



Chapter 2:

CLIMATE CHANGE AND HEALTH

Health impacts, vulnerability, and the need for an equity-focused approach.

Key Messages

- **Climate change is expected to be the most challenging public health issue of the 21st century and is already affecting the health of Canadians.**
- **Substantial scientific evidence links climate hazards with illness, injury and death from severe weather, poor air and water quality, food insecurity and food contamination, vector borne diseases, and ultraviolet radiation.**
- **Climate-related disasters can also have lasting negative mental health impacts.**
- **Healthcare systems will be impacted by a wide range of climate-driven emergencies.**
- **Not everyone has the same ability to protect themselves from harmful climate hazards and there is a need to prioritize those who are worst affected and least protected.**
- **A focus on health equity is essential to understanding the complex dimensions of vulnerability and addressing the different health impacts of climate change.**

Acronyms

CCHVA	Climate change and health vulnerability assessment
CRPD	Convention on the Rights of Persons with Disabilities
DRHD	Durham Region Health Department
EDOH	Ecological determinants of Health
GTA	Greater Toronto Area
HVAs	Health vulnerability assessments
IPCC	Intergovernmental Panel on Climate Change
MOHLTC	Ministry of Health and Ministry of Long-Term Care
SDOH	Social determinants of Health
UVR	Ultraviolet radiation

Terms & Definitions

Ableism

A set of beliefs or practices that sees persons with disabilities less worthy and results in discriminate and limited opportunities for persons with disabilities. [1]

Acute Hazard

Immediate and short-term events like floods, extreme heat events, wildfires, and tornados that can negatively impact health and wellbeing.

Adaptive Capacity

The ability of an individual or community to respond to and protect against the health impacts of climate hazards.

Climate Anxiety

Describes having knowledge of the possible dangers or impacts of climate change but not having the ability or resources to lessen it. [2]

Climate Change

Refers to a change in the condition of the climate that can be identified by changes in statistical measures like the average (mean) and/or variability in weather and atmospheric conditions that persists for an extended period, typically decades or longer. [3, 4]

Climate Change And Health Vulnerability Assessment

Helps to identify risks associated with climate changes and the populations most vulnerable to those risks. [5, 6, 7]

Climate-Resilient Health Systems

Can anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stresses, to bring sustained improvements in population health. [8]

Eco-Anxiety

Describes severe worry about climate change and the environment which can lead to physical and mental health impacts such as loss of appetite, sleeplessness, and panic attacks. [2] It is sometimes used interchangeably with climate anxiety.

Ecological Grief

Describes the feeling of grief or anxiety following an ecological event or disaster and/or a feeling of sense of shame when seeing the natural environment affected by climate change (e.g., mountain snow caps receding, rising river levels, wildfires). [2]

Exposure

The degree to which an individual or community faces climate hazards. It is influenced by underlying social and economic conditions that result in some individuals or communities experiencing more exposure to climate hazards than others.

Health System

All activities with a primary purpose to promote, restore and/or maintain health.

The people, institutions, and resources, arranged together in accordance with established policies to improve the health of the population, while responding to people's legitimate expectations and protecting against the cost of ill-health through a variety of activities with the primary intent to improve health.

Impacts

This term is used to refer to the effect of climate events and changes on natural and human-made environments. These impacts often refer to effects on lives, livelihoods, health, ecosystems, societies, economies, service delivery and infrastructure. Impacts are also sometimes called consequences or outcomes.

Intersectionality

Intersectionality recognizes that the experience of multiple forms of discrimination and disadvantage (e.g., racism, classism, sexism, homophobia) has accumulative negative effect that is greater than the sum of the parts. An intersectional approach to public health recognizes that health equity must address interwoven systems of power and oppression. [9]

“Nothing About Us Without Us” Principle

‘Nothing about us without us’ is a principle that was adopted by the International Disability Caucus during negotiations of the United Nations’ “Convention on the Rights of Persons with Disabilities” (“CRPD”). [10] It centres on including the voices and perspectives of underrepresented groups in decision-making processes that directly affects these groups. The principle aims to promote inclusivity, equity, and “best fit” policymaking.

Resilience

Describes the ability of a system to respond or cope with a hazardous event or disturbance in ways that maintain its essential function.

Sensitivity to Climate Hazards

The degree to which an individual or community is affected by a climate hazard. This can be influenced by age, genetics, health status or community health disparities.

Slow-Onset Hazard

Gradual changes or long-lasting events like drought, sea-level rise and melting permafrost that can have negative impacts on health and wellbeing.

Solastalgia

Describes feeling homesick while one is still in their home area. This often occurs after a dramatic change in the environment either through a sudden event or disaster like a wildfire or flood, or a gradual change such as rising river levels or disappearance of native tree species. [11]

Xenophobia

Fear, hostility or hatred against strangers or people from different cultures or places.

CHAPTER 2

CLIMATE CHANGE AND HEALTH

Climate change is the single biggest threat to human health and without urgent action, it will continue to result in injury, illness, and death. A strengthened public health system is a key partner on climate action, including by helping communities understand and adapt to the inevitable effects of a changing climate.

- Jean-Yves Duclos
former Minister of Health of
Canada

Health impacts, vulnerability, and the need for an equity-focused approach.

2.1 Background

Climate change is expected to be the most challenging public health issue of the 21st century and is already affecting the health of Canadians. [12]

Climate change poses a serious threat to human health and wellbeing. [13, 14, 15, 16, 17, 18, 19, 20, 21] Increased extreme heat days, extreme weather events, infectious diseases and other climate-related hazards are associated with greater health burdens that are expected to increase as the impacts of climate change intensify.

Most Canadians are concerned about the potential health effects of climate change. [22] A 2017 national study, showed that 93 per cent of Canadians who acknowledge the reality of climate change, identified that it is either a current health risk (53%) or a future health risk (40%). [23] Over half (55%) also felt their personal health was vulnerable to climate change impacts. [23]

There is a need to prepare for and adapt to a changing climate, and there is growing concern among the scientific and public health community that effective adaptation options will become constrained and less effective as climate impacts escalate. [4, 24]

2.2 The Health Impacts of Climate Change

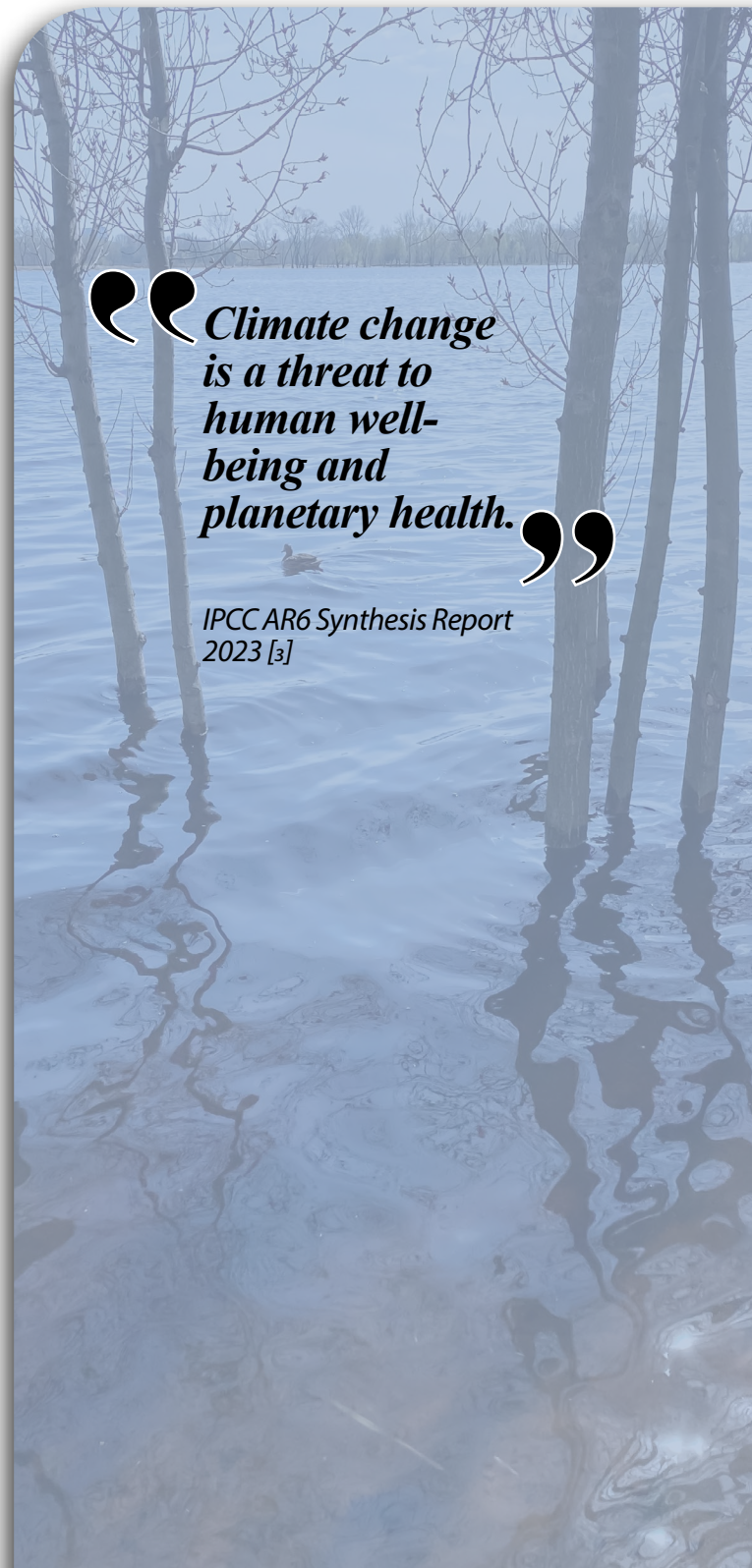
Substantial scientific evidence links climate hazards with direct and indirect health impacts. [24, 25]

The International Panel on Climate Change (IPCC) is the international body established by the United Nations and the World Meteorological Organization to provide policymakers with expert, objective scientific assessments on climate change. As the global authority on climate change science, their extensive reviews, syntheses and reports provide proven evidence of the association between climate change and negative health outcomes that range from mild to severe and even fatal. [3,18,20,26,27].

Climate change can have direct and indirect health effects that may be temporary, last many years, or be irreversible. [24, 25]

- **Direct impacts:** may include changes in the range and transmission of infectious diseases, food and water insecurity, and negative health outcomes related to air pollution and temperature stress. [12]
- **Indirect impacts:** may include psychosocial stress, loss of land and resources, changes in socioeconomic status, and displacement of people from their homes, land, and communities. [12, 28]

Increased illness, loss, trauma, injury and death are associated with more frequent and severe weather [22, 25], decreasing air quality [22, 29], reduced quality and access to safe drinking water [22, 30], increased food contamination [31], increased spread and density of vectors that can cause disease [22, 32], and greater exposure to UV radiation [25, 33]. Growing scientific evidence suggests that climate disasters can have lasting negative mental health consequences. [22]



“Climate change is a threat to human well-being and planetary health.”

IPCC AR6 Synthesis Report 2023 [3]

2.2.1 Climate Change and Physical Health

There are seven key climate hazards associated with health impacts in Canada.

Health Canada developed a list of climate hazard categories and corresponding health effects to serve as a preliminary guide and resource for investigating the impacts of climate change on the health of Canadian communities. [14, 24] These are summarized in **Figure 2.1**.

Figure 2.1 | Canadian Climate hazards and associated physical health impacts

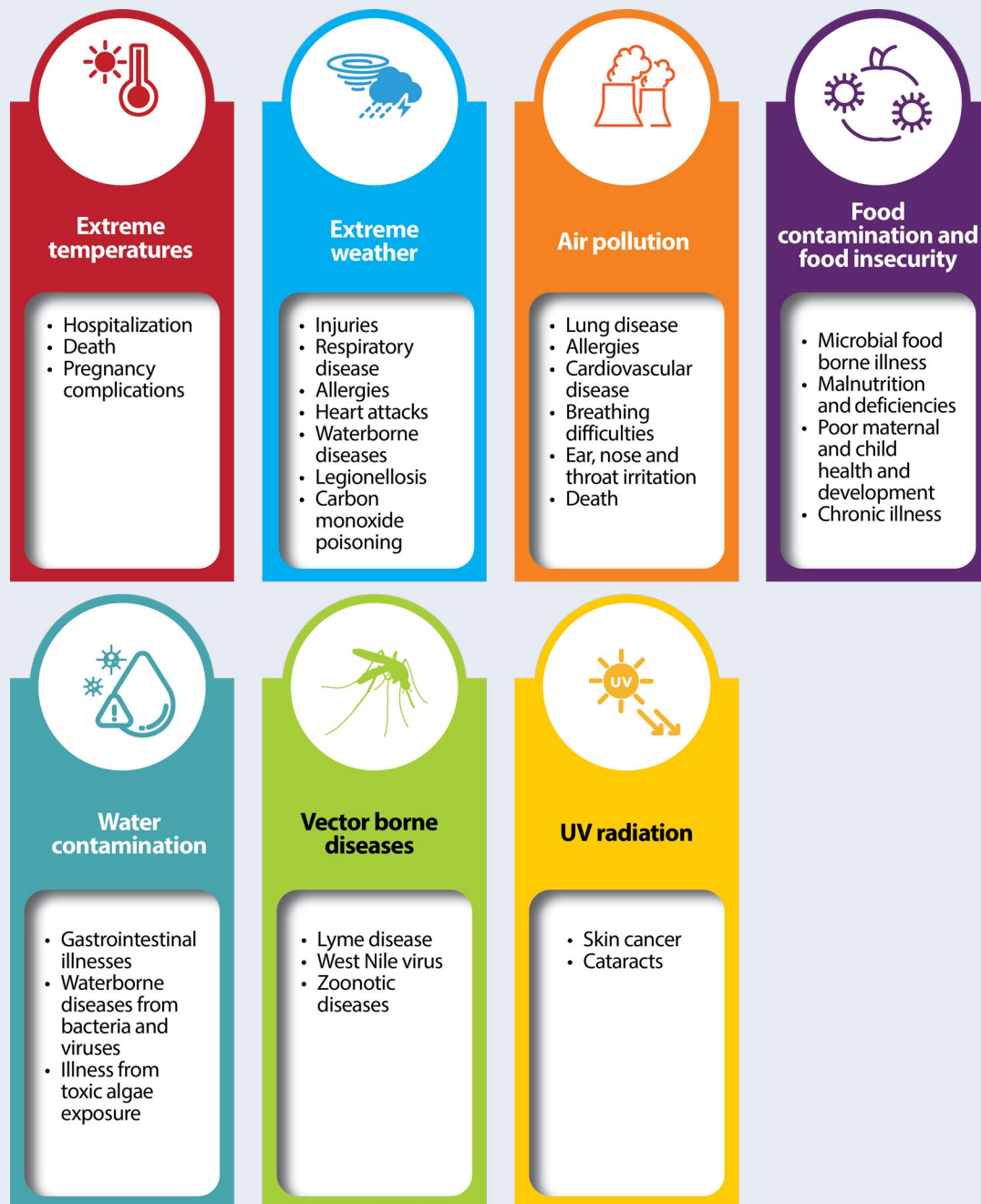


Table 2.1 provides a detailed summary of health impacts associated with these climate hazards. Although there are both direct and indirect health impacts, **Table 2.1** focuses on the direct physical health outcomes. This table provides a simplified overview but is not comprehensive and does not capture the complex intersection of climate hazards and health outcomes. For example, although flooding has been captured under the extreme weather category, flooding also impacts air, food and water quality and safety. In these cases, the climate-related impacts were captured under the main health hazard category to reduce duplication of information.

Table 2.1 | Detailed summary of climate hazards and direct physical health impacts to Canadian communities.

CLIMATE HAZARD	EFFECT	DIRECT HEALTH IMPACTS
Extreme temperatures	<ul style="list-style-type: none"> • Warmer environment • More frequent tropical nights • More frequent and severe heat waves and extreme heat events 	<ul style="list-style-type: none"> • While heat is a health risk outdoors, in Canada, many people die from extreme heat indoors. [34] The health impacts of extreme heat are wide reaching with mild, severe, and fatal outcomes. • Mortality: Extreme heat is associated with increased mortality rates from all causes [35, 36] including mortality rates for heart and lung diseases. [37, 38, 39, 40] Evidence shows that mortality rates increase as the intensity and duration of the heat wave or event increases. [36] • Hospitalization and emergency department (ED) visits: Extreme heat is associated with increased ED visit rates among individuals with heart and lung diseases [37, 38, 39, 40] and those experiencing severe symptoms of schizophrenia, mood disorders, and neurotic disorders. [41, 42] • Perinatal effects: Perinatal complications are dependent on which trimester the extreme heat exposure occurred. [43, 44, 45, 46] Exposure during the first trimester is associated with increased rates of miscarriage [46] and congenital complications. [44, 45] Exposure to extreme heat during the third trimester is associated with premature birth and early delivery. [43]
	<ul style="list-style-type: none"> • Changed/less predictable patterns of cold temperatures • Overall warmer winter season 	<ul style="list-style-type: none"> • Exposure to cold temperatures, regardless of if they are extreme or not, can lead to negative health consequences. [25, 47, 48, 49, 50, 51, 52, 53] The impact is not well understood because health effects following cold exposure are often delayed (two or more weeks) after the exposure event. [47,52,53] • Mortality: Cold temperatures are associated with increased mortality rates from all causes. [25] • Illness and hospitalization: Cold temperatures have also been associated with increased illness, emergency department visit and hospitalization rates due to respiratory, cardiovascular, and stroke-related illnesses. [38, 47, 51, 53, 54]

CLIMATE HAZARD	EFFECT	DIRECT HEALTH IMPACTS
<p>Extreme weather events</p>	<ul style="list-style-type: none"> • More violent storms and frequent tornadoes • More frequent and extreme thunderstorms and precipitation events, including rain, snow, and freezing rain 	<ul style="list-style-type: none"> • Injuries from slips and falls: Snow, rain, and freezing rain increase the risk of falling outdoors leading to increased incidence of hip and wrist fractures. [55] This risk increases exponentially as the precipitation events become more extreme. [25, 55] • Injury from road collisions and injuries: During precipitation events involving rain, ice and snow, the risk collisions and road injuries increase because the roadways become more slippery. [55] • Severe asthma symptoms: Periods of extreme precipitation and storms have been associated with more severe asthma symptoms. [56] • Emergency department visits: Thunderstorms have been associated with increased emergency department visits for individuals with pollen allergies since these storm events can lift massive amounts of pollen into the air. [56] • Heart attacks: Heavy snowfall has been linked to increased risk of heart attacks from walking in the snow and shovelling or removing snow. [57] • Waterborne diseases: Heavy precipitation events have been associated with increased incidence of water and foodborne diseases, particularly those that affect the gastrointestinal system. [58, 59] This is often caused by stormwater runoff which can contaminate surface waters with organisms that cause infectious diseases and chemical pollutants. • Legionellosis cases: A positive correlation has been found between the incidence of legionellosis cases and precipitation amounts. [60] • Carbon monoxide poisoning: Carbon monoxide poisoning events are more common during snowstorms, when the exhaust pipe of a running car can be blocked by snow. [61]

CLIMATE HAZARD	EFFECT	DIRECT HEALTH IMPACTS
	<ul style="list-style-type: none"> • Flooding 	<ul style="list-style-type: none"> • Injuries: Flood events can lead to injuries and cause drowning, with the risk of these outcomes more likely during flash flood events. During the recovery and cleanup period, flooding can also result in electrocution. [62, 63] • Hypothermia: Flooding can result in hypothermia and the risk of hypothermia is increased during flash flood events. [25] • Vector and waterborne diseases: Floods are associated with increased frequency of waterborne and vector-borne diseases. [59, 64] • Environmental contaminants: Flooding in urban areas can promote the spread of hazardous microorganisms, like moulds, and other toxic contaminants or chemicals that may negatively impact health. [25] • Skin, allergy, and lung conditions: Homes which are flooded can develop a variety of harmful microbes, like fungi, bacteria, and moulds, that increase the risk of developing or worsening skin, allergy, and lung conditions. [25, 65, 66]
	<ul style="list-style-type: none"> • Wildfires 	<ul style="list-style-type: none"> • It is estimated that between 570 and 2,700 premature deaths occur every year in Canada due to exposure to wildfire smoke. [34] The health impacts of wildfires are related to wildfire smoke and the types of air pollutants it is composed of. [48] Mortality: Both short-term and long-term exposure to wildfire smoke have negative impacts on human health and have been associated with increased mortality rates due to all causes. [68, 69] • Lung disease symptoms: Exposure to wildfire smoke exacerbates many lung or respiratory diseases, especially, asthma, chronic obstructive pulmonary disease (COPD), bronchitis, and pneumonia. [68, 70]

CLIMATE HAZARD	EFFECT	DIRECT HEALTH IMPACTS
<p>Poor air quality</p>	<ul style="list-style-type: none"> • Increased ground-level ozone due to warming • Higher levels of airborne particulate matter due to droughts • Increased airborne pollen 	<ul style="list-style-type: none"> • Exposure to air pollutants can have a wide range of negative health impacts with the risk of these impacts increasing with greater exposures. [29] • Illness and mortality: Exposure to ambient air pollution can increase mortality rates from respiratory and cardiovascular diseases. [29] • Lung disease symptoms: Exposure to air pollution can trigger severe symptoms of many lung or respiratory diseases like asthma and COPD. [29] • Allergies: Reduced air quality can increase the development and exacerbation of allergies. [29] • Cardiovascular diseases: Poor air quality can increase the risk of illness and mortality due to heart attacks, stroke, and other cardiovascular diseases. [29] • Eye, nose and throat irritation, and shortness of breath. [29]
<p>Food contamination and food insecurity</p>	<ul style="list-style-type: none"> • Food security impacts: • Increased disruptions to food systems • Climate-related reductions in biological diversity • Reduced nutritional content and production of some crops 	<ul style="list-style-type: none"> • Maternal and child health outcomes: Inadequate nutrition during pregnancy can have negative health impacts on the mother and child. Maternal food insecurity is associated with an increased risk of birth defects and household food insecurity can limit the sustainability of breastfeeding. [31, 71] • Child development: Food insecurity early in life can limit physical and cognitive growth and development. [31, 71] • Child health: Food insecurity is associated with poor general health in children and can increase the risk of developing iron deficiency anemia as well as several chronic conditions like asthma, depression, and suicidal ideation. [31, 71] • Exacerbation of chronic diseases and poorer health: Individuals who are food insecure are more likely to experience chronic health conditions and are more likely to self-report higher levels of poorer health. Food insecurity also makes chronic disease management more difficult which increases the risk of negative health outcomes as a result. [31, 71]

CLIMATE HAZARD	EFFECT	DIRECT HEALTH IMPACTS
	<ul style="list-style-type: none"> • Food safety impacts: • Behavioural changes due to warmer weather resulting in an increased risk of food mishandling • Changed survival and occurrence of microbial pathogens in food 	<ul style="list-style-type: none"> • Chemical toxicity: Exposure to high levels of toxic compounds through food ingestion can lead to a wide range of severe health impacts. Examples include, cancer, cardiovascular disorders, kidney and bone damage, endocrine system disruption and reproductive disorders. [31] • Gastrointestinal illness: Microbial food-borne illnesses can lead to gastrointestinal illnesses. In severe cases, especially in children or infants, these infections may lead to severe dehydration, inflammation of the brain, meningitis, or liver disease. [31] • Maternal health and birth outcomes: Microbial food-borne illnesses can have several prenatal impacts including increased risk for birth defects, stillbirth, and premature delivery. [31]
Water contamination	<ul style="list-style-type: none"> • Contamination of drinking and recreational water by run-off from heavy rainfall and flooding events • Changes in water temperature 	<ul style="list-style-type: none"> • Gastrointestinal illnesses: Contaminated drinking and recreational water is associated with increased incidence of gastrointestinal illnesses due to pathogens such as <i>Escherichia coli</i>, <i>Campylobacter spp.</i>, <i>Giardia</i> and <i>Hepatitis</i>. [30] • Leptospira and Leptonema bacterial infections: Flooding, increased water temperature and heavy precipitation have been associated with increased incidence of <i>Leptospira</i> and <i>Leptonema</i> bacterial infections from exposure to contaminated recreational waters, which cause influenza-like illness and can lead to meningitis, kidney, and liver failure. [30]
	<ul style="list-style-type: none"> • Changes in marine environments that result in algal blooms and higher levels of toxins in fish and shellfish 	<ul style="list-style-type: none"> • Illnesses from exposure to toxic algae species: Consumption of contaminated shellfish and fish is associated with increased risk of gastrointestinal and neurological illness caused by shellfish or fish poisoning. [72,73,74,75] Recreational exposure can lead to exacerbated asthma symptoms, as well as eye irritation. [30] • Illnesses from exposure to cyanobacteria: Exposure to cyanobacteria through contaminated drinking or recreational water can lead to liver and kidney damage, gastrointestinal illness, neurological disorders, and respiratory arrest. [30]

CLIMATE HAZARD	EFFECT	DIRECT HEALTH IMPACTS
Vector-borne disease	<ul style="list-style-type: none"> • Changes in biology and geographic distribution of disease-carrying insects and ticks • Longer disease transmission season 	<ul style="list-style-type: none"> • Increased disease incidence: Increased reproduction rates, greater survival, and increased geographic range of disease-carrying ticks and mosquitoes are associated with increased incidence of vector-borne diseases that are endemic to Canada (for example, West Nile virus and Lyme disease). [32] • Disease spread: Spread of US-endemic tick-borne or mosquito-borne diseases into Canada. [32] For example, in 2009 there were 144 reported cases of Lyme disease. In 2021 there were 2800 reported cases; the highest number ever recorded. [34]
Ultraviolet (UV) radiation	<ul style="list-style-type: none"> • Increased exposure to UV radiation 	<ul style="list-style-type: none"> • Skin cancer: Exposure to UV radiation (UVR) is the leading cause of skin cancer. Additionally, exposure to outdoor UVR has been associated with increased risk of developing malignant melanoma which has the highest mortality rate of all skin cancer types. [25, 33] • Cataracts: Exposure to UVA radiation can cause premature aging of the eye which can lead to the development of cataracts. [25, 76]

2.2.2 Climate Change and Mental Health

Mental illness is one of the leading causes of disability in Canada and approximately half of all Canadians will experience some form of mental illness by the time they reach the age of 40. [77] This mental health burden is expected to increase as the impacts of climate change intensify.

The effects of climate change on mental health are not fully understood, but research is growing; there is preliminary evidence linking both acute and slow-onset climate hazards with negative mental health. [77] For example, floods are often associated with decreased mental wellness and quality of life. [78, 79] Individuals exposed to flooding events are also more likely to experience an increase in depression, anxiety, post-traumatic stress, and suicidal ideation. [79, 80, 81]

Climate change has been associated with increased risks of the following mental health and psychosocial impacts [77]:

- Worsening of existing mental illnesses.
- Increased frequency of new-onset mental illnesses such as post-traumatic stress disorder.
- Increased experiences of mental health stressors for example, grief, worry, anxiety, and vicarious trauma.
- Reduced psychosocial well-being and resilience.
- A lost sense of place in which a person feels or is physically detached from their community, environment, or homeland.
- Impaired community interconnection, resilience, and increased social isolation.

These impacts to psychosocial health and well-being can result in serious health outcomes including higher rates of hospital admissions for mental illness, increased rates of suicide ideation or suicide, and increased substance misuse. [77]



2.2.3 Climate-Related Distress and Anxiety

There is evidence of widespread distress about climate change and its impacts. [2]

Figure 2.2 describes the unique characteristics of anxiety and grief related to climate change:

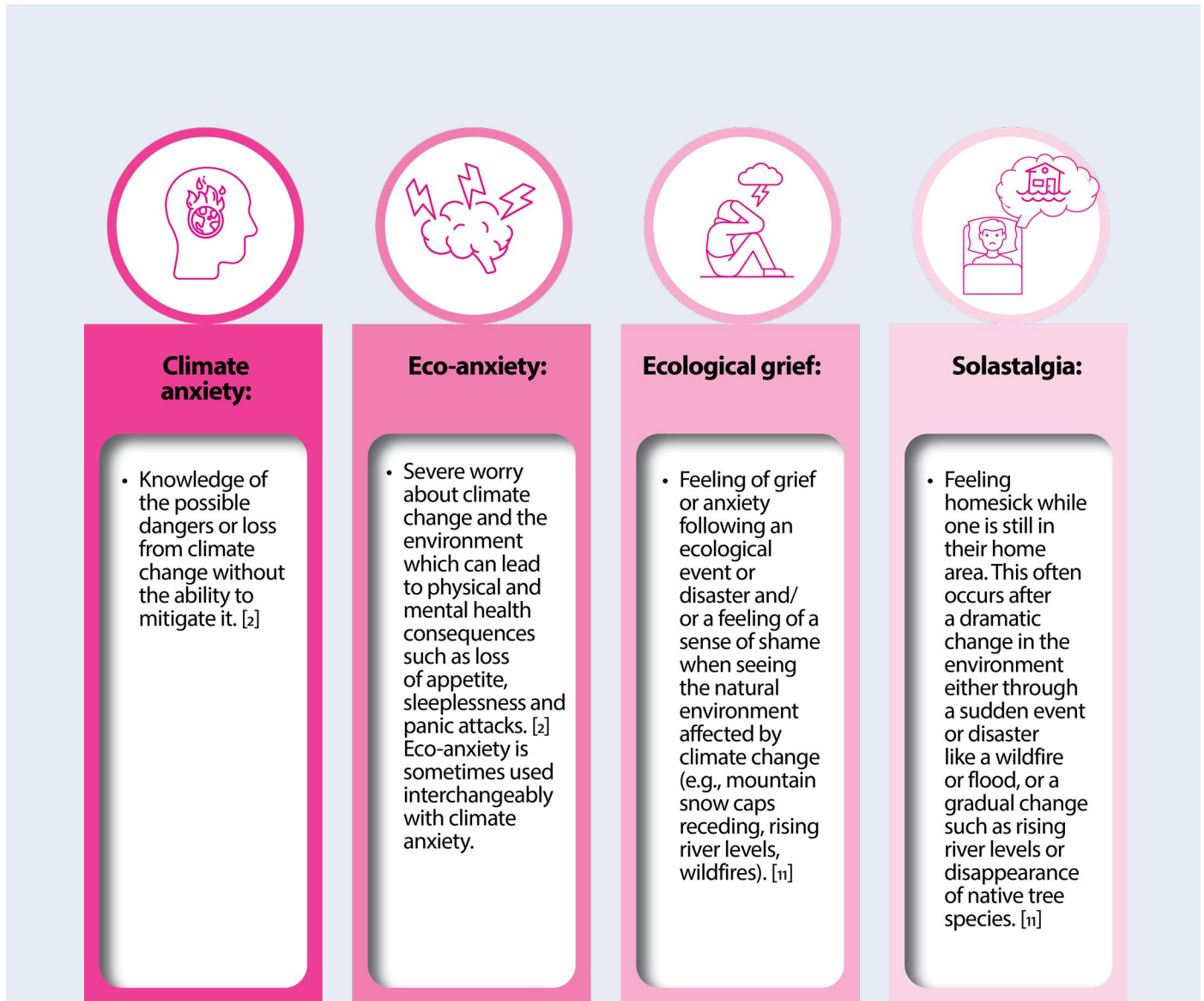


Figure 2.2 | Experiences of anxiety and grief related to climate change.

It is difficult to determine the extent of climate distress and prevalence of climate anxiety, however, there are indications that young people and youth (10 to 24 years) are most affected. [82]



Youth may be more likely to experience ill-effects associated with climate anxiety compared to adults as they are at a critical point in their physical and psychological development, and the effects of stress and everyday anxiety can increase their risk of developing depressive, anxiety and substance use disorders. [83]

2.3 Climate Change and Healthcare Systems

Resilient healthcare systems are critical for managing the expected increase in health burdens from climate change and climate driven health emergencies [84]

It is well-recognized that climate change will burden health systems and the communities they serve. [84, 85, 86, 87] The Canadian health system is already experiencing stress in response to increasing floods, wildfires and heat events. [84]

2.3.1. Health System Vulnerability

As climate change intensifies, the ability of health systems to adapt and mitigate the impacts on the communities they serve, will be increasingly challenged. [86, 87, 88]

The Lancet Countdown on Health and Climate Change is a global research collaboration that tracks the health impacts of climate change and measures progress in addressing this issue. The collaboration's recent report suggested that most health systems are unprepared to manage the health system effects and burdens expected from climate change. [21]

Future risks to Canadian health facilities, staff, operations, and infrastructure are expected due to climate hazards. [71] **Table 2.2** provides examples of vulnerabilities of Canadian health facilities due to climate hazards. [84]



A lack of progress in reducing emissions and building adaptive capacity threatens both human lives and the viability of national health systems they depend on, with the potential to disrupt core public health infrastructure and overwhelm health services.



- The Lancet Countdown on Health and Climate Change [21]

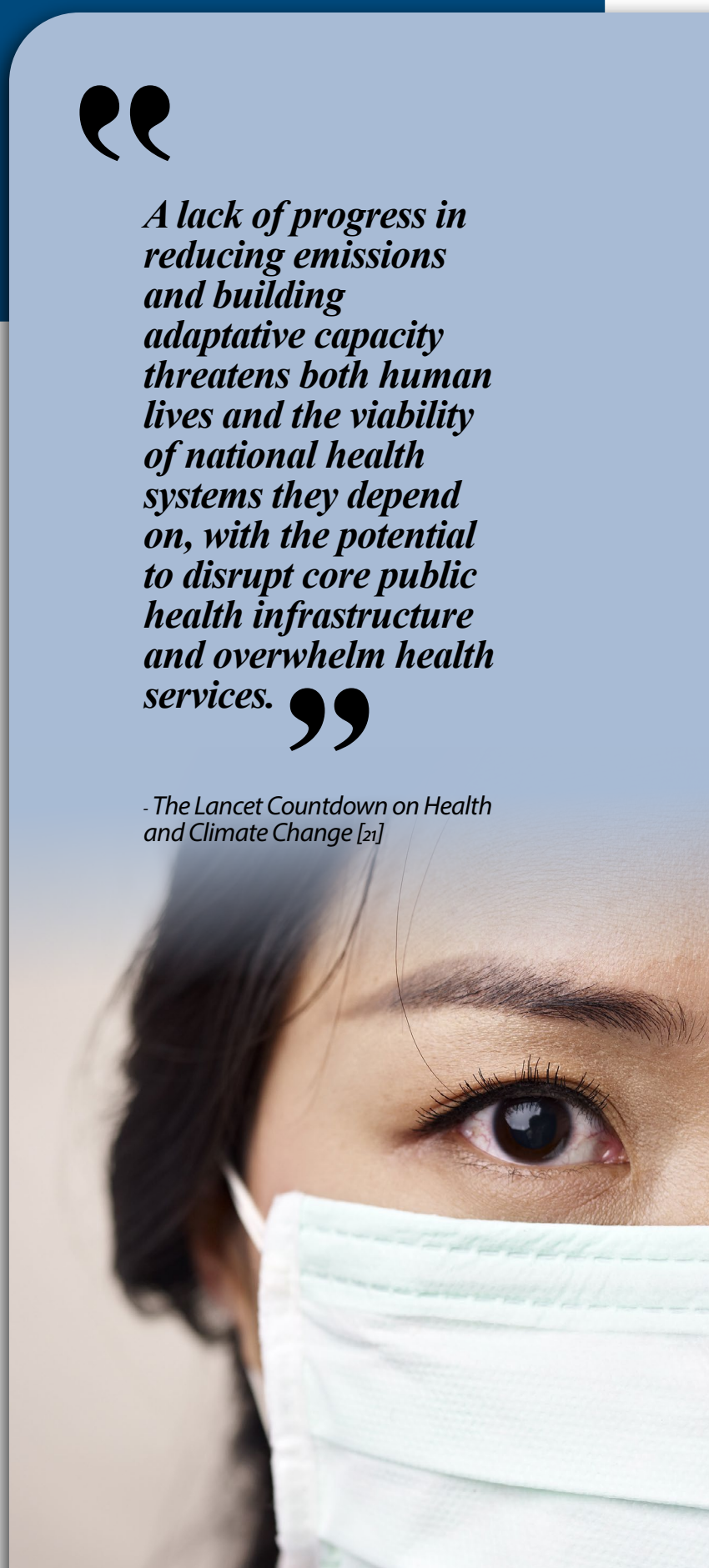


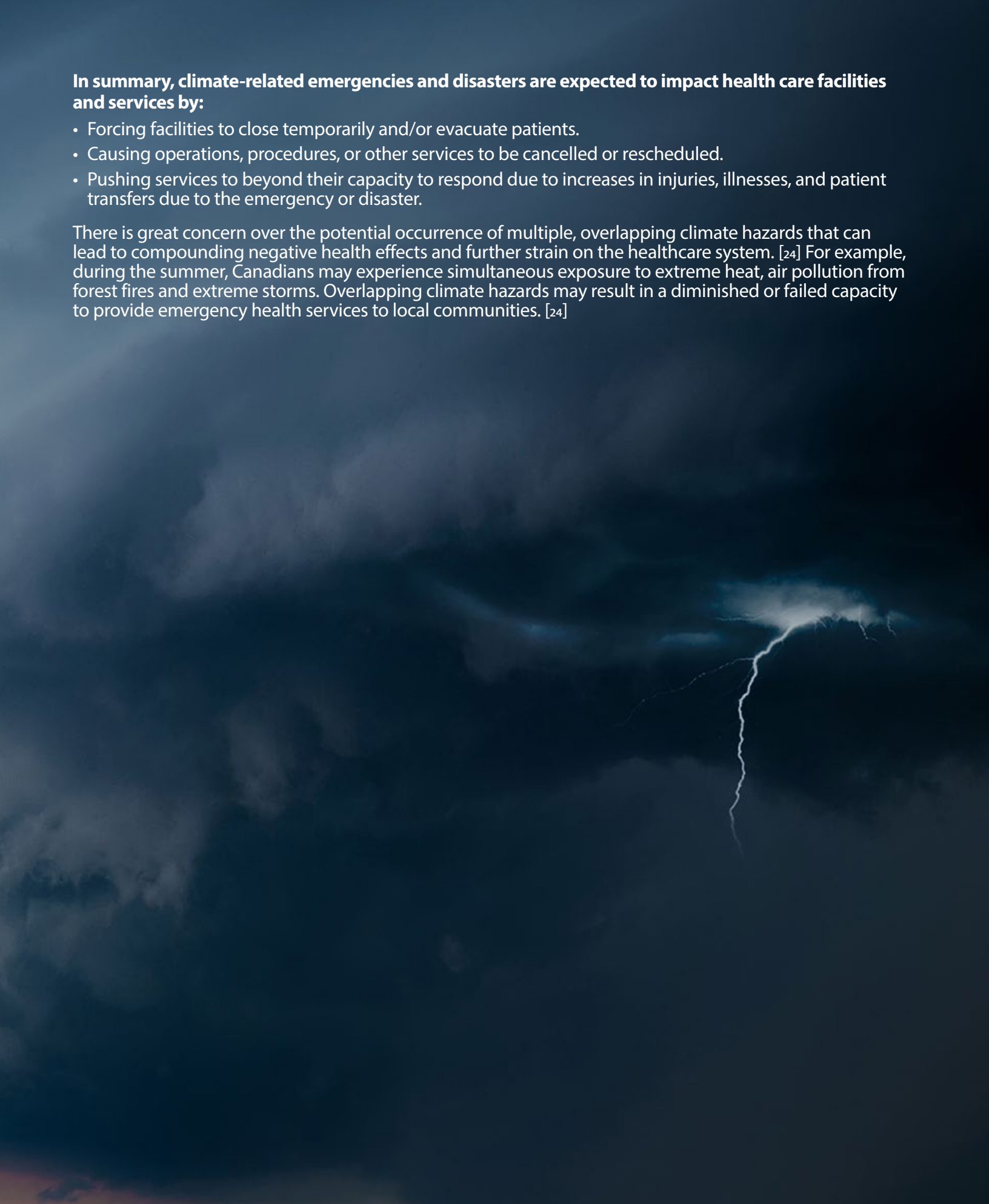
Table 2.2 | Canadian health facility vulnerabilities to climate change hazards

CLIMATE HAZARD	POTENTIAL IMPACTS ON HEALTH FACILITY	EXAMPLES OF VULNERABILITIES
<p>Extreme temperatures:</p> <ul style="list-style-type: none"> • Extreme heat events • High humidity • Increased frequency of tropical nights (nighttime minimum temp > 21°C) 	<ul style="list-style-type: none"> • Disruption or closure of specialty departments or procedures • Patient transfers • Increased patient admissions • Increased mortality and strain on morgue use • Power outages 	<ul style="list-style-type: none"> • Patients, staff, and visitors require safe temperatures to maintain good health • Some medical services and procedures require temperature and humidity levels to be maintained within specific limits for safety (e.g., operating theatres) • Warmer temperatures increase risk of food-, water-, and vector-borne diseases
<p>Extreme temperatures:</p> <ul style="list-style-type: none"> • Cold spells, including ice storms and extreme snowfall events 	<ul style="list-style-type: none"> • Disruption or closure of specific services or departments • Patient transfers • Increased patient admissions • Power outages • Staff shortages • Disruption to transportation networks • Shortages of blood supplies 	<ul style="list-style-type: none"> • Energy systems within health facilities can be negatively impacted by extreme cold and ice storms • Winter storms can affect transportation networks that are vital for the functioning of health care facilities
<p>Extreme weather events:</p> <ul style="list-style-type: none"> • Flooding caused by extreme rainfall, river flooding, freezing water pipes • Extreme winds including those caused by tornadoes • Wildfires 	<ul style="list-style-type: none"> • Transfer of patients from affected health care facilities • Staff shortages • Boil water advisories • Power outages • Disruption or closure of specific services or departments • Infrastructure or medical equipment damage • Internal flooding • Physical and mental health impacts on staff • Shortages of blood supplies 	<ul style="list-style-type: none"> • Flooding and tornadoes/extreme winds can damage health facility infrastructure and interrupt supply chains for food, water, energy, and medical supplies • Roads may be destroyed or closed to discourage travel • Post-event clean-up can reduce or prevent access to health care facilities

In summary, climate-related emergencies and disasters are expected to impact health care facilities and services by:

- Forcing facilities to close temporarily and/or evacuate patients.
- Causing operations, procedures, or other services to be cancelled or rescheduled.
- Pushing services to beyond their capacity to respond due to increases in injuries, illnesses, and patient transfers due to the emergency or disaster.

There is great concern over the potential occurrence of multiple, overlapping climate hazards that can lead to compounding negative health effects and further strain on the healthcare system. [24] For example, during the summer, Canadians may experience simultaneous exposure to extreme heat, air pollution from forest fires and extreme storms. Overlapping climate hazards may result in a diminished or failed capacity to provide emergency health services to local communities. [24]



2.4 Assessing Vulnerability: An Equity-Focused Approach

The health risks caused by climate change are experienced in different ways by different people and are often shaped by inequitable access to the social and ecological determinants of health. [7, 28, 29] A focus on health equity is essential to understanding the complex dimensions of vulnerability and addressing the different health impacts of climate change. [30, 31]



2.4.1. Health Equity and the Determinants of Health

Achieving health equity requires addressing unnecessary, avoidable, and unfair barriers to the social and ecological determinants of health.

The term “health equity” means that every person can reach their full health potential regardless of who they are, where they were born, or where they live. In contrast, “health inequity” refers to systematic, avoidable, and unjust conditions that result in health inequalities and prevent a person from reaching their full health potential. [9]

Our health is not simply a matter of lifestyle choices or healthcare access, but is affected by the conditions where we are born, grow, live, work, play, and age. [89] These conditions are referred to as the social determinants of health (SDOH) and include a variety of personal, social, economic, and environmental factors that come together to influence the health of an individual, community, or population (**Figure 2.3**). [90] These health factors do not operate independently; they intersect, compound, and interact in ways that determines a person’s experience of well-being through their lifetime. There is extensive evidence that a social gradient of health exists across Canadian communities, which shows that individuals with lower incomes generally experience poorer health than those with higher incomes. [90]

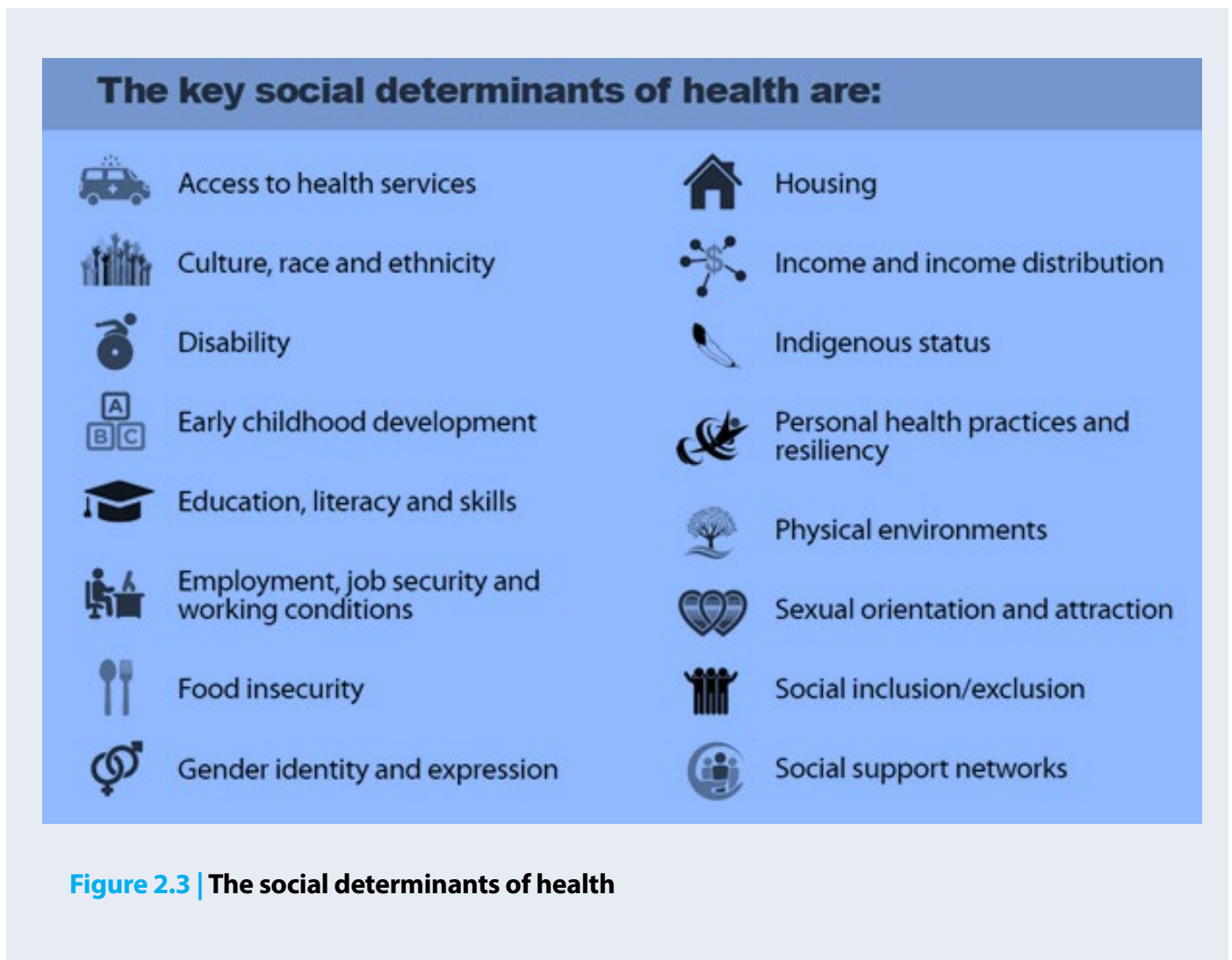


Figure 2.3 | The social determinants of health

Health is also influenced by the ecological determinants of health (EDOH). The EDOH are more than simply the environmental quality of a person's community. They encompass all the life supporting systems provided by nature including air, food, water, fuels, raw materials, nutrient cycling, a stable climate, and waste decomposition. Protecting and promoting the EDOH requires assessing and addressing root causes of ecological degradation.

The determinants of health within a community are not uniform and vary from person to person. These differences are often caused by structural determinants of health; policies, programs, and systems that can drive health inequities by benefiting some groups of people over others. [91] Social, cultural, economic, and political disadvantages result in health inequities due to the unequal distribution of power and resources. [92, 93] Social structures which can drive health inequities include social constructs of oppression (e.g., ableism, sexism, xenophobia, cisnormativity) as well as historic and ongoing structural forms of racism (e.g., colonialism, cultural trauma). [94, 95] These structures have cumulatively led to disenfranchisement, marginalization, discrimination, and social exclusion. Health inequities are often systemic and intergenerational and can exacerbate disadvantage and marginalization among oppressed and racialized groups. [93]



2.4.2. The Unequal Health Burden of Climate Change

Although everyone is exposed to climate hazards, not everyone shares the same ability to protect themselves from harmful health impacts.

The relationship between climate change and health is dynamic and complex. In Canada, the impacts of climate change vary substantially across individuals, communities, and regions. [96] Multiple and compounded forms of disadvantage overlap and influence a person's risk of negative health outcomes. Seniors, children, racialized populations, individuals with chronic health conditions, Indigenous Peoples, and individuals experiencing low income, disability, or insecure housing, experience more frequent and severe health impacts because of climate change. [24, 92]

Climate change can act as a “threat multiplier”; worsening existing health inequities while creating the conditions for new inequities to emerge. Those in good health with greater access to resources such as information, social support networks and a stable income, have a greater capacity to prepare and protect themselves. [92] Conversely, existing health inequities create significant barriers for some people to prepare for, cope with, and protect themselves from climate change impacts. Therefore, to accurately assess and identify health vulnerabilities due to climate change, the assessment methods must also include an intersectional, and equity-focused lens.

“

Climate change can act as a “threat multiplier”; worsening existing health inequities while creating the conditions for new inequities to emerge.

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- Health of Canadians in a Changing Climate: Advancing our Knowledge for Action [92]



2.4.3. Understanding Vulnerability

Climate vulnerability is determined by the degree of exposure, sensitivity, and adaptive capacity to climate hazards. Addressing climate vulnerability requires attention to upstream factors that include access to safe housing, a healthy environment, social support networks, technology, education and more.

Vulnerability refers to multiple and often intersecting factors that increase the risk of harm from climate hazards. Many aspects of climate vulnerability are rooted in a person's ability to earn an income, access healthcare, go to school, find safe and stable housing, and live in a healthy, supportive community. The risk of illness, injury, loss, trauma, and death from climate hazards is greater among those already burdened by health inequities. For these reasons, special attention is required when framing vulnerability and related health impacts of climate change. As stated in the Chief Public Health Officer of Canada's Report on the State of Public Health in Canada 2022: "the concept of vulnerability can be highly stigmatizing, so it is important to recognize that climate vulnerability is not a label for communities or populations." [91]

Figure 2.4 illustrates three main factors that determine vulnerability to health impacts from climate change: (1) a community's or individual's exposure to climate hazards; (2) sensitivity to health impacts; and (3) adaptive capacity.

- **Exposure** is the degree to which an individual or community encounters climate hazards. For example, a person living in a densely urbanized area or a person who works outdoors may be more exposed to extreme heat.
- **Sensitivity** is the degree to which an individual or community is affected by a climate hazard. This can be influenced by age, genetics, health status or community health disparities. For example, older adults and people with certain health conditions have a decreased ability to regulate their body temperature on a hot day.
- **Adaptive Capacity** is the ability of an individual or community to respond to and protect against the health impacts of climate hazards. For example, a person lacking social or financial supports may be unable to access a cool, safe space during an extreme heat event.

The intersection of these factors increases the relative vulnerability to health impacts from climate hazards. For example, an isolated older adult with limited mobility, living in an apartment without air conditioning in a densely urbanized area is at high risk of morbidity and mortality from extreme heat. Potential negative health impacts include illness, injury, loss, trauma and death.

Vulnerability is influenced by upstream factors that include access to safe housing, sufficient income, a healthy environment, social support networks, technology, resilient health systems, education and more. The intersecting legacy of programs, laws, policies, institutions, and practices can drive health inequities and vulnerability through differential exposure, sensitivity, and adaptive capacity to climate hazards.

"The concept of vulnerability can be highly stigmatizing, so it is important to recognize that climate vulnerability is not a label for communities or populations."

- Chief Public Health Officer of Canada's Report on the State of Public Health in Canada 2022 [91]



Figure 2.4 sets out several intervention pathways to reduce vulnerability and improve health outcomes through upstream policies and programs that address:

- (a) the drivers of climate change,
- (b) the ecological determinants of health,
- (c) the social determinants of health, and
- (d) health system capacity

Early upstream adaptation and mitigation strategies provide the greatest opportunity to improve health outcomes and reduce negative health impacts. It is expected that the health gains from adaptation will be decreased as the impacts of climate hazards increase.

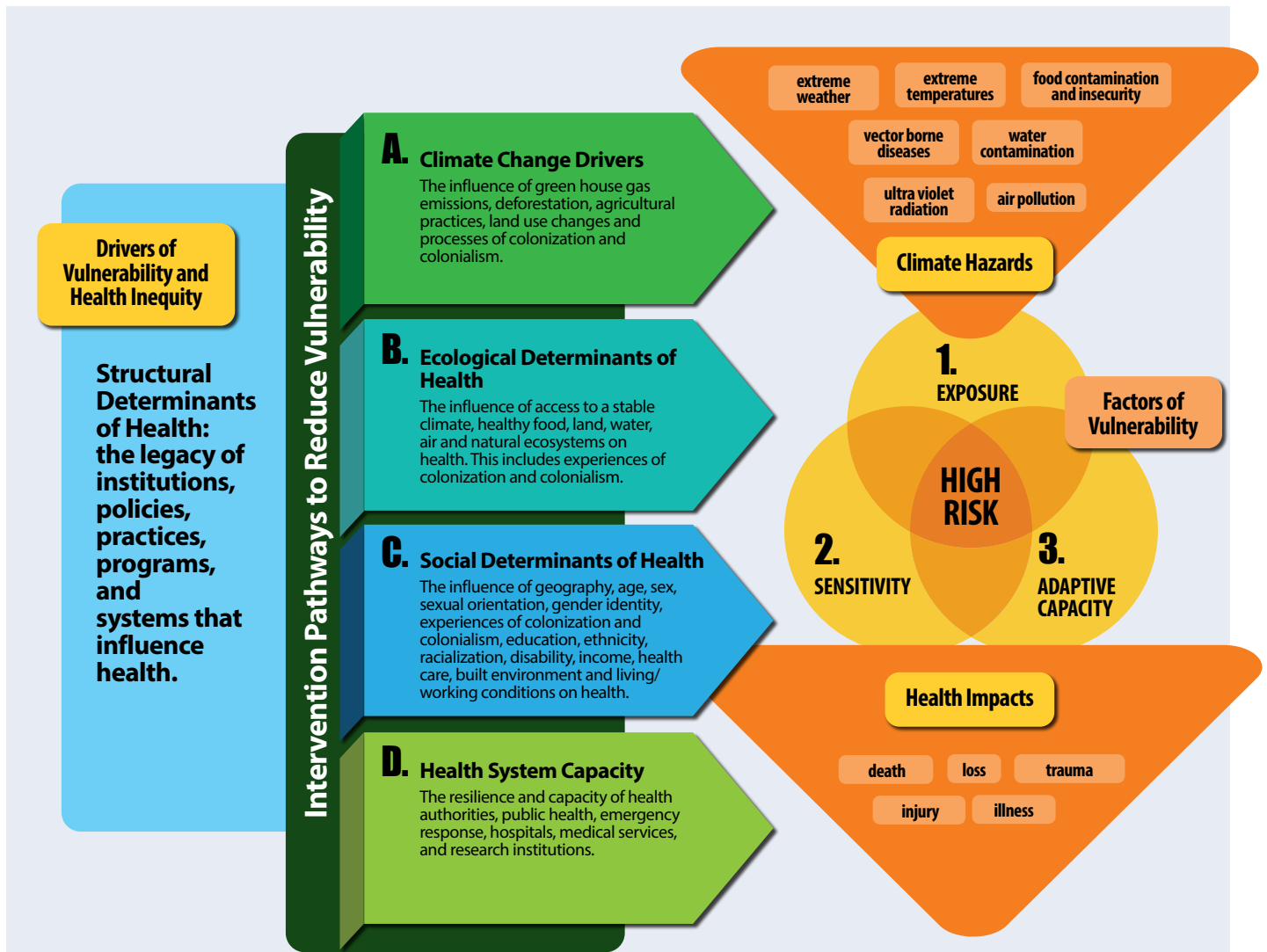


Figure 2.4 | Climate Change and Health Vulnerability Adaptation Framework (developed under guidance of Schnitter et al. 2022). [92]

2.5 The Way Forward

An equity-focused understanding of health risks and resilience to climate hazards is paramount to preparedness efforts and climate-resilient communities. [22]

2.5.1 The Challenge

Inclusive approaches to climate change and health planning are essential to meeting the needs and priorities of those most affected and least protected.

An equity lens is required across all public health functions of surveillance and population health assessment to identify and address the root causes of different health impacts. [31, 32] It is also required when evaluating adaptation options to avoid worsening existing inequities. [7, 30] For example, local neighbourhood and housing improvements to increase climate resiliency must coincide with protections to ensure housing affordability. To date, an equity lens has not been consistently applied to climate change vulnerability assessment and adaptation planning. [7, 34, 35, 36] For example, climate adaptation efforts have predominantly focused on inequities related to income and less on the experiences of First Nations, Inuit, and Métis, racialized, migrant [34] and LGBTQ2S+ populations [36, 37], and people with disabilities. [2, 34]

The exclusion of historically marginalized groups in climate change and health adaptation planning increases the risk of exacerbating health inequities. For example, Canadians living with disabilities face greater climate risks, including increased fatality rates from extreme weather events. [34] Including disadvantaged and high-risk groups in planning and adaptation processes is essential for developing effective plans that respond to the daily realities, barriers and needs of those most affected. It is, therefore, imperative that an equity lens is applied and thoroughly considered when assessing health vulnerability to climate change.

2.5.2 The Opportunity

Climate action offers many opportunities to improve health for all, now and in the future.

Expertise, knowledge, and resources are needed to identify climate-related health risks and to take equitable, evidence-informed action to protect health.

Local health departments are uniquely positioned to:

1. Understand the unique social, economic, environmental, and geographic factors that influence neighbourhood-level health risks and vulnerabilities to climate change.
2. Leverage local knowledge, partnerships, and relationships to identify adaptation strategies best suited to community needs.

Durham Region Health Department's Climate and Health Vulnerability Assessment will help our region to:

- Better understand local climate health risks, including those who may be most affected.
- Develop place-based strategies for protecting residents from specific climate hazards including extreme heat, infectious diseases, and wildfire smoke. Examples include surveillance and warning systems and training of health professionals and community agencies on climate related health impacts. [71]

- Promote health equity by prioritizing measures to reduce impacts to at-risk groups.
- Improve public engagement and local knowledge on how to prepare for and respond to the health risks of climate change.
- Advocate for climate action planning at the municipal level.
- Ensure a health lens is applied to broader regional climate action planning, policy, and program development.
- Promote community partnership development, including meaningful engagement with priority populations to understand barriers to climate adaptation measures, as well potential harms, or unintended consequences of adaptation plans.
- Establish health indicators and metrics of community climate resilience.
- Identify intersectional adaptation interventions that offer numerous health co-benefits.
- Identify opportunities for working across municipal sectors to deliver health benefits to Durham residents.

Figure 2.5 lists the numerous health benefits of climate change solutions including improvements to air and water quality, increased green spaces, stronger social support networks and healthier housing, neighbourhoods, and community services.

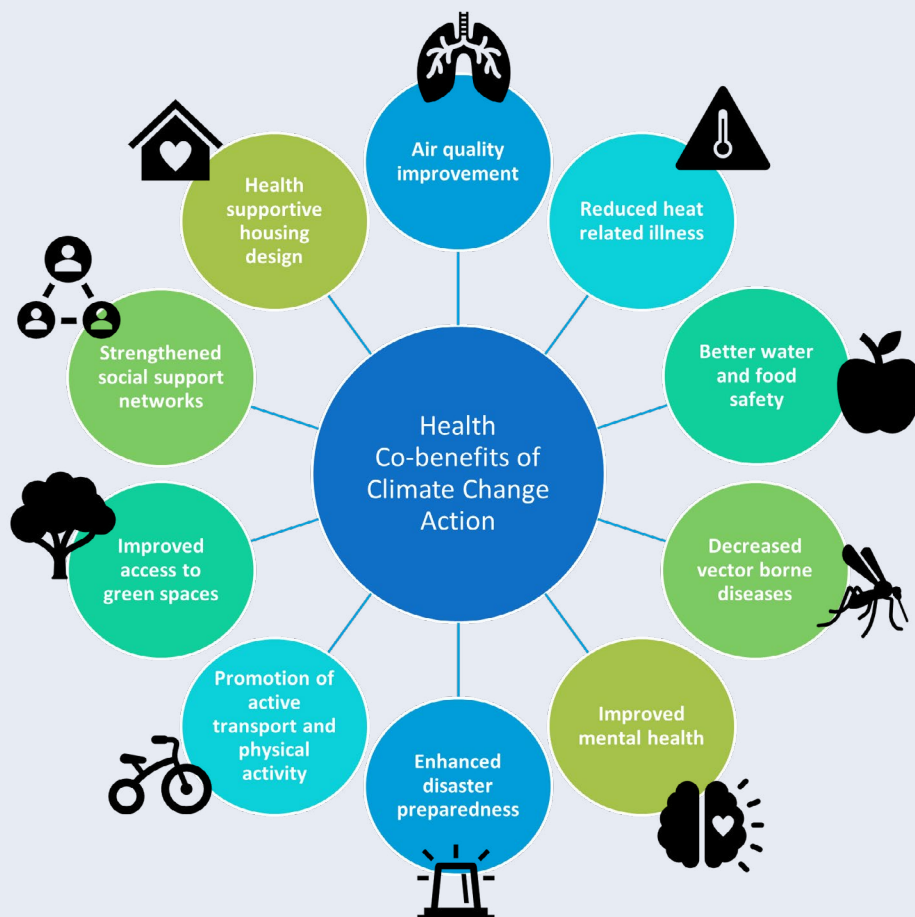


Figure 2.5 | Potential health co-benefits of climate action

Figure adapted from Haines, 2017. [97]

Helpful Resources

Want to learn more?

This section provides a summary of key resources to help understand the potential health impacts of climate change on individuals, communities, and health systems.

CLIMATE HEALTH

World Health Organization and World Meteorological Organization

2023

A collaboration between the World Health Organization and the World Meteorological Organization, this website provides global information on climate and public health to support actions that protect populations from the health risks of climate change.

HEALTH OF CANADIANS IN A CHANGING CLIMATE: ADVANCING OUR KNOWLEDGE FOR ACTION [24]

Berry, P., Schnitter, R. (ed.)

2022

This report provides a comprehensive overview of climate risks to the health of Canadians so that government decision makers, health practitioners, researchers, and individual Canadians can take effective measures to protect health now and in the future.

LET'S TALK: HEALTH EQUITY (2nd ed.) [90]

National Collaborating Centre for the Determinants of Health

2023

A collection of resources on the key concepts in health equity in public health practice.

MOBILIZING PUBLIC HEALTH ACTION ON CLIMATE CHANGE IN CANADA: The Chief Public Health Officer of Canada's Report on the State of Public Health in Canada 2022 [91]

Public Health Agency of Canada

2022

The 2022 Chief Public Health Officer of Canada (CPHO) annual report on the state of public health in Canada focuses on the impacts of climate change in and the role that public health systems can play in taking climate action.

CHIEF PUBLIC HEALTH OFFICER OF CANADA'S REPORT ON THE STATE OF PUBLIC HEALTH IN CANADA 2023: Creating the Conditions for Resilient Communities: A Public Health Approach to Emergencies

Public Health Agency of Canada

2023

The 2023 Chief Public Health Officer of Canada (CPHO) annual report on the state of public health in Canada focuses on health emergencies by looking beyond the immediate response and working on the foundational conditions that keep our communities healthy and strong.

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