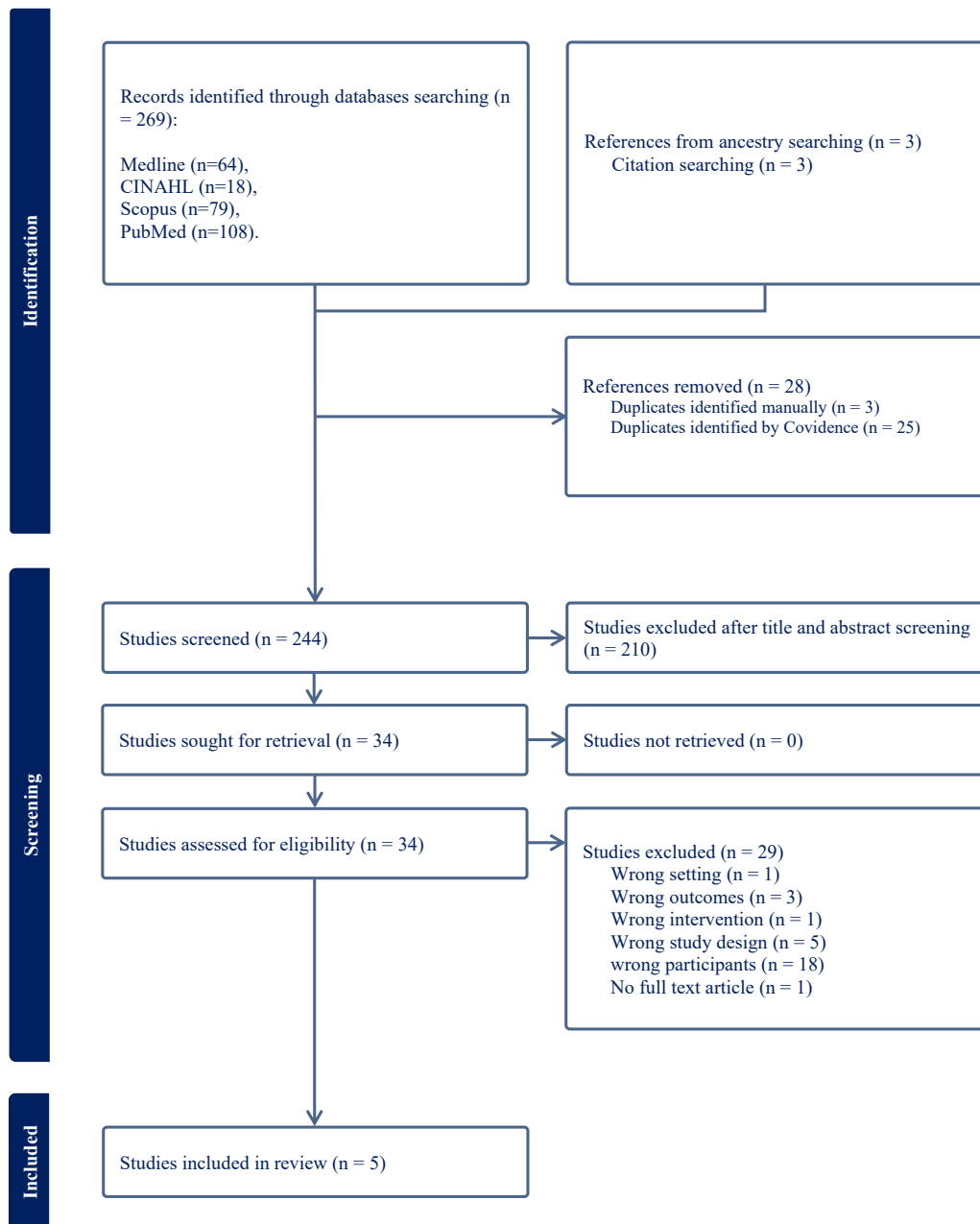


Fig. 1. PRISMA flow chart.

health risks related to climate change-related events and are prepared to provide appropriate care and guidance [34].

Secondary outcomes

Barriers and enablers influencing the effectiveness of midwifery practice. The synthesis of results reveals several barriers and enablers that influence the effectiveness of midwifery practice in the context of climate change-related events, particularly with regard to extreme heat and air pollution events. A consistent barrier identified across studies is the lack of adequate training and education on climate-related health risks. For example, the study by Montebalanco and Vanos (2021) highlighted that maternal health workers, including midwives, in El Paso, Texas, had minimal knowledge about the specific risks posed by extreme heat to pregnant women and their fetuses [35]. This knowledge gap was compounded by the fact that extreme heat did not constitute a significant health risk, leading to insufficient prioritisation of heat-related health

interventions. The study by Baharav et al. (2023) pointed out that one of the barriers complicating midwives' ability to offer clear guidance on managing health risks related to climate change during pregnancy is the lack of globally consistent definitions and criteria for climate change-related extreme heat care [34].

Furthermore, the study by Dağlı et al. (2024) in Turkey highlighted the midwives' recognition of the broader impacts of climate change on maternal and child health, including increased infant mortality and malnutrition [36]. The midwives in this study practiced measures such as promoting breastfeeding and balanced nutrition, which they identified as crucial in mitigating these impacts. However, they also expressed concerns about the lack of institutional support and educational initiatives, indicating a need for more robust training and policy support.

On the other hand, enablers such as community involvement and the use of culturally appropriate educational materials were identified as key factors in the success of midwife-led interventions. The studies from Uganda [33,37] emphasised the importance of engaging local leaders

and families in educational programs to support behavioural changes. Additionally, the use of practical information, such as constructing improved cooking areas with local materials, was found to be particularly effective in promoting sustainable health practices despite financial barriers.

Limitations of the current research. The included studies have several limitations that should be considered when interpreting the results. First, many of the included studies focus on a single area with relatively small sample sizes, which is due to the inherent characteristics of qualitative research. For instance, the study by Montebalanco and Vanos (2021) was limited by its small sample size and focus on a single metropolitan area, which may not be generalisable to other regions [35]. Similarly, the studies in Uganda were limited by their focus on specific rural districts, which could affect the generalisability of the findings to other settings. In addition, several studies noted the lack of control groups, which limits the ability to attribute changes directly to the interventions. For example, the study by Nantanda et al. (2019) did not include a control group, making it difficult to determine the extent to which observed changes in knowledge and behaviour were directly due

to the educational program [37]. The reliance on self-reported data also introduces the possibility of social desirability bias, whereby participants may have provided responses they believed aligned with the researchers' expectations.

Discussion

This scoping review is among the first to explore gaps in midwives' knowledge and preparedness regarding the health risks of climate change-related events, with a particular focus on extreme heat and air pollution. These environmental hazards, which are becoming increasingly common due to anthropogenic climate change-related events, pose serious risks to maternal and child health. While midwives potentially play a crucial role in managing these risks, our review suggests that their current level of training and knowledge may be insufficient to address the emerging challenges posed by the Anthropocene Era [38]. Given that midwives are often the primary healthcare providers for pregnant women, particularly in low-resource settings, their capacity to manage the health impacts of extreme weather events is an important area for further exploration [39,40]. The findings of this review suggest that many midwives may not currently be equipped with the necessary skills

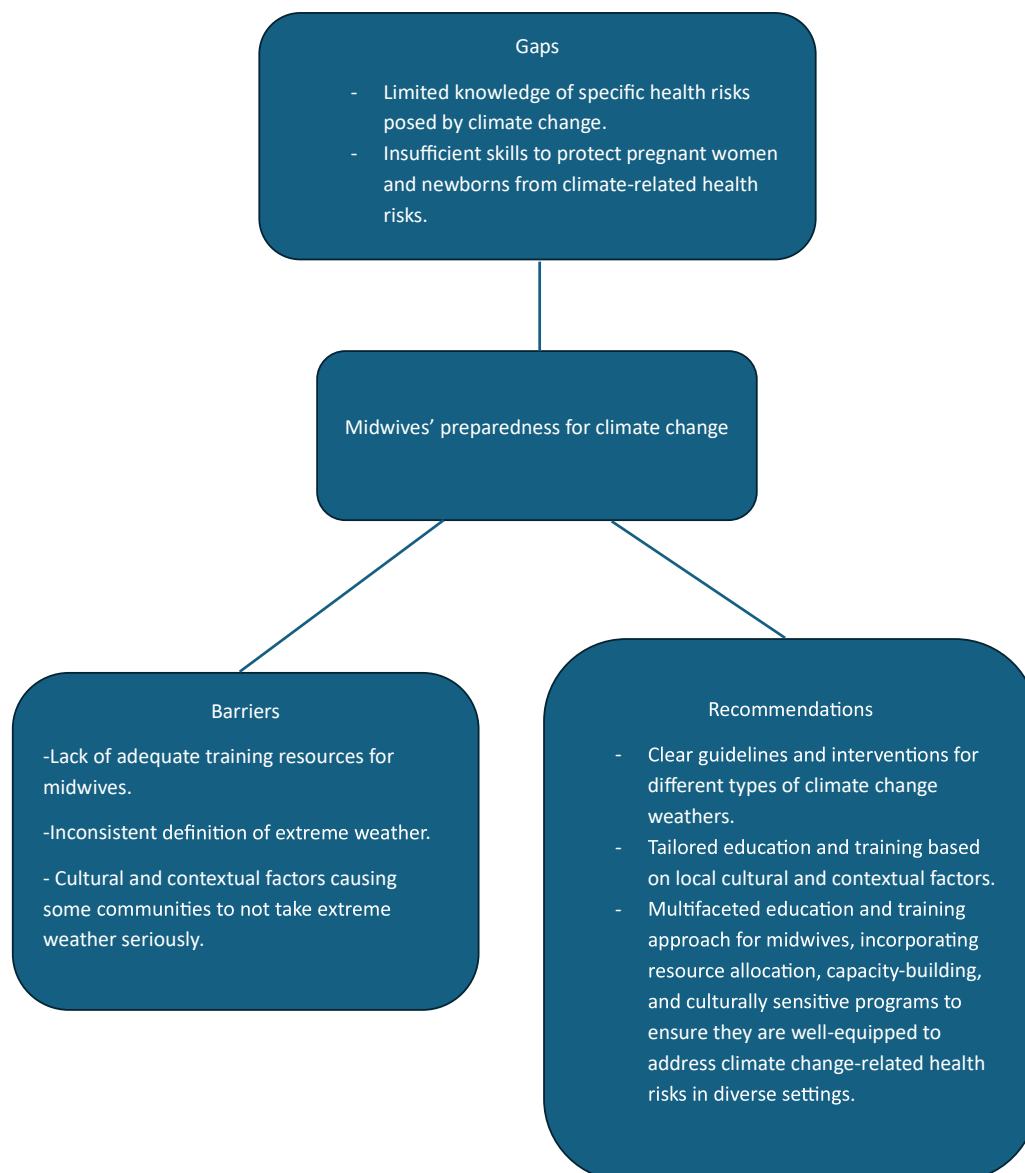


Fig. 2. Mapping midwives' preparedness for climate change –barriers and recommendations.

and knowledge to effectively protect pregnant women and their newborns from these climate-related risks (see Fig. 2). This gap in preparedness highlights the need for further research and targeted interventions to support midwives in adapting to the evolving challenges posed by climate change-related events [20]. The limited knowledge and preparedness among midwives, as suggested by this review, may have significant implications for both midwifery practice and policy. Consistent with our findings, previous research has also highlighted the vital role of midwives and the challenges they encounter when caring for pregnant women during climate-related crises [32–34]. Enhancing midwives' awareness and capacity to provide high-quality care in such contexts may require improvements in their education and training [32–34]. To support midwives in managing the health risks associated with climate change-related events, it would be beneficial to integrate climate-related health contents into midwifery education programs, beginning at the undergraduate level. Such training could include both theoretical knowledge and practical skills that midwives can apply during extreme weather events, such as advising pregnant women on hydration strategies during heatwaves or reducing exposure to air pollution. These recommendations represent potential strategies that warrant further exploration and evaluation through future research and curriculum development efforts.

Additionally, findings of this scoping review suggest considerable variation in how midwives across different regions and contexts understand and prepare for climate-related health risks. For example, midwives in Uganda and Turkey demonstrated a foundational awareness of the risks associated with climate change-related events yet faced challenges in applying this knowledge due to resource constraints and varying levels of institutional support [33,36,37]. In contrast, midwives in the United States appeared to lack basic awareness of the specific risks that extreme heat poses to pregnant women, indicating a potential gap in education and training [35]. These disparities point to emerging themes that warrants tailored approaches to midwifery education and resource allocation, taking into account local contexts to better support midwives in managing health risks associated with climate change-related events. Further, gaps in midwives' preparedness as highlighted through this review, may have implications for both maternal and child health. A growing body of evidence indicates that exposure to extreme heat and air pollution is associated with adverse outcomes such as preterm birth, low birth weight, stillbirth, and disruptions in newborn feeding practices [39,41,42]. These outcomes could have both immediate and long-term health and economic consequences.

The results of this scoping review also suggest a lack of globally consistent definitions and criteria for climate change-related events [43, 44], which may contribute to unclear or inconsistent guidance on managing health risks during pregnancy. To address this gap, the review points to the need for developing clear guidelines and criteria to differentiate between types of extreme weather events and to identify the appropriate interventions needed for each event. Establishing such guidelines could support midwives in providing more effective and consistent care in the context of climate-related health risks, which could potentially lead to better outcomes for both mothers and newborns [45]. However, further research and consultation with stakeholders is needed to co-design and explore the feasibility and impact of such interventions.

In addition to individual knowledge and training, broader systemic factors significantly influence midwives' capacity to respond to climate-related health risks. These include the resilience of healthcare infrastructure, supportive policies, and socioeconomic conditions that affects both midwifery practice and patient vulnerability [23]. Cultural perceptions of climate change-related events and community engagement also play a role in determining how effectively midwives can implement health interventions. Addressing these broader elements is essential for developing comprehensive strategies that support midwives in diverse settings [20].

Implementing these recommendations identified through this review

may present several challenges. One primary barrier is the limited availability of resources and trained educators capable of delivering specialised training on the intersection of climate change-related events and maternal health [18,46,47]. Previous research has highlighted similar concerns, suggesting that some educators may not fully acknowledge the reality of climate change-related events, which can be problematic given their role in providing evidence-based guidance to the public [17]. Furthermore, there seems to be a lack of standardised education for midwives on how to deliver optimal care during extreme weather events [48]. These challenges may be particularly pronounced in rural areas, where midwifery practices are more likely to be affected due to limited resources [49]. Additionally, cultural and contextual factors may also influence the effectiveness of these training programs, as some communities may not perceive climate change-related events as a priority issue [47]. To address these challenges, a multifaceted approach that includes resource allocation, capacity-building, and culturally sensitive training programs could be considered. Tailoring education and training programs to meet the distinct needs of midwives working in metropolitan and rural areas may also enhance their ability to respond effectively to climate-related health risks.

Strengths and limitations of the review

This scoping review offers valuable insights into the current state of midwifery preparedness in the context of climate change-related events, highlighting the need for further research and targeted interventions to address the identified gaps. However, there are also some limitations to this review. First, many of the studies included in this review were qualitative relying on self-reported data, which may be subject to biases. Additionally, the studies involved small sample sizes and focused on specific regions, which limits the generalisability and reliability of the findings to broader midwifery groups or those working in different healthcare systems.

Future research directions

Future research could benefit from longitudinal studies that evaluate the long-term impact of enhanced midwifery training and professional development initiatives on maternal and child health outcomes during extreme weather events. Additionally, there is a need for research that assesses the effectiveness of specific interventions aimed at improving midwives' preparedness for climate-related health challenges. This could include studies exploring the impact of community-based educational programs or the development of new curricula that integrate climate change-related events into midwifery education. Moreover, future studies should aim to establish causal relationships between climate-related interventions and health outcomes, using rigorous research designs capable of generating more definitive evidence on the benefits of improved training and education for midwives.

Conclusion

This scoping review provides insight into midwives' knowledge and preparedness to manage health risks associated with climate change-related events, particularly during extreme climate events such as heatwaves and exposure to air pollution. While midwives play a crucial role in safeguarding maternal and child health, the findings suggest that their effectiveness may be limited by gaps in training and resource availability. The review highlights the potential value of integrating education on climate change-related events and professional development initiatives into midwifery curricula and practice, alongside strengthening of community and institutional support systems. Addressing these emerging gaps could help midwives better support pregnant women and newborns in the context of climate related health risks. These efforts will contribute to more resilient healthcare system and improved outcomes for vulnerable populations.

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Declaration of Competing Interest

No potential conflict of interest was reported by the author(s).

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.wombi.2025.102112.

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