



GENERATING KNOWLEDGE TO
**Inform Public Health
Action on Climate Change
in Canada**

For the Chief Public Health Officer of Canada's Report
on the State of Public Health in Canada 2022

Mobilizing Public Health Action on Climate Change in Canada

Canada



Generating Knowledge to Inform Public Health Action on Climate Change in Canada

Introduction

In her 2022 annual report, Dr. Theresa Tam, Canada's Chief Public Health Officer (CPHO) explores what actions public health systems can take to prevent and reduce the health impacts of climate change. In her report, Dr. Tam identifies the need to generate new knowledge and evidence to inform and guide public health action on climate change. This knowledge may come from novel [research](#), knowledge synthesis and mobilization, or by exploring ideas from other sectors or disciplines that could be adapted or scaled for the public health context.

This document serves as a companion to the CPHO report and was developed by the Office of the Chief Science Officer (OCSO) of the Public Health Agency of Canada (PHAC) with the input of many public health partners and stakeholders.ⁱ It provides an overview of research and knowledge generation opportunities to advance action on public health and climate change. These opportunities span across disciplines and reflect the complex and multi-faceted challenges that climate change presents for public health.

i See [Appendix B](#) for more information on methods

Addressing these research and knowledge gaps will require intersectoral collaboration and engagement of key stakeholders across all stages of the research-to-action spectrum. It will also require a diversity of approaches, ranging from:

- ▶ exploratory research (e.g. advancing understanding, identifying, investigating or forecasting),
- ▶ innovation and evaluation approaches, including intervention research (e.g. strategic and methodological improvements and advances, implementation science), and
- ▶ knowledge co-creation (e.g. monitoring, partnerships and collaborations).

This list was generated as a resource to guide funding agencies, researchers and organizations at the intersection of climate change and public health. It is intended to develop evidence and guide action that informs, protects and promotes the health and well-being of all people in Canada.

Several climate-health approaches and concepts may be useful to guide researchers wishing to advance knowledge in this space and appear throughout this document. These include [health equity](#), [Indigenous health](#), [One Health](#), [place-based approaches](#) as well as work that considers differential exposures, sensitivity and adaptive capacity for [priority populations](#)ⁱⁱ.

ii A list of examples of priority populations can be found in [Appendix A](#)

Research and Knowledge Generation Opportunities

Public Health and Climate Change Interventions

- ▶ Explore upstream factors (e.g. market conditions, transportation access, public policy, international regulations) that can affect health vulnerability and adaptation, particularly in rural, northern, remote, coastal, or isolated regions.
 - ▶ Innovate, improve and/or evaluate:
 - Equitable, feasible and effective public health interventions to increase resilience and reduce climate change health impacts within relevant timescales (5–10 years).
 - Public health interventions or frameworks to better understand, prevent, and/or reduce the health impacts of climate change in Canada, with a particular emphasis on equity and upstream resilience.
 - Policies, programs, measures and new technologies to support the development of low carbon environmentally sustainable public health systems.
 - Evidence-based strategies, approaches and paradigms to guide community, government, and First Nations, Inuit and Métis led action and decision-making on climate change and health.
 - Design aspects of the physical and built environment (urban, indoor, outdoor) that can help mitigate climate change, support adaptation measures, and improve public health.
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Prioritizing Equity and Community in Climate Actions

- ▶ Explore public health approaches and interventions that promote equity and justice (local to global scales) and address climate-related vulnerabilities in diverse populations and communities.
 - ▶ Innovate, improve and/or evaluate frameworks and approaches to support the integration of equity and justice considerations into intersectoral climate change mitigation and adaptation action and initiatives.
 - ▶ Innovate, improve and/or evaluate transformative approaches for preventing and adapting to the health-related consequences of climate change in Canada (e.g. gender-transformative, early interventions for children and youth, life-course approaches).
 - ▶ Integrate priority populations' perspectives and intersectional experiences when addressing the psychological, social and behavioural impacts of climate change, adaptation and mitigation responses, as well as the factors that contribute to community resilience and protection.
 - ▶ Conduct **participatory research** with communities to understand local, place-based climate-related health threats and develop effective adaptation and mitigation strategies that focus on community wellness and resilience. Includes the co-development and/or evaluation of:
 - Local climate-health risk communication and adaptation interventions in culturally safe, inclusive and meaningful ways.
 - Effectiveness and feasibility of community-led monitoring, mitigation and adaptation initiatives.
 - Culturally safe and equitable response and recovery approaches to climate-related health emergencies.
 - ▶ Conduct research in collaboration with and/or led by First Nations, Inuit and Métis Peoples and communities to:
 - Support inclusion and prioritization of diverse Indigenous worldviews and knowledges with respect to climate change and public health action.
 - Explore Indigenous-led or co-developed adaptation and mitigation solutions to inform interventions to the multi-faceted impacts of climate change on Indigenous communities and livelihoods.
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**Building Knowledge
on Climate-Health
Connections**

- ▶ Explore the current and projected direct and indirect impacts of climate change on public health in Canadian contexts (e.g. mental health, infectious diseases, chronic diseases, maternal and child health, older adult health, food security and nutrition, environmental contaminants, working conditions, occupational health, housing and shelter, water, sanitation and hygiene, dermatological concerns, lifestyle and behaviour, social cohesion, transportation and economic considerations). Specific areas include:
 - Health impacts and vulnerabilities to neglected climate hazards, such as droughts, coastal erosion, flooding, wildfires, landslides, reduced sea ice, thawing permafrost and other landscape hazards, as well as the impacts of mitigation strategies.
 - Health effects of compounding and cascading slow-onset changes as well as climate events and extremes that occur simultaneously or successively.
 - Climate change sensitivity of a wide range of infectious diseases (e.g. vector-borne, zoonotic, food-borne, water-borne, transmitted from human to human, and wind or airborne from environmental sources).
 - Impacts of climate change on the physiology, behaviour, ecology and evolution of antimicrobial resistant (AMR) organisms, and their associated risks to human health.
 - Interrelated nature of infectious and chronic disease in the context of climate change, and the public health efforts that will be needed to address them.
 - Relationship between climate change and mental health, including projection modelling under different climate scenarios in Canada. Specific topics include the mental health impacts of climate change risks, climate-related anxiety, and particular considerations for youth, Indigenous, rural, remote, northern, isolated and disproportionately impacted populations.
 - Factors that contribute to community resilience and protection from the health impacts of climate change (e.g. affirmative mental and physical health outcomes, community cohesion).
 - Public health effects (including emergency response and public health interventions) of major climate emergencies and disasters, and/or associated short-term or prolonged evacuations and displacement.
 - Potential impacts of forecasted climate refugee displacements to inform Canada's public health system preparedness.

**Building Knowledge
on Climate-Health
Connections**
(continued)

- ▶ Explore the potential direct or indirect health co-benefits, risks or unintended consequences (maladaptive responses) of climate change mitigation and adaptation measures for individuals and communities, including how these measures may affect determinants of health and existing health inequities.
 - Impacts of climate change awareness and communication efforts on population socio-emotional responses and mental health, including anxiety, fear, grief and worry.
- ▶ Innovate, improve and/or evaluate interoperable and equity-informed public health indicators to better track climate change impacts on health.
- ▶ Innovate, improve and/or evaluate options for integrated and intersectoral risk monitoring and early warning systems that focus on climate change.
- ▶ Develop diagnostic methods and tools for emerging diseases related to climate change.
- ▶ Monitor and forecast existing, emergent or re-emergent infectious diseases (including zoonoses and antimicrobial resistant organisms), pests, and species of concern (e.g. invasive species and other vector populations) in light of expected climate changes in Canada.
- ▶ Monitor and forecast climate change impacts on water resources and water systems across Canada's diverse ecosystems and socio-cultural environments (e.g. frequency and severity of algal blooms, distribution of waterborne pathogens, contamination as a result of wildfires, water reuse requirements) and their resultant impacts on health outcomes.
- ▶ Monitor and forecast the interactions among climate change, food systems and human health in Canada to identify critical vulnerabilities (e.g. health, food security, changing availability of subsistence species, land- and sea-based cultural and harvesting opportunities, traditional food systems, food-borne disease) and points of adaptation intervention.
- ▶ Use improved seasonal, decadal and century-scale projections of climate events and extremes (e.g. tipping points, hard and soft limits to adaptation) to inform public health disaster risk management, advance emergency preparedness, and/or evaluate the effectiveness and feasibility of adaptation interventions under future climate scenarios.
- ▶ Use integrated air quality modelling to improve understanding of the population health impacts associated with climate change-dependent exposures (e.g. PM2.5 levels, pollution, wildfire smoke, airborne allergens) and to identify populations at greater risk.

Building Knowledge on Climate-Health Connections

(continued)

- ▶ Innovate, improve and/or evaluate modelling methods, simulations and technical frameworks to project and assess future compounding and cascading climate change events, climate hazards and climate-sensitive health outcomes over different timescales.
 - ▶ Innovate, improve and/or evaluate methods, tools and technologies to measure, model and map current and projected impacts of climate change on public health systems, and to monitor their state of resilience.
 - ▶ Innovate, improve and/or evaluate approaches to model and map future costs of climate change on public health systems (e.g. health policies, programs, services, and infrastructure; health human resources planning, management and training; supply chains critical for health), including those in northern, remote, and isolated regions, and those in urban centres serving primarily First Nations, Inuit and Métis Peoples.
 - ▶ Conduct climate change hazard and response mapping, as well as population health vulnerability and adaptation assessments that include information on the structural, social and ecological determinants of health.
 - ▶ Conduct intersectional analyses to better understand differential health-related risks, existing and compounding vulnerabilities and the impacts of climate change experienced by priority populations. Specific areas include:
 - Structural drivers and social determinants of health and inequities (e.g. food insecurity, low income, inadequate housing, racism, colonialism) that contribute to vulnerability to or factors associated with resilience against climate-related health impacts and the effectiveness of adaptation efforts.
 - Impacts of geographical and urban-rural-remote variation on climate change-related health outcomes within and among priority populations.
 - Holistic and long-term impacts of climate change within and among diverse First Nations, Inuit and Métis Peoples and communities. Specific topics include impacts on food and water safety, food security, air quality, health infrastructure, personal safety, mental health, transportation, livelihoods and identity.
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Intersectoral Action on Climate Change and the Determinants of Health

- ▶ Explore how public health agencies across various jurisdictional levels (in Canada or internationally) have adapted their structures and functions to address climate change.
 - Identify effective governance structures and mechanisms for effective intersectoral action on climate change at multiple levels.
 - ▶ Explore how effectively public health is integrated within intersectoral climate policies, plans and programs across Canada (including government climate plans, First Nations, Inuit and Métis governments and organizations, rights holders, Modern Treaty holders, etc.). Develop and/or evaluate approaches to better:
 - Engage intersectorally and build relationships with communities, professionals, experts, stakeholders and leadership outside of the public health sector, in order to support adaptation actions at the national, regional, local and individual level.
 - Integrate public health evidence, concepts, knowledge, and tools to public health policy and planning on climate adaptation and mitigation strategies at various jurisdictional levels.
 - ▶ Innovate, improve and/or evaluate best practices for the application and implementation of health-related frameworks and approaches (e.g. Health in all Policies, **One Health**, Planetary Health) to other sectors such as agriculture, housing, transportation, energy, and urban planning.
 - ▶ Partner with Indigenous scholars, public health experts and organizations, Community Elders, and Knowledge Keepers to explore governance mechanisms that would support self-determination among First Nations, Inuit, and Métis Peoples in public health climate change decision-making and action.
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Public Health System Leadership for Climate Action

- ▶ Explore policy approaches for Canadian public health systems to engage effectively in climate change adaptation and mitigation.
- ▶ Explore the outcomes of expenditure policies versus regulation in achieving equitable health outcomes within climate change adaptation and mitigation initiatives.
- ▶ Explore knowledge translation and mobilization tools, methods, and approaches to convey climate change and health evidence to decision makers and the public.
- ▶ Explore how public health surveillance and assessment systems can be used to monitor and act on climate hazards, health and health system vulnerabilities, and impacts on mental health, emerging diseases and other climate-sensitive public health outcomes.
- ▶ Explore climate-health tools and methods for policy makers and practitioners to support decision-making, bridge the knowledge action gap, and facilitate communication and action.
- ▶ Innovate, improve and/or evaluate approaches that incorporate health and equity considerations into economic analyses, modeling and forecasting of climate change adaptation and mitigation measures, as well as the costs of inaction and co-benefits of action.
 - Identify synergies between actions that support health and health system resilience, adaptation, and environmental sustainability and those that support financial and economic sustainability.
- ▶ Innovate, improve and/or evaluate communication strategies and narratives to effectively convey the public health risks of climate change, the co-benefits of climate change adaptation and mitigation, and climate-related health promotion.
 - Explore the factors that influence public trust/distrust/mistrust in public health authorities and how to address them, particularly among priority populations.
 - Explore approaches to support public health risk communications and to address mis- and dis-information relating to climate change.
 - Evaluate the effectiveness of current climate change and public health risk communication strategies.
- ▶ Innovate, improve and/or evaluate best practices for communities and governments to successfully mainstream health considerations into climate change planning and policy processes, including recovery across sectors.

Public Health System Leadership for Climate Action
(continued)

- ▶ Innovate, improve and/or evaluate strategies to better incorporate diverse types of knowledge, expertise, and approaches to understand health risks, climate stressors and vulnerabilities into public health decision-making and adaptation design.
 - Explore the determinants of health adaptation capacity (e.g. access to financial resources, social networks) in different contexts and the inter-relations between these factors.
 - Incorporate transdisciplinary approaches and/or Indigenous knowledges to public health knowledge sharing, data integration, and analytics.
 - Use implementation science to evaluate health adaptation initiatives, emergency management and response solutions, and other intervention strategies to reduce climate-related health impacts
 - ▶ Innovate, improve and/or evaluate strategies to train and build public health workforce and research capacity/competency in order to be responsive and resilient to future climate change related health emergencies.
 - ▶ Conduct behavioural and social science to understand public attitudes, behaviours and perceptions around climate change and health. Explore:
 - Perceptions of climate-related risks across populations and their solutions.
 - Challenges that priority populations (e.g. low-income, older adults, and racialized communities, people with disabilities and mental health issues) face in seeking and processing climate change and health risk communication information (including information overload and contradictory information), and co-develop strategies to address them.
 - Influence of household, family and social dynamics on risk perception, action, decision-making and preparedness during extreme weather and climate change events.
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APPENDIX A:

Glossary

- ▶ **Health Equity:** Longstanding inequities have an impact on populations' health. Inquiries and adaptation measures should consider equity in design and implementation and aim to advance equity and reduce inequities. Particular attention is needed to ensure that research and knowledge is collected and used in a culturally safe way.
- ▶ **Indigenous Health:** Amongst those who are most closely affected by environmental changes are First Nations, Inuit, and Métis Peoples and their communities, as Indigenous health and well-being are connected to the wellness of the land. Indigenous Peoples' rights and responsibilities over their lands, natural resources and ways of life must be respected, protected and prioritized in climate change policy, research and adaptation solutions.
- ▶ **One Health:** An integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, plants and the environment.
- ▶ **Participatory Research:** Inquiries related to improving population health and well-being should be informed by those with lived experience. This means working in collaboration with community partners and promoting community self-determination through authentic engagement, co-design and co-production.
- ▶ **Place-Based Approaches:** Target the specific circumstances of a place and engage the community and a broad range of local organizations from different sectors as active participants.
- ▶ **Priority Populations:** Refers to any populations whose characteristics, conditions and/or circumstances may result in being disproportionately at risk or impacted by the direct and indirect health risks of climate change. These include, but are not limited to: First Nations, Inuit and Métis Peoples; children and youth; women; older adults and persons living with dementia; marginalized populations; racialized populations; gender and sexually diverse populations; persons with disabilities, special health care needs or pre-existing conditions; persons who are unhoused or homeless; persons who use substances; certain occupational groups; as well as rural, remote, northern or isolated populations.
- ▶ **Research:** Continuum of evidence-or knowledge generating activities. Includes knowledge syntheses, operational/implementation research, applied research and observational and intervention studies.
- ▶ **Public Health-Related Research:** Research that aims to directly or indirectly address at least one of the essential public health functions: health promotion; health surveillance; health protection; population health assessment; disease and illness prevention; and emergency preparedness and response.

APPENDIX B:

Methods

A phased approach was used to synthesize a list of climate change knowledge gaps and priority research opportunities relevant to public health or public health systems in Canada.

Scoping and Literature Review

This list builds on early evidence scans conducted by Public Health Agency of Canada's (PHAC) Office of the Chief Science Officer (OCSO). The first phase entailed scoping of federal government and National Indigenous Organizations' health-related climate change assessment reports and strategic documents (see [References](#)) to develop a broad list of expert-identified knowledge gaps that were identified through the engagement of key subject matter experts and stakeholders in those processes. The OCSO also commissioned two rapid evidence profiles of the published literature on climate change and public health in Canada from the McMaster Health Forum. Research gaps were extracted from all sources if they met the following criteria: 1) addressed an impact related to public health and 2) provided knowledge and/or research that would affect or inform public health action.

Synthesis

In the next phase, the resulting list was first combined with the knowledge gaps and actionable research topics that emerged in the research and development of the Chief Public Health Officer (CPHO) Annual Report 2022, duplicate topics were removed, and then complementary concepts and research themes were synthesized and refined for clarity. Lastly, each knowledge gap was then mapped and organized according to the thematic objectives outlined in the CPHO's 2022 Report.

Validation

The synthesized list of research opportunities identified were validated for scientific and public health resonance by key climate change and public health stakeholders including the PHAC's National Adaptation Strategy (NAS) working group, CPHO 2022 Report Advisors, the National Collaborating Centres for Public Health, and the Canadian Institutes of Health Research.

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