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What tools are available to assess climate and environmental health impacts on perinatal families with an equity lens? A rapid review of the Canadian context

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Abstract

Objectives This rapid review is designed to identify existing tools in the Canadian literature that assess the impacts of climate change on the health of perinatal families, particularly those who are equity-denied. Addressing the needs of equity-denied perinatal populations in the face of climate change is crucial to promoting equitable and inclusive perinatal care in Canada.

Methods Rapid review methodology was selected to provide evidence in a timely and cost-effective manner. PubMed/MEDLINE and gray literature (Google and Google Scholar) were searched for English and French papers published from 2013 onward. The original research question, focused on climate change and health, yielded very few relevant results. Therefore, the search was broadened to include environmental health. Garrity et al's (*J Clin Epidemiol* 130:13–22, 2021) nine-stage process was used to identify 11 relevant papers, extract the relevant data, and complete the narrative synthesis.

Synthesis.

This review revealed a significant lack of tools for comprehensively assessing climate-health impacts on perinatal families and equity-denied perinatal families. While Canadian perinatal health screenings focus on equity via indicators of several social determinants of health (e.g., income, social support), they largely omit climate considerations. Environmental health factors are more commonly included but remain minimal.

Conclusion Climate-health screening tools are lacking yet needed in routine perinatal healthcare. Given the seriousness of climate change, urgent engagement of health systems and healthcare workers is essential to help mitigate and adapt to climate-health challenges, particularly for perinatal families experiencing health inequities.

Keywords Perinatal health, Equity, Climate change, Screening tool, Canada

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Introduction

Climate change poses a present threat to human and planetary health. Among those more likely to experience disproportionate adverse health impacts are perinatal families, which include birthing parents of all gender identities, neonates, and infants [1–3]. The perinatal period encompasses both the prenatal (from conception to birth) and postnatal (six weeks after childbirth) phases [4]. Perinatal families from equity-denied groups face even greater health risks due to climate change [5]. “Equity-denied” refers to people who face systemic discrimination that unjustly prevents them from accessing the same resources and opportunities available to others in society [6, 7]. These resources and opportunities are crucial for achieving full health potential. In Canada, examples of equity-denied perinatal families include Indigenous, Black, and other racialized peoples; newcomers, immigrants, and refugees; religious minorities; Two-Spirit, lesbian, gay, bisexual, transgender, queer, intersex, and asexual (2SLGBTQIA+) people; people with low-income or living below the poverty line; and people with disabilities [7, 8].

Existing health inequities experienced by equity-denied perinatal families rooted in racism, settler colonialism, classism, patriarchy, heteronormativity, and other oppressive social structures, are exacerbated by climate change [9]. For instance, Indigenous, Black, and other racialized perinatal families are made vulnerable to the health impacts of climate change because systemic racism already undermines health in all domains—physical, mental, social, economic, and more—resulting in well-documented health and social inequities [10, 11]. Additionally, intersectional marginalization due to racialization and low-income status [6], for example, leads to further discrimination, stigma, limited healthcare access, and poorer health outcomes for perinatal families [12]. Addressing the unjust differences in health opportunities and outcomes experienced by equity-denied perinatal populations in the face of climate change is crucial to promoting equitable and inclusive perinatal care in Canada.

While climate change is a leading structural determinant of health and health inequities [13], the development of climate-health screening tools is still an emerging area of public health research and policy. In this review paper, “climate-health” refers to the multifaceted relationship between climate change and human health. Various organizations and institutions in Canada [13–15] have been working to integrate climate change considerations into existing frameworks for health systems and healthcare workers (HCWs), while regional public health organizations, for example, are undertaking climate-health impact and vulnerability assessments

[16, 17]. In the domain of perinatal health, comprehensive provincial and territorial perinatal health screenings and guidelines have been developed for use by frontline HCWs, such as nurses working in the perinatal context, midwives, and perinatal support workers [18]. Although these guidelines address physical and mental perinatal health and emphasize key social determinants of health (SDoH), they do not highlight climate-related health and health equity risks.

Given this gap, the aim of this rapid review is to identify and analyze tools in the academic and gray literature that can be used to assess climate-health and equity impacts that can be adapted for use with perinatal families. We define “tool” as a practical and clinically relevant (“ready to use”) guide that frontline HCWs can employ to screen or assess their patients for physical and mental health and health equity impacts related to climate change, including extreme heat and weather events, air pollution, vector-borne diseases, and food and water security. This review holds relevance for local, regional, provincial, territorial, and federal public health and perinatal health services in Canada. The end goal of this review is to inform the development of a new tool for frontline HCWs serving equity-denied perinatal families to assist with climate awareness, mitigation, and adaptation.

Positionality statement

We acknowledge our social locations as White settler registered nurses working in academia, practicing in communities, and undergoing educational programs ourselves, which imbue us with privileges and biases. In the Canadian context, Western settler colonial practices have shaped how research is conducted, defined health and well-being, and influenced how research is applied. Research knowledge represents the interests of the colonial system, reinforcing hierarchical structures and what we see as valid and evidence-based knowledge [19]. While evidence-based healthcare practice has gained prominence, it has also perpetuated a hierarchical distinction of research approaches rooted in postpositivism, excluding equity-denied populations [20]. As such, we acknowledge that our methodology limits other ways of knowing, including but not limited to Indigenous ways of knowing.

Background

Impacts of climate change on perinatal health

In Canada, the health impacts of climate change are linked to more frequent and intense heat waves, increased air pollution, the spread of vector-borne diseases, food and water insecurity, and extreme weather events [2, 21]. These factors have direct, indirect, interconnected, and wide-ranging physical and mental

health consequences for perinatal families. The subsequent section will cover the specific implications of these impacts, underscoring the distinct health concerns of perinatal families.

Climate change is emerging as a determinant of mental health and is associated with elevated risk for perinatal families, potentially more so for equity-denied populations, given that perinatal mood and anxiety disorders affect 25% of birthing parents in Canada [22]. The perinatal period disproportionately impacts the mental health of 2SLGBTQIA+ individuals, largely due to system-level inequities and exclusion from perinatal care [23]. Indigenous perinatal families, having endured centuries of settler colonialism, face heightened mental health impacts due to socio-structural determinants of health, such as racism and poverty. Existing mental health inequities are further exacerbated by the cumulative effects of climate change, resulting in the depletion of salmon and permafrost, for example, which undermine Indigenous cultural lifeways, identities, and kinship networks [24–26].

It is well documented that heat stress during pregnancy can lead to dehydration, heat exhaustion, and heatstroke, harming the health of birthing parents and neonates [3]. A systematic review from Veenema et al. [27] revealed a significant association between extreme heat exposure and the risk of preterm birth, low birth weight, stillbirth, congenital disabilities, and an increased risk of cardiovascular complications such as stroke or myocardial infarction for the birthing parent at the time of delivery. Extreme heat may impact perinatal families with lower socioeconomic status more than those with higher socioeconomic status because socioeconomic status affects the choice of housing and location and access to or lack of green spaces—an important resource during extreme heat events [28, 29]. Indigenous, Black, and other racialized peoples, immigrants, refugees, 2SLGBTQIA+ persons, and persons with disabilities all experience higher rates of poverty in Canada [30].

Multiple sources have shown that air pollution from ground-level ozone and particulate matter caused by wildfire smoke, which is increasingly frequent and severe due to climate change, can increase the risk of respiratory problems and congenital heart defects in pregnant individuals and developing fetuses [31, 32]. Indigenous people, newcomers, and people living in low-income areas are already more likely to live in proximity to air pollution due to processes of marginalization that exclude them from quality housing or more desirable neighbourhoods and closer proximity to the confluence of industrial activity and traffic pollutants [33]. Although the latter two impacts do not stem from climate change, climate-related

air pollution exacerbates the disproportionate air pollution burdens already faced by equity-denied people.

According to the Government of Canada [34], changes in temperature and precipitation patterns will increase the incidence of vector-borne diseases such as West Nile virus and Lyme disease nationwide. Overall, climate change is expected to impact vector-borne diseases in Canada in three ways: through the risk of global infectious disease introduction, through the south-to-north spread of disease from the United States, and through outbreaks and possible epidemics of endemic diseases such as West Nile virus [35]. Birthing parents may be more susceptible to illnesses caused by insects, while neonates, for instance, are potentially affected by gestational Lyme disease [36, 37]. SDoH such as poverty and poor socioeconomic status, food insecurity, and decreased access to health care undermine resistance to infections, influence disease progression, and affect the treatment of disease [38]. Consequently, equity-denied perinatal families are at a heightened risk of vector-borne diseases and their sequelae due to these factors [39].

Changes in temperature and precipitation, extreme heat and extreme weather events such as flooding threaten food quality, production, transportation, availability, safety [40] and water security [41]. Inadequate nutrition and hydration during pregnancy can lead to fetal intrauterine growth restriction, low birth weight, and increased malnutrition for birthing parents and fetuses [42]. Furthermore, these impacts can disproportionately impact equity-denied perinatal families already facing greater food and water insecurity [43].

In addition to their direct health impacts, extreme weather events such as wildfires and floods can interfere with birthing parents' access to reliable transportation and medical care, impacting the care neonates receive, especially for perinatal families living in remote areas, many of whom are Indigenous [44]. Such events can disrupt access to healthcare services, lead to displacement, cause injuries and potentially death, and create stressful and unstable environments for perinatal families [42]. Those who are equity-denied may lack the economic resources and social support needed to adapt to or recover from the direct and indirect impacts of extreme weather events driven by climate change [21].

Methods

Review question

The preliminary research question for this rapid review was as follows:

What tools exist in the literature that assess the impacts of climate change on the health of perinatal

families, particularly equity-denied perinatal families?

This question yielded very few relevant results. The question was therefore adapted in consultation with key stakeholders and an information specialist. We broadened our search to include environmental health tools to capture climate-related impacts that may have been categorized as environmental.

The revised review question became:

What assessment tools exist in the literature that screen for the impacts of climate change or the environment on human health with an equity focus that includes or can be adapted for perinatal families?

Design

Given the intensity of climate change impacts on human health, rapid review methodology was selected to generate evidence quickly [45, 46]. Dobbins's [47] *Rapid Review Guidebook* provided general guidance for the methodology, while Garrity et al.'s nine-step rapid review process [48] guided each step (see Table 1).

Search strategy

Electronic search strategy

An information specialist designed the literature search following PRISMA-S guidance [49]. Published literature was identified by searching the PubMed database from 2013 to April 12, 2023. The search strategy consisted of controlled vocabulary, such as the National Library of Medicine's Medical Subject Headings (MeSH), and keywords. The key search concepts were assessment tools and climate change health impacts or perinatal-specific environmental health impacts. The complete search strategy is described in the supplementary material.

Gray literature

A broad internet search (using Google: <https://www.google.ca/>), a more focused search of published literature (using Google Scholar: <https://scholar.google.com/>), and a targeted search of organizations identified as relevant by the client and research team were performed from April–May 2023. The first 100 results retrieved from Google and Google Scholar were reviewed. Examples of targeted healthcare organizations included the Public Health Agency of Canada and provincial and territorial governments.

Table 1 Garrity et al.'s nine-stage process applied to this rapid review

| Review process stage | |
|--|---|
| Setting the research question – topic refinement | <ul style="list-style-type: none"> • Key stakeholders (NCCDH) were involved in setting and refining the review question, eligibility criteria, and the outcomes of interest • Protocol developed that used the PCC question framework |
| Setting eligibility criteria | <ul style="list-style-type: none"> • PCC clearly defined <ul style="list-style-type: none"> ◦ Population: Perinatal families with an emphasis on equity-denied groups ◦ Concept: Tools that assess the impacts of climate change and environment on health ◦ Context: Canadian • Carefully considered date restriction • Tool to apply to point-of-care practice • Quality of evidence, including clinical practice guidelines and systematic reviews, considered • French language literature included as language equity deemed important |
| Searching | <ul style="list-style-type: none"> • Involved an experienced information specialist • Database literature search included: MEDLINE (PubMed) • Grey literature and supplemental searching limited |
| Study selection | <p>Title and abstract screening</p> <ul style="list-style-type: none"> • Use of online systematic review software (Covidence) was incorporated to streamline the process • Pilot exercise conducted with approximately 20 abstracts for the entire screening team to calibrate and test the review form • Two reviewers for independent screen of at least 50% of abstracts, with conflict resolution • Use of one reviewer to screen remaining abstracts and to screen all excluded abstracts <p>Full-text screening</p> <ul style="list-style-type: none"> • One reviewer to include, and two reviewers independently excluded full text |
| Data extraction | <ul style="list-style-type: none"> • Data extracted using a table with concise description of PCC plus methodology with entire screening team • Two reviewers to extract data and third reviewer to check for consistency and completeness of extracted data |
| Risk of bias assessment | <ul style="list-style-type: none"> • Use of a single reviewer to rate risk of bias with full verification of all judgements by a second reviewer • AACODS critical appraisal tool checklist used to decide which papers to include in the final draft |
| Synthesis | <ul style="list-style-type: none"> • Narrative synthesis • Use of a single reviewer to grade the certainty of the evidence with verification of judgements by a second reviewer |

Inclusion and exclusion criteria

This rapid review included peer-reviewed and gray literature published between 2013 and 2023. To seek comparable information and transferable research findings, only Canadian literature was included due to similarities in provincial and territorial healthcare structures and geographical considerations. A guiding inclusion criterion was that the tool provided an assessment or screening with a high level of applicability to direct patient care for HCWs with respect to perinatal families. Items were excluded if tools could not be used in clinical practice by HCWs to assess or screen health implications related to climate change. The literature was included if it was published in French or English. The inclusion and exclusion criteria are outlined in Table 2.

Study quality

In accordance with rapid review methodology [48], quality assessment was conducted by a single reviewer, and a second reviewer independently reviewed the results. Given that the most relevant sources were found in the gray literature, the AACODS (authority, accuracy, coverage, objectivity, date, significance) checklist described by Tyndall [50] was selected. The AACODS is a flexible critical appraisal tool for evaluating gray and published literature according to the same standard. The trustworthiness and appropriateness of the included papers were assessed against the research objectives and questions with the checklist (Table 3). A Supplementary file was used for the completed AACODS checklists.

Table 3 AACODS checklist

| | |
|--------------|--|
| Authority | Who is responsible for the content, and are they credible? |
| Accuracy | Do credible, authoritative sources support the document? |
| Coverage | Does the document clearly state parameters that define their content coverage? |
| Objectivity | Is there bias? Is it easily detected? |
| Date | Can you find the date? |
| Significance | Does the document add something unique to the research? |

Extraction and synthesis

Two reviewers extracted the data addressing the review questions, while a third reviewer checked for accuracy [48]. The extracted data were categorized into a table (Table 4) according to population, health threat (e.g., heat), and tool used for assessing climate change health impacts, environmental health, equity, or perinatal health. These four themes were used to provide a descriptive summary of tool similarities and a narrative synthesis [48] organized in the following way: tools that assess climate or environmental health impacts with or without equity considerations and tools that assess perinatal climate or environmental health impacts with or without equity considerations.

Results

We identified 1536 unique citations through database and gray literature searches; 11 met our eligibility criteria and were included in this review (see Fig. 1 for details).

Table 2 Inclusion and exclusion criteria for the literature in this review

| Inclusion criteria | Exclusion criteria |
|--|--|
| Only literature involving climate change and health (i.e., extreme heat and heat stress, extreme weather events [wildfire, drought, landslide, avalanche, tornado, storms], air pollution, vector-borne diseases, food and water insecurity, mental health stressors) or environmental health (i.e., air, water, and soil pollution, pollutants) and/or health equity priorities | Literature that does not mention climate change or environmental health |
| Literature centered around health or that includes a human health lens | Literature that focused only on climate change mitigation or climate-resilient healthcare facilities |
| Perinatal populations and/or perinatal equity-denied populations | Literature that cannot be adapted to perinatal families and/or perinatal populations |
| Explicit mention of tool with a high level of applicability to point-of-care healthcare practice used to assess health and/or health equity impacts of climate change OR environmental pollution/degradation | Literature that does not include explicit mention of a tool defined as an assessment with a high level of applicability to point-of-care healthcare practice |
| Published literature (peer-reviewed), governmental, non-governmental and non-profit organization reports, technical documents, manuals, climate OR environmental health and health equity vulnerability assessments | Commentaries, press releases, speeches, letters to the editor, conference abstracts |
| English and French language – full-text | Literature published in languages other than English or French |
| Timeframe (1st January 2013 to May 2023) | Literature published before January 2013 |
| Geographical location: Canada | Non-Canadian literature |

Table 4 Summary of findings (Data Extraction Table) [51–61]

| Citation/Authors | Title | Province/Territory | Population | Health Threats | Tool that assesses: | | | |
|--|--|--|--|--|-------------------------------|------------------------------|------------------|--------|
| | | | | | Climate Change Health Impacts | Environmental Health Impacts | Perinatal Health | Equity |
| Alberta Health Services (2020) | Alberta Antenatal Pathway | AB | Antenatal | Vector-borne diseases (Lyme) | X | | X | X |
| Canadian Urban Environmental Health Research Consortium (2022) | HealthyPlan.city | Nation wide | All ages and has a function to specify vulnerable populations (e.g., children, older adults, low-income individuals, visible minority individuals, individuals living alone) | Air pollution, heat | X | X | | X |
| Chan et al. (2015) | Development of a Canadian socioeconomic status index for the study of health outcomes related to environmental pollution | Nation wide | Canadians (all ages) | Air pollution | X | X | | X |
| Government of NorthWest Territories (2021) | NWT Prenatal Record: User Guide and Resources | NWT | Perinatal families | Environmental contaminants, heat | X | X | X | X |
| Hamilton Bogart (2014) | Screening tools for community health nurses | Prepared for BC but from New Brunswick | Children | Indoor air pollution | | X | X | X |
| Health Emergency Management (2021) | British Columbia mental health and wellness recovery toolkit | BC | Individuals and families impacted by disasters (all ages) | Mental health, extreme weather events | X | X | | X |
| Institut National de Santé Publique du Québec (2019) | Post-disaster mental health impacts surveillance toolkit | QC | Those affected by disasters (all ages) | Mental health, extreme weather events | X | X | | |
| National Collaborating Centre for Environmental Health (2022) | Health checks during extreme weather events | Developed in ON but for nation wide | All ages | Extreme heat | X | X | | X |
| Province of Manitoba (2019) | Public Health Nursing Prenatal Practice: Evidence Informed Care Pathway | MB | Prenatal | Vector-borne diseases (insect bites), environmental hazards including insecticides, pollution, lead | | X | X | X |
| Reproductive Care Program of Nova Scotia (2019) | Zika Virus in Pregnancy and Lyme Disease in Pregnancy | NS | Antenatal | Vector-borne diseases (Lyme & Zika) | X | | X | |
| Rourke et al. (2020) | Rourke Baby Record (RBR) | ON | 0-5 years old | Vector-borne diseases (insect bites), heat (sun), environmental hazards including pesticides, lead, poisons and other toxins | X | X | X | X |

Tools that screen for climate or environmental health impacts

1.1 The Institut National de Santé du Québec [57] toolkit comprises mental health and substance use screening tools for assessing people who have experienced climate-related disasters such as wildfires or floods. While this resource includes population-based Indigenous health surveys, it does not otherwise focus on equity or equity-denied populations. The climate-health issues addressed by this tool include mental health, extreme heat, and extreme weather events.

Tools that screen for climate or environmental health impacts and equity

2.1 Health Emergency Management of British Columbia [56] developed a tool to address mental health and wellness following natural disasters. This tool addresses each phase or stage of recovery from natural disasters and includes at-risk populations, assessment considerations, resources, interventions, and services in the context of mental health impacts. This

tool has made a demonstrated effort to account for equity and equity-denied populations in the context of natural disasters. The climate-health issues addressed by this tool include equity considerations, mental health, extreme heat, and extreme weather events.

2.2 The HealthyPlan [52] is an urban digital map developed by the Canadian Urban Environmental Health Research Consortium (CANUE). The tool identifies populations at risk for extreme heat by mapping these populations in relation to potential heat islands determined by tree canopy cover and average temperature. The tool does not provide information on health assessment or intervention. The climate-health issues addressed by this tool include equity considerations and extreme heat.

2.3 The National Collaborating Centre for Environmental Health’s (NCCEH) *Health Checks During Heat Waves* [58] tool identifies populations more susceptible to extreme heat. The tool includes a brief screening checklist and a concise guide on signs and symptoms for HCWs to assess individuals and intervene. While the tool does not identify perinatal families as more at risk than others during heatwaves, it identifies mobility concerns that conceivably apply to

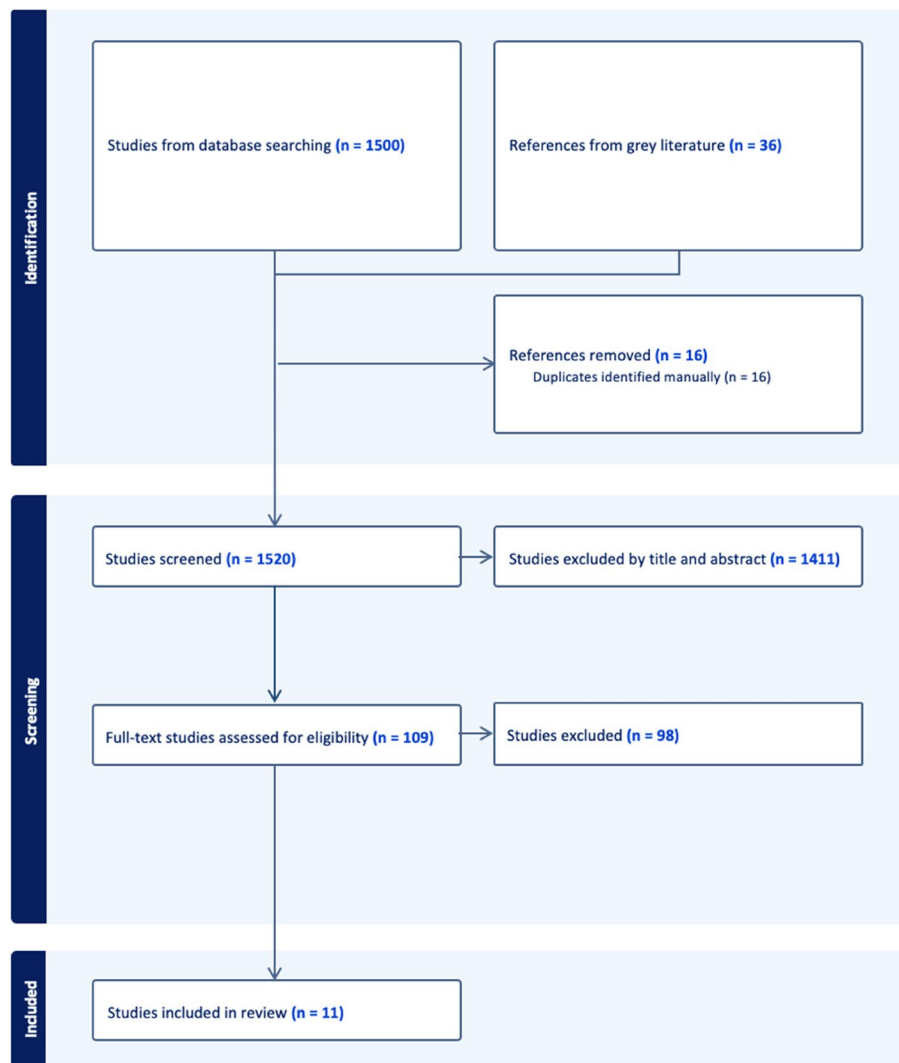


Fig. 1 PRISMA diagram

perinatal families. Equity is addressed by considering elderly individuals, people with chronic illnesses and people with low incomes. The climate-health issues addressed by this tool include equity considerations and extreme heat.

2.4 Chan and colleagues [53] developed a Canadian socioeconomic status (SES) index tool using known data about adverse birth outcomes such as low birth weight and exposure to environmental contaminants such as harmful particulate matter. The SES index includes an equity focus on ethnic origins, cultural background, particularly Indigeneity, housing security, and socioeconomic status. While low birth weight (relevant for perinatal health equity) was used to validate the tool, it was not included as a screening

tool itself. The climate-health issues addressed by this tool include equity considerations and air pollution.

Tools that screen for perinatal climate or environmental health impacts without addressing equity issues

3.1 The Reproductive Care Program of Nova Scotia [60] provides links to vector-borne disease tools, including for Zika virus, with a screening algorithm for symptoms and treatment and Lyme disease, including screening, treatment, and patient education. This resource does not include an equity focus. Despite its inclusion of the impact of climate change on health, the link between health and climate change has not been explicitly mentioned.

Tools that screen for perinatal climate or environmental health impacts with an equity focus

- 4.1 Hamilton Bogart [55] aimed to develop a prototype tool for public health nurses to screen for indoor air pollution during home visits; this tool is expected to include equity indicators. While this resource primarily focuses on pediatric health (including neonates and infants), it can be applied to assess the health of perinatal families. Although environmental health is considered in this tool, climate change is not included.
- 4.2 The *Rourke Baby Record* (0-1 months) [61] screens and assesses neonate growth and development and parents' knowledge of common child safety topics. The tool includes an in-depth questionnaire and information sheets for HCWs. The environmental health items indirectly relate to climate-related factors such as excessive sun, insect bites, and monitoring of the child's body temperature. Equity considerations cover food and financial security; however, equity-denied populations are not explicitly identified. Climate change is mentioned with links to Canadian Pediatric Society articles on the subject but is not explicitly included in the screening section of this tool.
- 4.3 The Provincial Manitoba [59] prenatal assessment tool assesses environmental health, including the prevalence of pesticides and herbicides and the risk of vector-borne diseases. There is a significant focus on equity and SDoH topics such as finances, food and housing security, and language and cultural barriers to care. Climate change impacts are missing or are not explicitly identified though resources are provided for vector-borne diseases and water quality.
- 4.4 Like Manitoba, the Alberta Health Services [51] perinatal screening tool has a significant focus on equity. Equity-denied perinatal populations such as recent immigrants, Indigenous peoples, and people living in low-income areas are included. The *Healthy Mother, Healthy Baby* (Alberta Health Services [AHS] [51] scale is linked to this assessment and comprises a questionnaire that asks about pesticides, environmental pollution, lead, and vector-borne diseases. The relationship between climate change and health impacts is present but not clearly defined or emphasized.
- 4.5 The Government of Northwest Territories (NWT) [54] highlights the importance of environmental contaminants in traditional foods, a major concern for northern Indigenous communities. Overheating in neonates is addressed but not in association with climate change. Like the other perinatal guidelines,

equity considerations are robust; however, climate change is only indirectly or marginally addressed.

Discussion

This review highlights the scarcity of tools for point-of-care climate-health screening and assessment in general and specifically for perinatal families. No tools look at climate change directly in a perinatal health and equity context. Perinatal environmental health screening and assessment were found to be more common but still relatively minimal. Equity is the most common variable among the results.

Equity considerations

This review highlights the reasonably consistent incorporation of equity in tools that assess environmental, climate, and perinatal health. All the tools included in this review, except for the Institut National de Santé du Québec [57] and the Reproductive Care Program of Nova Scotia [60], include equity considerations, indicating that equity is a standard of practice across health sectors in Canada. It is evident that while equity is a recognized standard, the focus of equity considerations in relation to equity-denied groups differs among the tools (see Table 5). Notably, the predominant equity considerations are socioeconomic status and race, ethnicity, or culture. While this signals positive progress in social and racial justice, assessments of the needs of equity-denied perinatal families lack uniformity within Canadian provincial and territorial perinatal guidelines. This absence of standardization poses a notable gap in addressing the specific needs of different equity-denied groups within the perinatal care framework. For example, AHS [51] is the only perinatal tool used in this review to identify the needs of perinatal newcomer families, whereas the Province of Manitoba [59] is the only perinatal tool used to acknowledge disparities that 2SLGBTQIA+ perinatal families may experience. Thus, there is a need not only to integrate climate-health into existing equity-inclusive perinatal health screening tools, but to consistently incorporate the diversity of equity-denied perinatal families at increased climate-health risk (i.e., Indigenous, Black, and other racialized peoples; newcomers, immigrants, and refugees; religious minorities; 2SLGBTQIA+ people; people with low-income or living below the poverty line; and people with disabilities). As inspiration, the Métis Nation of Alberta [62] has created a *Health and Climate Change Toolkit*, which not only addresses climate-health impact categories (e.g., heat) but also recognizes the profound connection that Métis people have with territories and ecologies that are integral to Métis cultural lifeways and identity. Cultural considerations for climate-health are vital to developing perinatal climate-health

Table 5 Tool content – equity considerations for perinatal equity-denied populations

| Tool | Equity Considerations |
|---|--|
| Alberta antenatal pathway [51] | <ul style="list-style-type: none"> • Socioeconomic status: Food, financial and housing insecurity; lack of social support • Race, ethnicity, or culture: New immigrants, Indigenous peoples • Gender: Perinatal women experiencing intimate partner violence • Age: < 18 years when pregnant |
| HealthyPlan.city [52] | <ul style="list-style-type: none"> • Socioeconomic status: Low-income • Race, ethnicity, or culture: People from a visible minority • Age: Children |
| Development of a Canadian socioeconomic status index for the study of health outcomes related to environmental pollution [53] | <ul style="list-style-type: none"> • Socioeconomic status: Housing insecurity • Race, ethnicity, or culture: Cultural identity, ethnic origin, Indigenous peoples |
| NWT prenatal record: User guide and resources [54] | <ul style="list-style-type: none"> • Socioeconomic status: Food and housing insecurity, low education level, low-income • Race, ethnicity, or culture: Cultural identity, ethnic origin, Indigenous peoples |
| Screening tools for community health nurses [55] | <ul style="list-style-type: none"> • Socioeconomic status: Housing security |
| British Columbia mental health and wellness recovery toolkit [56] | <ul style="list-style-type: none"> • Socioeconomic status: Low-income, people experiencing homelessness • Race, ethnicity, or culture: Newcomers and immigrants/English-language learners, Indigenous peoples • Gender & Sexual Orientation: LGBTQ2S+ people, perinatal women experiencing intimate partner violence • Age: Children • Ability: Persons with disabilities |
| Postdisaster mental health impacts surveillance toolkit [57] | |
| Health checks during extreme weather events [58] | <ul style="list-style-type: none"> • Disability: Persons with disabilities and chronic health conditions |
| Public health nursing prenatal practice: Evidence informed care pathway [59] | <ul style="list-style-type: none"> • Socioeconomic status: Food, financial and housing insecurity; lack of social support • Race, ethnicity, or culture: English as a second language, Indigenous peoples • Gender & Sexual Orientation: LGBTQ2S+ people, perinatal women experiencing intimate partner violence, young women • Age: Young women • Ability: Persons with disabilities |
| Zika Virus in Pregnancy and Lyme Disease in Pregnancy [60] | |
| Rourke Baby Record [61] | <ul style="list-style-type: none"> • Socioeconomic status: Food and financial insecurity |

screenings that are culturally intelligent, inclusive, and equity-oriented.

Synthesizing results in relation to climate change impacts on perinatal health

In the following discussion, the impacts of climate change on perinatal health identified in the Background section are synthesized with the results, following a sequence aligned with their prevalence according to the analyzed tools: extreme heat, air pollution, vector-borne diseases, food and water security, and mental health. Extreme weather events are discussed in terms of extreme heat and mental health. While each impact affects physical and mental health, a distinct emphasis on mental health is warranted considering its potential to magnify negative health outcomes for perinatal families. Furthermore, while climate change impacts are encompassed within the review results, their coverage often remains

peripheral or indirectly addressed in the tools, particularly perinatal screenings.

Extreme heat

In terms of extreme heat, several promising findings emerged from our results; however, perinatal screenings are surprisingly lacking. Perinatal screening guidelines from the Government of NWT [54], AHS [51], and Rourke et al. [61] offer only brief recommendations for parents, such as preventing overdressing and therefore overheating in neonates. These tools do not provide methods for assessing heat-related symptoms or links to the risk of climate change-related extreme heat, and there is a lack of discussion about assessing, addressing, and educating patients about the effect of extreme heat on pregnant people and the high risk of dehydration in neonates. The National Collaborating Centre for Environmental Health (NCCEH) [58] tool, which can be readily modified for perinatal families, identifies populations at

risk of extreme heat with an easy-to-use checklist and provides specific interventions and follow-up. In addition to identifying perinatal families at risk for extreme heat, the HealthyPlan [52] digital tool allows HCWs with internet access to determine whether a perinatal individual or family faces greater heat risks based on where they live, enabling informed, equity-oriented interventions at the point-of-care.

Air pollution

There is a lack of screening tools addressing the impacts of climate change-related air pollution on perinatal families. Among the perinatal tools included in this review, air quality is frequently discussed in terms of indoor pollutants such as secondhand smoke and carbon monoxide. Hamilton-Bogart [55] identified radon as a concern, and while not framed in the context of climate change, radon is a growing problem for all Canadians, given the release of radon from thawing permafrost [63]. Promisingly, Chan et al. [53] used the home's construction date as a proxy for assessing indoor air pollution and the infiltration of fine outdoor particles (PM 2.5). This item could be used in a climate-health screening tool to assess increased risk from wildfire smoke. Since our review was conducted, Health Canada [64] has released an information kit on wildfire smoke and health. This resource contains criteria for evaluating both manageable and emergency health impacts from wildfire smoke, along with detailed mitigation guidance for HCWs (e.g., the use of N95 masks and air purifiers) to share with their clients. Generally, climate change-related air quality issues are not well represented in this review's tools and need to be better integrated, particularly given the growing severity of wildfires in Canada.

Vector-borne diseases

Moreover, assessments of vector-borne diseases in this review were limited. Three perinatal screening tools mention the need to screen for Lyme disease in perinatal populations [51, 59] but lack specific guidance. The perinatal screening tool of the Province of Manitoba [59] is of clinical importance because it provides links to websites with information about preventing, treating, and reducing harm from insects and tick bites, while the Reproductive Care Program of Nova Scotia [60] has links to a screening algorithm for assessing Lyme disease and Zika virus infection. As climate change accelerates, the distribution and prevalence of vector-borne diseases are changing, posing new challenges [34]. Screening needs to expand to the perinatal context and could include West Nile virus, and given high travel rates in the perinatal population, Zika virus and malaria.

Food and water security

The perinatal screenings included in this rapid review [51, 54, 59] have a robust focus on food security and evidence of the translation of the SDoH into frontline healthcare practice. The Government of NWT [54] has a trauma-informed section on food security with explicit follow-up from HCWs. The Province of Manitoba [59] includes cultural considerations and precise interventions. However, current food security assessment and education topics do not speak to the collective threat that climate change poses to food security and subsequent impacts on nutrition [41] and assessing water security (aside from a discussion of well water quality) is not a part of any of the documents included in this review. According to the Government of NWT [54] and the Province of Manitoba [59] guidelines, perinatal screenings should explicitly consider the effects of climate change on food availability and accessibility. Assessments should be expanded to identify potential disruptions in food supply chains and natural disasters that could lead to food shortages. Integrating water security assessments into perinatal screenings will help identify potential risks to clean water access and enable HCWs to provide necessary support and resources. A concerted government response (e.g., enhanced perinatal nutrition subsidies) will be needed to enhance food and water security for equity-denied perinatal families.

Mental health

This review identified literature that assesses the mental health impacts of natural disasters, inclusive of climate change, on the general population [56, 57]. As perinatal mental health screening is universally recommended, the prenatal assessments and screening guides of Manitoba [59] and AHS [51] include mental health screenings for the perinatal period with equity considerations. Notably, none of the retained articles specify perinatal mental health as it relates to climate change. Tools that address perinatal mental health as relates to climate change are needed because accelerating, broad impacts such as extreme heat, extreme weather events, disasters, and evacuation can lead to and further exacerbate existing trauma, posttraumatic stress disorders (PTSD), anxiety, and depression, particularly for equity-denied perinatal populations [65, 66]. Equity-denied birthing parents experiencing gender-based or intersectional identities leading to marginalization are at increased risk of climate-related anxiety, PTSD, and gender-based violence during and after extreme events [14]. These disproportionate impacts necessitate a gender-based and intersectional analysis in developing climate-health assessment tools and interventions.

The current absence of point-of-care tools and supplemental information may lead to inadequate mitigation of and adaptation to the climate-health risks faced by perinatal families. To enhance climate-health screening, treatment, and education, concise questions should be integrated into existing perinatal screenings and perhaps a dedicated perinatal climate-health screening, ideally in a checklist format.

Limitations

Methodological constraints and decisions

Our reliance on gray literature results might introduce variations in study quality; however, the AACODS checklist was used to assess the credibility and relevance of the sources [50]. Limiting our geography to Canada may have excluded significant studies elsewhere, although our scan of the global literature obtained few results. Finally, environmental health was added to the study selection criteria, which may have skewed the results, as few studies were found when searching only for climate change, equity, and perinatal health.

Epistemic dominance and the value of diverse forms of knowledge

In the Canadian context, research methodology predominantly revolves around Western colonial practices, reinforcing colonial knowledge validation structures [19]. This point holds for this rapid review. For instance, we did not have an Indigenous co-author, collaborator, or expert to support a Two-Eyed Seeing approach [67], which combines Western evidence-based practices such as epidemiology with Indigenous knowledge such as storytelling [18]. The scoping review format, which is broader and invites expert consultation, may be more conducive to integrating different knowledge systems, such as Indigenous knowledge and local knowledge. Given the importance of decentering whiteness and Western centrism in scholarship and healthcare [68], a scoping review on this topic would be an important future contribution to the topic.

Conclusion

The purpose of this rapid review was to identify and analyze practical, clinically relevant tools that frontline HCWs can use to assess the impacts of climate-health on perinatal families with an equity lens. This review identified several screening tools that show promise while highlighting the shortcomings of available tools for assessing the climate-health risks faced by perinatal families and equity-denied perinatal families. Existing perinatal health tools in Canada lack an adequate integration of climate-health considerations, yet perinatal HCWs are needed

as actors in building climate awareness, mitigation, and adaptation among families. Furthermore, because the impacts of climate change in Canada are increasing in frequency and intensity, there is a compelling need for adequate health and climate policy and public health and environmental public health responses (e.g., surveillance, monitoring, health equity impact assessment). Public health planning needs to include frontline healthcare as well as community- and health-system-level interventions [69]. The “deep, rapid, and sustained” (IPCC, 2023) actions called for currently require the engagement of health systems and HCWs. In terms of the development of tools for frontline HCWs, we recommend expanding existing Canadian perinatal screening tools (e.g., provincial and territorial screening tools) to consistently include climate-health and considerations for diverse equity-denied perinatal families. Additionally, we propose creating a new planetary health tool specifically designed for perinatal families with an equity focus, encompassing climate and environmental health and justice factors. These measures are part of advancing equitable and inclusive perinatal care in Canada.

Abbreviations

| | |
|------------|---|
| AACODS | Authority, accuracy, coverage, objectivity, date, significance |
| AHS | Alberta Health Services |
| CANUE | Canadian Urban Environmental Health Research Consortium |
| HCW | Healthcare worker |
| HEMBC | Health Emergency Management of British Columbia |
| IPCC | International Panel on Climate Change |
| MeSH | Medical Subject Headings |
| NCCDH | National Collaborating Centre for Determinants of Health |
| NCCEH | National Collaboration Centre for Environmental Health |
| NWT | Northwest Territories |
| PCC | Population, concept, and context |
| PHAC | Public Health Agency of Canada |
| PM | Particulate matter |
| PTSD | Post-traumatic stress disorder |
| SDoH | Social determinants of health |
| SES | Socio-economic status |
| 2SLGBTQIA+ | Two-Spirit, lesbian, gay, bisexual, transgender, queer, intersex, asexual |

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

The authors confirm their contribution to the paper as follows: Study conception and design: ATJ, JAS, ET, AC. Data collection: ET, AC, ATJ; Analysis and interpretation of results: ATJ, ET, AC. Draft manuscript preparation: ATJ, ET, AC, JAS, AB. All authors reviewed the results and approved the final version of the manuscript.

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Competing interests

The authors declare no competing interests.

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References

- Garcia ER, Yim IS. A systematic review of concepts related to women's empowerment in the perinatal period and their associations with perinatal depressive symptoms and premature birth. *BMC Pregnancy Childbirth*. 2017;17(S2):347.
- International Panel on Climate Change. AR6 synthesis report: climate change 2023. IPCC; 2023. Available from: <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>. [cited 2023 June 20].
- Roos N, Kovats S, Hajat S, Filippi V, Chersich M, Luchters S, Scorgie F, Nakstad B, Stephansson O, Hess J, Kadio K, Kouanda S, Lusambili A, Marsham J, Ngugi A, Wright CY. Maternal and newborn health risks of climate change: a call for awareness and global action. *Acta Obstet Gyn Scand*. 2021;100(4):566–70.
- Canadian Association of Perinatal and Women's Health Nurses. Perinatal nursing standards in Canada. CAPWHN; 2018. Available from: https://capwhn.ca/wpcontent/uploads/2019/10/PERINATAL_NURSING_STANDARDS_IN_CANADA.pdf. [cited 2023 June 11].
- Thomas K, Hardy RD, Lazrus H, Mendez M, Orlove B, Rivera-Collazo I, Roberts JT, Rockman M, Warner BP, Winthrop R. Explaining differential vulnerability to climate change: a social science review. *Wires Clim Change*. 2018;10(2):e565.
- National Collaborating Centre for Determinants of Health. Let's talk language of health equity. NCCDH; 2023. Available from: https://nccdh.ca/images/uploads/NCCDH_Lets_Talk_Health_Equity_Language_Mar_30_EN.pdf. [cited 2023 July 5].
- Government of Canada. Guide on equity, diversity, and inclusion terminology. 2022. Available from: <https://www.noslangues-ourlanguages.gc.ca/en/publications/equite-diversite-inclusion-equity-diversity-inclusion-eng>. [cited 2023 July 3].
- Human Rights and Equity Office. Equity, diversity, inclusion and indigenization. Queen's University; 2020. Available from: https://www.queensu.ca/hreo/sites/hreo/www/files/uploaded_files/20201210KeyEDlTerms.pdf. [cited 2023 July 5].
- Crear-Perry J, Correa-de-Araujo R, Lewis Johnson T, McLemore MR, Neilson E, Wallace M. Social and structural determinants of health inequities in maternal health. *J Womens Health*. 2021;30(2):230.
- Boakye PN, Prendergast N, Bandari B, Anane Brown E, Odutayo A, Salami S. Obstetric racism and perceived quality of maternity care in Canada: voices of Black women. *Women's Health*. 2023;19. <https://doi.org/10.1177/17455057231199651>.
- Waldron I. There's something in the water: environmental racism in Indigenous and Black communities. Nova Scotia: Fernwood Publishing; 2018.
- Shroff FMC. Flames of transformation: Igniting better mental and physical health for racialized and gendered North Americans. *Front Glob Women's Health*. 2023;13(4):1126934.
- Pan American Health Organization. Just societies: health equity and dignified lives. Report of the Commission of the Pan American Health Organization on Equity and Health Inequalities in the Americas. PAHO; 2019. Available from: <https://iris.paho.org/handle/10665.2/51571>. [cited 2023 June 15].
- Public Health Agency of Canada. Mobilizing public health action on climate change in Canada. PHAC; 2022. Available from: <https://www.canada.ca/content/dam/phac-aspc/documents/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/state-public-health-canada-2022/report-rapport/report.pdf>. [cited 2023 June 8].
- University of Alberta. Climate health and environment epidemiology research lab. University of Alberta. Available from: <https://www.environmentalhealthresearch.ca/home-copy-1>. [cited 2023 June 9].
- Buse C, Brubacher J, Lapp H, Jackson E, Wilson R, Toews J, Cheyne B, Bevis B, Komorowski C, Zentner S, Folkema A, Trotz-Williams L. Climate change and health vulnerability assessment for Waterloo Region, Wellington County, Dufferin County, and the City of Guelph. Waterloo and Guelph: Region of Waterloo Public Health and Wellington-Dufferin-Guelph Public Health Unit; 2022. Available from: <https://www.regionofwaterloo.ca/en/health-and-wellness/resources/Documents/Climate-Change-and-Health-Vulnerability-Assessment.pdf>. [cited 2023 May 30].
- Vancouver Coastal Health. Healthy environments and climate change. Vancouver Coastal Health; 2023. Available from: <https://www.vch.ca/en/healthy-environments-and-climate-change>. [cited 2023 July 15].
- Perinatal Services BC. Provincial perinatal guidelines population and public health prenatal care pathway. Perinatal Services BC; 2014. Available from: <http://www.perinatalservicesbc.ca/Documents/Guidelines-Standards/HealthPromotion/PrenatalCarePathway.pdf>. [cited 2023 May 10].
- Quinless JM. Decolonizing data: unsettling conversations about social research methods. Toronto: University of Toronto Press; 2022.
- Holmes D, Perron A, O'Byrne P. Evidence, virulence, and the disappearance of nursing knowledge: a critique of the evidence-based dogma. *World Evid-Based Nu*. 2006;3(3):95–102.
- Berry P, Schnitter R. Health of Canadians in a changing climate: advancing our knowledge for action. Ottawa: Government of Canada; 2022. Available from: <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>. [cited 2023 May 30].
- Statistics Canada. Maternal mental health in Canada. Statistics Canada; 2019. Available from: <https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2019041-eng.htm>. [cited 2023 August 3].
- Kirubarajan A, Barker LC, Leung S, Ross LE, Zaheer J, Park B, Abramovich A, Yudin MH, Lam JSH. LGBTQ2S+ childbearing individuals and perinatal mental health: a systematic review. *BJOG-Int J Obstet Gy*. 2022;129(10):1630–43.
- Cunsolo A, Ellis NR. Ecological grief as a mental health response to climate change-related loss. *Nat Clim Change*. 2018;8:275–81.
- Ford JD, Willox AC, Chatwood S, Furgal C, Harper S, Mauro I, Pearce T. Adapting to the effects of climate change on Inuit health. *Am J Public Health*. 2014;104(S3):e9–17.
- Vecchio EA, Dickson APM, Zhang APY. Indigenous mental health and climate change: a systematic literature review. *J Clim Change Heal*. 2022;6:100121.

27. Veenema RJ, Hoepner LA, Geer LA. Climate change-related environmental exposures and perinatal and maternal health outcomes in the U.S. *Int J Environ Res Public Health*. 2023;20(3):1662.
28. Chersich MF, Pham MD, Areal A, Haghighi MM, Manyuchi A, Swift CP, Wernecke B, Robinson M, Hetem R, Boeckmann M, Hajat S, Climate Change and Heat-Health Study Group. Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis. *BMJ*. 2020;371:m3811.
29. Varickanickal J, Newbold B. Extreme heat events and health vulnerabilities among immigrant and newcomer populations. *Environ Health Rev*. 2021;64(2):28–34.
30. Government of Canada. Understanding systems: the 2021 report on the National Advisory Council on Poverty. Employment and Social Development Canada; 2021. Available from: <https://www.canada.ca/en/employment-social-development/programs/poverty-reduction/national-advisory-council/reports/2021-annual.html>. [cited 2023 July 3].
31. Yang S, Tan Y, Mei H, Wang F, Li N, Zhao J, Zhang Y, Qian Z, Chang JJ, Syberg KM, Peng A, Mei H, Zhang D, Zhang Y, Xu S, Li Y, Zheng T, Zhang B. Ambient air pollution the risk of stillbirth: a prospective birth cohort study in Wuhan. *China Int J Hyg Envir Heal*. 2018;221(3):502–9.
32. Zhang W, Spero TL, Nolte CG, Garcia VC, Lin Z, Romitti PA, Shaw GM, Sheridan SC, Feldkamp ML, Woomert A, Hwang S, Fisher SC, Browne ML, Hao Y, Lin S, Hobbs C, Carmichael S, Reefhuis J, Botto L. Projected changes in maternal heat exposure during early pregnancy and the associated congenital heart defect burden in the United States. *J Am Heart Assoc*. 2019;8(3):e01995.
33. Giang A, Castellani K. Cumulative air pollution indicators highlight unique patterns of injustice in urban Canada. *Environ Res Lett*. 2020;15(12):124063.
34. Government of Canada. HealthADAPT. Climate Change and Innovation Bureau; 2023. Available from: <https://www.canada.ca/en/health-canada/programs/health-adapt.html>. [cited 2023 June 30].
35. Ogden N, Gachon P. Climate change and infectious diseases: what can we expect? *Can Commun Dis Rep*. 2019;45(4):76–80.
36. Waddell LA, Greig J, Lindsay LR, Hincley AF, Ogden NH. A systematic review on the impact of gestational Lyme disease in humans on the fetus and newborn. *PLoS One*. 2018;13(11):e0207067.
37. Centre for Disease Control. Pregnancy and Lyme disease. CDC; 2020. Available from: <https://www.cdc.gov/lyme/resources/toolkit/factsheets/Pregnancy-and-Lyme-Disease-508.pdf>. [cited 2023 July 3].
38. Public Health Agency of Canada. Chief public health officer's report on the state of public health in Canada 2013: infectious disease: the never-ending threat. Ottawa: Public Health Canada; 2013. Available from: <https://www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/cphorsphc-respcacs/2013/assets/pdf/2013-eng.pdf>. [cited 2024 Aug 1].
39. Neiderud CJ. How urbanization affects the epidemiology of emerging infectious diseases. *Infect Ecol Epidemiol*. 2015;5(1):27060. <https://doi.org/10.3402/iee.v5.27060>.
40. Schnitter R, Berry P. The climate change, food security and human health nexus in Canada: a framework to protect population health. *Int J Env Res Pub Health*. 2019;16(14):2531.
41. Romanello M, Napoli CD, Drummond P, Green C, Kennard H, Lampard P, Scamman D, Arnell N, Ayeb-Karlsson S, Ford LB, Belesova K, Bowen K, Cai W, Callaghan M, Campbell-Lendrum D, Chambers J, van Daalen KR, Dalin C, Dasandi N, Dubrow R. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *Lancet*. 2022;400(10363):1619–54.
42. Rylander C, Øyvind Odland J, Manning ST. Climate change and the potential effects on maternal and pregnancy outcomes: an assessment of the most vulnerable – the mother, fetus, and newborn child. *Glob Health Action*. 2013;6(1):19538–9.
43. Mildon A, Francis J, Stewart S, Underhill B, Ng YM, Rousseau C, Stellen D. Household food insecurity is prevalent in a cohort of postpartum women who registered in the Canada Prenatal Nutrition Program in Toronto. *Public Health Nutr*. 2023;26(7):1468–77.
44. Kipp A, Cunsolo A, Vodden K, King N, Manners S, Harper SL. At-a-glance – climate change impacts on health and wellbeing in rural and remote regions across Canada: a synthesis of the literature. *Health Promot Chron*. 2019;39(4):122–6.
45. Langlois EV, Straus SE, Antony J, King VJ, Tricco AC. Using rapid reviews to strengthen health policy and systems and progress towards universal health coverage. *BMJ Glob Health*. 2019;4(1):e001178.
46. Tricco AC, Langlois EV, Straus SE. Rapid reviews to strengthen health policy and systems: A practical guide. Geneva: World Health Organization; 2017. Available from: <https://apps.who.int/iris/bitstream/handle/10665/258698/9789241512763-eng.pdf?sequence=1>. [cited 2023 April 25].
47. Dobbins M. Rapid review guidebook steps for conducting a rapid review. National Collaborating Centre for Methods and Tools; 2017. Available from: <https://www.nccmt.ca/uploads/media/media/0001/01/a816af720e4d587e13da6bb307df8c907a5dff9a.pdf>. [cited 2023 April 17].
48. Garrity C, Gartlehner G, Nussbaumer-Streit B, King VJ, Hamel C, Kamel C, Affengruber L, Stevens A. Cochrane rapid reviews methods group offers evidence-informed guidance to conduct rapid reviews. *J Clin Epidemiol*. 2021;130:13–22.
49. Rethlefsen ML, Kirtley S, Waffenschmidt S, Ayala AP, Moher D, Page MJ, et al. PRISMA-S: an extension to the PRISMA statement for reporting literature searches in systematic reviews. *Syst Rev*. 2021;10:39.
50. Tyndall J. AACODS. Flinders University; 2010. Available from: <https://fac.flinders.edu.au/dspace/api/core/bitstreams/e94a96eb-0334-4300-8880-c836d4d9a676/content>. [cited 2023 July 24].
51. Alberta Health Services. Alberta antenatal pathways. Maternal Newborn Child & Youth Strategic Clinical Network; 2020. Available from: <https://www.albertahealthservices.ca/scns/Page13655.aspx>. [cited 2023 June 15].
52. Canadian Urban Environmental Health Research Consortium. HealthyPlan.City. HealthyPlan.City. Dalla Lana School of Public Health; 2022. Available from: <https://healthyplan.city/en>. [cited 2023 June 30].
53. Chan E, Serrano J, Chen L, Stieb DM, Jerrett M, Osornio-Vargas A. Development of a Canadian socioeconomic status index for the study of health outcomes related to environmental pollution. *BMC Public Health*. 2015;15(1):714.
54. Government of Northwest Territories. NWT prenatal record: User guide and resources. Government of Northwest Territories; 2021. Available from: <https://www.hss.gov.nt.ca/professionals/sites/professionals/files/resources/prenatal-record-users-guide.pdf>. [cited 2023 June 30].
55. Hamilton Bogart B. Environmental health risks in children: Screening tools for community health nurses and paraprofessional home visitors and their integration within public health practice. New Brunswick Environmental Network; 2014. Available from: <https://nben.ca/fr/csee-resources-pour-les-professionnels.html#>. [cited 2023 May 2].
56. Health Emergency Management of British Columbia. British Columbia mental health and wellness recovery toolkit. HEMBC; 2021. Available from: <http://www.phsa.ca/health-emergency-management-bc-site/Documents/Mental%20Health%20and%20Wellness%20Toolkit%20July%202021.pdf>. [cited 2023 June 29].
57. Institut national de santé publique du Québec. Post-disaster mental health impacts surveillance toolkit. Québec: Bibliothèque et Archives nationales du Québec; 2019. Available from: https://www.inspq.qc.ca/sites/default/files/publications/2676_post_disaster_mental_health_impacts_toolkit.pdf. [cited 2023 June 15].
58. National Collaborating Centre for Environmental Health. Health checks during extreme heat events. NCCEH; 2022. Available from: <https://ncceh.ca/resources/evidence-reviews/health-checks-during-extreme-heat-events>. [cited 2023 June 20].
59. Province of Manitoba. Public health nursing prenatal practice - prenatal evidence informed care pathway. Province of Manitoba; 2019. Available from: <https://www.gov.mb.ca/health/publichealth/>. [cited 2023 June 20].
60. Reproductive Care Program of Nova Scotia. Optimal health for women, babies and families: practice resources. RCP; 2019. Available from: <https://rcp.nshealth.ca/clinical-practice-guidelines>. [cited 2023 June 17].
61. Rourke L, Leduc D, Rourke J. Rourke Baby Record. RBR; 2020. Available from: <https://www.rourkebabyrecord.ca/default>. [cited 2023 May 5].
62. Métis Nation of Alberta. Health and climate change toolkit. Métis Nation of Alberta. Available from: <https://albertametis.com/health-and-climate-change-toolkit/>. [cited 2023 May 18].
63. Canadian Association of Nurses for the Environment. Radon assessment tool. CANE; 2023. Available from: <https://cane-aiee.ca/radontool/>. [cited 2023 July 10].

64. Health Canada. Wildfire smoke and your health: an information kit for partners and stakeholders. Health Canada. Available from: https://ipac-canada.org/photos/custom/Members/pdf/Information%20kit%20Wildfires%202023_EN.pdf. [cited 2023 May 10].
65. Barkin JL, Philipsborn RP, Curry CL, Upadhyay S, Geller PA, Pardon M, Dimmock J, Bridges CC, Sikes CA, Kondracki AJ, Buoli M. Climate change is an emerging threat to perinatal mental health. *J Am Psychiat Nurses*. 2024;30(3):683–9.
66. Woodhall-Melnik J, Grogan C. Perceptions of mental health and wellbeing following residential displacement and damage from the 2018 St. John river flood. *Int J Env Res Pub Health*. 2019;16(21):4174.
67. Bartlett C, Marshall M, Marshall A. Two-Eyed Seeing and other lessons learned within a co-learning journey of bringing together indigenous and mainstream knowledges and ways of knowing. *J Environ Stud Sci*. 2012;2(4):331–40.
68. National Collaborating Centre for Determinants of Health. Let's talk whiteness and health equity. NCCDH; 2020. Available from: <https://nccdh.ca/resources/entry/lets-talk-whiteness-and-health-equity>. [cited 2023 August 3].
69. Rasmussen SA, Jamieson DJ. Protecting pregnant people and babies from the health effects of climate change. *New Engl J Med*. 2022;387(11):957–9. <https://doi.org/10.1056/NEJMp2210221>.

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