

## Rapid Evidence Profile #30.2

(21 June 2022)

### Question

What are the biggest gaps in evidence – both overall and for equity-deserving groups – about:

- 1) the impacts of climate change on population health in Canada; and
- 2) adaptation and mitigation strategies that are applicable to Canada?

### What we found

To identify gaps in evidence about the impacts of climate change on population health in Canada and on adaptation and mitigation strategies applicable to Canada, we used data from a [living evidence synthesis](#) that identified 17,105 documents as of the end of 2021, as well as from Social Systems Evidence. See Box 1 for additional details about our approach. We organized documents that mentioned Canada or one or more Canadian provinces using the components of the framework from the [living evidence synthesis](#) related to health risks and impact (for part 1 of the question above) and options and responses to address climate change (for part 2 of the question above). The framework is provided below. In this update, we have categorized the single studies by the form of evidence they address (data analytics, modelling, evaluation, behavioural/ implementation research, and/or qualitative insights) and provide more detailed findings from systematic reviews related to the first question. If there is an opportunity to further extend this work in future, we would move beyond relying on the machine-learning based assignment of documents to public-health related topics, and manually assign documents to a mutually exclusive and collectively exhaustive list of public-health functions.

### **Organizing framework**

- Health risks and impacts
  - All-cause mortality
  - Chronic

### **Box 1: Our approach**

We identified evidence related to the question from the 17,105 documents included in a [living evidence synthesis](#) that used machine learning to map the global research on climate change and health. The dataset was last updated in December 2021. We added to the dataset – drawing from Social Systems Evidence and excluding duplicates – systematic reviews, rapid reviews or protocols for systematic reviews that mention Canada or a province in the title or abstract, and/or include at least one study conducted in Canada. Each of the 402 documents that mentioned Canada and/or one or more provinces and territories was assessed by one reviewer to ensure relevance to Canada, climate change, and public health. In this update, we also classified each of the included single studies according to the forms of evidence profiled in the [Evidence Commission report](#) (data analytics, modelling, evaluation, behavioural/implementation, and/or qualitative insights). The 6,433 documents that included one or more authors with a Canadian affiliation were used to derive a list of Canadian institutions and authors who had published one or more documents related to climate change and health, and the number of publications from each.

We appraised the methodological quality of full systematic reviews and rapid reviews using AMSTAR. Note that quality-appraisal scores for rapid reviews are often lower because of the methodological shortcuts that need to be taken to accommodate compressed time frames. AMSTAR rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to delivery, financial or governance arrangements within health systems or to broader domains like climate change.

This update to a rapid evidence profile was prepared in the equivalent of three days of a ‘full-court press’ by all involved staff.

- Heat stress
  - Thermal stress and comfort
  - Stroke
- Food and nutrition
  - Farmers and agriculture
  - Food insecurity
- Patients and health systems
  - Public health
  - Hospital admissions (note that this sub-element and the next two are not relevant to public health per se)
  - Patients
  - Visits to healthcare facilities
- Infectious diseases
  - Infectious diseases general
  - Viral diseases
  - Mosquito vector dynamics
  - Malaria
  - Dengue
  - Influenza
  - Hand, foot, and mouth disease (HFMD)
  - Leptospirosis
  - Cholera
- Maternal and child health
  - Child health
  - Birth and pregnancy
- Mental health
  - Mental health and post-traumatic stress disorder (PTSD)
  - Suicide
- Occupational health and injury
- Respiratory
  - Air pollution
  - Respiratory viruses
  - Pollen and allergies
  - Asthma
  - Fungal spores
- Water, sanitation and hygiene (WASH)
  - Drinking water quality
- Options and responses
  - Developing community resilience
  - Disaster risk reduction
  - Mitigation
    - Energy policy and co-benefits
    - Greenhouse pathways
  - Policies and practices that support adaptation

The living evidence synthesis included 395 documents that mentioned Canada and/or one or more provinces and territories, and we identified another seven potentially relevant evidence syntheses from Social Systems Evidence. As summarized in Table 1, we included 360 documents (29 evidence syntheses and 331 single studies), of which 290 address question 1 about health risks and impacts from

climate change (25 evidence syntheses and 265 single studies), and 101 address question 2 about options and responses to climate change (18 evidence syntheses and 83 single studies). The 29 evidence syntheses include one overview of systematic reviews, 19 systematic reviews, six scoping reviews, and three non-systematic reviews. We classified the 331 single studies as providing data analytics (n=209), qualitative insights (n=50), modelling (n=40), behavioural/implementation research (n=13), evaluations (n=12), and technology assessment/cost-effectiveness (n=4). We also identified an in-progress scoping review of reviews focused on climate change that will provide additional synthesized evidence once available. No guidelines were identified.

For each question, we provide a high-level profile of the available evidence. In addition, based on the included evidence syntheses, we provide a more in-depth summary of key findings, gaps identified in the evidence, and insights about equity-deserving groups in relation to health risks and impacts from climate change (Table 2), and about adaptation and mitigation strategies that are applicable to Canada and within the sphere of control and/or influence of public-health leaders (Table 3). We then provide a profile of Canadian producers of evidence about climate change and health by institution (Table 4) and by author (Table 5). Note that the profile of producers includes Canadian institutions and authors with a Canadian affiliation in any of the 17,105 documents included in the data from the [living evidence synthesis](#). A detailed summary of our methods is provided in Appendix 1, key findings from all of the included evidence syntheses (including those deemed of medium and low relevance) in Appendix 2, and the documents identified as addressing equity-deserving populations are provided in Appendices 3a (for health risks and impacts) and 3b (for evidence syntheses).

## **Profile of Canadian studies, and key findings and gaps in available evidence syntheses about health risks and impacts from climate change**

### *Profile of included Canadian studies*

We identified 265 single studies relevant to Canada, which we defined as mentioning either Canada and/or one or more provinces or territories in Canada. As can be seen in Table 1, in relation to the health risks and impacts in the organizing framework, the three most addressed by the Canadian literature are: 1) patients and health systems (50% of the articles, with most focused on public health); 2) respiratory (25% of all articles, with most focused on the role of air pollution); and 3) all-cause mortality (16% of all articles). Fewer studies focused on infectious diseases (10.5%), maternal and child health (7.9%), mental health (7.5%), chronic diseases (4.9%), food and nutrition (4.2%), occupation health and injury (4.2%), and water, sanitation, and hygiene (3.4%).

The most common forms of evidence provided in the single studies addressing this question were data analytics (67%), qualitative insights (12%), and modelling (11%). Fewer studies included evaluations (3.7%), behavioural/implementation research (3.4%), and technology assessment/cost-effectiveness (1.1%).

Regarding the climate hazards addressed, most of the included articles had a general focus on climate change (25.6%), heat (20%), and particulate matter (17%). Emissions, extreme weather events and wildfires were each addressed in 13% of the studies included. Other hazards such as cold and extreme temperatures (4.9%), floods (4.5%), drought (2.3%), and hurricanes (0.8%) were uncommonly considered in the single studies. We also found that 25% of the Canadian studies had a national focus, and five provinces were most commonly the focus of the rest of the included studies: 27% from Quebec, 23% from Ontario, 10% from Alberta, 8.7% from British Columbia and 3% from Nunavut. Five provinces and territories (Saskatchewan, Manitoba, New Brunswick, Nova Scotia and Prince Edward Island) were only addressed in 1% or less of the studies included, while Yukon, Northwest

Territories, and Newfoundland and Labrador were not considered in any single study included. These data are not presented in Table 1, but are available upon request.

Several notable gaps are apparent from the profile of single studies, which include:

- few single studies addressing risks and impacts of climate change on infectious diseases, maternal and child health, mental health, chronic diseases, food and nutrition, occupation health and injury, and water, sanitation, and hygiene;
- limited study in Canada of climate hazards such as cold and extreme temperatures, floods, drought and hurricanes;
- limited evidence in several provinces and territories (as outlined above); and
- limited efforts to address equity considerations overall, but also specifically in relation to considering the risks and impacts of climate change on unhoused and homeless persons, persons who use substances, infants, and sex and gender considerations.

Moreover, the forms of evidence available are unbalanced with most from data analytics and modelling studies, and few providing evaluations, behavioural/implementation research, technology assessment or cost-effectiveness studies, and guidelines.

#### *Key findings and main research gaps identified in evidence syntheses*

One [low-quality scoping review](#) found that changing climate conditions are negatively affecting the health and well-being of individuals in rural and remote regions. The increased prevalence and severity of extreme weather events, changes to sea ice, vegetation, fish, wildlife, weather and environmental uncertainties have health impacts such as poor nutrition, obesity, [vector-borne/waterborne/food-borne](#) diseases, cardiovascular diseases, respiratory issues, and [mental health issues](#), among others. In addition, two low-quality systematic reviews reported on the significant health risks and impacts of climate change on the physical and [mental health](#) of [Aboriginal communities](#) and [long-term evacuees](#). [Acute and short-term weather](#) such as storms, flooding, temperature and seasonality were linked to a range of psychological and mental health impacts including depression, anxiety, suicide, self-harm, post-traumatic stress disorder, psychological resilience, mental illness and behavioural disorders, and strong emotional reactions such as fear and anxiety. [Sub-acute and chronic weather](#) events and environmental changes were often linked to feelings of loss, worry, anger, sadness, and ongoing emotional distress, but were not directly linked to many of the more acute presentations of mental health distress such as suicide and depression. One medium-quality scoping review found that age, gender, time, and proximity to wildfires can have psychosocial impacts in [children, adolescents](#) and their families. Another [medium-quality systematic review](#) reported the health impacts of climate change and air-pollution exposures in older adults and immigrants living in Canada, as well as factors influencing risk and resilience in these populations.

One [low-quality systematic review](#) identified eight health morbidity and mortality indicators used (or that could be used) in Canada to quantify the impacts of climate change. These include indicators or morbidity-mortality related to general climate change, or specifically related to air pollution, heat and infectious disease.

Regarding food and nutrition, a [medium-quality systematic review](#) found that the effects of climate change on subsistence harvesting and other land-based activities, and the determinants of vulnerability and adaptation to such changes are well understood. However, the effects of climate change on health are less known. No evidence syntheses were focused on chronic diseases, occupational health and injury, or water, sanitation and hygiene.

The main research gaps and/or priorities for future research identified from the evidence syntheses include:

- lack of [consistent available data](#) across the country to assess/model health morbidity and mortality indicators;
- need for [disaggregated population-level data](#) that allows for conclusions to be drawn about which populations are most vulnerable to climatic change factors;
- lack of studies that help to understand potential effects of [prolonged versus short-term displacement](#), and the long-term repercussions of emergencies and disasters;
- need for more studies focusing on [children and adolescent](#) perspectives to expand the understanding of their psychosocial responses to wildfires and other climate hazards;
- limited population-level studies providing a longitudinal perspective on the effects of meteorological, seasonal and climactic changes on [Indigenous mental health](#); and
- lack of studies that evaluate [the impact of air pollution](#) on health, especially on the population living in rural areas, provinces other than Ontario and Quebec, and in the elderly and immigrants.

### *Insights about equity-deserving groups*

From the 290 studies included, we identified five systematic reviews and 42 single studies that focus on the health risks and impacts from climate change on equity-deserving populations. We adopt the acronym PROGRESS-Plus to describe characteristics across which health-equity considerations may be relevant. Findings from the documents included in this rapid evidence profile focused on the following equity-deserving populations (ordered by PROGRESS-plus characteristics): those living in the Arctic (or sub-arctic) (n=8), those living in rural and remote regions (n=6), Indigenous populations (n=17), gender/sex differences (n=4), low-socio-economic and materially deprived neighbourhoods (n=14), unhoused and homeless persons (n=2), persons who use substances (n=1), older adults (n=11), and infants (n=3). It should be noted that these groupings are not mutually exclusive as documents could have relevance to several equity-deserving groups. The greatest concentration of equity-focused literature on health risks and impacts related to public health (n=22), followed by hospital admissions (n=7) and food insecurity (n=5).

### **Profile of single studies, and key findings and gaps in available evidence syntheses about adaptation and mitigation strategies that are applicable to Canada and within the sphere of control and/or influence of public-health leaders**

#### *Profile of included Canadian studies*

We identified 81 single studies relevant to Canada (defined as mentioning either Canada and/or one or more provinces or territories in Canada). As can be seen in Table 1, in relation to options and responses to climate change in the organizing framework, the most frequent areas of focus are policy and practice (48%), mitigation (41% of all articles, with half focused on energy policy and co-benefits, and the other half in greenhouse and pathways), developing community resilience (25%), and disaster and risk reduction (7%).

The most common forms of evidence provided in the single studies addressing this question were qualitative insights (38%), data analytics (31%), modelling (12%), and behavioural/implementation research (11%). Few studies were intended for evaluation (5%) or technology assessment/cost-effectiveness (2.5%).

Regarding the climate hazards addressed, most of the articles had a general focus on climate change (44%). Other climate hazards such as heat, emissions, extreme weather, wildfires, and floods were each addressed in approximately 10% of the studies included. Other hazards such as particulate matter and drought were only considered in one and two studies, respectively, while hurricanes were not addressed in any of the single studies included for this question. We also found that 39.5% of the Canadian studies had a national focus, and four provinces were most commonly the focus of the rest of the included studies: 21% from Quebec, 11% from Alberta, 10% from British Columbia and 7.5% from Ontario. Seven provinces and territories (Saskatchewan, Manitoba, New Brunswick, Nova Scotia, Prince Edward Island, Northwest Territories and Nunavut) were only addressed by one paper, while Yukon and Newfoundland and Labrador were not considered in any of the included studies. These data are not presented in Table 1, but are available upon request.

Several notable gaps are apparent from the profile of single studies, which include:

- a lack of single studies addressing options and responses to climate change, as most of the studies included in this rapid evidence profile were focused on health risks and impacts;
- options and responses to climate hazards such as particulate matter and drought having not been deeply studied in Canada (although particulate matter was frequently addressed in single studies assessing health risks and impacts of climate change, but was not in relation to options and responses); and
- limited evidence in several provinces and territories (as outlined above).

As with the studies addressing health risks and impacts, we found an imbalance in the forms of evidence available, with few providing evaluations of interventions for climate change adaptation or mitigation strategies, behavioural/implementation research, technology assessment or cost-effectiveness studies, and guidelines.

#### *Key findings and main research gaps identified in evidence syntheses*

We identified 18 evidence syntheses (one overview of systematic reviews, 13 systematic reviews, three scoping reviews, and one non-systematic review) addressing options and responses to climate change, which are summarized in Table 3 according to key findings, gaps in evidence identified, and insights about equity-deserving groups. Syntheses are grouped into the four areas related to options and responses from the organizing framework: developing community resilience (n=2), mitigation (n=4), and policies and practices that support adaptation (n=14) (note that some evidence syntheses addressed more than one category). We did not identify evidence syntheses addressing options for disaster-risk reduction.

Key findings from a [low-](#) and a [medium-quality](#) evidence synthesis addressing developing community resilience mentioned that changing climate conditions is negatively affecting the health and well-being of individuals in rural and remote regions. It highlights the necessity of strategies that promote community resilience. Examples of strategies highlighted include [using multiple knowledge systems specific to socio-cultural contexts](#), supporting sustainable-development practices, enhancing risk communication and knowledge of climate change, and increasing community-based monitoring to address the [disproportionate food security and climate-change impacts experienced by Indigenous communities](#). One review mentioned that [measuring resilience is challenging](#) because concepts like food-system resilience have not been well-defined for climate change, and the relationships between resilience of food systems and climate change are complex.

Regarding mitigation responses, two systematic reviews ([one medium-](#) and [one low-quality](#)) showed a potential risk of a trade-off between accountability and efficiency. When decision-makers are using

policies that target the [private sector](#), they will [need to carefully balance practical and feasible policies with political pressures to deliver for stakeholders](#). One [low-quality systematic review](#) also mentioned the necessity of mitigation responses to face the public-health effects of long-term evacuees in Canada. Another [low-quality systematic review](#) focused on understanding the direct effects of policy instruments that target environmental problems and how these policies interact. It reported that: 1) policy instruments designed to control expenditure perform better than regulatory instruments; 2) policy instruments with voluntary reporting procedures are much less likely to be positively evaluated than those with mandatory reporting procedures; and 3) as the defined time frame of policies increases, the likelihood these policies will be positively evaluated for efficiency and process also increases.

We identified a greater number of systematic reviews addressing policies and practices that support adaptation (seven low quality, two medium quality, and one high quality). One [medium-quality systematic review](#) reported the most frequent adaptation activities identified in the studies included community-based programs, ecological restoration, knowledge sharing and learning platforms, changing crop types, and planting and harvesting practices. Those activities demonstrated improvement in at least one category of [effectiveness](#) (that is, they reduced risk and vulnerability, developed resilient social systems, improved the environment, increased economic resources, or enhanced governance and institutions). One high-quality systematic review specifically reported that [multi-pronged heat action plans](#) were highly effective in reducing heat-related mortality and morbidity, especially among vulnerable populations such as the elderly and those with chronic conditions. Additional systematic reviews focused on [other adaptation](#) activities such as: enhancing [risk communication](#) and [knowledge of climate change](#); regular population-health risk assessments and [risk-management](#) activities by local public-health units; development of community [adaptation plans](#); and awareness, research and networking activities implemented by civil society organizations (CSOs) that aim to build [adaptive capacity](#), principally in water contamination and air quality.

One [low-quality systematic review](#) identified and characterized Canadian federal, provincial, territorial, and municipal adaptation to health risks. The review found that federal health-adaptation initiatives emphasize capacity building and gathering information to address general health, infectious disease, and heat-related risks. The review identified variations in adaptation strategies adopted by provinces and territories. For instance, Quebec is a leader in climate change adaptation, addressing almost all risks posed by climate change in the province, and having implemented various adaptation types. Meanwhile, all other Canadian provinces and territories are in the early stages of adaptation. Moreover, the review notes that in a sample of six sampled Canadian regional health authorities (Calgary, Edmonton, Montreal, Ottawa, Toronto, Vancouver), adaptation initiatives were not reported.

One [low-quality systematic review](#) focused on the impacts of climate change on occupational health and safety suggested some adaptation strategies such as developing training tools to prepare workers for the health effects of climate change, developing protective clothing and other equipment for extreme climates, and developing methods to heighten workplace awareness of potential risks.

A [low-quality systematic review](#) focused on adaptations being employed by Inuit population in the Arctic to manage the risks of current climate change found that financial resources are an important component of the means to adapt, and are identified as one of the main barriers preventing adaptation from taking place. Many adaptations are costly and exceed the financial ability of households, communities, businesses, regional governments, and regional institutions. Other adaptation barriers are social-cultural in nature, including the erosion of traditional land skills among younger generations, weakening of sharing networks, and the cultural value of hunting and consuming certain [traditional foods](#) at certain times of the year.

### *Gaps in evidence identified by included evidence syntheses*

Eleven systematic reviews (six low quality and five medium quality) identified several research gaps, which can be grouped into three areas related to options and responses to address climate change. First, there is [limited focus of studies](#) that [evaluate the effectiveness of mitigation and adaptation strategies](#). This includes a lack of detail about the context in which efforts were undertaken, which makes it difficult to generate programs and frameworks, because the approaches to [measuring variables](#) such as risk perception and a willingness to act are [not cohesive](#) or consistent. Second, the need for research focused on the rationale, [design, implementation](#) and performance measurement of [private policy initiatives](#) was identified as another key gap in the literature. Lastly, the necessity of considering [vulnerable populations](#) was noted as a gap and as a priority for future research. Specifically, there is a need for studies providing gender-disaggregated data that facilitate the understanding of how women, men, and gender-diverse people may have different experiences with [community resilience options](#), mitigation, and [adaptation responses](#). Additional studies are needed that contribute to a better understanding of the full spectrum of community-based monitoring practice occurring within [Indigenous communities](#), the representation of [diverse types of knowledge](#) and expertise in designing [adaptation](#) strategies, and the health impacts of [long-term evacuees](#) in Canada.

### *Insights about equity-deserving groups*

We identified insights about equity-deserving groups in seven of the 18 evidence syntheses included in question 2. These seven syntheses focus on people living in the Arctic (or sub-Arctic) (n=1), those living in rural and remote regions (n=2), Indigenous populations (n=3), gender/sex differences (n=1), low-socio-economic and materially deprived neighborhoods (n=1), older adults (n=2), and people with physical disabilities (n=1).

One medium-quality systematic review reported that only one-third of the reviewed articles provided gender-disaggregated data. The authors highlighted the necessity of studies establishing the relationship between [climate, food, and gender](#), for planning and designing a community-based monitoring systems that reflect gender equity.

A [medium-quality systematic review](#) found that vulnerable communities such as low-income communities, the elderly, racial and ethnic minorities, and people with disabilities, face challenges in seeking and processing risk-communication information, including complex language, information overload and contradictory information.

One [high-quality scoping review](#) found that multi-pronged heat-action plans are highly effective in reducing heat-related mortality and morbidity, especially among vulnerable populations such as the elderly and those with chronic conditions.

Lastly, two low-quality systematic reviews reported several challenges faced by Inuit populations in the Arctic. For instance, key challenges identified included: the [substitution of traditional foods](#) for store foods when hunting areas are not accessible; altered timing, mode, and methods of subsistence activities; the erosion of traditional land skills among younger generations; weakening of sharing networks; the [cultural value](#) of hunting and consuming certain traditional foods at certain times of the year; and households often do not have access to the [capital resources](#) to purchase new hunting equipment to take advantage of new conditions or replace equipment lost or damaged in climate-related hunting accidents.

## **Producers of Canadian evidence about climate change and health**

Table 3 provides a list of 30 Canadian institutions that have been listed at least five times in any of the 17,105 publications identified in the [living evidence synthesis](#) (a full list of institutions was too long to include here, but is available upon request). The list includes groups located in 18 universities with the rest being federal or provincial government agencies (n=7), other arm's-length government-funded agencies (n=3), and groups within hospital research centres (n=2). This is accompanied by a list of 195 authors who appear in at least five publications and who listed at least one Canadian affiliation (a full list of authors was too long to include here, but is available upon request).



	Leptospirosis	-	-	-	-	-	-	-	-
Maternal & child health	Child health	-	13	-	6	-	8	1	1
	Birth & pregnancy	-	8	-	2	-	8	-	-
Mental health	Mental health & PTSD	1	17	1	7	-	1-	2	7
	Suicide	-	2	-	1	-	1	1	1
Occupational health & injury	Occupational health & injury	-	11	-	3	-	8	1	1
Respiratory	Air pollution	1	55	-	15	1	40	-	5
	Respiratory viruses	-	3	-	-	-	2	-	-
	Pollen & allergies	-	1	-	-	-	1	-	-
	Asthma	-	12	-	1	-	11	-	-
	Fungal spores	1	-	-	-	1	-	-	-
Water, sanitation and hygiene (WASH)	Drinking water quality	1	8	1	1	-	7	-	2
<b>Options and responses to address climate change (n=101)</b>									
Developing community resilience		2	20	2	12	0	8	2	6
Disaster risk reduction		-	6	-	3	-	3	-	-
Mitigation	Energy policy	1	17	1	5	0	12	-	2
	Greenhouse pathways	3	16	2	4	1	12	-	1
Policies and practices that support adaptation		14	39	7	16	7	23	9	16

\*Includes documents that mention Canada at the national level as at least part of the focus of the document

\*\*Includes documents that mention one or more Canadian provinces and territories as at least part of the focus of the document

**Table 2: Summary of key findings and gaps identified from included evidence syntheses about health risks and impacts that are applicable to Canada**

Area of focus		Key findings from included evidence syntheses	Gaps identified from included evidence syntheses	Insights about equity-deserving groups
Health risks and impacts with climate change	All-cause mortality (n=1)	<ul style="list-style-type: none"> <li>• One <a href="#">low-quality systematic review</a> identified eight health morbidity and mortality indicators used (or that could be used) in Canada to quantify the impacts of climate change:               <ul style="list-style-type: none"> <li>○ Excess daily all-cause mortality due to heat</li> <li>○ Premature deaths due to air pollution</li> <li>○ Preventable deaths from climate change</li> <li>○ Disability adjusted life years lost from climate change</li> <li>○ Daily all-cause mortality (trends associated with heat and air pollution)</li> <li>○ Daily non-accidental mortality (trends associated with heat and air pollution)</li> <li>○ West Nile disease incidence (in humans)</li> <li>○ Lyme borreliosis incidence (in humans)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Consistent availability of data</a> across the country to assess/model indicators and expertise, and human resources to continuously evaluate and modify the analysis</li> </ul>	<ul style="list-style-type: none"> <li>• None identified</li> </ul>
	Chronic (n=0)	<ul style="list-style-type: none"> <li>• No evidence syntheses identified</li> </ul>		
	Food and nutrition (n=1)	<ul style="list-style-type: none"> <li>• A <a href="#">medium-quality systematic review</a> found that the effects of climate change on subsistence harvesting and other land-based activities, and the determinants of vulnerability and adaptation to such changes are well understood; however, the effects of climate change on health are less known</li> </ul>		<ul style="list-style-type: none"> <li>• None identified</li> </ul>
	Patients and health systems (n=4)	<ul style="list-style-type: none"> <li>• A <a href="#">low-quality systematic review</a> identified some determinants related to constraining adaptive capacity and increasing sensitivity to climate change on Aboriginal health, among those:               <ul style="list-style-type: none"> <li>○ Poverty, technological capacity constraints, socio-political values and inequality, institutional capacity challenges, and information deficit</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• One low-quality systematic review reported a research gap on understanding potential effects of prolonged versus short-term displacement, and the long-term repercussions of emergencies and disasters in high-income countries</li> </ul>	<ul style="list-style-type: none"> <li>• Some factors constrain adaptive capacity and increase <a href="#">sensitivity to climate change on Aboriginal health</a>, including:               <ul style="list-style-type: none"> <li>○ Material conditions and behaviours</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ The magnitude and nature of these determinants are distributed unevenly within and between Aboriginal populations necessitating place-based and regional level studies to examine how these broad factors will affect vulnerability at lower levels</li> <li>● A <a href="#">low-quality scoping review</a> provided a list of criteria for vector-borne disease prioritization, and the most common categories of criteria included: public health impacts, economic or market impacts, animal health impacts (generally pertaining to market impacts, but also for animal-welfare), public perception and public health capacity to deal with a disease</li> <li>● A <a href="#">low-quality scoping review</a> found that changing climate conditions is negatively affecting the health and well-being of individuals in rural and remote regions, including: increased prevalence and severity of extreme weather events, changes to sea ice, vegetation, fish, wildlife, weather and environmental uncertainties <ul style="list-style-type: none"> <li>○ Health impacts of these include poor nutrition, obesity, vector-borne/waterborne/food-borne disease, cardiovascular disease, respiratory issues, and mental health issues, among others</li> </ul> </li> <li>● A <a href="#">low-quality systematic review</a> which explored the roles and responses of public health for long-term evacuees (LTEs) in Canada found that: <ul style="list-style-type: none"> <li>○ In Canada, most evacuations have lasted less than two weeks, but in some instances, people have been displaced for months or years</li> </ul> </li> </ul>		<p>associated with poverty will increase sensitivity and constrain adaptive capacity to climate change</p> <ul style="list-style-type: none"> <li>○ Surveillance and early warning capacity for those living in remote regions is underdeveloped for identifying emerging risks and vulnerable populations</li> <li>○ Comprehensive, reliable, and culturally specific health-assessment measures from which to assess climate change impacts are absent</li> <li>○ Access to health information, diagnosis, and treatment is insufficient for timely and effective intervention to manage climate-sensitive health outcomes</li> <li>○ The special rights and needs of Aboriginal peoples have often been neglected, resulting in continued and persistent</li> </ul>
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		<ul style="list-style-type: none"> <li>○ It is difficult to determine if there are public health effects of prolonged evacuation and to what extent</li> <li>○ Trends in the incidence of disasters and emergencies underscore the urgency of conducting more research to improve our understanding of prolonged displacement within Canada and in other high-income countries</li> </ul>		<p>inequality which exacerbates climate change health vulnerability</p> <ul style="list-style-type: none"> <li>● Institutions responsible for Aboriginal health are challenged by jurisdictional conflict and resource constraints, limiting the ability to identify and prepare for future risks and address inequalities</li> </ul>
Infectious (n=1)	<ul style="list-style-type: none"> <li>● One <a href="#">low-quality systematic review</a> found strong evidence for the association between climatic factors for food- and waterborne diseases, largely because of increased temperature and increased precipitation which raises the incidence of these diseases</li> <li>○ Some evidence was found for an expected increase in vector- and rodent-borne diseases as climate changes in temperature, precipitation, and changes to the length of seasons change the suitability, reproduction, distribution and abundance of vectors and rodents</li> </ul>	<ul style="list-style-type: none"> <li>● One <a href="#">low-quality systematic review</a> noted that because of the frequently aggregated, population-level data used in the included studies, it was difficult to draw conclusions regarding which populations were most vulnerable to climatic factors</li> <li>○ Additional gaps in knowledge include surveillance mechanisms to ensure risk of disease is appropriately and reliably calculated, and additional studies focused on confounding and intermediate factors, particularly for climatic effects of vector- and rodent-borne diseases</li> </ul>	<ul style="list-style-type: none"> <li>● A <a href="#">low-quality systematic review</a> examined the association between climatic factors and infectious disease in the arctic and sub-arctic regions and found strong evidence for the association between climatic factors for food- and waterborne diseases, largely as a result of increased temperature and increased precipitation which increases the incidence of these diseases</li> </ul>	
Maternal and child health (n=1)	<ul style="list-style-type: none"> <li>● A <a href="#">medium-quality scoping review</a> focused on studies assessing the psychosocial impacts of wildland fires on children, adolescents, and family functioning found that age, gender, time, and proximity to the wildfire can have an impact on both children and adolescents, while</li> </ul>	<ul style="list-style-type: none"> <li>● One <a href="#">medium-quality scoping review</a> reported the following research gaps: <ul style="list-style-type: none"> <li>○ Insufficient discussion of research questions or findings</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● None identified</li> </ul>	

		<p>behaviours of family members and home and property loss are important among families</p>	<p>within a larger disaster framework</p> <ul style="list-style-type: none"> <li>○ More studies focusing on children and adolescent perspectives of community factors would expand our understanding of their psychosocial responses to wildfires</li> <li>○ Investigators need to clearly outline differences between groups of participants and time periods post-event</li> <li>○ Family units (i.e., parents or surrogates with children) also need to be studied to gain information useful for programs needed to address the issues this group experiences post-fire</li> </ul> <ul style="list-style-type: none"> <li>● <a href="#">Authors</a> highlighted the lack of research that included children or adolescents' perspectives of domestic violence post-disaster</li> </ul>	
Mental health (n=2)		<ul style="list-style-type: none"> <li>● <a href="#">A medium-quality scoping review</a> focused on studies assessing the psychosocial impacts of wildland fires on children, adolescents, and family functioning found that age, gender, time, and proximity to the wildfire can have an impact on both children and adolescents, while behaviours of family members and home and property loss are important among families</li> <li>● One <a href="#">medium-quality systematic review</a> synthesized literature on the effects of meteorological, seasonal and climactic changes on Indigenous mental health, and found that:</li> </ul>	<ul style="list-style-type: none"> <li>● One <a href="#">medium-quality scoping review</a> reported the following research gaps: <ul style="list-style-type: none"> <li>○ Insufficient discussion of research questions or findings within a larger disaster framework</li> <li>○ More studies focusing on children and adolescent perspectives of community factors would expand our understanding of their</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Age, gender, time, and proximity to the <a href="#">wildfire can have an impact both on children and adolescents</a>, while behaviours of family members and home and property loss are important among families</li> <li>● There is some evidence to show that females report higher levels of</li> </ul>

		<ul style="list-style-type: none"> <li>○ Acute and short-term weather such as storms, flooding, temperature and seasonality were linked to a range of psychological and mental health impacts including depression, anxiety, suicide, self-harm, post-traumatic stress disorder, psychological resilience, mental illness and behavioural disorders, and strong emotional reactions such as fear and anxiety</li> <li>○ Sub-acute and chronic weather events and environmental changes were often, linked to feelings of loss, worry, anger, sadness, and ongoing emotional distress, but were not directly linked to many of the more acute presentations of mental health distress such as suicide and depression</li> <li>○ Climatic stressors did not need to be experienced directly to induce mental health impacts, but rather can be experienced through vicarious distress, whereby individuals fear or empathize with those experiencing intense weather or environmental conditions</li> <li>○ Climatic change was also found to disrupt place-attachment, which is critical for enabling Indigenous populations feelings of identity, self-worth and for strengthening interpersonal relationships and cultural practices</li> </ul>	<p>psychosocial responses to wildfires</p> <ul style="list-style-type: none"> <li>○ Investigators need to clearly outline differences between groups of participants and time periods post-event</li> <li>○ Family units (i.e., parents or surrogates with children) also need to be studied to gain information useful for programs needed to address the issues this group experiences post-fire</li> <li>● <a href="#">Authors</a> highlighted the lack of research that included children or adolescents' perspectives of domestic violence post-disaster</li> <li>● One <a href="#">medium-quality systematic review</a> focused on the effects of meteorological, seasonal and climactic changes on Indigenous mental health, and reported that very little of the included research were population-level studies or provided a longitudinal perspective</li> </ul>	<p>frustration, sadness, fear, anger, and helplessness in the face of climatic changes</p> <ul style="list-style-type: none"> <li>● Climactic changes were reported to compound existing feelings of abandonment of Indigenous peoples by government and the broader global community</li> </ul>
Occupational health and injury	<ul style="list-style-type: none"> <li>● No evidence syntheses identified</li> </ul>			
Respiratory (n=1)	<ul style="list-style-type: none"> <li>● One <a href="#">medium-quality scoping review</a> explored the reported health impacts of climate change and air pollution exposures in older adults and immigrant people living in Canada, as well as factors influencing risk and resilience in these populations, and found:</li> </ul>	<ul style="list-style-type: none"> <li>● One <a href="#">medium-quality scoping review</a> found the following research gaps: <ul style="list-style-type: none"> <li>○ There are substantial gaps in terms of the location of</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● The health impacts of climate change in rural populations and the specific factors that influence this relationship in Canada</li> </ul>	

		<ul style="list-style-type: none"> <li>○ That older adults in Canada experience health risks due to climate and air pollution exposures</li> <li>○ Little information about the climate- and air pollution-related health impacts experienced by immigrant communities</li> </ul>	<p>populations that have been studied</p> <ul style="list-style-type: none"> <li>○ The impact of climatic and air pollution variables on health was studied most frequently in southern Ontario and Quebec, but less in other provinces, especially in rural areas</li> <li>○ The Prairie and Maritimes provinces were largely understudied, with urban populations in Alberta being studied the most frequently within this group</li> <li>○ No studies in the territories were found, despite the fact that these northern regions are facing greater impacts from climate change</li> <li>○ Most publications were also set in urban areas, though some province-wide population studies included urban and rural residence indicators</li> </ul> <ul style="list-style-type: none"> <li>● The health impacts of climate change in rural populations and the specific factors that influence this relationship in Canada are largely undetermined for older adults and immigrants</li> </ul>	<p><a href="#"><u>are largely undetermined for older adults and immigrants</u></a></p>
	<p>Water, sanitation, and hygiene (WASH)</p>	<ul style="list-style-type: none"> <li>● No evidence syntheses identified</li> </ul>		

**Table 3: Summary of key findings and gaps identified from included evidence syntheses about adaptation and mitigation strategies that are applicable to Canada and within the sphere of control and/or influence of public-health leaders**

Area of focus		Key findings from included evidence syntheses	Gaps identified from included evidence syntheses	Insights about equity-deserving groups
Options and responses to address climate change	Developing community resilience (n=2)	<ul style="list-style-type: none"> <li>• One <a href="#">low-quality scoping review</a> mentioned that changing climate conditions is negatively affecting the health and well-being of individuals in rural and remote regions, including: increased prevalence and severity of extreme weather events; changes to sea ice; vegetation; fish, wildlife; and weather and environmental uncertainties</li> <li>• Adaptation strategies were identified as being needed to address these challenges, including:               <ul style="list-style-type: none"> <li>○ Using multiple knowledge systems, specific to socio-cultural context</li> <li>○ Addressing socio-cultural barriers</li> <li>○ Using innovative technology</li> <li>○ Improving and integrating public health and environmental surveillance</li> <li>○ Supporting sustainable-development practices</li> <li>○ Enhancing risk communication and knowledge of climate change</li> <li>○ Developing capacity of health systems to respond to the health impacts of climate change</li> </ul> </li> <li>• One <a href="#">medium-quality systematic review</a> reported an increasing interest in community-based monitoring (CBM), which is a strategy to address the disproportionate food security and climate change impacts often experienced by Indigenous communities globally               <ul style="list-style-type: none"> <li>○ Considering the history of unethical research conducted on and not with Indigenous communities, there is increasing demand for the recognition of Indigenous peoples' contributions and knowledge</li> <li>○ Community engagement is important for generating local ownership and understandings of environmental change, and to facilitate the development of local adaptation responses</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• One <a href="#">medium-quality systematic review</a> identified the following gaps:               <ul style="list-style-type: none"> <li>○ Lack of studies providing gender-disaggregated data, resulting in an incomplete understanding of how Indigenous women, men, and gender-diverse people may differentially participate in, and experience community-based monitoring</li> <li>○ The limited focus of studies on reporting evaluation findings</li> <li>○ The need of analyzing the grey literature to better understand the full spectrum of community-based monitoring practice occurring within Indigenous communities, especially of autonomous monitoring systems which may be investigated or evaluated outside of research and the published literature</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• One <a href="#">medium-quality systematic review</a> reported that only one third of the reviewed articles provided gender-disaggregated data; authors highlighted the necessity of studies establishing the relationship between climate, food, and gender, for planning and designing community-based monitoring systems that reflect gender equity</li> </ul>

		<ul style="list-style-type: none"> <li>○ Measuring resilience is challenging because the concept of food-system resilience has not been well defined for climate change, and the links between resilience of food systems and climate change are not straight forward</li> </ul>		
Disaster risk reduction (n=0)		<ul style="list-style-type: none"> <li>• No evidence syntheses identified</li> </ul>		
Mitigation (n=3)		<ul style="list-style-type: none"> <li>• One <a href="#">low-quality systematic review</a> reported the difficulty in determining if and to what extent the public-health effects of prolonged evacuation and the public-health needs of long-term evacuees (LTEs) in Canada are being assessed, monitored, and addressed</li> <li>• One <a href="#">medium-quality systematic review</a> that focused on the use of alternative fuels in cement manufacturing found that energy recovery in cement manufacturing is one of the best end-of-life options, even though the performance in resource consumption and conservation, and metal and hazardous air pollutant emissions can be worse than for other end-of-life options, such as recycling</li> <li>• One <a href="#">low-quality systematic review</a> focused on understanding the direct effects of policy instruments that target environmental problems and how these policies interact, reported the following key findings: <ul style="list-style-type: none"> <li>○ A potential risk of a trade-off between accountability and efficiency depending on a policy instrument's source of authority; this indicates that decision-makers using policies that target the private sector must carefully balance a need for practical and feasible policies against the threat of becoming captured by these interests</li> <li>○ Expenditure instruments perform better than regulatory instruments in overall and impact evaluations</li> <li>○ Policies with built-in flexibility are more likely to have positive overall, process and efficiency evaluation results</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Trends in the incidence of disasters and emergencies underscore the urgency of conducting more research to improve our understanding of <a href="#">prolonged displacement</a> within Canada and in other high-income countries</li> <li>• Academic papers focused on the use of <a href="#">alternative fuels in cement manufacturing</a> did not discuss health or social impacts, and economic impacts were investigated for few end-of-life options</li> <li>• More research is needed to examine the leaders in the water management field to understand <a href="#">what works and does not work</a> for adapting to climate change in different coastal and fresh-water systems</li> <li>• It is also important to study the emerging nexus between water and energy, for instance, countries that experienced water's significance first-hand during droughts, can bring acute electricity blackouts and energy rationing to the populous, and this risk also exists in other power generation sources, <a href="#">such as nuclear energy</a></li> <li>• The need for primary research with business on the rationale, design, implementation and performance measurement of <a href="#">private policy</a></li> </ul>	<ul style="list-style-type: none"> <li>• None identified</li> </ul>

		<ul style="list-style-type: none"> <li>○ Policy instruments with voluntary reporting procedures are much less likely to be positively evaluated than those with mandatory reporting procedures</li> <li>○ There is a possible trade-off between environmental effectiveness and cost-effectiveness depending on the stage of activity that a policy targets</li> <li>○ As the defined time frame of policies increases, the likelihood these policies will be positively evaluated for efficiency and process also increases</li> </ul>	<p>initiatives; similarly, primary research examining a wider swath of policies would help verify that expenditure policies fare better than regulation in overall evaluations</p>	
	<p>Policies and practices that support adaptation (n=9)</p>	<ul style="list-style-type: none"> <li>● One <a href="#">high-quality scoping review</a> reporting effective population-level heat-related interventions found that: <ul style="list-style-type: none"> <li>○ Heat-action plans might include establishing heat monitoring systems, information campaigns, mobilization of healthcare professionals, volunteers, social workers and trained caregivers in the surveillance, and management of individuals with known vulnerabilities</li> <li>○ Other action plans addressed education and awareness campaigns</li> </ul> </li> <li>● Multi-pronged heat-action plans were highly effective in reducing heat-related mortality and morbidity, especially among vulnerable populations such as the elderly and those with chronic conditions</li> <li>● One <a href="#">medium-quality systematic review</a> reported which adaptation activities are most frequently represented, which include community-based programs, ecological restoration, knowledge sharing and learning platforms, and changing crop types and planting and harvesting practices <ul style="list-style-type: none"> <li>○ While these activities demonstrated improvement in at least one category of effectiveness (that is, they reduced risk and vulnerability, developed resilient social systems, improved the environment, increased economic resources, or enhanced governance and institutions), several activities indicated <a href="#">effectiveness across multiple categories</a></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● It is necessary for more research addressing issues of justice, including representation of diverse <a href="#">types of knowledge and expertise</a>, fair distribution of adaptation benefits, and imbalanced power relationships within the adaptation process</li> <li>● Research and evaluation offer techniques to reveal issues in <a href="#">leadership, decision-making</a>, access, and profit, and to monitor progress towards developing more equitable adaptation practices</li> <li>● Assessments of <a href="#">heat-health vulnerabilities</a> require projections of the future frequency and severity of extreme heat events, information related to the geographical variation in exposure to extreme heat, identification of vulnerable populations, and identification of actual temperature and morbidity/mortality thresholds</li> <li>● Public-health interventions that may be implemented to reduce climate change impacts on health within <a href="#">relevant time scales</a> (five to 10 years) need to be identified through assessments</li> </ul>	<ul style="list-style-type: none"> <li>● <a href="#">Vulnerable communities</a> such as low-income communities, the elderly, racial and ethnic minorities, and people with disabilities, face challenges in seeking and processing risk communication information, including complex language, information overload and contradictory information</li> <li>● A <a href="#">low-quality systematic review</a> reported several adaptations documented as being employed by Inuit population in the Arctic to manage the risks of current climate change, among those: <ul style="list-style-type: none"> <li>○ The substitution of traditional foods for store foods when hunting areas are not accessible</li> <li>○ Altered timing, mode, and methods of subsistence activities</li> <li>○ The establishment of community evacuation</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>• One <a href="#">low-quality systematic review</a> suggests the following adaptation strategies: identify and evaluate adaptation methods; develop training tools to prepare workers for the health effects of climate change; develop protective clothing and other equipment for extreme climates; explore adaptation methods using organization of work and work schedule management; and develop methods to heighten workplace awareness of potential risks</li> <li>• A <a href="#">low-quality systematic review</a> identified the following adaptation strategies needed to address climate change challenges: <ul style="list-style-type: none"> <li>○ Using multiple knowledge systems, specific to socio-cultural context</li> <li>○ Addressing socio-cultural barriers</li> <li>○ Using innovative technology</li> <li>○ Improving and integrating public-health and environmental surveillance</li> <li>○ Supporting sustainable development practices</li> <li>○ Enhancing risk communication and knowledge of climate change</li> <li>○ Developing capacity of health systems to respond to the health impacts of climate change</li> </ul> </li> <li>• One <a href="#">low-quality systematic review</a> that aimed to identify and characterize Canadian federal, provincial, territorial, and municipal adaptation to health risks found that federal health-adaptation initiatives emphasize capacity building and gathering information to address general health, infectious disease and heat-related risks <ul style="list-style-type: none"> <li>○ Provincial and territorial adaptation is varied (e.g., Quebec is a leader in climate change adaptation, addressing almost all risks posed by climate change in the province, and having implemented various adaptation types, but all other Canadian provinces and territories are in the early stages of health adaptation)</li> <li>○ Six sampled Canadian regional health authorities (Calgary, Edmonton, Montreal, Ottawa, Toronto, Vancouver) did not report any adaptation initiatives</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• It is necessary for more research in adaptations to <a href="#">flooding and extreme heat</a></li> <li>• It is necessary for more research that considers adaptations for <a href="#">vulnerable groups</a></li> <li>• The <a href="#">literature is context specific</a> and difficult to use to generate programs and frameworks because the approaches to measuring variables such as risk perception and a willingness to act are not cohesive or consistent</li> <li>• Lack of evaluation of current <a href="#">risk-communications</a> strategies, especially poor integration of community-led initiatives in future planning, often because such initiatives were not properly evaluated</li> <li>• Future research might <a href="#">include families</a> and various intimate social groupings as a starting point in theoretical frameworks, and allow analysis of household dynamics as they pertain to preparedness activity for climate change risks</li> <li>• Studies lack detailed <a href="#">policy analysis</a> and often present adaption responses as part of ‘wish lists’</li> <li>• No published studies have undertaken <a href="#">cost benefit</a></li> <li>• Few publications report on <a href="#">adaptations in health</a>, cultural and education, or economy and business sectors</li> <li>• There needs to be more research to understand the policy implications of either allowing municipalities, the provinces and territories, or the federal government to take the lead</li> </ul>	<p>and preparedness plans in case of extreme events</p> <ul style="list-style-type: none"> <li>○ The development of new ice-based transportation routes to avoid dangerous areas</li> <li>○ The strengthening of municipal infrastructure to cope with altered climatic extremes</li> <li>○ The development of youth–elder mentoring programs to transmit traditional knowledge on environmental risks</li> </ul> <ul style="list-style-type: none"> <li>• Some adaptation barriers are <a href="#">social–cultural</a> in nature including the erosion of traditional land skills among younger generations, weakening of sharing networks, and the cultural value of hunting and consuming certain traditional foods at certain times of the year</li> <li>• <a href="#">Multi-pronged heat-action</a> plans were found highly effective in reducing heat-related mortality and morbidity, especially among vulnerable populations such as the elderly and those with chronic conditions</li> </ul>
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		<ul style="list-style-type: none"> <li>• One <a href="#">low-quality systematic review</a> found that regular population-health risk assessments and risk-management activities by local public-health units can help to address risks related to climate hazards</li> <li>• One <a href="#">low-quality systematic review</a> found that adaptations being implemented by civil society organizations (CSOs) in Canada consist predominantly of groundwork interventions including awareness, research and networking activities that aim to build adaptive capacity <ul style="list-style-type: none"> <li>○ Adaptations most frequently address water contamination and air quality, and occur most often as awareness-raising and research activities</li> <li>○ Adaptations infrequently recognize vulnerable groups or climate change as a motivator</li> <li>○ While water contamination and air quality are commonly addressed, extreme heat, which is widely acknowledged as a key vulnerability facing Canadians in a changing climate, is reported in fewer than 2% of initiatives</li> <li>○ Similarly, flooding is another key vulnerability yet is addressed in fewer than 7% of actions</li> </ul> </li> <li>• One <a href="#">medium-quality systematic review</a> focused on practices for risk communication, found that the most common practices were public-media campaigns, including radio and internet-based messages, and organization or expert-led presentations or workshops to communities affected by natural hazards <ul style="list-style-type: none"> <li>○ Within Ontario, communication activities such as promotional messaging, response guidelines, and heat alerts and warning systems were typical risk communication tools used in practice</li> <li>○ Self-efficacy and feelings of adequate preparedness were positively correlated with risk reduction behaviours in communities at high risk for wildfires</li> <li>○ People were more aware of extreme weather risks and more likely to initiate protective activities if they were involved in a participatory exercise</li> </ul> </li> </ul>	<p>on <a href="#">direct potable reuse</a> policies and implementation</p> <ul style="list-style-type: none"> <li>• Specifically for the Arctic, <a href="#">one medium-quality systematic review</a> identified several gaps in different fields, which are summarized in the remaining points below</li> <li>• Infrastructure and transportation <ul style="list-style-type: none"> <li>○ Limited published research exists on the vulnerability of municipal infrastructure (e.g., community drinking water, waste management, buildings), industry-related infrastructure, including mine sites, ice roads, and shipping access, permafrost thaw and other landscape hazards, and extreme weather (except for southern Baffin)</li> <li>○ Studies that examine sensitivity and capacity to adapt to future climate change are typically speculative in nature, and these topics are not the primary focus of the research being reported on</li> </ul> </li> <li>• Health and well-being <ul style="list-style-type: none"> <li>○ There are significant gaps in understanding climate change impacts on health and well-being in the eastern and central Canadian Arctic</li> <li>○ Mental health is largely neglected in the scholarship, despite the disproportionate rates of suicide and other mental health issues in the North and rapid acculturation that is likely to increase sensitivity to such impacts</li> <li>○ Vector-, food- and waterborne diseases (e.g., E. coli, salmonella, trichinella, brucellosis) that could</li> </ul> </li> </ul>	
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		<p>overburden citizens with technical information, but at the same time, should not withhold information because experts feel the public may lack the knowledge or understanding to provide accurate feedback</p> <ul style="list-style-type: none"><li>• This review also suggested that <a href="#">post-secondary education</a> should do more to focus on curricula that includes alternative energy models and policy solutions</li></ul>	<ul style="list-style-type: none"><li>○ As with the other sectors, future dimensions of vulnerability have been less examined, despite ample evidence for substantial disruption with changing ice regimes and animal populations</li><li>• The wildlife-management literature has been the most forward looking, although future social-economic trends have not been comprehensively assessed</li></ul>	
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**Table 3: Canadian institutions with publications relevant to climate change and health**

Institutions	Number of affiliation mentions in articles*	Percent
McGill University	194	3.02
University of Toronto	148	2.30
University of British Columbia	128	1.99
University of Guelph	119	1.85
University of Alberta	98	1.52
Health Canada	97	1.51
Dalhousie University	86	1.34
McMaster University	80	1.24
Institut National de Santé Publique du Québec	64	0.99
British Columbia Centre for Disease Control	62	0.96
University of Laval	59	0.87
Hamilton Health Sciences, Population Health Research Institute	57	0.89
Public Health Agency Canada	56	0.87
Public Health Ontario	49	0.76
University of Ottawa	43	0.67
Western University	37	0.58
Institute of Clinical and Evaluative Sciences	49	0.76
University of Montreal	30	0.47
Simon Fraser University	29	0.45
Institute National Recherche Scientifique, Eau Terre Environnement Research Centre	23	0.36
Carleton University	22	0.34
Montreal Heart Institute	18	0.28
Concordia University	15	0.23
University of Waterloo	15	0.23
University Regina	14	0.22
Environment and Climate Change Canada	13	0.20
Environment Canada, Atmospheric Science and Application Unit	12	0.19
Ontario Agency of Health Protection and Promotion	11	0.17
Ryerson University	11	0.17
University of Calgary	10	0.16

\*Note that this column provides the total number of mentions of an institution in the articles identified, and includes articles that have two or more mentions of the same affiliation

**Table 4: Canadian authors of publications relevant to climate change and health**

Author	Affiliation	Number of publications	Percent of contribution to all Canadian publications
Gosselin, Pierre	Ouranos & Univ Laval, Inst Natl Sante Publ Quebec, Quebec City, PQ G1V 5B3, Canada.	97	1.51
Henderson, Sarah B.	Univ British Columbia, Sch Populat & Publ Hlth, Vancouver, BC V5Z 1M9, Canada.	65	1.01
Smargiassi, Audrey	Univ Montreal, Sch Publ Hlth, Dept Environm & Occupat Hlth, Montreal, PQ, Canada.	59	0.92
Lavigne, Eric	Univ Ottawa, Interdisciplinary Sch Hlth Sci, Ottawa, ON, Canada.	54	0.84
Harper, Sherilee L.	Univ Guelph, Dept Populat Med, Guelph, ON N1G 2W1, Canada.	50	0.80
Auger, Nathalie	Univ Montreal, Dept Social & Prevent Med, Montreal, PQ H3C 3J7, Canada.	45	0.70
Ford, James D.	McGill Univ, Dept Geog, Montreal, PQ, Canada.	44	0.70
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Vélez CM, Waddell K, Berrang-Ford L, Callaghan M, Minx J, Harper S, Lavis JN, Wilson MG. Rapid evidence profile #30.2: What are the biggest gaps in evidence about the impacts of climate change on population health in Canada, and adaptation and mitigation strategies that are applicable to Canada? Hamilton: McMaster Health Forum, 21 June 2022.

To help health- and social-system leaders as they respond to pressing challenges related, the McMaster Health Forum prepares rapid evidence profiles like this one. This rapid evidence profile was commissioned by the Office of the Chief Science Officer, Public Health Agency of Canada. The opinions, results, and conclusions are those of the McMaster Health Forum and are independent of the funder. No endorsement by the Public Health Agency of Canada is intended or should be inferred.



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## **Appendices for COVID-19 Rapid Evidence Profile #30.2**

(21 June 2022)

### **Appendix 1: Methodological details**

#### **Identifying research evidence**

To identify gaps in evidence about the impacts of climate change on population health in Canada and on adaptation and mitigation strategies applicable to Canada, we used data from a [living evidence synthesis](#) that identified 17,105 documents as of the end of 2021. Of these documents, 402 mentioned Canada and/or one or more province in the title or abstract, and/or included at least one study conducted in Canada. Each of the 402 documents were assessed by a single reviewer to ensure relevance to Canada, climate change, and public health. In addition, each of the included single studies were categorized by one reviewer according to the forms of evidence profiled in the [Evidence Commission report](#) (data analytics, modelling, evaluation, behavioural/implementation, and/or qualitative insights).

We supplemented this dataset by drawing on Social Systems Evidence and excluding duplicates that had already been included from the living evidence synthesis. In Social Systems Evidence, we used filters under programs and services for “climate action,” “environmental conservation,” “food safety and security,” and “natural resources.” We combined these with key words searches for “climate change” AND (health OR public health) and required that the documents mentioned Canada and/or one or more studies was conducted in Canada. A single reviewer assessed these documents for inclusion to ensure they related to climate change and public health.

#### **Searching and triaging process to identify and include equity-relevant evidence**

We draw on WHO’s definition of equity and health equity, defining equity as the absence of avoidable, unfair, or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically, or by other means of stratification. Health equity implies that everyone should have a fair opportunity to attain their full health potential and that no one should be disadvantaged from achieving this potential.

To identify documents that include an equity focus, we compiled key words across 10 equity-related search strings or filters identified in the literature or through recognized library and information science organizations. In addition to terms describing PROGRESS-Plus (acronym used to describe the many dimensions across which health equity may exist), we also included an ethics-specific filter, developed by the Health Technology Assessment division of the Institut national de l’excellence en santé et services sociaux (INESSS). Our final list included 243 unique keywords addressing various equity-related terms.

We individually searched for each keyword in the titles and abstracts of all included documents. Documents were screened by a single reviewer.

## Assessing relevance and quality of evidence

We assess the relevance of each included evidence document as being of high, moderate or low relevance to the question. We then use a colour gradient to reflect high (darkest blue) to low (lightest blue) relevance.

Two reviewers independently appraised the methodological quality of systematic reviews and rapid reviews that are deemed to be highly relevant. Disagreements are resolved by consensus with a third reviewer if needed. AMSTAR rates overall methodological quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. High-quality reviews are those with scores of eight or higher out of a possible 11, medium-quality reviews are those with scores between four and seven, and low-quality reviews are those with scores less than four. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to health-system arrangements or to economic and social responses to COVID-19. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, a review that scores 8/8 is generally of comparable quality to a review scoring 11/11; both ratings are considered 'high scores.' A high score signals that readers of the review can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8.

## Preparing the profile

Each included document is hyperlinked to its original source to facilitate easy retrieval. For all included guidelines, systematic reviews, rapid reviews and single studies (when included), we prepare declarative headings that provide a brief summary of the key findings and act as the text in the hyperlink. Protocols and titles/questions have their titles hyperlinked given that findings are not yet available. We then draft a brief summary that highlights the total number of different types of highly relevant documents identified (organized by document), as well as their key findings, date of last search (or date last updated or published), and methodological quality.

**Appendix 2: Key findings from evidence syntheses that address the question, organized by document type and sorted by relevance to the question**

Type of document	Relevance to question	Key findings	Recency or status
Scoping review	<ul style="list-style-type: none"> <li>• Climate risks               <ul style="list-style-type: none"> <li>○ Heat</li> </ul> </li> <li>• Health risks and impacts               <ul style="list-style-type: none"> <li>○ All-cause mortality</li> </ul> </li> <li>• Options and responses               <ul style="list-style-type: none"> <li>○ Policy and practice                   <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups               <ul style="list-style-type: none"> <li>○ Elderly</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This review focused on the negative consequences of extreme temperatures on the environment, ecosystem, and human health, especially heat-related illnesses</li> <li>• The review synthesized effective population-level heat-related interventions from 17 studies</li> <li>• Heat action plans included but were not limited to establishing a heat monitoring system, informative campaigns, the mobilization of healthcare professionals, volunteers, social workers and trained caregivers in the surveillance, and management of individuals with known vulnerabilities</li> <li>• Other action plans addressed education and awareness campaigns</li> <li>• Multi-pronged heat action plans were highly effective in reducing heat-related mortality and morbidity, especially among vulnerable populations such as the elderly and those with chronic conditions</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 7/9)</p>	Literature last searched 2020
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks               <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts               <ul style="list-style-type: none"> <li>○ Food and nutrition                   <ul style="list-style-type: none"> <li>▪ Food insecurity</li> </ul> </li> </ul> </li> <li>• Options and responses               <ul style="list-style-type: none"> <li>○ Developing community resilience</li> </ul> </li> <li>• Equity-deserving groups               <ul style="list-style-type: none"> <li>○ Indigenous</li> <li>○ Women and gender-diverse people</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This review synthesized 86 articles focused on the global trends and future actions for community-based monitoring of Indigenous food security</li> <li>• Authors reported an increasing interest in community-based monitoring (CBM) and explained this increase in interest as part of a broader trend around the need to address the disproportionate food security and climate change impacts often experienced by Indigenous communities globally</li> <li>• One third of the reviewed articles provided gender-disaggregated data; authors recommend a better understanding of the gendered nature of CBM, as well as the relationship between climate, food and gender, for planning and designing a CBM system that reflects gender equity</li> <li>• Considering the history of unethical research conducted on and not with Indigenous communities, there is increasing demand for the recognition of Indigenous peoples'</li> </ul>	Literature last searched 2018

		<p>contributions and knowledge in the context of research, including climate change research</p> <ul style="list-style-type: none"> <li>• Successful CBM generally occurs when Indigenous communities monitor things they personally connect with and care about, rather than for externally driven needs</li> <li>• Community engagement is also important for generating local ownership and understandings of environmental change, and to facilitate the development of local climate change adaptation responses</li> <li>• It is likely that monitoring is carried out without documentation in the published literature, as many Indigenous communities often monitor environmental changes and the health of their land</li> <li>• In studies where the food-security pillar was specified, CBM typically focused on food availability and access</li> <li>• Measuring resilience is challenging because the concept of food-system resilience has not been well defined for climate change, and the links between resilience of food systems and climate change are not straight forward; moreover, limited conceptual tools and frameworks are available to guide such assessments</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• Lack of studies providing gender-disaggregated data, resulting in an incomplete understanding of how Indigenous women, men, and gender-diverse people may differentially participate in, and experience CBM</li> <li>• The limited focus on reporting evaluation findings</li> <li>• Analyzing the grey literature is recommended for future research to better understand the full spectrum of CBM practice occurring within Indigenous communities, especially of autonomous monitoring systems which may be investigated or evaluated outside of research and the published literature</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 4/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Mitigation co-benefits <ul style="list-style-type: none"> <li>▪ Energy policy and co-benefits</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This systematic review synthesized 204 studies to understand how and whether characteristics of environmental problems influence the effectiveness of policy instruments, as well as to understand the possible trade-offs between cost-effectiveness, solving the environmental problems and government accountability</li> </ul>	Literature last searched 2011

		<ul style="list-style-type: none"> <li>• Authors found that there is the potential risk of a trade-off between accountability and efficiency depending on a policy instrument's source of authority; this indicates that decision-makers using policies that target the private sector must carefully balance a need for practical and feasible policies against the threat of becoming captured by these interests</li> <li>• Expenditure instruments perform better than regulatory instruments in overall and impact evaluations</li> <li>• Policies with built-in flexibility are more likely to have positive overall, process and efficiency evaluation results</li> <li>• Policy instruments with voluntary reporting procedures are much less likely to be positively evaluated than those with mandatory reporting procedures</li> <li>• There is a possible trade-off between environmental effectiveness and cost-effectiveness depending on the stage of activity that a policy targets</li> <li>• As the defined time frame of policies increases, the likelihood these policies will be positively evaluated for efficiency and process also increases</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• More research is needed to examine the leaders in the water-management field to understand what works and does not work for adapting to climate change in different coastal and fresh-water systems <ul style="list-style-type: none"> <li>○ It is also important to study the emerging nexus between water and energy, for instance, countries that experienced water's significance first-hand during droughts, can bring acute electricity blackouts and energy rationing to the populous, and this risk also exists in other power generation sources, such as nuclear energy</li> <li>○ Thermal power production across Canada in 2005 consumed 64 percent of national gross water use, underscoring its high reliance on water and the close connection of water and energy</li> </ul> </li> <li>• The need for primary research with business on the rationale, design, implementation and performance measurement of private policy initiatives; similarly, primary research examining a wider swath of policies would help verify that expenditure policies fare better than regulation in overall evaluations</li> <li>• <a href="#">Source</a> (AMSTAR rating 2/9)</li> </ul>	
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<p>Systematic review</p>	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Arctic inhabitants</li> <li>○ Indigenous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This systematic review, which synthesized 117 articles, focused on the current knowledge about human dimensions of climate change in the Canadian Arctic</li> <li>• Authors found that the effects of climate change on subsistence harvesting and other land-based activities, and the determinants of vulnerability and adaptation to such changes are well understood; however, the effects of climate change on health are less known</li> <li>• Studies on food security and personal safety dominate, and little peer-reviewed scholarship focuses on the business and economic sector</li> <li>• Published research shows a strong bias toward case studies in smaller communities, especially communities in Nunavut, with studies focused primarily on negative impacts of climate change, present-day vulnerabilities, and adaptive capacity</li> <li>• Studies proposing opportunities for adaptation intervention are beginning to emerge</li> <li>• Authors highlighted the adaptability of northern populations and the effects of economic-political stresses on vulnerability to changing climate</li> <li>• There is a lack of studies that examine how Northerners can benefit from new opportunities that may arise from climate change, or assess how the interaction of future climatic and socio-economic changes (specifically, resource development and enhanced shipping) will affect their experience of and response to climate change, or discuss the broader determinants of vulnerability and adaptation</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• Infrastructure and Transportation <ul style="list-style-type: none"> <li>○ Broader vulnerabilities in the infrastructure and transportation sector have been neglected</li> <li>○ Only limited published research exists on the vulnerability of municipal infrastructure (e.g., community drinking water, waste management, buildings), industry-related infrastructure, including mine sites, ice roads, and shipping access, permafrost thaw and other landscape hazards, and extreme weather (except for southern Baffin)</li> <li>○ Studies that examine sensitivity and capacity to adapt to future climate change are typically speculative in nature,</li> </ul> </li> </ul>	<p>Published September 2012</p>
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		<p>and these topics are not the primary focus of the research being reported on</p> <ul style="list-style-type: none"><li>○ Community-based studies have not included shipping and resource development, which are major factors affecting vulnerability and adaptation in Arctic communities</li><li>● Health and well-being<ul style="list-style-type: none"><li>○ There are significant gaps in understanding climate change impacts on health and well-being in the eastern and central Canadian Arctic</li><li>○ Mental health is largely neglected in the scholarship, despite the disproportionate rates of suicide and other mental health issues in the North, and rapid acculturation that is likely to increase sensitivity to such impacts</li><li>○ Vector-, food- and waterborne diseases (e.g., E. coli, salmonella, trichinella, brucellosis) that could become more problematic with climate change have been largely overlooked</li><li>○ Few food security projects have examined potential risks or opportunities associated with environmental changes</li><li>○ Little research has examined how changing species availability might affect future food-sharing networks that structure who gets what and when</li></ul></li><li>● Business and economy<ul style="list-style-type: none"><li>○ Only 11% of the articles reviewed here focus on the business and economy sector</li><li>○ Few studies have examined opportunities for shipping and how they should be managed to take advantage of its potential for significant economic benefits</li><li>○ Few independent studies in the peer-reviewed scholarship have tried to determine the socio-economic and environmental impacts of mineral extraction on surrounding communities, and their implications (positive or negative) for climate vulnerability and adaptation</li><li>○ Few studies examine how market conditions, transportation access, government policy, or international regulations will affect vulnerability and adaptation in the eastern and central Canadian Arctic</li><li>○ No projects reviewed examined opportunities and challenges for the changing of cultural traditions regarding the selling or buying of traditional foods towards creating</li></ul></li></ul>	
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		<p>economic opportunity and reinvestment for supporting traditional ways</p> <ul style="list-style-type: none"> <li>• Culture and education <ul style="list-style-type: none"> <li>○ It is necessary for more research about the potential mental health ramifications of cultural impacts of climate change in the Arctic</li> <li>○ There is an absence of scholarship comprehensively examining how the cultural dimensions of climate change might evolve in the future considering climate projections and socio-economic change</li> <li>○ Many questions remain unanswered: will larger regional communities with their strong and growing wage-based economies be as vulnerable as smaller communities to the cultural implications of climate change?; are non-Inuit residents susceptible to similar cultural effects?; would reduced reliance on subsistence hunting reduce sensitivity to potential cultural impacts?; and as northern self-determination proceeds, will communities feel better prepared to address the cultural effects of climate change?</li> </ul> </li> <li>• Hunting and subsistence harvesting <ul style="list-style-type: none"> <li>○ As with the other sectors, future dimensions of vulnerability have been less examined, despite ample evidence for substantial disruption with changing ice regimes and animal populations</li> <li>○ The wildlife-management literature has been the most forward looking, although future social-economic trends have not been comprehensively assessed</li> <li>○ Resource development could have significant implications for wildlife management, through its effects on populations, by altering socio-economic characteristics of communities, and in other ways that have not been examined</li> </ul> </li> </ul> <p><a href="#">Source</a> (AMSTAR rating 4/9)</p>	
Scoping review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Particulate matter</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Respiratory <ul style="list-style-type: none"> <li>▪ Air pollution</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Developing community resilience</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The objective of this review was to explore the reported health impacts of climate change and air pollution exposures in older adults and immigrant people living in Canada, as well as factors influencing risk and resilience in these populations</li> <li>• Authors identified 52 eligible studies, most of them focused on Ontario and Quebec</li> </ul>	Literature last searched June 2020

		<ul style="list-style-type: none"> <li>• Older people in Canada experience health risks due to climate and air-pollution exposures</li> <li>• Authors found little information about the climate- and air pollution-related health impacts experienced by immigrant communities</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• There are substantial gaps in terms of the location of populations that have been studied</li> <li>• The impact of climatic and air-pollution variables on health was studied most frequently in southern Ontario and Quebec, but less in other provinces, especially in rural areas</li> <li>• The Prairie and Maritimes provinces were largely understudied, with urban populations in Alberta being studied the most frequently within this group</li> <li>• No studies in the territories were found, despite the fact that these northern regions are facing greater impacts from climate change</li> <li>• Generally, urban areas in southern Ontario, Alberta, and British Columbia experience higher levels of PM2.5, O3, and NO2 relative to other regions</li> <li>• Variations in climate adaptation and mitigation policy between regions may also reflect research priorities and provide some explanation for geographical gaps</li> <li>• Most publications were also set in urban areas, though some province-wide population studies included urban and rural residence indicators</li> <li>• The health impacts of climate change in rural populations and the specific factors that influence this relationship in Canada are largely undetermined for older adults and immigrants</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 6/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This review focused on identifying climate change adaptation initiatives that have been implemented and show some degree of effectiveness, with most relevant findings from the synthesis of 110 case studies being: <ul style="list-style-type: none"> <li>○ Adaptation activities most frequently represented in this review were community-based programs, ecological restoration, knowledge sharing and learning platforms, and changing crop types and planting and harvesting practices</li> </ul> </li> </ul>	Literature last searched 2018

		<ul style="list-style-type: none"> <li>• While these activities demonstrated improvement in at least one category of effectiveness (that is, they reduced risk and vulnerability, developed resilient social systems, improved the environment, increased economic resources, or enhanced governance and institutions), several activities indicated effectiveness across multiple categories</li> <li>• The development of local cooperative associations improved individual and community access to resources, improved livelihoods through offering financial assistance and increasing income levels, and facilitated learning and knowledge sharing within and across communities</li> <li>• Community-based and institutionalized techniques for sharing physical, financial and informational resources, and techniques that aim to improve human well-being, institutional relations, and environmental security</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• It is necessary for more research addressing issues of justice, including representation of diverse types of knowledge and expertise, fair distribution of adaptation benefits, and imbalanced power relationships within the adaptation process</li> <li>• Research and evaluation offer techniques to reveal issues in leadership, decision-making, access, and profit, and to monitor progress towards developing more equitable adaptation practices; however, these techniques are not often implemented in practice</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 4/9)</p>	
Scoping review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Extreme weather events</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Low-income communities</li> <li>○ The elderly</li> <li>○ Racial and ethnic minorities</li> <li>○ People with disabilities</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This scoping review was led by Public Health Ontario, and highlighted three main themes:</li> <li>• First, the most common practices for risk communication were public-media campaigns, including radio and internet-based messages, and organization- or expert-led presentations or workshops to communities affected by natural hazards <ul style="list-style-type: none"> <li>○ Within Ontario, communication activities such as promotional messaging, response guidelines, and heat alerts and warning systems were typical risk-communication tools used in practice</li> <li>○ Self-efficacy and feelings of adequate preparedness were positively correlated with risk reduction behaviours in communities at high risk for wildfires</li> </ul> </li> </ul>	Literature last searched 2014

		<ul style="list-style-type: none"> <li>• Second, vulnerable communities, such as low-income communities, the elderly, racial and ethnic minorities, and people with disabilities, face challenges in seeking and processing risk communication information, including complex language, information overload and contradictory information</li> <li>• Third, the importance of leveraging social networks and creating strategies housed [or based] in communities; for instance, people were more aware of extreme weather risks and more likely to initiate protective activities if they were involved in a participatory exercise <ul style="list-style-type: none"> <li>○ Broader involvement of civil society organizations such as the Red Cross and YMCA play important social roles in health adaptation and community engagement</li> </ul> </li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• Authors highlighted three major research gaps surrounding EWCC (extreme weather climate change) risk communications</li> <li>• First, a shortage of empirical studies and a limited amount of applied theory in study design and execution; the reviewed literature is context specific and difficult to use to generate programs and frameworks because the approaches to measuring variables such as risk perception and a willingness to act are not cohesive or consistent</li> <li>• Second, a lack of evaluation of current risk-communications strategies, especially poor integration of community-led initiatives in future planning, often because such initiatives were not properly evaluated</li> <li>• Third, the research base relates to a focus on individuals, at the expense of the household and extended family networks, so future research might therefore include families and various intimate social groupings as a starting point in theoretical frameworks, and allow analysis of household dynamics as they pertain to preparedness activity for EWCC risks</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 4/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Extreme weather events</li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups</li> </ul>	<ul style="list-style-type: none"> <li>• Several adaptations are documented as being employed by Inuit populations in the Arctic today to manage the risks of current climate change: <ul style="list-style-type: none"> <li>○ The substitution of traditional foods with store foods when hunting areas are not accessible</li> </ul> </li> </ul>	Literature last searched 2009

○ Indigenous

- Altered timing, mode, and methods of subsistence activities
  - The establishment of community evacuation and preparedness plans in case of extreme events
  - The development of new ice-based transportation routes to avoid dangerous areas
  - The strengthening of municipal infrastructure to cope with altered climatic extremes
  - The development of youth–elder mentoring programs to transmit traditional knowledge on environmental risks
  - Increasing use of community freezers to store and make accessible traditional foods
  - Financial resources are an important component of the means to adapt, and are identified as one of the main barriers preventing adaptation from taking place
    - Many adaptations are costly and exceed the financial ability of households, communities, businesses, regional governments, and regional institutions
    - Households often do not have access to the capital resources to purchase new hunting equipment to take advantage of new conditions or replace equipment lost or damaged in climate-related hunting accidents
    - Municipalities often struggle to afford existing maintenance projects and are not able to invest in climate-proofing infrastructure
  - Other adaptation barriers are social–cultural in nature, including the erosion of traditional land skills among younger generations, weakening of sharing networks, and the cultural value of hunting and consuming certain traditional foods at certain times of the year
  - Some adaptations have the potential to reduce future exposure sensitivities and increase adaptive capacity, including integrated regional planning to anticipate future conflicts and stresses, enhanced harvester support assistance, improved skills training, improved search and rescue capacity, better weather and ice hazard forecasting, protection of cultural sites, infrastructure strengthening, and support for new technology
- Research gaps
- There is a need to identify a suite of potential adaptations and examine their effectiveness in reducing climate change

		<p>vulnerability, specify their costs and benefits, and assess broader non-climatic benefits</p> <ul style="list-style-type: none"> <li>• Studies lack detailed policy analysis and often present adaptation responses as part of ‘wish lists’</li> <li>• No published studies have undertaken cost benefit analysis of adaptation options, examined how adaptations would be developed and implemented, assessed support for various options among stakeholders and community members, or examined the performance of adaptation options under different climate change scenarios</li> <li>• Few publications report on adaptations in health, cultural and education, or economy and business sectors</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 3/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ All-cause mortality</li> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The review aims to identify health morbidity and mortality indicators used (or that could be used) in Canada to quantify the impacts of climate change</li> <li>• The review identified 77 health indicators of which eight were identified based on an indicator rating scale for best use: <ul style="list-style-type: none"> <li>○ Excess daily all-cause mortality due to heat</li> <li>○ Premature deaths due to air pollution</li> <li>○ Preventable deaths from climate change</li> <li>○ Disability adjusted life years lost from climate change</li> <li>○ Daily all-cause mortality (trends associated with heat and air pollution)</li> <li>○ Daily non-accidental mortality (trends associated with heat and air pollution)</li> <li>○ West Nile disease incidence (in humans)</li> <li>○ Lyme borreliosis incidence (in humans)</li> </ul> </li> <li>• The first four indicators are modelled (i.e., require statistical calculations based on collected data) while the second four are non-modelled</li> <li>• The modelled indicators may be difficult for public-health adaptation applications as they are not currently available for many communities in Canada, while the non-modelled indicators may be more readily available for immediate use by Canadian public-health authorities</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• The authors of the review also identified two existing gaps: <ul style="list-style-type: none"> <li>○ The need for indicators, such as those above, to evaluate the health effects of climate change</li> </ul> </li> </ul>	Literature last searched December 2012

		<ul style="list-style-type: none"> <li>• Consistent availability of data across the country to assess/model indicators and expertise and human resources to continuously evaluate and modify the analysis</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Mental health <ul style="list-style-type: none"> <li>▪ Mental health and post-traumatic stress disorder</li> <li>▪ Suicide</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Indigenous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Review aims to synthesize literature on the effects of meteorological, seasonal and climactic changes on Indigenous mental health</li> <li>• The review found that climactic stressors were not exclusive to any one pathway, people or region, and were often overlapping</li> <li>• Acute and short-term weather events such as storms, flooding, temperature and seasonality were linked to a range of psychological and mental health impacts, including depression, anxiety, suicide, self-harm, post-traumatic stress disorder, psychological resilience, mental illness and behavioural disorders, and strong emotional reactions such as fear and anxiety</li> <li>• Sub-acute and chronic weather events and environmental changes were often linked to feelings of loss, worry, anger, sadness, and ongoing emotional distress, but were not directly linked to many of the more acute presentations of mental health distress such as suicide and depression</li> <li>• Climatic stressors did not need to be experienced directly to induce mental health impacts, but rather can be experienced through vicarious distress, whereby individuals fear or empathize with those experiencing intense weather or environmental conditions</li> <li>• Climatic change was also found to disrupt place-attachment which is critical for enabling Indigenous populations feelings of identity, self-worth, and for strengthening interpersonal relationships and cultural practices</li> <li>• There is some evidence to show that females report higher levels of frustration, sadness, fear, anger and helplessness in the face of climatic changes</li> <li>• Climactic changes were reported to compound existing feelings of abandonment of Indigenous peoples by government and the broader global community</li> <li>• No estimates were provided regarding the prevalence or incidence of these impacts</li> </ul> <p>Research gaps</p>	Literature last searched 2018

		<ul style="list-style-type: none"> <li>The review notes that very little of the included research were population-level studies or provided a longitudinal perspective <a href="#">Source</a> (AMSTAR rating 5/9)</li> </ul>	
Systematic review	<ul style="list-style-type: none"> <li>Climate risks <ul style="list-style-type: none"> <li>General climate change</li> </ul> </li> <li>Health risks and impacts <ul style="list-style-type: none"> <li>Patients and health systems <ul style="list-style-type: none"> <li>Public health</li> </ul> </li> </ul> </li> <li>Equity-deserving groups <ul style="list-style-type: none"> <li>Indigenous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>This review focused on effects of climate change on Aboriginal health, with synthesized literature on Aboriginal health outcomes, determinants, and trends in Canada using a vulnerability framework to identify the broad-level factors constraining adaptive capacity and increasing sensitivity to climate change</li> <li>Authors identified some determinants related to constraining adaptive capacity and increasing sensitivity to climate change on Aboriginal health, including: <ul style="list-style-type: none"> <li>Poverty, technological capacity constraints, socio-political values and inequality, institutional capacity challenges, and information deficit</li> <li>The magnitude and nature of these determinants are distributed unevenly within and between Aboriginal populations, necessitating place-based and regional level studies to examine how these broad factors will affect vulnerability at lower levels</li> </ul> </li> <li>Authors concluded that is necessary for collaboration across all sectors and levels of government, open and meaningful dialogue between policymakers, scientists, health professionals and Aboriginal communities, and capacity building at a local level, to plan for climate change <a href="#">Source</a> (AMSTAR rating 2/9)</li> </ul>	Literature last searched July 2009
Systematic review	<ul style="list-style-type: none"> <li>Climate risks <ul style="list-style-type: none"> <li>General climate change</li> </ul> </li> <li>Health risks and impacts <ul style="list-style-type: none"> <li>Patients and health systems <ul style="list-style-type: none"> <li>Public health</li> </ul> </li> </ul> </li> <li>Options and responses <ul style="list-style-type: none"> <li>Policy and practice <ul style="list-style-type: none"> <li>Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>This study aimed to identify and characterize Canadian federal, provincial, territorial, and municipal adaptation to health risks</li> <li>Federal health adaptation initiatives emphasize capacity building and gathering information to address general health, infectious disease and heat-related risks</li> <li>Provincial and territorial adaptation is varied, for instance, Quebec is a leader in climate change adaptation, addressing almost all risks posed by climate change in the province, and having implemented various adaptation types; meanwhile, all other Canadian provinces and territories are in the early stages of health adaptation</li> <li>The six sampled Canadian regional health authorities, or equivalent (Calgary, Edmonton, Montreal, Ottawa, Toronto, Vancouver) are not reporting any adaptation initiatives</li> </ul>	Published January 2015

<p>Scoping review</p>	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Developing community resilience</li> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> <li>• Mediating pathways <ul style="list-style-type: none"> <li>○ Geographic exposure <ul style="list-style-type: none"> <li>▪ Rural households</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Rural and remote regions</li> </ul> </li> </ul>	<p><a href="#">Source</a> (AMSTAR rating 2/9)</p> <ul style="list-style-type: none"> <li>• Changing climate conditions is negatively affecting the health and well-being of individuals in rural and remote regions, including increased prevalence and severity of extreme weather events, changes to sea ice, vegetation, fish, wildlife and weather, and environmental uncertainties</li> <li>• Health impacts of these include poor nutrition, obesity, vector-borne/waterborne/food-borne disease, cardiovascular disease, respiratory issues, and mental health issues, among others</li> <li>• Adaptation strategies are needed to address these challenges, including: <ul style="list-style-type: none"> <li>○ Using multiple knowledge systems, specific to socio-cultural context</li> <li>○ Address socio-cultural barriers</li> <li>○ Use innovative technology</li> <li>○ Improve and integrate public health and environmental surveillance</li> <li>○ Support sustainable development practices</li> <li>○ Enhance risk communication and knowledge of climate change</li> <li>○ Develop capacity of health systems to respond to the health impacts of climate change</li> </ul> </li> <li>• Additional details for the implementation or evaluation of these adaptation strategies were not provided</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	<p>Literature last searched 2019</p>
<p>Systematic review</p>	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Health impacts of climate change on populations include greater morbidity and mortality from poor air quality, food shortages, water- and food-borne contamination, extreme weather events, and changing patterns of disease spread by animals</li> <li>• Literature review examines the similarities and difference between the climate change adaptation frameworks that have been developed and the Ontario Public Health Standards</li> <li>• The review found that regular population-health risk assessments and risk-management activities by local public-health units can help to address risks related to climate hazards</li> <li>• The comparison between frameworks and Ontario Public Health Standards shows many similarities in the steps to address health impacts – steps featured in both include:</li> </ul>	<p>Literature last searched 2008</p>

		<ul style="list-style-type: none"> <li>○ Engagement of stakeholders</li> <li>○ Identification and burden of climate-related illness and injury</li> <li>○ Identification of vulnerable populations</li> <li>○ Assessment of the effectiveness of programs and activities to reduce climate-related health risks</li> <li>○ Identification and prioritization of policy and program options to meet health needs</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>● Assessments of heat-health vulnerabilities require projections of the future frequency and severity of extreme heat events, information related to the geographical variation in exposure to extreme heat, identification of vulnerable populations and identification of actual temperature and morbidity/mortality thresholds</li> <li>● Public-health interventions that may be implemented to reduce climate change impacts on health within relevant time scales (five to 10 years) need to be identified through assessments</li> <li>● It is necessary for case studies and community examples that aid public-health officials in their efforts to obtain, analyze and integrate findings from climate scenarios and models to gauge future impacts on health</li> <li>● Additional efforts should be made to understand the most effective and efficient ways to provide this information to authorities charged with protecting the public from climate-related health risks</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>● Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>● Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> <li>○ WASH <ul style="list-style-type: none"> <li>▪ Drinking-water quality</li> </ul> </li> </ul> </li> <li>● Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● This review aimed to identify and examine what adaptations are being developed by civil society organizations (CSOs) to adapt to the health effects of climate change, based on a systematic review of the activities of 190 organizations</li> <li>● Adaptations being implemented by CSOs in Canada consist predominantly of groundwork interventions including awareness, research and networking activities that aim to build adaptive capacity</li> <li>● Adaptations most frequently address water contamination and air quality, and occur most often as awareness raising and research activities</li> <li>● Adaptations infrequently recognize vulnerable groups or climate change as a motivator</li> </ul>	Literature last searched 2013

		<ul style="list-style-type: none"> <li>• There is a deficit in terms of what needs to be done to address adaptation and what is being done, which is part of a broader problem identified in Canada and beyond and that is reflected in limited CSO action on key vulnerabilities, for instance: <ul style="list-style-type: none"> <li>○ While water contamination and air quality are commonly addressed, extreme heat, which is widely acknowledged as a key vulnerability facing Canadians in a changing climate, is reported in fewer than 2% of initiatives</li> <li>○ Similarly, flooding is another key vulnerability yet is addressed in fewer than 7% of actions</li> <li>○ Such impacts will affect the activities of multiple CSOs that deal with the elderly, low-income households, marginalized communities and the homeless</li> </ul> </li> <li>• The diversity of organizations engaged in adaptation indicates potential for collaboration between public health bodies and CSOs</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• It is necessary for more research on adaptations to flooding and extreme heat</li> <li>• Consideration of vulnerable groups is limited</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Drought</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ WASH <ul style="list-style-type: none"> <li>▪ Drinking-water quality</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This review provided an analysis of the existing literature about direct potable reuse of water in developed countries, mainly the United States, Australia and Canada</li> <li>• When municipalities are considering a shift to direct potable reuse (DPR), while conducting public engagement, planners, engineering and policymakers should ensure information does not overburden citizens with technical information, but at the same time, should not withhold information because experts feel the public may lack the knowledge or understanding to provide accurate feedback <ul style="list-style-type: none"> <li>○ In the United States, Australia and Canada, citizens would report negative feedback when asked about drinking recycled wastewater</li> </ul> </li> <li>• Post-secondary education should do more to focus on curricula that includes alternative energy models and policy solutions</li> <li>• Research points to decentralized direct potable reuse (DPR) either being already competitive, or shortly becoming</li> </ul>	Published May 2017

		<p>competitive against traditional wastewater treatment plants (WWTPs)</p> <ul style="list-style-type: none"> <li>• Some of the major reasons that DPR has not been implemented in Canada are: <ul style="list-style-type: none"> <li>○ A lack of understanding on public opinion around drinking and using recycled wastewater for potable reuse</li> <li>○ Policies and regulations are varied across provinces, territories and municipalities</li> <li>○ Canada has not had to experience as many extreme weather events as a result of global warming</li> <li>○ A lack of research and interest by industry, academia and the federal government</li> </ul> </li> <li>• Due to the diversity of climate, urbanization and landscape across Canada, it can be difficult to standardize a triple bottom line (TBL) that could serve as the backbone for many municipalities</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• There needs to be more research to understand the policy implications of either allowing municipalities, the provinces and territories, or the federal government to take the lead on DPR policies and implementation</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Less than half of the articles included in this review covered climate change solutions in a health context</li> <li>• Examples of mitigation strategies included decreasing greenhouse gas emissions by installing solar panels, improving household insulation, and increasing active transport use</li> <li>• Suggested adaptation strategies included creating community adaptation plans, cutting back on strenuous outdoor activity on hot or smoggy days, and building coastal protection</li> <li>• Adaptation was discussed more frequently than mitigation in Quebec, the Prairies, and British Columbia, and adaptation was also more frequently mentioned than mitigation between 2007 and 2008 compared to other years</li> <li>• The limited coverage on climate change solutions may contribute to the feelings of hopelessness commonly associated with climate change, thereby undermining the public's feelings of self-efficacy and impetus to engage in climate-mitigating or adaptive actions</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	Literature last searched 2016

Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Hurricanes</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Mitigation co-benefits <ul style="list-style-type: none"> <li>▪ Greenhouse pathways</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Long-term evacuees</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This review explored literature specific to Canada and then expanding to include literature on other high-income countries focused on the roles and responses of public health for long-term evacuees (LTEs) in Canada</li> <li>• Authors found that in Canada, most evacuations have lasted less than two weeks, but in some instances, people have been displaced for months or years</li> <li>• It is difficult to determine if there are public-health effects of prolonged evacuation and to what extent</li> <li>• There is a lack of evidence regarding whether the public-health needs of long-term evacuees (LTEs) in Canada are being assessed, monitored and addressed</li> <li>• Trends in the incidence of disasters and emergencies underscore the urgency of conducting more research to improve our understanding of prolonged displacement within Canada and in other high-income countries</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• Some studies broadly consider the long-term repercussions of emergencies and disasters in high-income countries, but they pay little or no attention to the effects of evacuation, and potential effects of prolonged versus short-term displacement</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	Literature last searched 2018
Systematic review	<ul style="list-style-type: none"> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Infectious diseases <ul style="list-style-type: none"> <li>▪ Infectious diseases general</li> <li>▪ Viral diseases</li> <li>▪ Leptospirosis</li> </ul> </li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Indigenous</li> <li>○ Arctic inhabitants</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The review examined the association between climactic factors and infectious disease in the Arctic and sub-Arctic regions</li> <li>• Strong evidence was found for the association between climactic factors for food- and waterborne diseases, largely as a result of increased temperature and increased precipitation which increases the incidence of these diseases</li> <li>• Some evidence was found for an expected increase in vector- and rodent-borne diseases as climate changes in temperature, precipitation, and changes to the length of seasons change the suitability, reproduction, distribution and abundance of vectors and rodents</li> <li>• Three studies from Canada also point to the potential increase in bacterial and airborne diseases given the increase in air temperature and humidity</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• The review noted that because of the frequently aggregated, population-level data used in the included studies, it was</li> </ul>	Literature last searched May 2013

		<p>difficult to draw conclusions regarding which population were most vulnerable to climatic factors</p> <ul style="list-style-type: none"> <li>• Additional gaps in knowledge include surveillance mechanisms to ensure risk of disease is appropriately and reliably calculated, and additional studies focused on confounding and intermediate factors, particularly for climatic effects of vector- and rodent-borne diseases</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Water, sanitation and hygiene <ul style="list-style-type: none"> <li>▪ Drinking-water quality</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The review focuses on different approaches that can be used to inform waterborne disease burden and source attribution estimates on a national level</li> <li>• Links between extreme precipitation and other climate events and increases in waterborne disease, show it is critical to understand how to reliably assess the risk of waterborne disease and source attributions</li> <li>• The review suggests relatively few methods are available to quantify the burden of acute gastrointestinal illness, however those that do exist include simple point estimates, quantitative microbial risk assessment, and monte carlo simulations that rely on epidemiological data from robust studies</li> <li>• The review included 11 studies that quantified the burden of waterborne disease, and two of these were Canadian studies which reported burden estimates of between \$40.3 million (1997) and \$2.7 billion (2012) as a result of costs associated with acute gastrointestinal illness and respiratory infections</li> <li>• The authors of the review identified knowledge and data gaps that limit the ability to accurately calculate disease burdens and make source attributions, including: <ul style="list-style-type: none"> <li>○ Epidemiological studies that quantify the risk of: <ul style="list-style-type: none"> <li>▪ Illness due to consumption of water from small and private water systems</li> <li>▪ Illness attributable to drinking-water distribution system operation and events</li> <li>▪ Illness due to the consumption of groundwater supplies</li> </ul> </li> <li>○ Pathogen occurrence water-quality data, particularly for groundwater supplies</li> <li>○ Centralized data on populations served by different types of water supplies such as small systems and private systems</li> </ul> </li> </ul>	Literature last searched 2013

		<ul style="list-style-type: none"> <li>○ Data on the state and condition of drinking-water infrastructure including treatment systems, distribution means, and private wells</li> <li>○ Water consumption-related health effects on vulnerable sub-populations such as children, the elderly and immunocompromised</li> <li>○ Research that quantifies the risk of acute gastrointestinal illness associated with the effects of changing climate (increased precipitation) on drinking supplies</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 6/9)</p>	
Scoping review	<ul style="list-style-type: none"> <li>● Climate risks <ul style="list-style-type: none"> <li>○ Wildfires</li> </ul> </li> <li>● Health risks and impacts <ul style="list-style-type: none"> <li>○ Mental health <ul style="list-style-type: none"> <li>▪ Mental health and PTSD</li> </ul> </li> <li>○ Maternal and child health <ul style="list-style-type: none"> <li>▪ Child health</li> </ul> </li> </ul> </li> <li>● Equity-deserving groups <ul style="list-style-type: none"> <li>○ Children and adolescents</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● This scoping review found 19 studies that assessed the psychosocial impacts of wildland fires on children, adolescents, and family functioning</li> <li>● Age, gender, time, and proximity to the wildfire can have an impact on both children and adolescents, while behaviours of family members and home and property loss are important among families</li> <li>● Authors reported contradictory findings, for instance, the reported association between parent and child PTSD symptom agreement</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>● Insufficient discussion of research questions or findings within a larger disaster framework</li> <li>● More studies focusing on children and adolescent perspectives of community factors would expand our understanding of their psychosocial responses to wildfires</li> <li>● Investigators need to clearly outline differences between groups of participants and time periods postevent</li> <li>● Family units (i.e., parents or surrogates with children) also need to be studied to gain information useful for programs needed to address the issues this group experiences post-fire</li> <li>● Authors highlighted the lack of research that included children or adolescents' perspectives of domestic violence post-disaster</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 4/9)</p>	Literature last searched October 2017
Scoping review	<ul style="list-style-type: none"> <li>● Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>● Health risks and impacts <ul style="list-style-type: none"> <li>○ Patients and health systems <ul style="list-style-type: none"> <li>▪ Public health</li> </ul> </li> <li>○ Infectious</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● This study, which included a systematic review of literature focused on criteria for vector-borne disease prioritization, summarized findings from 26 studies</li> <li>● A preliminary list of criteria was identified, with the most common categories of criteria being public-health impacts, economic or market impacts, animal-health impacts (generally</li> </ul>	Literature last searched Spring 2014

	<ul style="list-style-type: none"> <li>▪ Infectious diseases in general</li> </ul>	<p>pertaining to market impacts but also for animal welfare), public perception, and public-health capacity to deal with a disease</p> <ul style="list-style-type: none"> <li>• Authors also included the “Risk and Epidemiology” category aimed at capturing epidemic potential, recent disease trends and proportion of susceptible population</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/8)</p>	
Overview	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Extreme weather events</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ Occupational health and injury</li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Policy and practice <ul style="list-style-type: none"> <li>▪ Adaptation</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The review identifies five categories of climate hazards that are likely to affect occupational health and safety in Canada, including heat waves/increased temperatures, air pollutants, UV radiation, extreme weather events, and vector-borne/zoonotic diseases</li> <li>• The review notes that they will have a significant effect on occupations related to natural resources such as agriculture and fishing, as well as changing the built environment and emerging green industries which in turn will change the occupational-hazard landscape</li> <li>• In addition to acquiring new knowledge on hazards and ongoing surveillance, the review suggests the following adaptation strategies: <ul style="list-style-type: none"> <li>○ Identify and evaluate adaptation methods</li> <li>○ Develop training tools to prepare workers for the health effects of climate change</li> <li>○ Develop protective clothing and other equipment for extreme climates</li> <li>○ Explore adaptation methods using organization of work and work-schedule management</li> <li>○ Develop methods to heighten workplace awareness of potential risks</li> </ul> </li> </ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	Literature last searched December 2010
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ Emissions</li> </ul> </li> <li>• Options and responses <ul style="list-style-type: none"> <li>○ Mitigation co-benefits <ul style="list-style-type: none"> <li>▪ Greenhouse pathways</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• This review focused on the use of alternative fuels in cement manufacturing</li> <li>• Overall, energy recovery in cement manufacturing is one of the best end-of-life options, even though the performance in resource consumption and conservation, and metal and hazardous air-pollutant emissions, can be worse than for other end-of-life options, such as recycling</li> <li>• Landfilling should be avoided, and incineration discouraged in favour of better end-of-life options</li> </ul>	Literature last searched 2010

		<ul style="list-style-type: none"> <li>• An environmentally sound end-of life solution is the use of sludge as fertilizer, although the practice is illegal in some countries if the sludge is not treated</li> <li>• Landfilling or reusing tires in asphalt road pavement appeared to be the worst options</li> </ul> <p>Research gaps</p> <ul style="list-style-type: none"> <li>• The social impact of the use of alternative energy sources in cement manufacturing were not identified</li> <li>• Academic papers did not address comparisons between the use of animal and bone meal, industrial, commercial and institutional residues, and waste wood in cement kilns with other end-of-life options</li> <li>• Academic papers did not discuss health or social impacts, and economic impacts were investigated for few end-of-life options</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 4/9)</p>	
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Health risks and impacts <ul style="list-style-type: none"> <li>○ All-cause mortality</li> </ul> </li> <li>• Equity-deserving groups <ul style="list-style-type: none"> <li>○ Low-income and materially deprived neighbourhoods</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The review aims to identify climate change-related risk factors at the local community level and create actionable health vulnerability index scores to map community risks to previously identified priority climate-related exposures in British Columbia</li> <li>• The review presents priority risk factors for each of four climate hazards: <ul style="list-style-type: none"> <li>○ The percentage of days per year over 25 degrees Celsius</li> <li>○ Inland flooding and predicted sea-level rise</li> <li>○ Extreme wildfire smoke</li> <li>○ Ground level ozone</li> </ul> </li> <li>• Category-specific indices were also created to identify populations that may be more or less adaptive to the four hazards</li> </ul> <p><a href="#">Source</a> (AMSTAR rating 3/9)</p>	Published March 2021
Systematic review	<ul style="list-style-type: none"> <li>• Climate risks <ul style="list-style-type: none"> <li>○ General climate change</li> </ul> </li> <li>• Food and nutrition <ul style="list-style-type: none"> <li>○ Food insecurity</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The review develops a framework for the climate change and food security nexus that details the ways in which climate change will alter the production, processing, distribution, preparation and consumption of food in Canada</li> <li>• In relation to food production heavy rainfall and temperature have an effect on water yields and have additional effects on fresh-water, biodiversity, soil degradation and fisheries</li> </ul>	Literature last searched April 2019

		<ul style="list-style-type: none"><li>• For food distribution, climate change can disrupt food distribution through acute weather events, limiting the ability for distribution channels to be used</li><li>• For food safety and nutrition, climate change will have a significant effect on altering the availability of traditional foods which provide an important nutritional value and contribute to healthy diets, particularly for Indigenous populations</li><li>• Limited research has been conducted on the effects of climate change on Indigenous, rural and remote communities in regions south of 60 degrees latitude</li></ul> <p><a href="#">Source</a> (AMSTAR rating 2/9)</p>	
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**Appendix 3a: Identified documents on health risks and impacts of climate change that include an equity focus, organized by PROGRESS-Plus**

Progress-Plus characteristics	Progress-plus characteristics identified in included documents	Identified documents
Place of residence	Arctic (or sub-Arctic)	<ul style="list-style-type: none"> <li>• <a href="#">Identifying and achieving consensus on health-related indicators of climate change in Nunavut</a></li> <li>• <a href="#">Food insecurity among Inuit women exacerbated by socioeconomic stresses and climate change</a></li> <li>• <a href="#">“From this place and of this place:” climate change, sense of place, and health in Nunatsiavut, Canada</a></li> <li>• <a href="#">Climate change influences on environment as a determinant of Indigenous health: Relationships to place, sea ice, and health in an Inuit community</a></li> <li>• <a href="#">What we know, do not know, and need to know about climate change vulnerability in the western Canadian Arctic</a></li> <li>• <a href="#">SOS! Summer of smoke: A retrospective cohort study examining the cardiorespiratory impacts of a severe and prolonged wildfire season in Canada’s high sub-Arctic</a></li> <li>• <a href="#">“We’re people of the snow” Weather, climate change, and Inuit mental wellness</a></li> <li>• <a href="#">Inuit vulnerability and adaptive capacity to climate change in Ulukhaktok, Northwest Territories, Canada</a></li> <li>• <a href="#">Protective factors for mental health and well-being in a changing climate: Perspectives from Inuit youth in Nunatsiavut Labrador</a></li> <li>• <a href="#">Community vulnerability to climate change in the context of other exposure sensitivities in Kugluktuk, Nunavut</a></li> <li>• <a href="#">Using qualitative scenarios to understand regional environmental change in the Canadian North</a></li> </ul>
	Rural and remote	<ul style="list-style-type: none"> <li>• <a href="#">The association between farming activities, precipitation, and the risk of acute gastrointestinal illness in rural municipalities of Quebec, Canada: A cross-sectional study</a></li> <li>• <a href="#">Household access to capital and its effects on drought adaptation and migration: A case study of rural Alberta in the 1930s</a></li> <li>• <a href="#">Use of traditional environmental knowledge to assess the impact of climate change on subsistence fishing in the James Bay Region of Northern Ontario, Canada</a></li> <li>• <a href="#">Climate change impacts on health and well-being in rural and remote regions across Canada</a></li> </ul>

		<ul style="list-style-type: none"> <li>• <a href="#">Exploration of the spatial patterns and determinants of asthma prevalence and health services use in Ontario using a Bayesian approach</a></li> <li>• <a href="#">Energy poverty in Canada: Prevalence, social and spatial distribution, and implications for research and policy</a></li> <li>• <a href="#">Waterborne outbreaks: A public health concern for rural municipalities with unchlorinated drinking-water distribution systems</a></li> </ul>
	Urban	<ul style="list-style-type: none"> <li>• <a href="#">Air quality in Canadian port cities after regulation of low-sulphur marine fuel in the North American Emissions Control Area</a></li> <li>• <a href="#">Nature-based equity: An assessment of the public health impacts of green infrastructure in Ontario Canada</a></li> <li>• <a href="#">A multilevel analysis to explain self-reported adverse health effects and adaptation to urban heat: A cross-sectional survey in the deprived areas of 9 Canadian cities</a></li> <li>• <a href="#">Neighbourhood and dwelling characteristics associated with the self-reported adverse health effects of heat in most deprived urban areas: A cross-sectional study in 9 cities</a></li> <li>• <a href="#">Healthy neighbourhoods: Walkability and air pollution</a></li> <li>• <a href="#">Reduction of disparities in access to green spaces: Their geographic insertion and recreational functions matter</a></li> <li>• <a href="#">The impact of climate change on the food systems in Toronto</a></li> </ul>
Race/ethnicity/ culture/language	Indigenous populations	<ul style="list-style-type: none"> <li>• <a href="#">Identifying and achieving consensus on health-related indicators of climate change in Nunavut</a></li> <li>• <a href="#">Food insecurity among Inuit women exacerbated by socioeconomic stresses and climate change</a></li> <li>• <a href="#">Health effects of flooding in Canada: A 2015 review and description of gaps in research</a></li> <li>• <a href="#">"From this place and of this place:" climate change, sense of place, and health in Nunatsiavut, Canada</a></li> <li>• <a href="#">Vulnerability of Aboriginal health systems in Canada to climate change</a></li> <li>• <a href="#">What we know, do not know, and need to know about climate change vulnerability in the western Canadian Arctic</a></li> <li>• <a href="#">Preparing for the health impacts of climate change in Indigenous communities: The role of community-based adaptation</a></li> <li>• <a href="#">Use of traditional environmental knowledge to assess the impact of climate change on subsistence fishing in the James Bay Region of Northern Ontario, Canada</a></li> <li>• <a href="#">Frequent flooding and perceived adaptive capacity of sub-Arctic Kashechewan First Nation, Canada</a></li> </ul>

		<ul style="list-style-type: none"> <li>• <a href="#">Spring flooding and recurring evacuations of Kashechewan First Nation, northern Ontario, Canada</a></li> <li>• <a href="#">Climate change impacts on health and well-being in rural and remote regions across Canada</a></li> <li>• <a href="#">Community-based monitoring of Indigenous food security in a changing climate: Global trends and future directions</a></li> <li>• <a href="#">Evacuating First Nations during wildfires in Canada</a></li> <li>• <a href="#">“We’re people of the snow” Weather, climate change, and Inuit mental wellness</a></li> <li>• <a href="#">Indigenous mental health in a changing climate</a></li> <li>• <a href="#">Inuit vulnerability and adaptive capacity to climate change in Ulukhaktok, Northwest Territories, Canada</a></li> <li>• <a href="#">Protective factors for mental health and well-being in a changing climate: Perspectives from Inuit youth in Nunatsiavut Labrador</a></li> <li>• <a href="#">Community vulnerability to climate change in the context of other exposure sensitivities in Kugluktuk, Nunavut</a></li> <li>• <a href="#">Using qualitative scenarios to understand regional environmental change in the Canadian North</a></li> <li>• <a href="#">Like the plains people losing the buffalo: Perceptions of climate change impacts, fisheries management, and adaptation actions by Indigenous peoples in coastal British Columbia, Canada</a></li> </ul>
	Immigrant populations	<ul style="list-style-type: none"> <li>• <a href="#">Risk and resilience: How is the health of older adults and immigrant people living in Canada impacted by climate- and air pollution-related exposures?</a></li> </ul>
Occupation	-	<ul style="list-style-type: none"> <li>•</li> </ul>
Gender/sex	Gender/sex	<ul style="list-style-type: none"> <li>• <a href="#">Risk of hospitalization for fire-related burns during extreme cold weather</a></li> <li>• <a href="#">Spatial variability of climate effects on ischemic heart disease hospitalization rates for the period 1989-2006 in Quebec, Canada</a></li> <li>• <a href="#">Food insecurity among Inuit women exacerbated by socioeconomic stresses and climate change</a></li> <li>• <a href="#">A difference-in-difference approach to assess the effect of a heat action plan on heat-related mortality, and differences in effectiveness according to sex, age, and socioeconomic status (Montreal, Quebec)</a></li> <li>• <a href="#">Threats to mental health and well-being associated with climate change</a></li> </ul>
Religion	-	
Education	Education levels	<ul style="list-style-type: none"> <li>• <a href="#">A difference-in-difference approach to assess the effect of a heat action plan on heat-related mortality, and differences in effectiveness according to sex, age, and socioeconomic status (Montreal, Quebec)</a></li> </ul>

		<ul style="list-style-type: none"> <li>• <a href="#">Threats to mental health and well-being associated with climate change</a></li> </ul>
Socio-economic status and social capital	Low socio-economic status or experiencing material deprivation	<ul style="list-style-type: none"> <li>• <a href="#">Nature-based equity: An assessment of the public health impacts of green infrastructure in Ontario Canada</a></li> <li>• <a href="#">Spatial variability of climate effects on ischemic heart disease hospitalization rates for the period 1989-2006 in Quebec, Canada</a></li> <li>• <a href="#">A multilevel analysis to explain self-reported adverse health effects and adaptation to urban heat: A cross-sectional survey in the deprived areas of 9 Canadian cities</a></li> <li>• <a href="#">Neighbourhood and dwelling characteristics associated with the self-reported adverse health effects of heat in most deprived urban areas: A cross-sectional study in 9 cities</a></li> <li>• <a href="#">A difference-in-difference approach to assess the effect of a heat action plan on heat-related mortality, and differences in effectiveness according to sex, age, and socioeconomic status (Montreal, Quebec)</a></li> <li>• <a href="#">Quantifying vulnerability to extreme heat in time series analyses: A novel approach applied to neighbourhood social disparities under climate change</a></li> <li>• <a href="#">Factors influencing the mental health consequences of climate change in Canada</a></li> <li>• <a href="#">Threats to mental health and well-being associated with climate change</a></li> <li>• <a href="#">Risk and protective factors for heat-related events among older adults of Southern Quebec (Canada): The NuAge study</a></li> <li>• <a href="#">Reduction of disparities in access to green spaces: Their geographic insertion and recreational functions matter</a></li> <li>• <a href="#">The role of maps in neighbourhood-level heat vulnerability assessment for the City of Toronto</a></li> </ul>
Personal characteristics associated with discrimination and/or exclusion	Infants and children	<ul style="list-style-type: none"> <li>• <a href="#">The association between climate, geography and respiratory syncytial virus hospitalizations among children in Ontario, Canada</a></li> <li>• <a href="#">Extreme heat and pediatric emergency department visits in Southwestern Ontario</a></li> </ul>
	Older adults	<ul style="list-style-type: none"> <li>• <a href="#">Risk of hospitalization for fire-related burns during extreme cold weather</a></li> <li>• <a href="#">A difference-in-difference approach to assess the effect of a heat action plan on heat-related mortality, and differences in effectiveness according to sex, age, and socioeconomic status (Montreal, Quebec)</a></li> <li>• <a href="#">Incidence of hot tap water scalds after the introduction of regulations in Ontario</a></li> <li>• <a href="#">Reducing the risks of extreme heat for seniors: Communicating risks and building resilience</a></li> <li>• <a href="#">Risk and protective factors for heat-related events among older adults of Southern Quebec (Canada): The NuAge study</a></li> <li>• <a href="#">Canadian forest fires and the effects of long-range transboundary air pollution on hospitalizations among the elderly</a></li> </ul>

		<ul style="list-style-type: none"> <li>• <a href="#">How do non-catastrophic natural disasters impact middle-aged-to-older persons?</a></li> <li>• <a href="#">Risk and resilience: How is the health of older adults and immigrant people living in Canada impacted by climate- and air pollution-related exposures?</a></li> <li>• <a href="#">Effects of climate and fine particulate matter on hospitalizations and deaths for heart failure in elderly</a></li> <li>• <a href="#">Effects of diurnal variations in temperature on non-accidental mortality among the elderly population of Montreal, Quebec, 1984-2007</a></li> </ul>
	Unhoused or homeless	<ul style="list-style-type: none"> <li>• <a href="#">Health effects of flooding in Canada: A 2015 review and description of gaps in research</a></li> <li>• <a href="#">Cold weather conditions and risk of hypothermia among people experiencing homelessness: Implications for prevention strategies</a></li> </ul>
	People who use substances	<ul style="list-style-type: none"> <li>• <a href="#">Ambient air pollution exposure and emergency department visits for substance abuse</a></li> </ul>
Time dependent relationships	-	

**Appendix 3b: Identified systematic reviews about adaptation and mitigation strategies that include an equity focus, organized by PROGRESS-Plus**

Progress-Plus characteristics	Progress-plus characteristics identified in included documents	Identified documents
Place of residence	Arctic (or sub-Arctic)	<a href="#">What we know, do not know, and need to know about climate change vulnerability in the western Canadian Arctic</a> <a href="#">Association of climatic factors with infectious diseases in the Arctic and sub-Arctic region - a systematic review</a> <a href="#">Research on the Human Dimensions of Climate Change in Nunavut, Nunavik, and Nunatsiavut: A Literature Review and Gap Analysis</a>
	Rural and remote regions	<a href="#">Climate change impacts on health and well-being in rural and remote regions across Canada: a synthesis of the literature</a>
Race/ethnicity/culture/language	Indigenous populations	<a href="#">Community-based monitoring of Indigenous food security in a changing climate: Global trends and future directions</a> <a href="#">What we know, do not know, and need to know about climate change vulnerability in the western Canadian Arctic</a> <a href="#">Civil society organizations and adaptation to the health effects of climate change in Canada</a> <a href="#">Indigenous mental health in a changing climate: a systematic scoping review of the global literature</a> <a href="#">Association of climatic factors with infectious diseases in the Arctic and sub-Arctic region - a systematic review</a> <a href="#">Research on the Human Dimensions of Climate Change in Nunavut, Nunavik, and Nunatsiavut: A Literature Review and Gap Analysis</a> <a href="#">Vulnerability of Aboriginal health systems in Canada to climate change</a> <a href="#">Climate change impacts on health and well-being in rural and remote regions across Canada: a synthesis of the literature</a>
Occupation	-	
Gender/sex	Gender/sex	<a href="#">Community-based monitoring of Indigenous food security in a changing climate: Global trends and future directions</a>
Religion	-	
Education	-	
Socio-economic status and social capital	Low-income and materially deprived neighbourhoods	<a href="#">Evaluating risk communication during extreme weather and climate change: A scoping review</a> <a href="#">Geospatial indicators of exposure, sensitivity, and adaptive capacity to assess neighbourhood variation in vulnerability to climate change-related health hazards</a>

Personal characteristics associated with discrimination and/or exclusion	Children and adolescents	<a href="#">The psychosocial impacts of wildland fires on children, adolescents and family functioning: A scoping review</a>
	Older adults	<a href="#">Evaluating risk communication during extreme weather and climate change: A scoping review</a> <a href="#">Effective Community-Based Interventions for the Prevention and Management of Heat-Related Illnesses: A Scoping Review</a>
	People with physical disabilities	<a href="#">Evaluating risk communication during extreme weather and climate change: A scoping review</a>
Time dependent relationships	-	