



Executive Summary

HEALTH OF CANADIANS IN A CHANGING CLIMATE:
ADVANCING OUR KNOWLEDGE FOR ACTION



Health
Canada

Santé
Canada

Canada



Summary

Climate change is already affecting the health of Canadians and, without taking concerted action, will continue to result in injury, illness, and death – with greater warming comes greater health risks. Many of these health impacts can be prevented if Canada rapidly and substantially scales up efforts now to adapt to growing threats to health. With increased awareness of the issue and collaboration among partners, health decision makers and communities should seize this window of opportunity to adopt strong adaptation measures and make health systems and facilities environmentally sustainable and resilient to climate change. Otherwise, climate change will continue to stress health systems, through longer-term impacts and by increasing disasters and emergencies that threaten to overwhelm their ability to protect Canadians and their communities.

How to use this report

The report [*Health of Canadians in a Changing Climate: Advancing Our Knowledge for Action*](#) assesses the latest research and knowledge to inform Canadians about the effects of climate change on health and health systems, populations most at risk of these effects, and the adaptation measures being taken in Canada.

The report is designed to help decision makers plan for the health effects of climate change and take action to reduce risks as well as to empower individuals to protect themselves and their loved ones. Public health officials can learn from promising practices to mainstream consideration of climate change and health into their plans and activities.

Information presented in the report and the accompanying infographics, policy briefs, and presentations may be used by local and regional health authorities, and provincial and territorial governments to undertake climate change and health vulnerability and adaptation assessments, and engage and mobilize partners in adaptation efforts. It can also be used to raise awareness among all Canadians of the need to take concerted efforts to address the climate change challenge and of the many health benefits of doing so.



Climate Change Impacts on Health

Research shows that the health of Canadians has been affected by climate variability and change in recent years – both directly, when extreme heat and other natural hazards result from climate change, and indirectly, through a range of social, environmental, cultural, and economic pathways that have effects on health. Recent health effects related to rising temperatures and extreme heat, wildfire events, and the expansion of zoonotic diseases into Canada, such as Lyme disease, are linked to a warming climate.

All Canadians can be affected by climate change; however, the distribution of these impacts and related health risks are not uniform. Seniors, children, racialized populations, low-income individuals, individuals with chronic health conditions, and First Nations, Inuit, and Métis peoples often experience greater health impacts of climate change. Existing health inequities and variations in the status of determinants of health can drive this increased risk, as can an individual's sensitivity (such as pre-existing health conditions) and exposure (such as geographic location) to climate hazards.

Natural Hazards

A range of natural hazards, including extreme weather events, routinely affect the health of Canadians, but sometimes effects on communities can be catastrophic. The number of days when the maximum temperature climbs over 30°C has increased in Canada, by about one to three days annually from 1948 to 2016 {3.4.1.2}. Such extreme heat increases deaths in Canadian cities by 2% to 13%, according to one study {3.4.2.1}. It is estimated that recent extreme heat events (“heat waves”) in Quebec have led to a significant number of deaths: 291 in a 2010 extreme heat event and 86 in a 2018 extreme heat event. A severe extreme heat event in British Columbia in 2021 resulted in the death of 740 people {3.4.2.2}. Extreme heat can also increase hospitalization for cardiovascular problems {3.4.2.4} and pregnancy complications, including premature birth, early delivery, miscarriage, and congenital abnormalities such as neural tube defects {3.4.2.6}. While some risks, such as injury and death from cold, may decrease, the increase in death due to heat is expected to outpace the reduced rates of death due to cold {3.6.3.2}.

Drought increases fine dust in the air, which affects cardiovascular and respiratory health function. During droughts, winds spread pollen, fungi, mould, and bacteria, causing allergies and diseases. When rain falls after drought, pathogens can be carried into water bodies and drinking water systems, causing water-borne disease. Crop failures due to drought have many ripple effects on food security and food prices, as well as on the mental health of farmers and others in agricultural communities {3.7.2.4}.

Rainstorms and freezing rain result in pedestrian and motor vehicle-related injuries and other health risks due to infrastructure failure (such as power outages). Wind can also lead to accidents, especially if it reaches speeds of more than 70 km/h. Storms can lift massive amounts of pollen into the air, causing asthma outbreaks. In addition to washing viruses, bacteria, and parasites into surface and groundwater, leading to acute gastrointestinal illness, storms can spread the bacteria in airborne particles that cause legionellosis {3.9.2.5}.



Flooding can result in injuries, drowning, hypothermia, and electrocution. Because floodwaters can become contaminated from various sources, including sewage overflow, they can cause gastrointestinal and skin disease as well as infect wounds. Flooded homes can become unsafe because of mould, fungi, and bacteria. If power outages result from storms or floods, these can lead to accidents due to darkness, hypothermia from lack of heat, and carbon monoxide poisoning from using barbecues, camp stoves, and outdoor heaters indoors {3.9.2.6; 3.10.2.5}. Flooding can result in the evacuation of communities and cause long-term displacement, including from traditional territories, which can cause significant impacts on the health and well-being of affected Indigenous Peoples {2.4.1}. Studies show that flood victims can suffer mental health problems and cardiac events after a flood {3.10.2}.

Climate projections show increased extreme heat events in communities across Canada, and less precipitation in the summer throughout Southern Canada, with more droughts and water shortages in the summer in the Southern Prairies and the British Columbia Interior throughout the rest of this century {3.7.1}. While summer rain will decrease in Southern Canada, paradoxically, overall annual precipitation is increasing, especially in Northern Canada. More extreme precipitation events (unusually heavy rainfalls) are expected in the future {3.9.1}, leading to increased urban flood risk. Rising sea levels on the east coast of Canada are expected to submerge and erode coastlines.

With changing rainfall, snowfall, and temperatures, landslides are expected to become more common; the effect on avalanches has not yet been determined {3.11.1}. These hazards are rare in Canada but pose a risk of injury and death when they do happen. Avalanches are a risk for back-country skiers and snowmobilers, and landslides threaten homes and other infrastructure on hillsides {3.11.3}.

A growing threat to health in Northern communities is permafrost melting. Permafrost currently covers 40% of Canada's landmass, but this area is expected to decrease by between 16% to 20% by 2090, compared with 1990 {3.11.1}. Thawing threatens the stability of buildings, roads, and communities in Northern Canada, with concomitant effects on transportation and access {2.4.1}. As it melts, permafrost may release infectious diseases from frozen wildlife carcasses and heavy metals such as mercury that can threaten health {3.11.2.3}.

Air Quality

Exposure to air pollution causes a range of adverse health effects, including respiratory symptoms, development of heart and lung diseases including cancer, and premature death. Three major outdoor air pollutants – fine particulate matter, ground-level ozone, and nitrogen dioxide – together cause about 15,300 premature deaths in Canada annually, with an economic cost of \$114 billion {5.3}. Climate change and air quality are closely linked. Key air pollutants are produced from fossil fuel combustion, which is also a primary source of greenhouse gases (GHGs) {5.4}, and from wildfires, which are increasing as a result of climate change. Some air pollutants, such as methane and soot, worsen climate change, whereas some scatter solar radiation, cooling the planet. Climate change affects air quality, as higher temperatures can increase pollutants in smog, such as ground-level ozone. Large, slow-moving high-pressure weather systems, which are expected to become more common with climate change, also worsen air pollution {5.4.3 and Figure 5.1}.

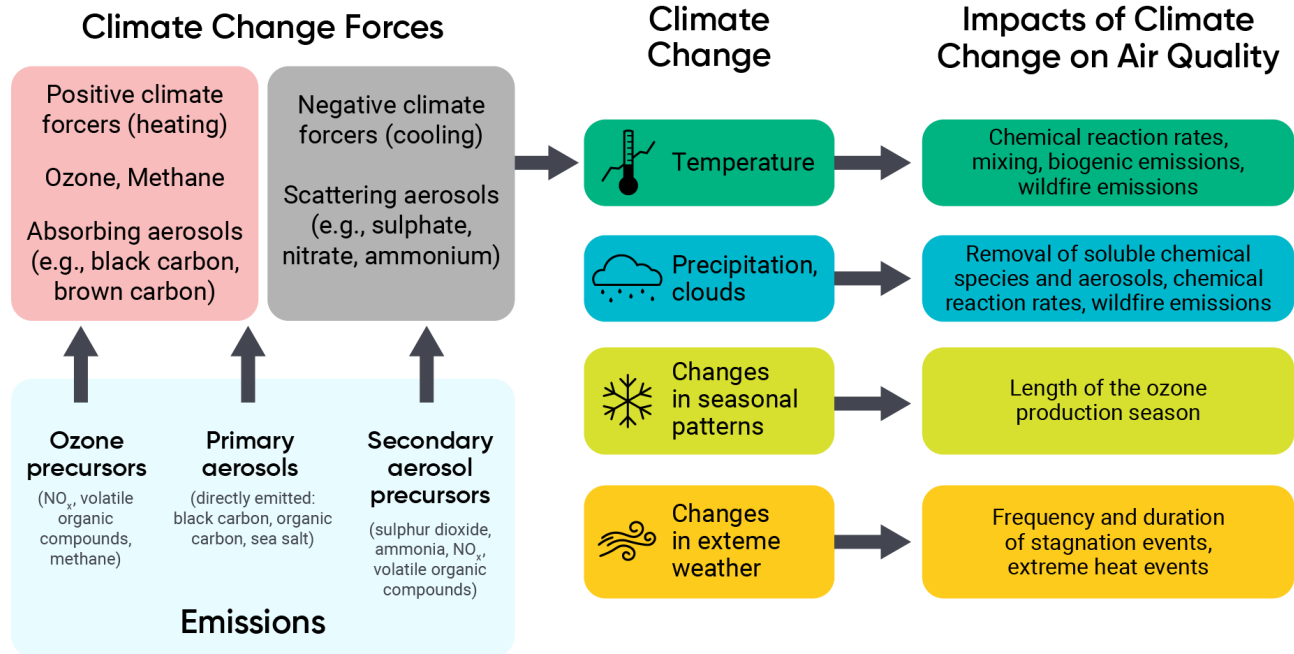


Figure 5.1 Linkages between air quality and climate change.

The area burned by wildfires in Canada is increasing, doubling from the 1970s to the 2000s. Western Canada, in particular, has seen significant increases in the number of fires and area burned from 1959 to 2015 {3.8.1}. In addition to residents and firefighters injured and killed by wildfire, smoke from wildfires, which can travel in plumes in the atmosphere up to several thousand kilometres, has adverse effects on health. Wildfire smoke contains many different air pollutants including fine particulate matter that can penetrate deep into lungs {5.3.1}. Exposure to wildfire smoke is associated with an increase in all-cause mortality as well as exacerbations of asthma and chronic obstructive pulmonary disease and increased respiratory infections. In Canada, the health burden of air pollution from wildfire smoke varies from year to year and between regions. Over five recent years, it is estimated that 54 to 240 premature deaths due to short-term exposure and 570 to 2500 premature deaths due to long-term exposure per year were attributable to fine particulate matter from wildfires as well as many non-fatal cardiorespiratory health outcomes. Studies project increases in these effects in North America throughout the century, including thousands of deaths, depending on the climate change scenario {5.6.4}. Wildfires in Canada causes property loss, evacuations, and environmental degradation, leading to increased mental health impacts in affected communities, such as depression, anxiety, and post-traumatic symptoms, even in young children {3.8.2.4; 3.8.3.3}.

Climate change can also affect indoor air quality, such as when elevated levels of outdoor air pollutants (including wildfire smoke) infiltrate buildings or when mould is produced after floods. Changes in the climate are also affecting airborne allergens by expanding the geographic distribution of plant species, extending pollen seasons and increasing pollen counts, which can affect the health of individuals with asthma and allergies.



Infectious Diseases

Risk from infectious diseases is affected by three factors: presence of the disease, protective behaviours by individuals, and people's sensitivity to the pathogen (which may be affected by their overall health and underlying health issues). Climate change is expected to affect all three of these factors directly or indirectly.

In 2008, a previous science assessment report projected that climate change would increase the prevalence of Lyme disease, as blacklegged tick vectors (*Ixodes scapularis*) and the infectious agents they carry (*Borrelia burgdorferi*) expand their range further into Canada from the United States, as a result of warming temperatures. Surveillance now provides strong evidence that Lyme disease emerged in Canada and spread northward as a result of climate change, causing a dramatic increase in human cases from 2009 to 2017 {6.3.1.5; Figure 6.5}.

Like Lyme disease, many other diseases will emerge or spread within Canada as our climate warms. These include viruses transmitted to humans by mosquitoes that are already found in regions of the United States bordering Canada, including La Crosse encephalitis virus. Like West Nile virus, which was probably imported to North America by infected mosquitoes on an airplane, other exotic viruses could reach Canada and spread if their reservoir hosts and vectors are found here. New species of mosquitoes and ticks may expand their range into Canada or arrive on human transportation, bringing both the vectors and the diseases they transmit. For example, a species of mosquito new to Canada that transmits chikungunya, dengue, and Zika viruses in other countries has become established in an area of Southern Ontario {Box 6.2}.

In addition to West Nile virus, Canada already has several diseases that can be transmitted by mosquitoes – eastern equine encephalitis virus, snowshoe hare virus, and Jamestown Canyon virus {6.3.1.3} – and one carried by fleas – *Yersinia pestis*, which causes pneumonic or bubonic plague {6.3.1.4}. Infections with these diseases are fortunately rare, and mainly result in mild or asymptomatic illness, but climate change could change the range and abundance of host animals and vectors, and lead to disease outbreaks {6.3.1.3}. Researchers are also watching other illnesses transmitted by blacklegged ticks (anaplasmosis, babesiosis, Powassan virus, and *Borrelia miyamotoi*), which are expected to spread in Canada with the expanding range of these ticks {Box 6.3}.

Climate change may have effects on diseases transmitted to humans directly by animals. Of concern is rabies in Arctic foxes, since the Arctic is warming more quickly than Southern Canada, affecting Arctic fox ecology. Hantavirus pulmonary syndrome, carried by mice, is a climate-sensitive disease, but it is not yet clear how climate change will affect it in Canada {6.3.2.1}. Roundworms and other parasites carried by domestic dogs, coyotes, foxes, or raccoons may expand their range in Canada {6.3.2.2}.

Weather and climate affect diseases transmitted from human to human. For instance, respiratory infections are often more prevalent in the winter. With climate change, milder and shorter winters may decrease incidence in that season, but research shows that warmer winters can lead to more widespread influenza the following year {6.3.3.1}.

Some infections acquired from the environment may also be sensitive to aspects of climate. *Cryptococcus gattii* {6.3.4.2}, blastomycosis {6.3.4.3}, and coccidioidomycosis {6.3.4.5} are fungal infections found in Canada, and risks from these are likely to change with expected changes in temperature and rainfall.



Water Quality

Climate change can affect the quality of drinking water, which is critical to health, and the safety and availability of water can have cascading effects on some other health risks discussed in this report. First, climate change can affect the sources of drinking water. Extreme rain events and rapid spring snowmelts can wash disease-causing bacteria and chemicals into oceans, lakes, and rivers. Heavy rainfalls can also lead to sewage overflows, which can contaminate bodies of water {7.3.2.3}. Conversely, droughts and low river flows can concentrate harmful substances and pathogens, causing health risks {7.3}. Rising temperatures can lead to outbreaks of toxic algae and cyanobacteria (together referred to as “harmful algal blooms”) in oceans and lakes, which can contaminate surface water and fish and shellfish.

Contaminated water can reach consumers directly if they use private surface or groundwater sources. Contaminated stormwater and wastewater can reach drinking water systems, which must be treated effectively to prevent illness in consumers. Fifteen per cent of Canadians get their drinking water from small non-municipal systems, and most water-borne acute gastrointestinal illnesses have been linked to such systems {7.3.2.1}. But even large municipal drinking water systems can be overwhelmed by extreme precipitation {7.3.3.2}. Stormwater can stir up sediments, making water more turbid and thus difficult to treat. If storms batter treatment facilities, water treatment systems can become ineffective or inoperative {7.3.2.1.1}.

Heavy rainfalls have been increasing in most regions of Canada under a changing climate. Such heavy rainfall was a contributing factor in the Walkerton, Ontario, tragedy in 2000, when bacteria entered the drinking water system, killing seven people and making hundreds ill. A single heavy rainfall was also involved in the worst outbreak of illness from drinking water in North America to date, in Milwaukee, Wisconsin, in 1993 {7.3.2.1}. Climate change driven sea-level rise also threatens to intensify water quality issues in coastal areas reliant on groundwater, with salt water intrusion of aquifers and private wells already challenging some coastal regions (such as British Columbia’s Gulf Islands and Atlantic Canada) {7.3.2.2}.

Access to safe drinking water is a particular problem for many Indigenous communities across Canada {2.4.5}. For example, 61 First Nations communities had been under a drinking water advisory for more than a year as of February 15, 2020. Such communities may use a variety of water systems, including wells, trucked water stored in tanks, and piped water, and may have few or no household water services. Lack of water can lead to dehydration and unhygienic conditions, and breakdowns in water safety can lead to gastrointestinal illness. Water insecurity may also lead community members to use “gathered water” from the environment, which may be unsafe.

Risks to Food Safety and Security

Climate change is an increasing threat to food safety and security in Canada. Storms and heavy precipitation can cause sewage overflow, carrying pathogens from the ground and sewage into water bodies, and contaminating crops in fields. If water treatment systems do not treat contamination effectively, food can become contaminated during production and processing, which require large amounts of clean water {7.3.3}.



Rising temperatures, changes in precipitation patterns, and extreme weather events can also contaminate food directly (Figure 8.4). Higher temperatures in fields and farms can mean that disease-causing pathogens grow more successfully in manure and soil. If food is not kept cold throughout its journey to the plate, warm temperatures can allow dangerous bacteria and other pathogens to grow. These pathways can lead to contaminated food, which is a particular problem for food eaten raw, such as leafy greens.

Health depends on food security – eating sufficient nutritious food. Food security, in turn, depends on the ability of the food system to support food availability, accessibility, and use (Figure 8.1). These are interconnected and affected by steps in the food system and social determinants of food security, such as income and cultural food traditions. If climate change affects the food system or determinants of food security, it can have cascading effects on health. Household food insecurity is associated with many adverse physical and mental health outcomes, including nutritional deficiencies, cardiovascular disease, diabetes, oral health issues, and depression. Furthermore, malnutrition can make people more susceptible to disease {8.4.2}.

Climate change is projected to affect global food availability, as rising temperatures, changing precipitation patterns, extreme weather, droughts, and sea level rise (saltwater flooding of coastlines) could all directly damage crops and decrease yields {Table 8.2}. These factors could also increase pests, invasive species, and diseases affecting food supplies. We are already seeing impacts on crops due to shifting climate patterns, such as the loss of the strawberry crop in Ontario in 2012 because of unusual spring temperatures {8.4.3.1}. As a storm in St. John's, Newfoundland and Labrador, demonstrated, food security can be affected when people cannot reach grocery stores for long periods {8.4.3.1}.

Rising carbon dioxide levels in the atmosphere may affect the nutritional content of food. Experiments have found that growing crops such as wheat, rice, and legumes in controlled environments with high atmospheric concentrations of carbon dioxide reduces zinc, iron, and protein concentrations by 3% to 15% {8.4.3.3.1}. Furthermore, pesticides and herbicides are less effective as carbon dioxide increases, which might lead to greater use and more health risks from these products {8.5.2.1.1}.

Climate change will also affect food accessibility. Research has shown disruptions to the global food system and supply chain from natural hazards, and climate-related lower crop yields have already been linked with increased food prices in Canada and may push them higher. These prices could make it more difficult for low-income Canadians to obtain essential foods they need to stay healthy.

Food insecurity can also result in changes in how people use food. This is particularly evident in Indigenous communities, where climate change is affecting the distribution, quality, and quantity of traditional food sources. In the absence of stable sources for traditional foods, Indigenous Peoples may rely more heavily on store-bought food, which can contribute to diets high in calories, salt, sugar, and saturated fat, and low in whole grains, nuts, seeds, legumes, fruits, and vegetables {2.4.4}. Such diets are a leading risk factor for death and disability in Canada {8.4.3.3.3}.

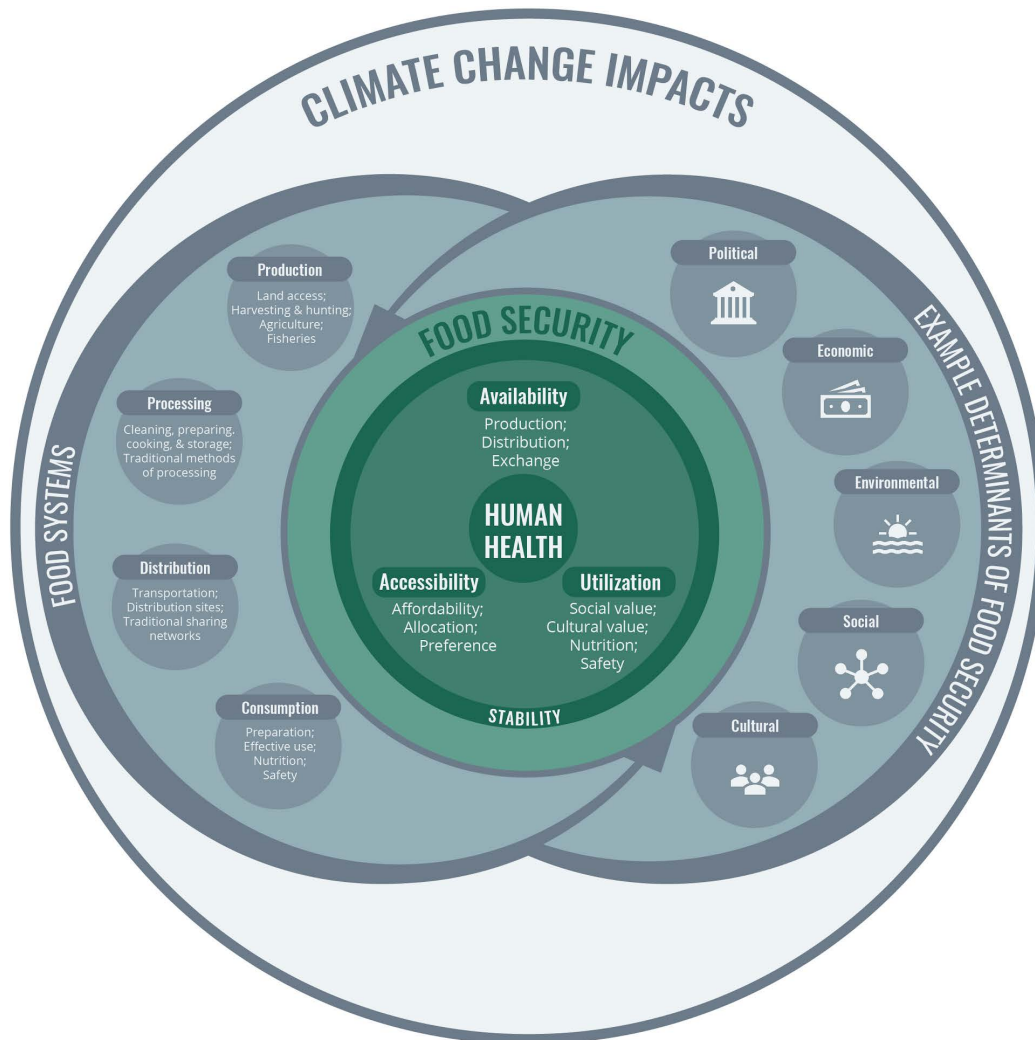


Figure 8.1 Conceptual framework outlining the relationships among food security, food safety, and health in a changing climate.

Mental Health

According to the Mental Health Commission of Canada, 7.5 million people in Canada experience mental health problems every year. While there are no known Canadian studies that project the mental health impacts of climate change, the current burden of mental ill health in Canada is likely to rise as a result of climate change. Costs of mental ill health borne by Canadians and health systems are expected to increase in the absence of further adaptation measures.



Climate change increases the risks of mental health impacts:

- worsening of existing mental illness such as psychosis;
- new-onset mental illness such as post-traumatic stress disorder;
- mental health stressors such as grief, worry, anxiety, and vicarious trauma; and,
- a lost sense of place, which refers to perceived or actual detachment from community, environment, or homeland.

Impacts can also include disruptions to psychosocial well-being and resilience, disruptions to a sense of meaning in a person's life, and lack of community cohesion. All of these can result in distress, higher rates of hospital admissions, increased suicide ideation or suicide, and increased substance misuse, violence, and aggression. Studies are also showing that people can become distressed about climate change itself, resulting in increased anxiety (often termed eco- or climate anxiety), grief (often termed eco-grief or climate grief), worry, anger, hopelessness, and fear.

Climate-related disasters are associated with mental health outcomes. For example, flooding, the most frequent form of disaster globally, can lead to increased levels of PTSD, general distress, depression, and anxiety among flood survivors {4.4.3.1}. Even people who are indirectly exposed to climate-related hazards can experience poor mental health outcomes, including vicarious trauma, secondary stress, and/or compassion fatigue for those whose lives have been disrupted by extreme events {4.4.3}.

Economic insecurity, displacement, and food and water insecurity after a disaster can also lead to mental health problems such as stress, anxiety, and depression {Chapter 4}. Research also shows that extreme heat can increase aggression and suicide rates, as well as increase social isolation for people who must stay inside {3.4.2.8}. Further, extreme heat can put people with mental illness at disproportionate risk because some mental illnesses, and some medications that treat mental illness, can affect the body's ability to cool down {4.4.3.2}. In addition, people with mental illness may face greater challenges in adapting to extreme heat because of cognitive impairment (for example, they do not seek shade) and/or socio-economic barriers, which disproportionately affect people with mental illness {4.4.3.2}.

Vulnerability to the Health Effects of Climate Change

As many sectors of Canadian society work together to mitigate and adapt to climate change, they must focus on the Canadians who are most at risk of the impacts. While climate change can affect any Canadian's health, an individual's sensitivity to climate change, exposure to its effects, and capacity to take protective measures and adapt (Figure 9.1) can increase or decrease vulnerability and their risk of being harmed.

The conditions and factors that affect a person's health, such as income, education, employment, and working and living conditions, are known as determinants of health. These determinants can increase or

decrease an individual's exposure or sensitivity to climate-related health hazards and can create barriers that limit their ability to take protective measures. Existing health inequities (avoidable and unjust differences in health) and determinants of poor health (such as low income, substandard housing, food insecurity) can compound climate change vulnerability and create barriers to adaptation. Structural systems of oppression that result in health inequities are underlying drivers of vulnerability to climate change. Such systems of oppression include racism, heteronormativity, and colonialism. Redressing inequities and strengthening determinants of good health is required to increase climate change resilience {9.4.3}.

Increased risk can also be linked to certain locations, such as Canada's North, which is undergoing more rapid climate change than Southern areas; rural and remote areas, where access to health care may pose problems {9.4.3.3}; and urban heat islands in cities, where dark, paved surfaces and lack of green space can cause temperatures to exceed those in surrounding areas, endangering residents during extreme heat events.

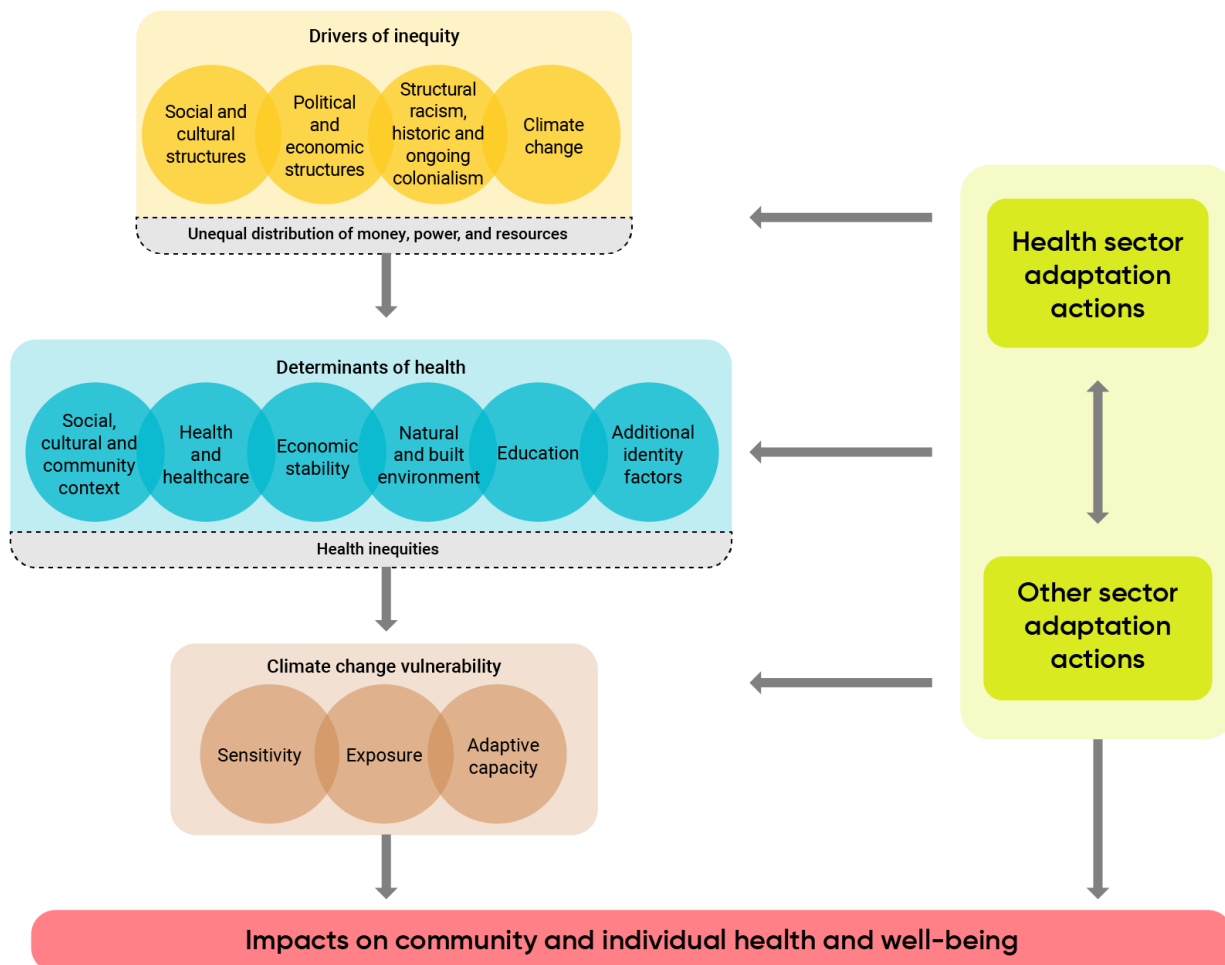


Figure 9.1 Climate change and health equity framework.

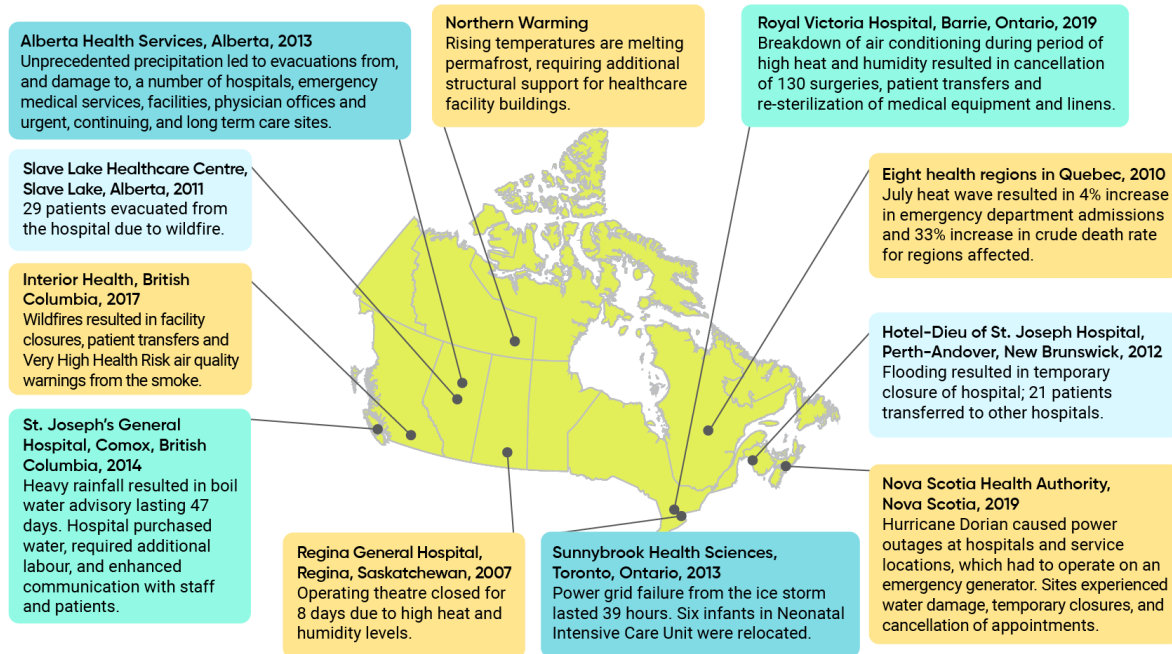


Research shows that the populations most affected by many climate change hazards are seniors, children, racialized populations, low-income individuals, individuals with chronic health conditions, and First Nations, Inuit, and Métis peoples {Chapter 2, Chapter 3, Chapter 9}. However, each individual within these broad population groups has a wide range of intersecting factors and characteristics that can increase or decrease resilience. Evidence shows that individual characteristics and resources should be taken into account when considering vulnerability and developing measures to empower people to adapt and to assist those disproportionately affected. In the absence of careful planning and accounting for existing health inequities, adaptation measures may benefit only part of the population and inadvertently worsen existing inequities {9.5.1}.

Many Indigenous communities, while experiencing disproportionate impacts of climate change and increased risk, draw on Indigenous knowledges that have enabled them to adapt and be resilient to climate over the millennia {2.5.1}. Thanks to strong community ties, for example, in Indigenous communities in the Arctic, people help each other cope with hazards and threats to health and safety {9.4.3.4}. There are gaps in current research of how some social groups, such as gender-diverse and 2SLGBTQIA+ people, experience the health effects of climate change {9.2}.

Current Impacts on the Health System

When climate-related emergencies and disasters strike, health facilities and services are among those affected. The report lists many examples of storms, floods, and wildfires that forced health care centres and hospitals in Canada to close temporarily, evacuate patients, and/or cancel operations and other services {Table 10.5}. But it is precisely during these disasters that Canadians need emergency services, and health care disruptions can have major effects on health and well-being. Even if health facilities and services remain operational during a climate-related disaster, they can be pushed beyond their capacity to respond because of injuries, illnesses, and patient transfers due to the disaster {10.4.1}. Combined effects of climate change that overlap and interact could lead to cascading effects on several health outcomes simultaneously.



Climate variability and change impacts on Canadian health facilities (Chapter 10, Table 5).

Adaptation and Preparedness

Canada can reduce the health risks – and thus the injuries, illnesses, and deaths – from climate change by taking steps to prepare for risks and adapt to climate change. To stay ahead of the climate change curve of increasing impacts, health officials must increase current efforts, in collaboration with those in other fields, to understand, assess, prepare for, and help prevent the health impacts of climate change {10.3.1}.

Many actions are already being taken to protect Canadians, and these provide a foundation for learning and expanding such efforts. For example, heat alert and response systems are increasing in Canada. They allow residents facing impending hot weather to take necessary precautions, such as staying hydrated, seeking cool areas, and helping family members and friends who may need assistance. Since an extreme heat event in 2010, the province of Quebec has had an early warning system, which may have helped alleviate the effects of an extreme heat event in 2018 {3.4.4.2}. Tests of a telephone alert system for seniors and those with chronic diseases in case of extreme heat in the Montérégie region of Quebec showed that it resulted in fewer medical appointments {Box 3.3}.

To reduce risks from air pollution, Environment and Climate Change Canada forecasts an Air Quality Health Index across the country (except in Quebec, which has its own system), which provides a risk rating, health messages, and health protection advice, the latter two aimed at specific groups that may be at increased risk



to the health impacts of poor air quality {5.7.1}. Further, the department has implemented Canada's Wildfire Smoke Prediction System (FireWork) to forecast fine particulate concentrations due to wildfire across Canada over the coming 48 hours {3.8.4.2; 5.7.2}.

Another common adaptation is "greening" of spaces in cities through planting trees and shrubs and creating parks. Several provinces and cities in Canada have actively adopted this measure, to combat urban heat islands. The soil in green spaces can also soak up excess water during heavy rainfalls and floods. However, greening of urban spaces has to be carefully planned and accompanied with public health guidance and messaging to avoid increasing risks from infectious diseases such as Lyme disease, and impacts of pollen on allergies.

Adaptation to infectious diseases that may emerge or increase with climate change requires a "One Health" approach that integrates our knowledge of disease in humans, the role of animal disease reservoirs, and the role of the environment, including climate. This integrated approach is needed to design and undertake systematic assessments of where disease risks may emerge, conduct surveillance for emerging diseases, and develop prevention and control responses (ranging from public alerts to vaccination programs) to protect Canadians from infectious diseases driven by climate change.

Generally, health authorities are lagging in climate change and health actions needed to keep up with growing risks to Canadians. For example, many do not have a climate change and health program or dedicated resources to support the development of adaptation measures. Research also shows that many health facilities — a critical component of health systems in efforts to reduce climate change impacts — are not taking needed actions to prepare for current risks and future warming {10.4.1}.

Many sectors must come together to address climate change impacts, as adaptation efforts related to land-use planning, infrastructure development, emergency preparedness, environmental management, and transportation planning can all affect health {Chapter 10}. Climate change adaptation plans, from local to national levels, can reduce health outcomes if they "mainstream" consideration of health in these plans and routinely evaluate their effectiveness as the country continues to warm.

While adaptation carries costs, these are offset by mitigating the escalating costs of health care due to climate change. Recent research in Quebec suggests that the projected costs of the increase in ragweed allergies due to climate change are \$360 million for governments in that province and \$475 million for society as a whole. For extreme heat, the study estimated increased costs of \$370 million for governments in Quebec. In addition, increases of Lyme disease due to climate change are projected to cost governments in Quebec \$60 million to \$95 million {10.4.2}.

Making Adaptation Inclusive and Equitable

Research suggests that vulnerability and adaptation assessments (V&As) for climate change and health can be helpful in identifying the root causes of vulnerability, such as food insecurity, inadequate income,



and social exclusion {Box 9.3}. They can also be used to identify unintended – negative or positive – health impacts of a planned policy, program, or initiative on marginalized populations {9.4.4}.

Adaptation planning should involve communities and those most affected by climate change. Participation of marginalized individuals and communities that already experience a disproportionate burden of illness and health inequities, such as Indigenous Peoples and racialized populations, is particularly important {Chapter 9}. Health adaptation planning can also include partnering with populations at highest risk, including women, persons with disabilities, seniors, immigrants, low-income residents, non-English/non-French speakers, outdoor workers, people exposed to environmental pollution, people with existing illnesses, people without access to insurance, public housing residents, newcomers to Canada, lone-parent households, students, transient and homeless populations, and parents with young children {10.3.2}.

A number of frameworks familiar to public health authorities are available to help decision makers engage with communities. To increase the representation and participation of groups that have often been excluded, decision makers and researchers need to recognize, acknowledge, and remove barriers to participation (such as financial burdens, travel requirements, language, child care, etc.). Investing time and resources in relationship-building and cultivating trust is key to this process {9.5.3}.

Adaptations affecting Indigenous communities should be Indigenous-led. There are many examples of adaptation projects that have improved health and were led by the community: a project to develop climate-resilient, healthy, and culturally appropriate housing in Nain, Nunatsiavut, Newfoundland and Labrador {9.5.2}; and a project to map flooding hazards and its effects in the Cree community of Kashechewan, in Northern Ontario {2.4.1; Box 2.2}.

Tailoring actions to protect health to specific communities and locations is one of the ways to avoid “maladaptation” – inadvertently causing other health risks when implementing adaptation measures. For example, greening in a city by planting pollen-producing trees can cause health problems for allergy sufferers {10.3.3; Table 2}. Or creating an urban green space can backfire if it leads to gentrification and displaces low-income people the park was designed to benefit. Adaptation needs to be carefully considered to avoid such missteps {10.3.3; Table 10.2}.

Adaptation of the Health System

The health system needs to be included in adaptation. Adaptation can help the health system prepare for climate-related effects on health and protect it from future effects on infrastructure, staff, and services. The adaptation framework for health systems {10.3.2} includes, among other areas of focus, analyzing health facility resilience, a first step in ensuring that health services remain functional. To support such an analysis, the Canadian Coalition for Green Health Care, in partnership with Health Canada, has developed a Health Care Facility Climate Change Resilience Checklist that can find gaps in resilience. More facilities need to assess their readiness for climate change impacts. In a recent survey, only 9% of health care facility staff



respondents reported having completed resilience assessments, while only 4% have completed vulnerability assessments {10.4.1}.

Adaptation measures taken for health care facilities can include a range of actions in areas such as workforce training, food and medical supplies procurement, emergency preparedness, and design and engineering changes or upgrades to cope with heat, flooding, and power outages. As an example, the Nanaimo Regional General Hospital in British Columbia completed renovations in 2012 designed to lower risks in case of an extreme-weather emergency and to lower energy costs {Box 10.6}.

Health Co-Benefits of Climate Change Mitigation and Adaptation Actions

Measures taken in many sectors to mitigate climate change (by reducing GHGs or sequestering carbon) or to adapt to climate change can also have very large benefits for health – immediately or in the long term. These “co-benefits” of climate change mitigation and adaptation add to the value of action taken and can avoid poor health outcomes and economic costs to health systems and society {10.6}. Economic savings from such actions can also help to offset the costs to society of reducing GHGs.

As some examples, reducing fossil fuel use can improve air quality through reductions in fine particulates including soot and ground-level ozone. Better air quality has multiple co-benefits, including reductions in cardiovascular and respiratory diseases, and deaths. Greening communities to cool them can also have multiple knock-on health benefits, such as reductions in chronic diseases and improvements to mental health. Measures to make communities more liveable, such as installation of walking and biking paths, can improve exercise levels and mental health in residents. Such measures can also have positive impacts by reducing social isolation and crime {10.6}. Analysis in this assessment estimated that reductions in Canadian GHG and air pollutant emissions consistent with an RCP 6.0 pathway could result in 5200 avoided deaths for a single summer in 2050.

Several successful GHG mitigation and adaptation projects in Canada have had major co-benefits. To mention one, the University Health Network (UHN) in Toronto, Ontario, has reduced GHGs from its on-site natural gas use and consumption of purchased electricity, heat, or steam by 19% from 2010 to 2019. Much of this reduction came out of 214 energy projects completed between 2013 and 2018, saving UHN \$18.9 million in utility costs. For cooling, UHN has also replaced traditional chillers with Deep Lake Water Cooling Technology at some of its facilities; this technology uses water cooled by Lake Ontario, improving the capacity, resilience, and reliability of UHN’s chilled water system, and saves more than \$22 million over 20 years. Such projects improve air quality, by removing sources of fossil fuel use, and water availability, by foregoing the use of water in cooling (in this case, 67 million litres per year) {Box 10.8}.



Scaling-Up Efforts to Protect Canadians

The health of Canadians can be protected from climate change. Canada has a historic opportunity to avoid many of its health effects. Decision makers in the health sector are recognizing the need to take adaptation measures to prepare for the health impacts of climate change. Levels of inequity, social cohesion, and technological innovation will influence how greatly the health of Canadians and their communities are affected by climate change and should be taken into account in all adaptation plans and processes. The resilience of health systems and the willingness and capacity of decision makers to take needed adaptive actions, in close collaboration with other sectors, will determine how the health system responds to climate change and helps Canadians affected by it. Reducing health risks to First Nations, Inuit, and Métis peoples requires respect for rights and responsibilities over their lands, natural resources, and ways of life, and advancing these rights through distinctions-based, Indigenous-led, climate change adaptation, policy, and research {Chapter 2}.

A number of health authorities, from local to national levels, in Canada are taking adaptation actions to reduce health risks. These experiences can be shared to mobilize further efforts to protect health. Such efforts must be scaled up rapidly and focused on health and health systems to take advantage of this opportunity to prevent and prepare for the health impacts of climate change.

The health of Canadians and their communities cannot be protected if warming continues unabated. Increased efforts to reduce GHGs can have very large health co-benefits, building individual and health system resilience and countering the effects of a warming climate. The health sector has the opportunity to show leadership in reducing its carbon footprint and preparing for climate change. The future health of Canadians will rely on such efforts from our decision makers.

Source:

Berry, P., & Schnitter, R. (Eds.). (2022). [*Health of Canadians in a Changing Climate: Advancing our Knowledge for Action*](#). Ottawa, ON: Government of Canada.