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Climate Change and Perinatal Mental Health: A Scoping Review of Environmental Exposures, Risk Factors, Protective Processes, and Potential Mechanisms

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A B S T R A C T

Introduction: Perinatal mental health disorders, including depression, anxiety, and trauma-related distress, are common conditions with potential long-term consequences for maternal functioning, infant development, and family well-being. Climate change is increasingly recognized as a health threat multiplier through environmental exposures and psychosocial stressors that may affect women during pregnancy and the postpartum period. **Objective:** This scoping review aimed to map and synthesize evidence on climate change–related exposures and perinatal mental health outcomes among pregnant and postpartum women, with attention to risk pathways, protective factors, and implications for nursing and maternal health services. **Methods:** This scoping review followed Joanna Briggs Institute guidance and was reported according to PRISMA-ScR. Searches were conducted in PubMed and Google Scholar for studies published between January 2010 and March 2025. Eligible studies included qualitative, quantitative, mixed-methods, and quasi-experimental. Human studies involving pregnant women or women up to 12 months postpartum formed the primary synthesis. Two reviewers independently screened studies and extracted data for descriptive and thematic synthesis. **Results:** Of 766 records identified, 14 studies met the inclusion criteria. Evidence was predominantly observational and focused on human populations; animal studies, where identified, provided contextual insight and were not included in the primary synthesis. Five domains emerged: extreme heat and weather events, heat-related psychiatric emergency encounters, wildfire exposure, air pollution, and climate anxiety with climate-related food insecurity. These exposures were generally associated with greater psychological distress, anxiety, depressive symptoms, and poorer maternal mental health, while social support appeared protective. **Conclusions:** Current evidence suggests that climate change–related exposures may be associated with adverse perinatal mental health outcomes through interconnected pathways. However, causal interpretation remains limited. Climate-informed screening, counseling, and social support integration may strengthen climate-resilient perinatal mental health services.

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1. INTRODUCTION

Perinatal mental health disorders, including depression, anxiety, and trauma-related symptoms, represent a major public health concern because of their lasting effects on maternal functioning, infant development, and family well-being. Globally, these conditions affect a substantial proportion of pregnant and postpartum women, with prevalence influenced by social conditions, environmental exposures, and access to care (Caffieri et al., 2024). Identifying modifiable and emerging determinants during this sensitive life stage is therefore a priority for nursing and maternal health systems.

Climate change has increasingly been recognized as a health threat multiplier that may affect perinatal mental health through multiple interconnected pathways. For conceptual clarity, these pathways can be grouped into three domains: (1) direct climate-related environmental exposures, including extreme heat, wildfires, and climate-related disasters; (2) indirect climate-linked psychosocial stressors, including displacement, economic insecurity, food insecurity, and climate anxiety; and (3) environmental pollutants and toxicants whose exposure patterns may be influenced or intensified by climate conditions, including air pollution and persistent chemical contaminants (Barkin et al., 2025).

Evidence suggests that direct climate-related exposures may increase vulnerability to psychological distress during pregnancy and postpartum. Extreme heat has been associated with fatigue, sleep disturbance, psychological distress, and increased psychiatric emergency encounters, particularly in contexts of limited adaptive capacity (Ulrich et al., 2025a; Vrkljan et al., 2025). Similarly, wildfires and climate-related disasters have been linked to symptoms of depression, anxiety, and posttraumatic stress, while social support may buffer adverse effects (Cherbuin et al., 2023; Verstraeten et al., 2021).

Indirect climate-linked stressors also appear relevant to maternal mental health. Emerging studies describe experiences of trauma, helplessness, avoidant coping, and anticipatory concern regarding future child well-being among pregnant and postpartum women exposed to climate-related uncertainty, alongside evidence of resilience and adaptive responses (Chan et al., 2024; Lykins et al., 2024).

A related but conceptually distinct body of evidence concerns environmental pollutants and toxicants. Exposure to air pollutants, including $PM_{2.5}$ and NO_2, has been associated with increased risk of antenatal and postpartum depressive symptoms, potentially through inflammatory and neuroendocrine pathways (Duan et al., 2022; Hu et al., 2024; Kanner et al., 2021). Experimental animal studies further support biological plausibility by demonstrating that gestational exposure to environmental toxicants such as PFAS may alter maternal behavior and contribute to anxiety- and depressive-like phenotypes postpartum (Niedzwiecki et al., 2020; Sun et al., 2023).

Despite growing evidence, findings remain fragmented across exposure categories, study designs, and disciplinary perspectives, limiting integrated understanding of how climate-related risks, protective factors, and mechanisms jointly shape perinatal mental health. Existing reviews often focus on single exposures or general populations, whereas synthesis integrating qualitative, epidemiological, and experimental evidence in perinatal populations remains limited (Amin et al., 2025; Ramakrishna et al., 2019). This scoping review therefore aims to map and synthesize evidence on climate change–related exposures and perinatal mental health outcomes among

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pregnant and postpartum women, with particular attention to risk pathways, protective factors, and mechanisms relevant to nursing practice, maternal health services, and future research.

2. METHODS

Study Design

This scoping review was conducted to systematically map and synthesize existing evidence on climate-related environmental exposures and their associations with perinatal mental health outcomes. The review followed the Joanna Briggs Institute (JBI) methodology for scoping reviews and is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). A scoping review approach was selected to capture the breadth of heterogeneous evidence across epidemiological, qualitative, mixed-methods, and experimental studies in this emerging and multidisciplinary field.

Review Questions

The review was guided by the following questions:

(1). What types of climate-related environmental exposures have been examined in relation to perinatal mental health?

(2). What perinatal mental health outcomes have been reported in association with these exposures?

(3). What study designs, populations, and measurement approaches characterize the existing literature?

Eligibility Criteria

Eligibility criteria were defined using the Population–Concept–Context (PCC) framework: (1) Population: Studies involving pregnant women, postpartum women (up to 12 months after birth). (2) Concept: The review focused on climate-related and environmental exposures, including extreme weather events (eg, heatwaves, wildfires), air pollution (eg, $PM_{2.5}$, NO_2), and environmental toxicants (eg, PFAS, arsenic). Eligible outcomes included perinatal mental health indicators such as depression, anxiety, posttraumatic stress symptoms, psychological distress, stress, coping responses, maternal functioning, and related behavioral outcomes. (3) Context. Studies conducted in any geographical setting and income context were eligible, reflecting the global relevance of climate-related exposures. (4) Types of Sources. Peer-reviewed empirical studies using qualitative, quantitative, mixed-methods, cohort, case-crossover, and experimental designs were included. Reviews, editorials, commentaries, protocols without primary data, and non–peer-reviewed reports were excluded.

Information Sources and Search Strategy

A comprehensive literature search was conducted in PubMed and Google Scholar to identify relevant studies published from January 2010 to March 2025. These databases were selected to capture biomedical and interdisciplinary literature relevant to climate change and perinatal mental health. Search terms combined controlled vocabulary and free-text keywords related to climate exposure (“climate change,” “extreme heat,” “heatwave,” “wildfire,” “air pollution,”

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"environmental toxicants," "PFAS"), perinatal populations ("pregnancy," "postpartum," "perinatal"), and mental health outcomes ("mental health," "depression," "anxiety," "psychological distress," "PTSD"). An example search strategy used in PubMed was:
(("climate change" OR heatwave OR wildfire OR "air pollution" OR PFAS) AND (pregnancy OR postpartum OR perinatal) AND ("mental health" OR depression OR anxiety OR distress OR PTSD))

Reference lists of included studies were manually screened to identify additional eligible studies. Although limiting the search to PubMed and Google Scholar may not capture all relevant literature from environmental science, psychiatry, psychology, and nursing databases, this approach was intended to provide broad interdisciplinary coverage while maintaining feasibility.

Although restricting searches to PubMed and Google Scholar may not fully capture literature across environmental science, psychology, psychiatry, and nursing databases, this approach was selected to maximize interdisciplinary coverage while maintaining feasibility.

Study Selection

All retrieved records were exported into a reference management software and duplicates were removed. Titles and abstracts were independently screened by two reviewers against the eligibility criteria. Full-text articles were subsequently assessed for inclusion. Discrepancies at any stage were resolved through discussion and consensus.

Data Extraction

Data were extracted using a standardized charting form developed iteratively by the review team. Extracted variables included author and year, country and setting, study design, sample characteristics, type of climate-related exposure, data sources or instruments used to assess mental health outcomes, and key findings related to perinatal mental health. For animal studies, exposure type, experimental timing, behavioral assessments, and key outcomes were charted.

Data Synthesis and Presentation

Extracted data were synthesized descriptively and organized thematically according to exposure type and study design. Findings were summarized to highlight patterns across human observational, qualitative, and experimental studies, with attention to convergent and divergent evidence. Results are presented in tabular form (Table 1) and accompanied by a narrative synthesis to contextualize mental health impacts, adaptive responses, and potential mechanistic pathways.

Ethical Considerations

As this study involved secondary analysis of publicly available data, ethical approval was not required.

3. RESULT

Searching results

The PRISMA-ScR flow diagram shows that a total of 766 records were identified through database searching. After removing duplicates and records flagged as ineligible by automation

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tools, 482 records were screened at the title and abstract level. Of these, 389 were excluded, leaving 93 reports sought for full-text retrieval. Fifty-eight reports could not be retrieved, and 35 full-text articles were assessed for eligibility. Following full-text review, 21 articles were excluded because outcomes were not related to perinatal mental health or exposures were not climate- or environment-related. Finaly, 14 studies met all eligibility criteria and were included in the scoping review (Figure 1).

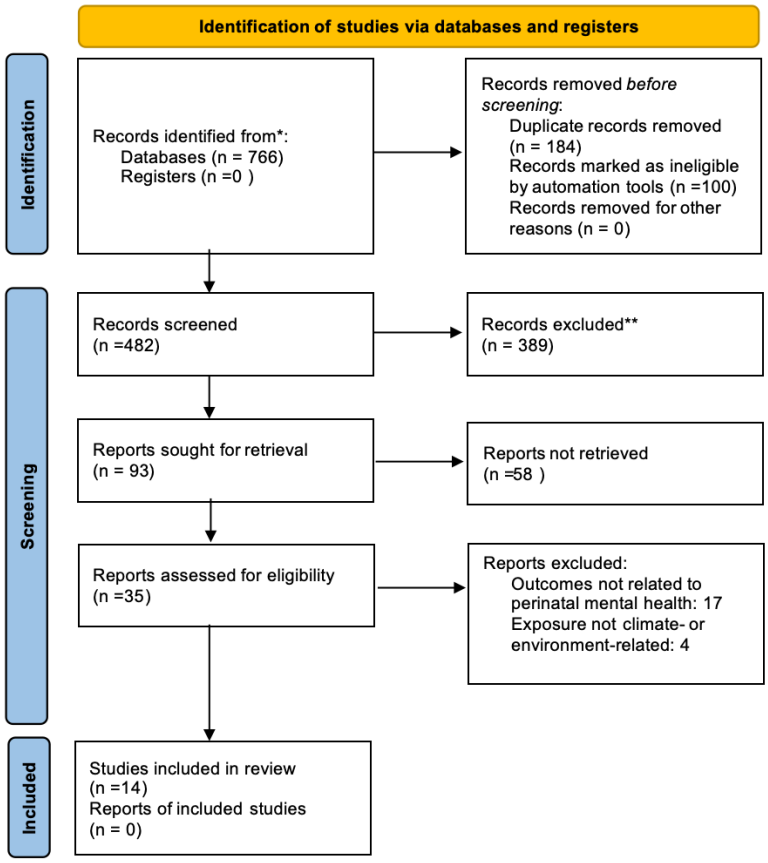

Figure 1. PRISMA-ScR flow diagram of study selection

Characteristics of included studies

The included evidence base demonstrated substantial methodological diversity and consisted exclusively of human studies. Although animal studies were initially considered during eligibility development to explore biological plausibility, no animal studies met the final inclusion criteria and therefore none were included in the synthesis or Table 1.

Qualitative and mixed-methods studies were prominent in examining climate-related stressors and lived experiences during pregnancy and the postpartum period, particularly in Australia and low-resource settings. These studies provided insight into coping strategies, psychological responses, and adaptive capacity in the context of climate change and extreme weather events (Pardon et al., 2024).

Quasi-experimental and post-disaster cohort approaches were commonly used to investigate wildfire and bushfire exposure and trauma-related mental health outcomes among pregnant and postpartum women (Cherbuin et al., 2023; Verstraeten et al., 2021). Epidemiological and

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population-based observational studies were used to assess acute mental health risks associated with extreme heat and air pollution exposure during pregnancy (Ulrich et al., 2025a; Vrkljan et al., 2025; Zhao et al., 2022).

Studies included in the review differed from those cited in the Introduction, as background references were used to contextualize the broader literature and were not intended to represent the final included evidence base. Final inclusion was determined through application of eligibility criteria and full-text screening procedures.

Thematic findings

Heat and extreme weather events (EWEs) as direct perinatal stressors

Qualitative and mixed-methods studies consistently identify climate change, extreme heat, and extreme weather events as salient perinatal stressors that contribute to physical strain, emotional burden, and heightened psychological distress during pregnancy and the postpartum period. Mothers described trauma-like reactions, feelings of helplessness, avoidant coping, and emotional exhaustion in response to climate-related threats, alongside evidence of resilience and adaptive responses (Pardon et al., 2024). In low-resource contexts, climate stress was closely intertwined with food insecurity and livelihood disruption. Qualitative evidence from Uganda illustrates how climate-related shocks and seasonal variability constrain food access during pregnancy, generating sustained psychological stress and vulnerability (Bryson et al., 2021). These findings suggest that climate-related stressors operate not only through direct environmental exposure but also through indirect socioeconomic pathways that shape perinatal mental health.

Acute Mental Health Risk During Heat Extremes

Beyond chronic stress pathways, epidemiological evidence indicates that extreme heat may function as an acute trigger for severe mental health deterioration during pregnancy. A time-stratified case-crossover study demonstrated that days of extreme heat were associated with increased psychiatric emergency encounters among pregnant individuals, highlighting short-term escalation of acute mental health risk (Vrkljan et al., 2025). Complementary matched analyses further showed that heatwave exposure was associated with maternal mental health disparities, suggesting differential vulnerability across populations exposed to extreme heat (Ulrich et al., 2025a).

Wildfire and Bushfire Exposure and Trauma-Related Pathways

Post-disaster and cohort-based studies consistently demonstrate that wildfire and bushfire exposure during pregnancy and the postpartum period are associated with poorer maternal mental health outcomes, including elevated psychological distress and trauma-related symptoms. Evidence from the Fort McMurray wildfire indicated that pregnant and postpartum women exposed to wildfire experienced worse mental health, while social support emerged as an important protective factor in the post-disaster context. Similarly, exposure to the 2019–2020 Australian bushfires was associated with worse maternal mental health during pregnancy and the early postpartum period.

Air Pollution and Perinatal Depression Risk

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Observational studies provide convergent evidence that exposure to ambient air pollution is associated with adverse perinatal mental health outcomes. In a large population-based study in Southern California, higher antepartum and postpartum air pollution exposure was associated with increased risk of postpartum depression. Additional evidence indicates that prenatal exposure to fine particulate matter ($PM_{2.5}$) is associated with higher levels of anxiety and depressive symptoms during pregnancy, suggesting vulnerability during the antenatal period (Zhao et al., 2022).

Climate-Related Psychological Stress and Emotional Pathways

Beyond physical exposures, psychological responses to climate change represent an important pathway influencing perinatal mental health. Quantitative evidence indicates that climate change anxiety is positively associated with antenatal distress among expectant parents (Li et al., 2021). Similarly, stronger emotional responses to climate change were associated with higher antenatal anxiety and differences in maternal–fetal attachment among primigravida women (Ulrich et al., 2025b). These findings suggest that climate-related cognitions and emotional responses may independently contribute to perinatal mental health risk.

Climate-Linked Food Insecurity and Indirect Pathways

Several studies highlight food insecurity as a key indirect pathway linking climate stress to perinatal mental health outcomes. Cohort and cross-sectional evidence from South Africa and Bangladesh indicates that food insecurity among pregnant and postpartum women is associated with higher risk of common mental disorders and postnatal depression, with perceived social support acting as a protective or mediating factor (Bryson et al., 2024; Mathew et al., 2025). Qualitative evidence from Uganda further illustrates lived pathways from climate shocks to food stress and subsequent psychological distress during pregnancy (Bryson et al., 2024).

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Table 1. Summary of climate-related exposures (including climate-linked insecurity) and perinatal mental health outcomes (revised based on provided reference list)

Author (Year)	Design	Sample	Instrument / Data Source	Main Findings
Pardon et al. (2024), Australia	Mixed-methods (qualitative + cross-sectional)	Mothers (n=31) with infants <12 months	Measures of maternal mental health and functioning; items on climate change and extreme weather events	Climate change and extreme weather events were linked to maternal psychological impacts (eg, trauma-related distress, helplessness), coping responses (including avoidance), and resilience/adaptive responses.
Verstraeten et al. (2021), Canada (Fort McMurray wildfire)	Post-disaster study (cohort-based analysis)	Pregnant and postpartum women exposed to wildfire	Standardized measures of maternal mental health and social support	Wildfire exposure was associated with poorer maternal mental health; social support showed protective associations in the post-disaster context.
Cherbuin et al. (2023), Australia (bushfires)	Survey/cohort-based study	Pregnant and recently postpartum mothers	Maternal mental health questionnaires	Exposure to the 2019–2020 bushfires was associated with worse maternal mental health during pregnancy and the early postpartum period.
Vrkljan et al. (2025), USA (Boston)	Time-stratified case-crossover	Psychiatric emergency encounters during pregnancy (n=861)	Clinical psychiatric diagnoses and emergency visit codes; temperature metrics	Extreme heat days were associated with increased psychiatric emergency encounters among pregnant people, indicating acute heat-related mental health risk.
Ulrich et al. (2025), USA (North Carolina)	Matched analysis / quasi-experimental	Maternal populations exposed to heatwaves (2011–2019)	Health/administrative data linked with heatwave exposure	Heatwave exposure was associated with maternal mental health disparities, suggesting differential vulnerability across populations following extreme heat.
Sun et al. (2023), USA (Southern California)	Population-based observational study	Large perinatal population (clinical records)	Modeled air pollution exposure (antepartum + postpartum) and postpartum depression outcome	Higher antepartum and postpartum air pollution exposure was associated with increased risk of postpartum depression.
Zhao et al. (2022), China	Observational study	Pregnant women	$PM_{2.5}$ exposure estimates; standardized anxiety/depression assessments	$PM_{2.5}$ exposure was associated with higher prenatal anxiety and depressive symptoms.
Lykins et al. (2024), Australia	Quantitative study	Expectant parents (pregnancy)	Climate change anxiety; antenatal distress/worry measures	Climate change anxiety predicted higher antenatal distress, supporting a psychological pathway beyond physical hazards.
Amin et al. (2025), Egypt	Cross-sectional	Primigravida women	Climate-related emotional responses; antenatal anxiety; maternal–fetal attachment	Stronger emotional responses to climate change were associated with higher antenatal anxiety and differences in maternal–fetal attachment.
Abrahams & Lund (2022), South Africa	Cohort study	Perinatal women in low-SES settings	Food insecurity measures; common mental disorders outcomes	Food insecurity in perinatal women was associated with higher risk of common mental disorders, relevant as climate-linked livelihood stressor.
Hasan et al. (2021), Bangladesh	Cross-sectional	Pregnant women (rural)	Household food insecurity; mental health assessment	Household food insecurity was associated with poorer mental health among pregnant women.
Mathew et al. (2025), South Africa	Observational (postnatal)	Postnatal women	Food insecurity; postnatal depression; perceived social support	Food insecurity was associated with postnatal depression, with perceived social support acting as a mediating/protective pathway.
Bryson et al. (2024), Uganda	Qualitative study	Pregnant women (Bakiga and Batwa)	In-depth qualitative interviews	Climate-related food insecurity was linked to psychological stress during pregnancy, describing lived pathways from climate shocks → food stress → mental distress.
Bryson et al. (2021), Uganda	Observational (seasonality/climate)	Pregnant women (Indigenous and non-Indigenous)	Seasonality/climate indicators; food security	Seasonal/climate variability affected food security during pregnancy, with implications for maternal–infant health and potential mental health vulnerability.

Mechanistic Pathway Synthesis

Across qualitative and epidemiological studies, a convergent mechanistic pathway emerges in which climate-related exposures, including extreme heat, extreme weather events, air pollution,

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and climate-linked food insecurity interact to increase psychological stress, emotional burden, and vulnerability to perinatal mood and anxiety symptoms. Direct environmental exposures may precipitate acute mental health crises during extreme heat, while indirect pathways involving food insecurity and climate-related anxiety contribute to sustained distress across pregnancy and the postpartum period (Abrahams & Lund, 2022; Bryson et al., 2024; Pardon et al., 2024).

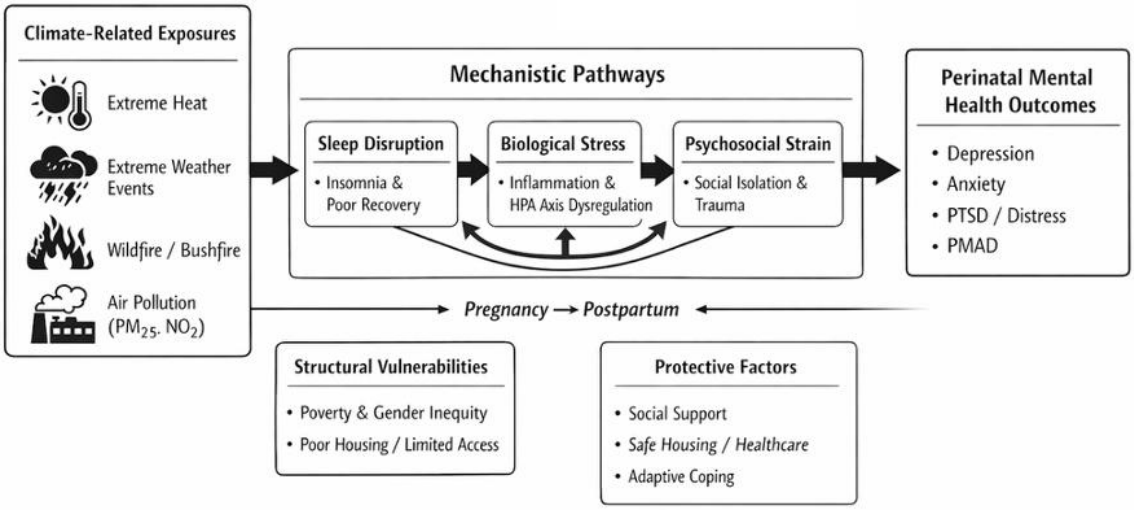

Figure 2. Conceptual pathways linking climate change–related environmental exposures to perinatal mental health outcomes

4. DISCUSSION

This scoping review synthesized recent evidence on the relationship between climate change–related exposures and perinatal mental health, integrating findings across qualitative, epidemiological, and population-based studies. Overall, the evidence suggests that climate change–related exposures may be associated with perinatal mental health outcomes through multiple interconnected pathways, including direct environmental exposures and indirect psychosocial and structural stressors. These findings are consistent with emerging frameworks positioning climate change as a compound risk factor for women's mental health during sensitive reproductive periods (Bansal et al., 2023; Veenema et al., 2023).

Extreme heat and heatwaves emerged as salient risk factors for perinatal mental health, operating through both chronic stress and acute risk pathways. Qualitative and mixed-methods evidence indicates that climate change and extreme weather events are experienced by mothers as psychologically salient stressors, contributing to trauma-related distress, helplessness, emotional exhaustion, and maladaptive coping, alongside evidence of resilience and adaptation (Pardon et al., 2024). These lived experiences underscore how environmental stressors interact with caregiving demands, sleep disruption, and emotional regulation during the perinatal period.

Epidemiological studies complement these qualitative insights by demonstrating acute mental health risks associated with heat exposure. A time-stratified case-crossover study in the United States showed that extreme heat days were associated with increased psychiatric emergency encounters among pregnant individuals, suggesting that heat may precipitate short-

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term escalation of severe mental health crises in vulnerable populations (Amekpor et al., 2025; Amin et al., 2025). Similarly, matched analyses of heatwave exposure identified disparities in maternal mental health outcomes, indicating that vulnerability to heat-related psychological harm is socially patterned (Ulrich et al., 2025). Together, these findings support the conceptualization of extreme heat as both a chronic stressor and an acute trigger for perinatal mental health deterioration.

Wildfire and bushfire exposure during pregnancy and the postpartum period were consistently associated with adverse maternal mental health outcomes, particularly trauma-related symptoms and psychological distress. Evidence from the Fort McMurray wildfire demonstrated poorer mental health among pregnant and postpartum women exposed to wildfire, with social support showing a protective association (Verstraeten et al., 2021; Cherbuin et al., 2023). Similarly, population-based studies following the 2019–2020 Australian bushfires reported worse maternal mental health during pregnancy and early postpartum, particularly among women experiencing more severe exposure (Boateng et al., 2022). These findings align with disaster mental health literature suggesting that environmental disasters act as stress multipliers during pregnancy, amplifying vulnerability through displacement, disruption of care, loss of social networks, and prolonged uncertainty. The consistent protective role of social support across wildfire studies highlights an important modifiable factor for mitigating climate-related perinatal mental health risk.

Ambient air pollution was associated with both antenatal and postpartum mental health outcomes. Large population-based evidence from Southern California demonstrated that higher antepartum and postpartum exposure to air pollutants was associated with increased risk of postpartum depression (Goldstein et al., 2025; Goudet et al., 2024; López-Morales et al., 2021). Additional observational evidence indicates that prenatal exposure to fine particulate matter ($PM_{2.5}$) is associated with higher anxiety and depressive symptoms during pregnancy. These findings suggest that air pollution may be associated with perinatal mental health outcomes through several hypothesized biological pathways, including systemic inflammation, oxidative stress, and altered neuroendocrine signaling, which have been proposed in prior literature but were not directly evaluated in most included studies. Given the predominance of observational evidence, these mechanisms should be interpreted as biologically plausible rather than empirically confirmed within the reviewed studies. The observed associations during the postpartum period may indicate continued vulnerability beyond pregnancy; however, causal interpretation remains limited.

Beyond physical environmental exposures, psychological responses to climate change emerged as an independent pathway influencing perinatal mental health. Quantitative evidence indicates that climate change anxiety is positively associated with antenatal distress among expectant parents (Lykins et al., 2024). Similarly, stronger emotional responses to climate change were associated with higher antenatal anxiety and differences in maternal–fetal attachment among primigravida women (Boateng et al., 2022). These findings suggest that anticipatory worry, perceived threat regarding future child well-being, and emotional responses to climate change may contribute to perinatal distress, although the underlying mechanisms remain incompletely understood. This pathway is particularly relevant for perinatal care, as climate-related distress may be under-recognized in routine mental health screening.

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Food insecurity emerged as a critical indirect pathway linking climate stress to perinatal mental health outcomes. Cohort and cross-sectional studies consistently showed that food insecurity among pregnant and postpartum women was associated with higher risk of common mental disorders and postnatal depression (Bansal et al., 2023; Veenema et al., 2023). Qualitative evidence from Uganda further illustrated how climate shocks and seasonal variability translate into food stress and subsequent psychological distress during pregnancy (Bryson et al., 2024), supported by observational evidence linking climate seasonality with food insecurity during pregnancy. Several studies suggested that perceived social support may mediate or buffer the relationship between food insecurity and postnatal depression, reinforcing the role of relational and community resources in mitigating climate-related mental health risks (Rahman et al., 2021; Roos et al., 2021; Rothschild & Haase, 2023). The findings of this review have important implications for nursing practice and perinatal health services. Climate-informed perinatal mental health screening may be warranted, particularly during heatwaves, post-disaster periods, and seasons of poor air quality (Fan & Zlatnik, 2023; Samara et al., 2025). Incorporating brief assessment of recent environmental exposures, climate-related distress, and food insecurity alongside standard screening for perinatal mood and anxiety disorders could improve early identification of at-risk women (Kuehn & McCormick, 2017; Major-Smith et al., 2025).

Nurses are also well positioned to provide anticipatory guidance on heat protection, smoke exposure reduction, and coping strategies for climate-related stress, as well as to strengthen linkage to social support and food assistance programs. Given the protective role of social support observed across studies, nursing-led interventions that enhance relational support and continuity of care may be particularly effective in climate-affected settings (Mnyigumba et al., 2025).

Study limitations

This scoping review has several limitations. First, as a scoping review, the focus was on mapping the breadth of evidence rather than formally assessing risk of bias, limiting causal inference. Second, heterogeneity in exposure definitions and mental health outcome measures constrained direct comparability across studies. Third, although studies spanned multiple geographic contexts, evidence from the most climate-vulnerable regions remains limited, and longitudinal data from low- and middle-income countries are scarce. Finally, most included studies focused on risk identification rather than intervention effectiveness, limiting conclusions about mitigation strategies. Finally, interpretation of potential mechanistic pathways should be undertaken cautiously because most included studies were observational and were not designed to directly test biological or causal mechanisms.

5. CONCLUSION

In summary, this scoping review suggests that climate change–related exposures may be associated with perinatal mental health outcomes through interconnected biological, psychological, and structural pathways. Evidence across included studies indicates that extreme heat, wildfire exposure, air pollution, climate anxiety, and climate-linked food insecurity are associated with increased vulnerability to perinatal mood and anxiety symptoms, while social support consistently emerged as a potential protective factor. These findings highlight the

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importance of developing climate-resilient perinatal care models that integrate environmental awareness, psychosocial screening, and social support into routine nursing and maternal health practice. However, interpretation of these findings should consider the predominance of observational evidence and the limited representation of climate-vulnerable low-income settings. Future research should prioritize longitudinal, intervention-based, and implementation-focused studies to strengthen understanding of causal pathways and inform effective climate-responsive perinatal mental health services, particularly in populations most vulnerable to climate change.

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8. AUTHOR CONTRIBUTIONS

Conceptualization: S.N.E.H., R.N.S., F.N.
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Data Curation: R.N.S., F.N.
Writing – Original Draft Preparation: S.N.E.H.
Writing – Review & Editing: S.N.E.H., R.N.S., F.N.
Visualization: R.N.S.
Supervision: S.N.E.H.
Project Administration: S.N.E.H.
All authors have read and agreed to the published version of the manuscript.

9. CONFLICT OF INTEREST

The authors declare that they have no conflict of interest related to this study.

10. DATA AVAILABILITY STATEMENT

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request. Data sharing is subject to ethical considerations and protection of participant confidentiality.

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