



CHAPTER 4

Mental Health and Well-Being

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



Health
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Summary

Climate change increases risks to the mental health and well-being of many people in Canada. Specific populations that can be disproportionately and inequitably affected include those experiencing health inequities based on race, culture, gender, age, socio-economic status, ability, and geographic location. These factors are encompassed within the social, biological, environmental, and cultural determinants of health that are amplified by climate change. Mental health can be impacted by hazards that occur over the shorter and longer term, such as floods, extreme heat events, wildfires, and hurricanes as well as drought, sea-level rise, and melting permafrost. Knowledge and awareness of climate change threats can also affect mental health and well-being, resulting in emotional and behavioural responses, such as worry, grief, anxiety, anger, hopelessness, and fear.

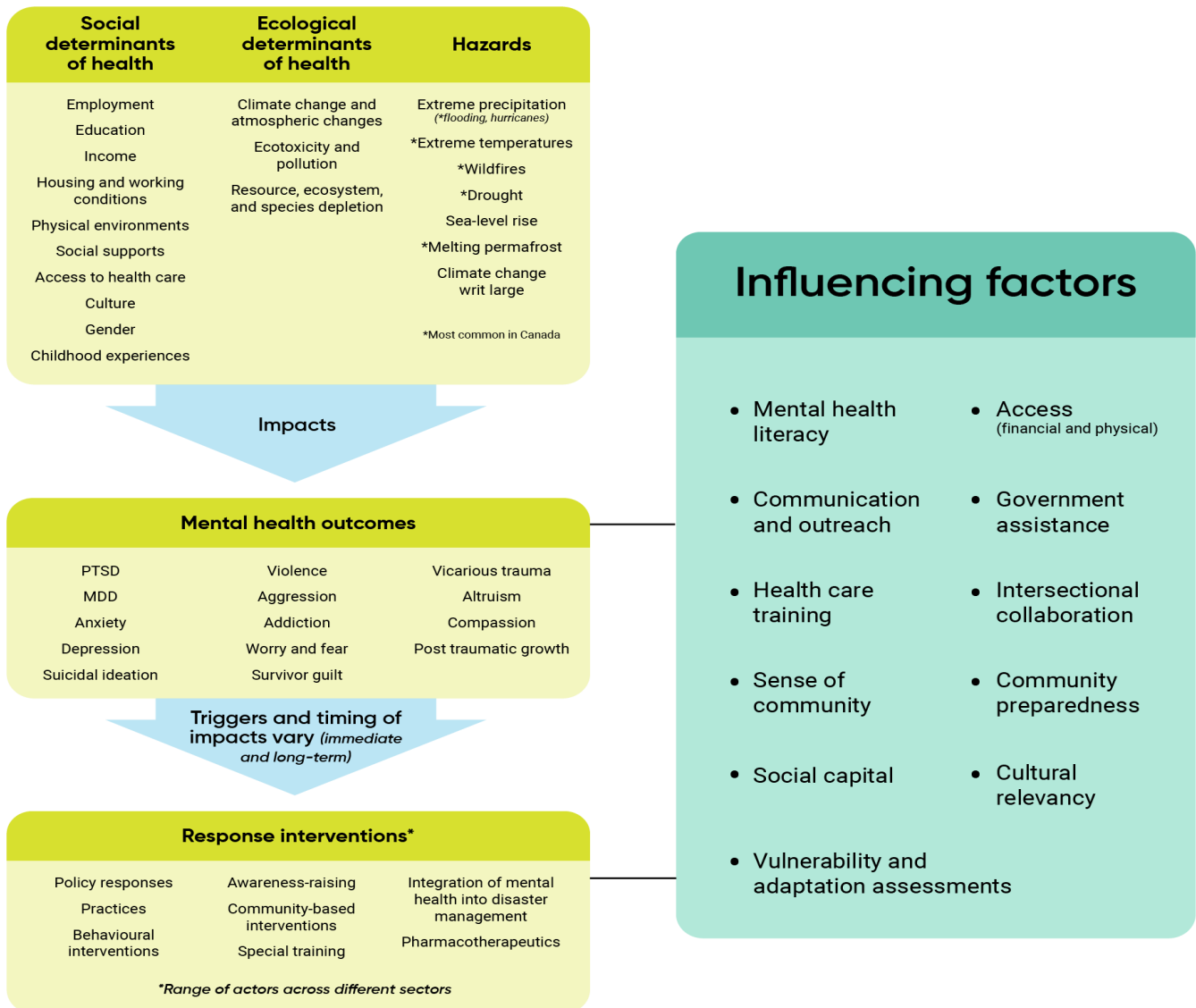
Mental health impacts of climate change may include exacerbation of existing mental illness such as psychosis; new-onset mental illness such as post-traumatic stress disorder; mental health stressors such as grief, worry, anxiety, and vicarious trauma; and a lost sense of place, which refers to the perceived 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 which can result in distress, higher rates of hospital admissions, increased suicide ideation or suicide, and increased negative behaviours such as substance misuse, violence, and aggression. Adaptation efforts that can reduce the mental health impacts of climate change include expanded communication and outreach activities and community preparedness, greater access to health care for those requiring assistance, and improved mental health literacy and training.

Key Messages

- The current burden of mental ill health in Canada is likely to rise as a result of climate change. Given the very large number of Canadians who experience mental health problems, the potential increase of mental ill health outcomes from future climate change is large.
- Climate change hazards that can affect the mental health of people in Canada include acute hazards such as floods, extreme heat events, wildfires, and hurricanes, as well as slow-onset hazards such as drought, sea-level rise, and melting permafrost. Secondary impacts of climate hazards (such as economic insecurity, displacement, food and water insecurity) can lead to ongoing stress, anxiety, and depression.



- Mental health impacts of climate change may include exacerbation 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 the 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 which can result in distress, higher rates of hospital admissions, increased suicide ideation or suicide, and increased negative behaviours such as substance misuse, violence, and aggression.
 - Climate change and related environmental change can cause complex emotional and behavioural reactions in individuals, that are not necessarily pathological. These environmental distress reactions, called psychoterratic syndromes, include ecoanxiety, solastalgia, and ecoparalysis.
 - Climate change disproportionately affects the mental health of specific populations, including Indigenous Peoples; women; children; youth; older adults; people living in low socio-economic conditions (including the homeless); people living with pre-existing physical and mental health conditions; and certain occupational groups, such as land-based workers and first responders. For example, Indigenous Peoples are at greater risk of being displaced by climate-related hazards and this can result in a loss of community connections and loss of livelihoods that affect individual and collective well-being.
 - Given the current high costs of mental illness to society, and the breadth of mental health impacts that are related to climate change, future costs borne by Canadians and health systems are expected to be large as the climate continues to warm.
 - Access to mental health practitioners, mental health and health care facilities, social services, and culturally relevant mental health care information can prevent adverse mental health outcomes, improve outcomes, and enhance well-being in a changing climate. Rural, remote, and urban settings that currently face challenges providing mental health care will face increased demands for services from climate change impacts.
 - Greater communication and outreach about the mental health impacts of climate change, enhanced community preparedness for possible impacts, broad access to culturally relevant health care to assist people in need, intersectoral and transdisciplinary collaboration on adaptation initiatives, and improved mental health literacy and training support efforts to prepare for climate change impacts on Canadians.
 - Well-designed actions to mitigate greenhouse gas emissions and adapt to climate change – for example, active transportation, environmental stewardship, green infrastructure, and enhanced social networks and community supports – can also benefit mental health.
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Factors that influence the psychosocial health impacts of climate change. Source: Hayes et al., 2019.



Overview of Climate Change Impacts on Mental Health

HEALTH IMPACT OR HAZARD CATEGORY	CLIMATE-RELATED CAUSES	POSSIBLE HEALTH EFFECTS
Mental health	<ul style="list-style-type: none">• Increased frequency and severity of precipitation (such as hurricanes, flooding, ice storms)• Droughts• Wildfires• Extreme temperatures• Decreased food and water security• Melting permafrost• Sea-level rise• Gradual warming	<ul style="list-style-type: none">• Post-traumatic stress disorder (PTSD)• Anxiety• Worry and fear• Depression• Stress• Vicarious trauma• Recovery fatigue• Suicide ideation• Weakened social ties• Addictions (such as drug and alcohol usage)• Aggression including domestic violence• Ecoanxiety/climate anxiety• Ecogrief/climate grief• Solastalgia• Post-traumatic growth• Impacts on health and social services

4.1 Introduction

Climate change poses significant risks to the mental health of Canadians. The past decade has seen rapid growth in research, discussion, and media reporting on climate change and its associated mental health implications. In a 2019 national survey of 2,000 residents of Canada (aged 18 and older), 49% of respondents indicated they were increasingly worried about the effects of climate change, and 25% indicated that they often think about climate change and are “really anxious about it” (Abacus Data, 2019). There is growing concern among public health officials in Canada about these impacts and how to support psychosocial¹ adaptation and resilience (BC Ministry of Environment and Climate Change Strategy, n.d.; Toronto Public Health, 2015; Yaffe, 2016; Howard et al., 2017). Supporting psychosocial adaptation means developing or enhancing existing coping behaviours, practices, tools, or interventions to protect mental health and social well-being in a changing climate (Séguin, 2008; Brown & Westaway, 2011). This chapter provides information on the mental health impacts of climate change in Canada to support public health officials, practitioners, and decision makers in their efforts to prepare Canadians and their health systems.

The mental health impacts from climate change are associated with both acute and slow-onset hazards. Acute hazards – such as floods, extreme heat events, wildfires, and hurricanes – can result in mental health impacts, such as mood and behavioural disorders (Berry et al., 2010a; Clayton et al., 2014; Dodgen et al., 2016; Clayton et al., 2017). Acute hazards may also result in secondary impacts on mental health from physical harm and displacement, which can result in loss of livelihood, trauma, a lost sense of place, fear of impending impacts, and ongoing mood and behavioural disorders such as post-traumatic stress disorder (PTSD), depression, and anxiety (Berry et al., 2011; Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Clayton et al., 2014; Dodgen et al., 2016; Clayton et al., 2017; Cunsolo & Ellis, 2018; Clayton, 2020; Clayton & Karazsia, 2020). Acute hazards can also result in affirmative outcomes, such as a sense of community cohesion, altruism, and a sense of meaning in a person’s life as communities come together to support one another in the aftermath of acute events (Weissbecker, 2011; Hayes & Poland, 2018; Hayes et al., 2020). Slow-onset hazards, such as drought, sea-level rise, and melting permafrost, can affect an individual’s sense of place, ecosystem health, culture and identity, and can lead to emotional responses of anxiety, grief, anger, helplessness, and depression (Cunsolo Willox et al., 2012; Clayton et al., 2017; Adlard et al., 2018; Cunsolo & Ellis, 2018; Middleton et al., 2020b). Both acute and slow-onset hazards can have secondary impacts on mental health (e.g., income insecurity, food and water insecurity). Knowledge and awareness of climate change threats, often identified as “vicarious,” “mediated,” or “anticipatory” experiences, can also affect mental health and well-being, resulting in emotional and behavioural responses, such as worry, grief, anxiety, anger, hopelessness, and fear (Clayton et al., 2017; Cunsolo & Ellis, 2018; Clayton, 2020; Clayton & Karazsia, 2020; Pihkala, 2020).

Addressing the impacts of climate change on the mental health of people living in Canada requires both greater understanding of risks and of adaptation efforts, as risks are increasing with climate warming. Temperatures in Canada have increased at a rate that is twice the global average, with Northern communities

1 Mental health is one aspect of the broader definition of psychosocial health. As defined in Section 4.2 Key Terms, psychosocial health is the interplay between social well-being, which arises from relationships with others and one’s context and culture, and psychological well-being, including thoughts, feelings, and behaviours (Berry et al., 2014).



warming even faster, particularly throughout Inuit Nunangat² (Inuit homelands) (Bush & Lemmen, 2019). Future occurrences of many of the acute and slow-onset climate-related hazards that affect mental health are projected to increase (see Chapter 3: Natural Hazards, and Chapter 5: Air Quality). In addition, mental illness is already a leading cause of disability in the country, even before considering the projected increase in climate change hazards (CAMH, 2012). According to the Mental Health Commission of Canada (MHCC), approximately 7.5 million Canadians experience mental health problems each year (MHCC, 2017). Mental illness can affect anyone of any age, background, education level, income, or culture (MHCC, 2017). By the time they reach the age of 40, approximately 50% of people living in Canada will have, or have had, some form of mental illness (MHCC, 2017). Also, while the burden of mental health problems is high, many people in Canada lack access to mental health services, which affects opportunities for adaptation to reduce risks (Cunsolo Willox et al., 2013b; Petrasek MacDonald et al., 2015; Moroz et al., 2020). For example, in Northern, rural, and remote places in Canada, many communities do not have access to regular mental health care providers or related resources (including a family physician), and transportation within and to remote communities can be impeded by changing weather patterns and disruptions to land, water, ice, and air travel routes (CMHA, 2009; Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Standing Committee on Indigenous and Northern Affairs, 2017; MHCC, 2020). Barriers to accessing mental health care throughout Canada are numerous, and can include, for example, financial and/or physical constraints; mental health stigma; a lack of mental health literacy; and limited culturally relevant mental health resources (Rodriguez & Kohn, 2008; Osofsky et al., 2010; MHCC, 2016; Hayes et al., 2019).

The total burden of mental illness related to climate change in Canada is currently unknown; however, a number of empirical studies have documented the effects of a warming climate on mental health, largely in Northern and Indigenous³ communities (Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Donaldson et al., 2013; Durkalec et al., 2015; Dodd et al., 2018; Hayes et al., 2020; Middleton et al., 2020a). Compared with the number of studies on climate change impacts on physical health, far fewer have examined mental health. Reasons for this difference include challenges related to:

- attributing environmental hazards to climate change and then attributing mental health outcomes to these hazards;
- isolating the mental health outcomes related to climate change from other compounding life stressors;
- measuring some types of mental health impacts and compounding stressors (e.g., the difficulty of measuring compounding stressors of those experiencing colonialism, intergenerational trauma, and connections to the land, such as many Indigenous Peoples);
- studying and reporting on mental health indicators when mental health can be understood differently among diverse populations; and,

2 Inuit Nunangat includes Inuvialuit (part of the Northwest Territories and Yukon), Nunavut, Nunavik (Northern Quebec), and Nunatsiavut (Labrador).

3 The term Indigenous is used in this chapter to refer collectively to the original inhabitants of Canada and their descendants, including First Nations, Inuit, and Métis peoples, as defined under Section 35 of the *Constitution Act, 1982*. Wherever possible, clear distinctions are made between these three distinct, constitutionally recognized groups. Indigenous Peoples outside of Canada are also referenced in some instances particularly with respect to international climate policy, processes, and rights and are identified as such.



- under- or over-reporting of mental health outcomes related to climate change; under-reporting may occur because of the stigma surrounding mental illness, and over-reporting may occur because research is conducted too soon after a climate hazard, and, thus, normal reactions to abnormal events may be inappropriately pathologized (Hayes et al., 2018a).

4.2 Key Terms

The World Health Organization (WHO) defines **mental health** as: “A state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (WHO, 2018, n.p.). Mental health can be demonstrated by the range of thoughts, feelings, and behaviours that people experience in their lifetimes. This conceptualization of mental health goes beyond diagnostic categories to encompass broader definitions of mental health across cultures and contexts. Mental health, like physical health, exists on a spectrum and includes states of mental wellness, mental challenges, and mental illness, each of which can influence functioning across life domains (MHCC, 2018). Throughout this chapter, the term mental health refers to specific mental health–related outcomes, such as PTSD, anxiety, depression, and post-traumatic growth (PTG).

Mental wellness refers to affirmative mental health outcomes, such as psychosocial resilience, which is the ability to adapt, thrive, develop, and transform despite experiencing stressors (Kumar, 2016).

Mental challenges include problems related to thoughts, feelings, or behaviours, such as overwhelming emotions, including fear, panic, and worry (American Psychiatric Association, n.d.).

Mental illness includes moderate to severe diagnosable mental disorders, such as major depressive disorder, psychosis, and PTSD (Coppock & Dunn, 2009; American Psychiatric Association, 2013).

Emotional distress refers to experiencing symptoms of poor mental health outcomes (e.g., anxiety, depression, loss of motivation). The term **mental ill health** encompasses the definitions of mental challenges, formally diagnosable mental illnesses, and emotional distress.

Mental health is one aspect of the broader definition of psychosocial health. **Psychosocial health** is defined as the interplay between social well-being, which arises from relationships with others and one’s context and culture, and psychological well-being, including thoughts, feelings, and behaviours (Berry et al., 2014). Psychosocial health depends on social factors in a person’s life domain (home, work, school, and community) that are related to mental health and that allow people to live in optimal social conditions. **Psychosocial impacts** refer to outcomes that affect social relationships and context; for example, a lost sense of place related to experiencing climate change hazards.

A holistic understanding of mental health also includes an understanding of important social, cultural, and environmental determinants, which may include spiritual well-being, connectedness to nature and one’s environment, and sense of place (MHCC, 2016; Hayes et al., 2018a). There are many approaches to understanding, supporting, and treating mental health from multiple cultural perspectives, which are valued and shared by people in Canada. For example, First Nations, Inuit, and Métis communities often have their own definitions of

mental wellness, which include connections to land; an interplay among physical, mental, emotional, and spiritual wellness; and the importance of community and culture (Kirmayer et al., 2003; Health Canada, 2015; ITK, 2016; Sawatzky et al., 2019).

Specific qualities of environment-related trauma can foster complex emotional and behavioural reactions. For example, Glenn Albrecht noted the increase in environmental distress following climate-related hazards, such as drought and wildfires in Northern Australia, Hurricane Katrina, and the changing ice conditions in Northern Canada (Albrecht, 2011; Albrecht, 2012; Albrecht, 2017). He and his colleagues coined these environmental distress reactions “psychoterratic syndromes” and they include ecoanxiety, ecoparalysis, and solastalgia (Albrecht, 2011). These terms describe complex emotional and behavioural reactions of experiencing climate change that are not necessarily pathological. These reactions might actually be quite justified in response to climate change impacts and may serve as normal expressions of grief and/or loss in response to environmental degradation from climate change (Albrecht, 2011; Albrecht, 2019).

Table 4.1 provides definitions for some common environment-related distress.

Table 4.1 Definitions of environment-related distress

TERM	DEFINITION
Ecoanxiety	Ecoanxiety (or climate anxiety) refers to the anxiety people experience that is triggered by awareness of ecological threats facing the planet due to climate change (Albrecht, 2011; Albrecht, 2012).
Ecoparalysis	Ecoparalysis refers to the complex feelings of not being able to do anything grand enough to mitigate or stop climate change (Koger et al., 2011).
Solastalgia	Solastalgia refers to the distress of bearing witness to ecological changes in one’s home environment due to climate change; conceptualized as feeling homesick when a person is still in their home environment (Albrecht, 2011; Albrecht, 2012).
Ecological grief	Ecological grief (or ecogrief) refers to distress related to ecological loss or anticipated losses related to climate change. These losses may relate to land, species, culture, or lost sense of place and/or of cultural identity and ways of knowing. Ecogrief can include loss and trauma related to specific hazards such as climate-related flooding or wildfires, or slow-onset climate change impacts such as rising global temperatures, drought, melting permafrost, and sea-level rise (Cunsolo & Ellis, 2018).

4.3 Methods and Approach

As the literature in Canada on climate change and mental health is limited, this chapter also draws on the global literature and applies lessons learned to a Canadian context, where appropriate, to substantiate existing studies and fill knowledge gaps. A scoping review was conducted of English- and French-language peer reviewed and grey literature on climate change and mental health. Peer reviewed literature was identified by searching the PubMed, Scopus, PsycINFO (Proquest), Cochrane Review, and Google Scholar databases, using the search terms “climate change” or “changing climate” and “mental health” or “psychosocial” or “well-being/well-being,” as well as synonyms and related words, such as “mental ill health,” and “mental wellness.” In an effort to capture literature that addressed psychosocial adaptation, the terms “resilience,” “response,” and “adaptation” were used in combination with the primary search terms. Grey literature sources included government reports, workshop reports, unpublished project reports, conference presentations, and communication with practitioners, and knowledge leaders.

The initial scoping review took place in July 2017, and English-language literature on climate change and mental health from the year 2000 onward was captured. An updated review took place in May 2019 and, at that time, French-language literature from 2000 to 2019 was included. After removing duplicates and irrelevant articles, a total of 207 articles were reviewed in depth for relevance and incorporated into this literature review.

Studies of climate change and psychosocial health tend to apply either survey or interview methods to learn about the lived experiences of psychosocial distress associated with a changing climate (e.g., Cunsolo Willox et al., 2012; Alderman et al., 2013; Ampuero et al., 2015; Durkalec et al., 2015; Eisenman et al., 2015; Harper et al., 2015; Albrecht, 2017; Dodd et al., 2018; Hayes et al., 2020; Middleton et al., 2020a). Most surveys and interviews are self-reported accounts from people who have experienced extreme temperatures or extreme weather events. Many of the findings presented in this chapter are from self-reported surveys and interviews, which mostly used a variety of validated survey tools and scales to assess how extreme temperatures or extreme events affect people’s psychosocial health.

4.4 Mental Health Impacts of Climate Change

4.4.1 Causal Pathways

The casual pathways linking climate change hazards to mental health are multifaceted. Figure 4.1 describes how climate change negatively affects mental, physical, and community health. In the centre of this figure are the geophysical impacts of climate change, which amplify pre-existing social, individual, and physical health inequities. The interactions among climate hazards and pre-existing health inequities can lead to a host of mental, physical, and community health outcomes.

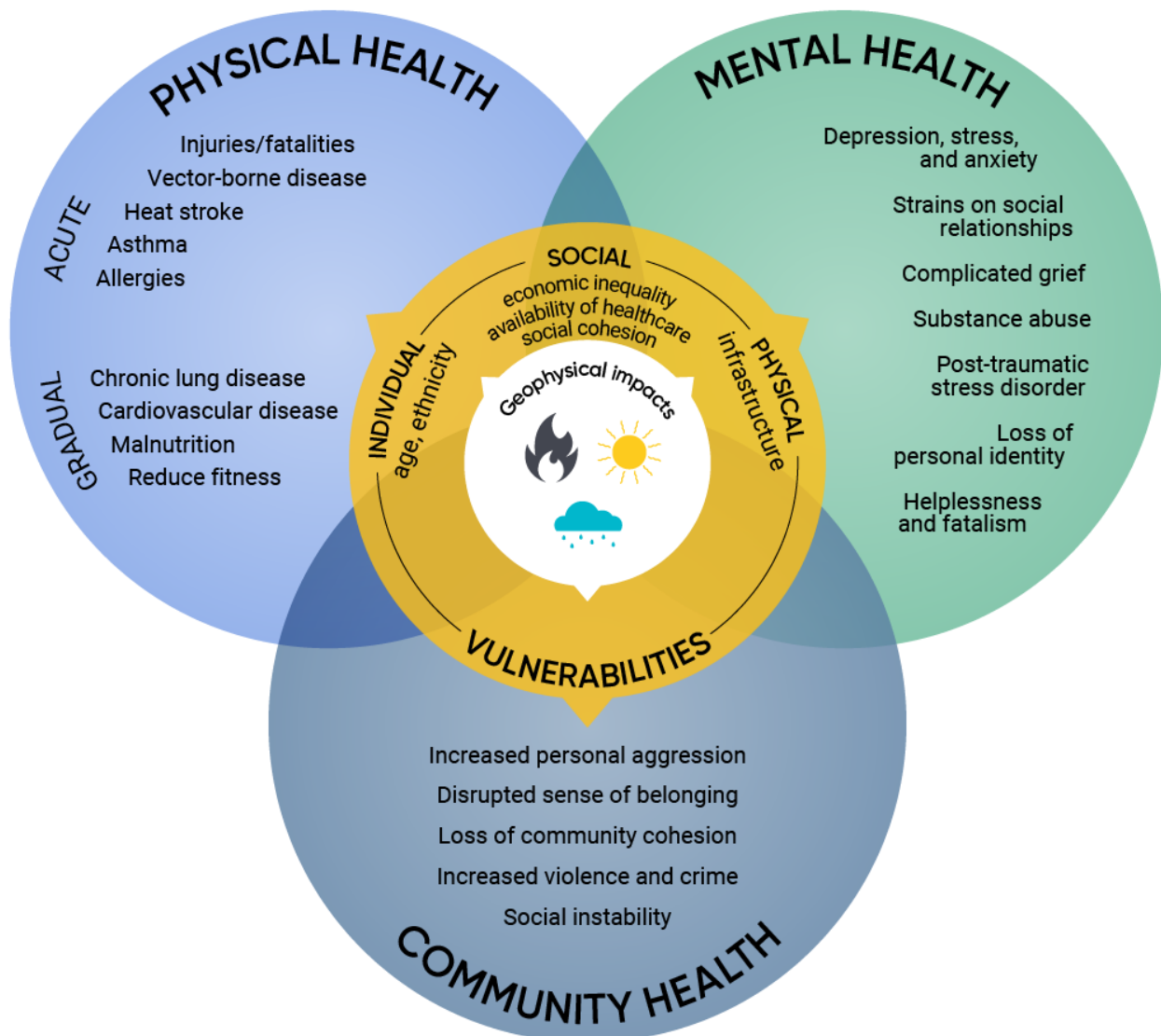


Figure 4.1 Linkages among climate change and physical, mental, and community health. Source: Clayton et al., 2017.

Exposure to climate hazards may trigger direct mental health impacts, such as depression, grief, or PTSD (Clayton et al., 2014; Dodge et al., 2016; Clayton et al., 2017; Hayes & Poland, 2018; Middleton et al., 2020b). Psychological reactions may also occur as a result of experiencing physical health impacts, such as heat stress, vector-borne disease, or injury (Berry et al., 2010a; Clayton et al., 2017) or impacts on community well-being, such as economic disruptions, displacement, and a loss of social cohesion (Berry et al., 2010a; Agnew, 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Sahni et al., 2016; Clayton et al., 2017; Miles-Novelo & Anderson, 2019). Disruption of social cohesion and resource scarcity can significantly affect health and related services for those who already have mental health problems and/or substance use disorder (Dodgen et al., 2016; Clayton et al., 2017). After experiencing climate stressors, some people may experience

a combination of both affirmative mental health outcomes and mental problems or illness (Weissbecker, 2011; Hayes & Poland, 2018; Hayes et al., 2020). Affirmative outcomes can include a sense of optimism for the future, compassion, and altruism for others who have been affected by climate hazards, and a sense of meaning or purpose in one's life. Post-traumatic growth (PTG) can result from an increase in social cohesion after a climate disaster (Edwards & Wiseman, 2011; Ramsay & Manderson, 2011).

4.4.2 Timing of Impacts

In the literature, three timeframes related to the onset of psychosocial responses from acute hazards have been identified. They include immediate effects (hours, days, weeks), mid-range effects (six months to a year), and long-term effects (2.5 years and beyond) (Tunstall et al., 2006; Fritze et al., 2008; Anderson et al., 2017; Clayton et al., 2017). Immediate effects of acute, extreme weather events can include acute trauma, a normal response to a disaster (e.g., "normal reactions to abnormal situations") in which the traumatic reaction tends to subside once security and safety are established (Fritze et al., 2008). However, this is not always the case, as higher rates of more severe mental health concerns, such as suicide, have been reported in relation to acute climate change hazards such as extreme heat events (Carleton, 2017; Burke et al., 2018). Some mental health impacts can also extend over the medium- and long-term; those most commonly identified in the literature include anxiety, depression, PTSD, and drug and alcohol misuse, which can occur any time during ongoing climatic stressors or well after a climate-related extreme event has ended. They may also be related to the awareness of the threats posed by a changing climate (Fritze et al., 2008; Dodgen et al., 2016; Clayton et al., 2017). Notably, there are no key timeframes specified in the literature related to slow-onset hazards. People exposed to these hazards may experience an ongoing lost sense of place and/or distress from displacement, economic insecurity, food insecurity, and water insecurity.

4.4.3 Mental Health Impacts of Acute Hazards

The majority of studies in the climate change and mental health literature examine the mental health outcomes of acute hazards, such as flooding, extreme heat events, wildfires, and hurricanes. Exposure to acute disasters can trigger a host of mental health outcomes, including PTSD, major depressive disorder, anxiety, complicated grief, survivor guilt, recovery fatigue, and suicidal ideation or attempts (Berry et al., 2010a; Berry et al., 2011; Doherty & Clayton, 2011; Reser & Swim, 2011; Weissbecker, 2011; Cunsolo Willox et al., 2012; Stanke et al., 2012; Cunsolo Willox et al., 2013b; Bourque & Cunsolo Willox et al., 2014; O'Brien et al., 2014; Harper et al., 2015; Durkalec et al., 2016; Gifford & Gifford, 2016; Clayton et al., 2017; Mantoura et al., 2017; Dodd et al., 2018; Hayes et al., 2018a; Clayton, 2020; Clayton & Karazsia, 2020; Middleton et al., 2020a; Middleton et al., 2020b). In many cases, people exposed to acute disasters experience relatively little distress or only brief experiences with mental illness or mental health challenges, and instead demonstrate significant resilience (Bonanno, 2004). There is also evidence that suggests that people who are not exposed to acute hazards can experience mental health outcomes, such as vicarious trauma, secondary stress, and/or compassion fatigue for those whose lives have been disrupted by extreme events (Lambert & Lawson, 2013; Naturale, 2015). These forms of indirect distress are often due to close connection with people exposed to extreme events, media coverage of survivor experiences, or caring for survivors in a professional capacity

(Naturale, 2015). The following sections provide information on specific hazards and mental health outcomes, with a focus on literature that is specific to Canada and/or relevant to the Canadian context.

4.4.3.1 Flooding

Flooding has become the most frequent type of disaster globally, and risks of flooding are projected to increase as a result of the impacts of climate change in Canada (Alderman et al., 2012; Stanke et al., 2012; IPCC, 2014; Fernandez et al., 2015; UNISDR, 2015; Zhang et al., 2019). Evidence suggests that flooding can significantly affect mental health, and its effects can include increased levels of PTSD, general distress, depression, and anxiety among flood survivors (Alderman et al., 2012; Berry et al., 2014; Fernandez et al., 2015; Sahni et al., 2016; Waite et al., 2017). People exposed to flooding events may also experience an enhanced sense of community, compassion, and altruism, as community members come together to support one another in the wake of a disaster (Weissbecker, 2011; Hetherington et al., 2018; Hayes et al., 2020). These affirmative mental health outcomes may co-occur with poor mental health outcomes, such as anxiety or general distress (Weissbecker, 2011; Hayes et al., 2020). People do not need to be directly exposed to a flood to experience poor mental health outcomes. For example, a study based in England by Waite et al. (2017) surveyed 2126 people to understand the effects of flooding on mental health. Respondents included individuals whose homes had been flooded and those who were disrupted by the flood (e.g., could not travel to work), but whose homes were not directly flooded (Waite et al., 2017). Psychological morbidity was highest among respondents directly affected by flooding (622), with PTSD being the most commonly reported impact (36.2%), followed by anxiety (28.3%), and depression (20.1%) (Waite et al., 2017). Interestingly, those who were disrupted by the flood, but who had not directly experienced flooding (1099), also experienced PTSD (15.2%), anxiety (10.7%), and depression (9.6%) related to the flood event (Waite et al., 2017).

Flooding can exacerbate pre-existing mental health conditions and contribute to new ones (Stanke et al., 2012). The impacts of floods can include increased substance misuse, increased family violence after the flood exposure, and effects on sleep, which can lead to poor mental health outcomes (Burton et al., 2016; Sahni et al., 2016). Broader psychosocial health outcomes associated with flooding are often related to job insecurity and economic insecurity from flood damage to homes and businesses that strain individuals' and families' sense of place and livelihoods.

There is also evidence to suggest long-term mental health and psychosocial effects of experiencing flooding, including anxiety when it rains many years after experiencing a flooding event; reduced sense of security, including fears and anxiety about experiencing another extreme event; stress of living in floodplains; financial stress and family breakdown related to housing insecurity and/or economic insecurity from rebuilding; and lost sense of place due to displacement from flooding (Burton et al., 2016; Decent & Feltmate, 2018; Hayes et al., 2020).

4.4.3.2 Extreme Heat Events

There is a growing body of literature documenting the mental health impacts from exposure to extreme heat events. These impacts include increased mood and behavioural distress; exacerbated mental illness;

and increased risk of aggression, violence, and suicide (Anderson & Jané-Llopis, 2011; Agnew, 2012; Vida et al., 2012; Bélanger et al., 2014; Dixon et al., 2014; Wang et al., 2014; Ding et al., 2016; Dodgen et al., 2016; Obradovich et al., 2018; Thompson et al., 2018; Kaiser et al., 2019; Miles-Novelo & Anderson, 2019). People who tend to be at greater risk of poor mental health outcomes from exposure to extreme heat include the elderly, people with chronic physiological conditions, and people with pre-existing mental health conditions, including those taking psychotropic medications that affect thermoregulation (Price et al., 2013; Bélanger et al., 2014; Wang et al., 2014; Trang et al., 2016; Anderson et al., 2017). Some mental illnesses may be associated with inefficient physiological reactions to extreme heat, which make it harder for the body to cool down (Trang et al., 2016). Also, some medications may predispose people to heat illnesses (Health Canada, 2011), as they can inhibit important physiological reactions and/or cause cognitive impairment that may affect judgment and limit the uptake of protective measures. In addition, people with mental illness may face greater challenges in adapting because of cognitive impairment (e.g., not seeking shade) and/or socio-economic barriers, which disproportionately affect people with mental illness (Cusack et al., 2011; Page et al., 2012; Price et al., 2013; Bélanger et al., 2014; Wang et al., 2014; Dodgen et al., 2016; Trang et al., 2016; Anderson et al. 2017).

Higher temperatures may also be linked with violence (including suicide) and aggression (Stephen et al., 1999; Anderson & Jané-Llopis, 2011; Agnew, 2012; Dixon et al., 2014; Dodgen et al., 2016; Thompson et al., 2018; Kim et al., 2019; Miles-Novelo & Anderson, 2019). A 2019 study analyzed the association between the daily mean temperature and incidence of suicide for 341 locations in 12 countries and found that the pooled excess relative risk (1.46, 95% confidence interval [CI] 1.25 to 1.70) for suicide for 26 Canadian locations (1986 to 1999) was highest at a daily mean temperature of 24.2°C (Kim et al., 2019). It is important to note that this temperature is at the 99th percentile; however, as climate change progresses, reaching this threshold more often is likely. This may result in an increased number of suicides, depending on the levels of acclimatization and adaptation. Some Canadian locations have higher increases in the relative risk than the pooled value at different temperatures, including Oshawa, with a relative risk of 3.80 (95% CI 1.06 to 13.59) at 24.9°C; Ottawa, with a relative risk of 2.44 (95% CI 1.18 to 5.02) at 25.9°C; and Toronto, with a relative risk of 1.75 (95% CI 1.18 to 2.59) at 26.5°C (Kim et al., 2019).

Extreme heat also poses strain on systems that support mental health and well-being. Increased ambulance calls, emergency department visits, calls to telehealth and other helplines, and/or increases in people seeking outpatient care for mental health-related reasons during periods of extreme heat have been observed (Basu et al., 2018). In addition, drug storage in extreme temperatures may affect the efficacy of medications (De Winter et al., 2013; Armenian et al., 2017).

4.4.3.3 Wildfires

The research on the mental health impacts of wildfires has grown in recent years, likely due to the increase in wildfire disasters (particularly in communities in Western Canada). Similar to the research on flooding, the main mental health impacts of wildfires include increased risk of PTSD, anxiety (including generalized anxiety disorder), worry, and depression (Hutton, 2005; Eisenman et al., 2015; Yusa et al., 2015; Klinkenberg, 2017; Agyapong et al., 2018; Dodd et al., 2018). Wildfires can also lead to population displacement, damage to infrastructure, loss of property, threats to food security, and respiratory conditions, which can result in

exacerbated or the onset of psychological distress (including anxiety, stress, and PTSD) (Hutton, 2005; Yusa et al., 2015; Dodd et al., 2018). Recent findings from a study on the 2016 wildfire in Fort McMurray, Alberta, revealed significant increases in PTSD. Findings revealed 60% of respondents self-reported symptoms of PTSD, while 29% were formally diagnosed with PTSD (Klinkenberg, 2017). Another 26% of respondents highlighted experiences of depression and 36% noted experiences of insomnia (Klinkenberg, 2017). Researchers comparing youth exposed to the Fort McMurray wildfires to controls in Red Deer, Alberta, found that depression scores, suicidal thinking, and increased tobacco use were significantly higher in the youth from Fort McMurray (Brown et al., 2019).

A study published in 2018 of the health impacts of wildfires in the Northwest Territories between June and August of 2014 revealed that displacement and evacuation related to the wildfires resulted in increased stress, fear, and long-term mental and emotional trauma (Dodd et al., 2018). Indigenous Peoples' mental health and well-being was at particular risk because the fires disrupted land-based activities and cultural practices that are essential to the livelihoods in many of these communities (Dodd et al., 2018).

4.4.3.4 Hurricanes

There is limited literature documenting the mental health outcomes related to hurricanes in Canada, as hurricane exposure is relatively low compared to that in the U.S., for example. The primary mental health impacts from hurricanes that have been documented in studies outside of Canada include increased risk of PTSD and anxiety and mood disorders (Galea et al., 2007; Kessler et al., 2008; Whaley, 2009; Zwiebach et al., 2010; Ferré et al., 2019; Orengo-Aguayo et al., 2019). The literature also highlights long-term effects, including affirmative outcomes such as a sense of resilience. Negative outcomes include, for example, lingering depression and PTSD (Rhodes & Chan, 2010; Pitts, 2015; Ferré et al., 2019).

Much of the literature documenting the mental health impacts of hurricanes is focused on the experiences of Hurricane Katrina and Hurricane Maria survivors. Hurricane Katrina was a Category 5 hurricane that struck the Gulf Coast of the U.S. in 2005, devastating the city of New Orleans (Whaley, 2009). It has been estimated that 20% to 35% of survivors experienced some form of mental health impact following Hurricane Katrina (Whaley, 2009). Nearly half (47.7%) of marginalized community members of New Orleans (mainly low-income, African-American women) showed probable signs of PTSD (Rhodes & Chan, 2010). This rate is significantly higher than the representative sample obtained by Kessler et al. (2008), which showed the prevalence of PTSD among the population at large who were affected by the hurricane to be between 14% and 20% (Kessler et al., 2008). Moreover, a 31.2% prevalence of anxiety and mood disorders among Hurricane Katrina survivors was observed (Kessler et al., 2008).

Similar to the findings on the mental health impacts of Hurricane Katrina, researchers exploring the impacts of Hurricane Maria, which struck Puerto Rico in 2017, found clinically significant increases in depression, anxiety, and PTSD among two-thirds of the 74 households surveyed six months after the event (Ferré et al., 2019). When looking at the mental health impacts of Hurricane Maria survivors who relocated to Florida, researchers found that adaptation and adjustment to a new environment added psychological burdens (Scaramutti et al., 2019). Therefore, adaptation efforts that lead to displacement do not always correlate with affirmative mental health outcomes (see section 4.4.5.1 Migration and Displacement).



In Canada, Hurricane Igor, which struck the Eastern coast of Newfoundland in 2010, was one of the most devastating hurricanes in Canadian history, reaching a Category 4 status (Gosse, 2010; Insurance Board of Canada, 2010; Pitts, 2015). While there are no known empirical investigations of the mental health impacts of this hurricane, there were reports documenting the psychosocial toll of loss and destruction (Gosse, 2010; Insurance Board of Canada, 2010). There was also one media report, five years after the hurricane, that documented psychosocial outcomes among community members in Clarenville and the Bonavista Peninsula in Newfoundland. These outcomes included an increased sense of community and resilience in the wake of the hurricane and in the months and years that followed the rebuilding efforts (Pitts, 2015).

4.4.4 Mental Health Impacts of Slow-Onset Hazards

Climate change impacts on mental health may also occur as result of slow-onset hazards, such as drought, melting sea ice, and sea-level rise.

4.4.4.1 Drought

Climate change is expected to continue to increase the risk of drought in Canada (Bush & Lemmen, 2019). Drought can affect livelihoods, socio-economic status, drinking water resources, food availability, and respiratory function (Vins et al., 2015; Watts et al., 2017). As a consequence of these impacts, drought can also affect mental health (Yusa et al., 2015; Bard, 2017). The literature documenting the mental health impacts of drought highlights the secondary impacts from drought-related income, water, and food insecurity. These mental health impacts include increased risk of suicide, lost sense of place, and general despair (Nicholls et al., 2006; Polin et al., 2011; Rigby et al., 2011; Hanigan et al., 2012; Bryant & Granham, 2015).

Those at greatest risk of experiencing poor mental health outcomes from drought include land-based workers (in the current research literature, land-based workers tended to be male and farmers), rural dwellers, and Indigenous Peoples (Rigby et al., 2011; O'Brien et al., 2014; Bryant & Granham, 2015; Powers et al., 2015; Flechter & Knuttila, 2016; Ellis & Albrecht, 2017). People involved in the agricultural industry are among the most commonly affected by the mental health impacts of drought because their economic livelihoods depend on environmental conditions (Vins et al., 2015; Ellis & Albrecht, 2017). For example, Ellis and Albrecht (2017) found that climate change contributed to increased worry and place-based distress, and also increased the perceived risk of depression and suicide among farmers in Australia. These outcomes emerged as a result of a lost sense of identity, deep emotional links to family farms, feelings of failure due to the inability to protect the land, and an understanding of ecological destruction occurring in their community (Ellis & Albrecht, 2017).

Emotional responses to drought can be complex, involving both negative and positive effects. For example, in a study of drought impacts among First Peoples of Australia in New South Wales, Rigby et al. (2011) found impacts on culture and place, in particular, the inability to conduct cultural practices and displacement from traditional lands, which led to feelings of despair (Rigby et al., 2011). Noting the complexity of psychosocial responses to drought, authors also found that “the drought prompted increased love of and concern for land and a renewed enthusiasm for expressing connectedness to land through all forms of art” (Rigby et al., 2011, p. 249).



Droughts place significant psychosocial burdens on people because they tend to last longer than other extreme weather events, they tend to be more geographically expansive, and, thus, they have wide-ranging economic impacts. Furthermore, ecological recovery tends to be slow (Yusa et al., 2015; Fletcher & Knuttila, 2016).

4.4.4.2 Melting Sea Ice and Sea-Level Rise

The mental health impacts of melting sea ice and sea-level rise are a growing field of study, and much of the Canadian literature is focused on sea-ice decline in Northern communities. This is the region of Canada where the most rapid warming is being experienced, particularly in remote Inuit and First Nations communities (Bush & Lemmen, 2019). The mental health impacts from melting sea ice and sea-level rise include psychosocial distress related to food insecurity, a lost sense of place and identity, increased stress and anxiety from unsafe travel conditions, and increased substance use (Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Asugeni et al., 2015; Durkalec et al., 2015; Harper et al., 2015). For example, it has been documented that warming temperatures and melting sea ice caused a variety of strong emotional reactions, including fear, anxiety, sadness, anger, frustration, stress, and distress among Nunatsiavut Inuit (Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Durkalec et al., 2015; Harper et al., 2015). Changing weather patterns and sea ice thickness and extent affected community members' abilities to travel and to participate in traditional food-gathering methods, thus affecting food security. These impacts affected the sense of place and identity, as cultural practices were disrupted by the lack of access to stable and safe ice (Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Harper et al., 2015). Mental health problems, suicidal ideation, family stress, and increased drug and alcohol use were often associated with this disrupted sense of place and identity (Cunsolo Willox et al., 2012).

4.4.5 Overarching Issues Related to Mental Health and a Changing Climate

4.4.5.1 Migration and Displacement

People exposed to climate hazards may be subject to job losses (particularly land-based workers), food and water insecurity, and forced migration, all of which can impact psychosocial health (Fritze et al., 2008; Agnew, 2012; Vins et al., 2015). Global displacement due to climate change is projected to vary from 25 million to 1 billion by 2050; however, 200 million is the most frequently cited estimate (IEHS, 2015). In addition to the effects of being displaced, migrants often face psychosocial impacts related to racism and discrimination experienced by many people in their new host countries or when people are displaced within a country (Gleick, 2014).



Box 4.1 Mental health and cultural safety in Indigenous communities affected by evacuations caused by extreme weather events

Understanding the history of relocation of First Nations, Inuit, and Métis populations in Canada is integral for informing effective and culturally safe evacuations during climate change impacts. Relocations have historically been implemented to establish the reserve system in Canada. Historical displacement among First Nations communities, for example, has meant moving communities to reserve lands through forcible means, often to unknown territory and land (Bussidor & Bilgen-Reinart, 1997; Christmas, 2013). Indigenous Peoples today inhabit less than 1% of their traditional lands and territories in Canada (Usher, 2003). Climate change and the increased impacts on Indigenous Peoples, paired with this history of relocation, have significant impacts on community members, which may exacerbate pre-existing trauma as a result of colonial legacy.

In 2018, the Climate Change and Health Adaptation Program at Indigenous Services Canada launched a three-year project entitled Addressing Mental Health Impacts in Indigenous Communities Due to Evacuations Caused by Extreme Weather Events. Participants included people from First Nations communities across Canada. This research was piloted in collaboration with First Nations community members and other key stakeholders to identify tangible solutions to inform policy and programs during evacuations, responses and recovery efforts, and to ensure that Indigenous voices are included in emergency planning and management.

Various conversations with participants suggested that climate change intensifies existing inequities experienced by communities by affecting subsistence lifestyles and connections to land and territory. First Nations communities were disproportionately evacuated due to climate change events, at 28.7 times the rates of their off-reserve Canadian counterparts, between 2009 and 2016 (Durocher, 2018). During times of evacuations, mental health and cultural safety are often not adequately considered in emergency response. Mental health challenges of experiencing an evacuation are often compounded and exacerbated through:

- the breakdown of communications systems between multiple jurisdictions;
- the intergenerational trauma of residential school systems;
- limited cultural wellness supports; and
- the often limited cultural spaces to provide country food and other spaces of healing.

Recommendations to reduce the mental health challenges of these events included integrating First Nations communities and knowledge systems into all stages of evacuation planning and process, and promoting and strengthening resilience before, during, and after evacuations. Importantly, concepts of resilience differ among clans, families, Nations, and communities. However, more broadly, resilience work for many Indigenous communities means understanding what capacity looks like from a space of cultural and traditional knowledge – including incorporating the role of oral history, maintaining or re-establishing access to subsistence practices, and involving social and familial structures in emergency management and preparedness.

Acute and slow-onset hazards due to climate change interact with existing socio-economic and political conditions to drive increases in voluntary and forced migration (Schwerdtle et al., 2017). In response to hazards related to climate change, not all populations migrate voluntarily, and some populations are not able to do so at all (Black et al., 2011). Some populations experiencing climate-related impacts may choose not to migrate, but rather to adopt other adaptation strategies (Black et al., 2011). Others may choose temporary migration with planned return or circular mobility between home and new host areas. “Trapped populations” represent those who are unable or less able to migrate because of social, political, or economic conditions, despite high vulnerability to climate change hazards (Bogic et al., 2015). These populations often live in low-resource settings (within or outside of Canada) and already experience various health inequities. Populations exposed to climate hazards who are unable to relocate remain at heightened or increased risk of mental health impacts of climate change (Foresight: Migration and Global Environmental Change, 2011). Climate-related migration can involve adverse health impacts but may also include positive impacts on health and well-being. For example, a review by Schwerdtle et al. (2017) on climate change and migration, which included case studies from various countries, described how voluntary, planned relocation can be an effective adaptation if it is based on the consent of migrating communities, if it improves the standards of living, and if used as a last resort.

In Canada, displacement related to climate change is an important issue, particularly for Indigenous communities. For example, the 2011 Manitoba flood displaced residents of Lake St. Martin First Nation in Manitoba for over six years (Macyshon, 2017). Approximately 7% of the evacuees never returned home, and some of these cases were due to suicide and homelessness (Macyshon, 2017). Substance misuse may also be related to displacement. The health director of the Montreal Lake Cree Nation in Saskatchewan suggested that increased use of crystal methamphetamine by 600 community members is related to a 2015 wildfire evacuation that displaced the entire community of 1200 people (Zakreski, 2019). The psychosocial effects of displacement related to climate change can therefore include increased rates of suicide, homelessness, and substance misuse among Indigenous communities that are impacted by evacuations caused by extreme weather events in Canada (Box 4.1). However, more research is needed to better understand these impacts.

4.4.5.2 Impacts on Health Systems and Facilities

Climate change also has implications for mental health services, treatment, and facilities. For example, mental health care facilities may be inaccessible due to infrastructure damage to buildings or roads following acute climate hazard events (Hasket et al., 2008; Osofsky et al., 2010; Clayton et al., 2017). Further, mental health professionals may be unable to reach health care facilities to provide services because of damage to their own property, personal injuries, or damage to infrastructure between their dwellings and health facilities. For the same reasons, people may be unable to access prescription medication to treat pre-existing mental health disorders (Balbus et al., 2013).

Many communities in Canada may not have access to mental health care facilities or practitioners on site even before a climate-related hazard, particularly in rural and remote areas (Cunsolo Willox et al., 2013b; Petrusek MacDonald et al., 2015; Moroz et al., 2020). In such cases, mental health care is often introduced in a community after the event for a short period of time and long-term mental health care needs are often not met (Hayes et al., 2020).



Box 4.2 Strengthening mental health care in High River, Alberta

The town of High River, Alberta, has experienced three major flooding events since 2005, most notably the 2013 flash flood that was declared a state of emergency, with four reported deaths and 13,000 people displaced from their homes (Canadian Disaster Database, 2016). Soon after the 2013 flood, the provincial government responded to the current and future mental health needs of Albertans by investing \$50 million in mental health care and creating the first Chief Mental Health Officer in the province (Government of Alberta, 2013). This investment resulted in:

- the deployment of 15 mental health experts to High River;
- 28 additional mental health experts from British Columbia brought in to support evacuees;
- clinical staff visits to hotels where evacuees were housed;
- the hiring of six additional child and youth mental health specialists;
- training for first responders and flood victims in suicide prevention and psychological First Aid;
- 85,000 mental health promotion resources related to mental health care delivered digitally; and,
- mental health care translation services for the mental health promotion resources and services (Government of Alberta, 2013).

Further, staff from the Calgary Counselling Centre were brought into the community to provide free mental health care for residents affected by the flood. According to the Calgary Counselling Centre website, over 2750 people received counselling related to their experiences with the flooding event and 93% reported improved well-being after treatment (Foothills Community Counselling, 2020).

Due to funding shortages, however, the Calgary Counselling Centre in High River closed in 2016. Clients were notified that they could travel to the Calgary offices an hour away to seek support (Foothills Community Counselling, 2020). However, this was not feasible for people of low socio-economic status or with mobility issues, who were unable to travel to Calgary. Further, many of the mental health care responders who were sent into High River following the flood began to leave in 2016, despite persistent mental health care needs in the community (Hayes et al., 2020).

Noting the long-term effects of the flood and the overarching mental health care needs of the community, the municipality of High River and a private donor stepped in to establish the Foothills Community Counselling Service (Foothills Community Counselling, 2020; Hayes et al., 2020). This service is offered in the community with costs on a sliding-scale, so that High River residents, irrespective of income, can receive long-term care.

The municipality has also created the Safe Spot Initiative to build citizen capacity to support the mental health of High River residents (McCracken, 2017). This initiative trains businesses and agencies in psychological First Aid. After receiving training, businesses and agencies post a large orange dot in their window to let community members know that their establishment is a “safe spot” to talk about their mental health with a trained staff member. The aim of this program is to increase access to community-based mental health care (Hayes et al., 2018b).



Clayton et al. (2017) noted that, where cities have set plans in place to enhance or build resilient infrastructure to support climate change and health needs, they often overlook mental health infrastructure (including mental health care facilities and wellness services). Enhancing access to and expanding mental health services can support psychosocial resilience to climate change (Box 4.2).

4.4.5.3 Loss and Damage

The United Nations Framework Convention on Climate Change (UNFCCC) highlights the community-wide negative impacts of loss and damage related to climate change (Tschakert et al., 2017; UNFCCC, 2020). Loss and damage refer to physical losses and damage to environmental resources, biodiversity, properties, businesses, and infrastructure from slow-onset and acute climate hazards. There is a growing body of literature that highlights how climate-related loss and damage affects psychosocial well-being (Barnett et al., 2016; Tschakert et al., 2017; Cunsolo & Ellis, 2018; Tschakert et al., 2019). As noted earlier, a lost sense of place, particularly among Indigenous Peoples in Canada and globally, is tied to a loss of culture, identity, and connectedness to the land and land-based activities; thus, the psychosocial effects of loss are myriad and complex (Rigby et al., 2011; Cunsolo Willox et al., 2012; Tam et al., 2013; Cunsolo & Ellis, 2018; Middleton et al., 2020a; Middleton et al., 2020b). For example, Tam et al. (2013) assessed how climate change affected well-being in a First Nation community in the Western region of James Bay, and found that both slow-onset hazards (e.g., increased temperatures, changes in the timing of seasons, etc.) and acute hazards (e.g., flooding events) led to the loss of traditional harvesting practices, damaged the winter road, and disrupted the behaviour of animals. Similarly, in Nunatsiavut, Labrador, it was found that disruptions from increasing temperatures, melting sea ice, and shifting plant and wildlife patterns, as well as subsequent impacts on food and cultural security, resulted in decreased sense of place, diminished cultural continuity, and concerns about loss of place-based connections moving forward (Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Middleton et al., 2020a). These experiences of loss, damage, and disruption subsequently led to socio-economic challenges and food insecurity that affected the communities' psychosocial well-being (Tam et al., 2013).

In a systematic analysis, entitled *One thousand ways to experience loss*, Tschakert et al. (2019) documented the many ways people and communities experience climate-related loss and damage through a comparative review of over 100 case studies. An array of negative emotional outcomes, including sadness, worry, trauma, depression, and suicidal ideation, a lost sense of place, a lost sense of safety, feeling homesick in one's home environment (solastalgia), grief, and loss of identity were identified (Tschakert et al., 2019). Further, a systematic literature review of climate-sensitive mental health outcomes for Indigenous Peoples globally found that changing place attachments and food systems can lead to diverse, interconnected, and overlapping emotional and psychological outcomes (Middleton et al., 2020b). The authors of this study highlight that there is no one single or simple relationship between climate stressors and intangible loss and damage and that climate-related harm is "mediated by personal circumstance, culture, and socio-economic context" (Tschakert et al., 2019, p. 69). An overview of how health inequities – based on biological, cultural, social, and environmental determinants of health – influence climate-related exposures, risks, and impacts is provided in the following section.

4.5 Populations at Higher Risk

While all people are at risk of experiencing the health impacts of climate change, some populations and communities are disproportionately affected. This section highlights populations throughout Canada who are at higher risk of the mental health impacts of a changing climate, including Indigenous Peoples; children, youth, and older adults; low socio-economic groups and the homeless; people with pre-existing health conditions; and certain occupational groups. This section emphasizes the need for appropriate attention, promotion, prevention, and care for specific subsets of the population.

In many cases, individuals who experience existing health inequities are at increased risk of mental health outcomes related to climate change. Health inequities refer to avoidable differences in health status and occur as a result of unfair or unjust systems, policies, and factors that influence health status (Government of Canada, 2018; see also Chapter 9: Climate Change and Health Equity). In order to address these systemic health inequities, it is important to better understand who is most at risk and the systemic factors that increase risk.

Individuals may fit into several population groups of higher concern and experience multiple health inequities, which can compound risks of the mental health impacts of climate change. The way multiple risk factors and health inequities can compound risk is not well understood. For example, there are many populations who may be at increased risk of the mental health impacts of climate change and who also experience discrimination. This can include racialized groups, those discriminated against because of sexual orientation, and those discriminated against as a result of mental health conditions. There is limited information about how discrimination can exacerbate the mental health impacts of climate change in specific populations.

Importantly, many populations who are at increased risk of mental health outcomes related to climate change have and continue to demonstrate adaptive and/or resilient behaviours, despite the challenges and inequities they face. While there is a nascent base of literature that explores the strengths and adaptation actions among populations considered at higher risk to mental health outcomes related to climate change (Ford et al., 2016; Hayes et al., 2019), such information can elucidate important learnings about those experiencing the most severe climate change impacts to better understand adaptation and resilience (Hayes, 2019).

4.5.1 Indigenous Peoples

There is a large body of literature documenting climate change impacts on the mental health of Indigenous Peoples in Canada and globally, with a specific focus on Indigenous Peoples in remote Australia (Shiple & Berry, 2010; Bardsley & Wiseman, 2012; Green & Minchin, 2014; O'Brien et al., 2014; Bowles, 2015) and Inuit Nunangat in Canada (Cameron, 2012; Cunsolo Willox et al., 2012; Ford, 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Durkalec et al., 2015; Harper et al., 2015; Ford et al., 2016). Indigenous Peoples in these distinct geographic locations are on the front lines of a changing climate and are bearing witness to the loss or degradation of land, which can take a toll on individual and collective well-being (Cunsolo Willox et al., 2012; Tam et al., 2013; Cunsolo Willox et al., 2014; Middleton et al., 2020b).

Compounding the impacts of a rapidly changing climate are the ongoing legacies and traumas stemming from colonization, land dispossession, residential schools, forced relocation, racism, social exclusion, and the continued marginalization of First Nations, Inuit, and Métis peoples in Canada (Kirmayer et al., 2009; Cameron, 2012; Ford, 2012). There is also a lack of culturally relevant health services for many First Nations, Inuit, and Métis peoples in Canada, leading to systematic and cultural barriers to service access and uptake (see Chapter 2: Climate Change and Indigenous Peoples' Health in Canada). It is also well understood that Indigenous Peoples have a greater burden of chronic physical illness as a result of experiencing systemic health inequities that can exacerbate climate-related mental ill health outcomes (Earle, 2013; ITK, 2016).

4.5.2 Sex and Gender

Evidence suggests that women⁴ tend to be more prone to anxiety, worry, and PTSD related to a changing climate (Tunstall et al., 2006; Lowe et al., 2013; Dodgen et al., 2016; Clayton et al., 2017). The literature also suggests that women tend to be at greater risk from climate changes as a result of gender-based marginalization (Fletcher & Knuttila, 2016; Williams et al., 2018). In particular, women tend to be in caregiving roles, which are typically undervalued and underpaid, and, in these roles, women are at greater risk of experiencing compassion fatigue, particularly during periods of exposure (or vicarious exposure) to climate hazards (Hayes, 2019). Pacheco (2020) also highlights that pregnant people are at greater risk of heat-induced illnesses and nutritional deficiencies, which are exacerbated by climate-related heat events and food insecurity.

Studies indicate that men also experience mental health impacts of climate change. For example, Cunsolo Willox et al.'s (2012) work in Northern Inuit communities in Nunatsiavut found that middle-aged men often suffered the most from changing environmental conditions because they were unable to provide food for family and community, with resulting negative effects on sense of place and identity (Durkalec et al., 2015). Further, as discussed previously, there is an increased risk of suicide among male farmers during times of drought (Hanigan et al., 2012). It is important to consider the role of gender-based socialization related to seeking mental health care (Tunstall et al., 2006). The literature suggests that the issue may be less about who is affected and more about who is socialized to engage in help-seeking behaviours and who has access to mental health services (Tunstall et al., 2006; Alston & Kent, 2008; Berry et al., 2011; Polain et al., 2011; Granham, 2015).

4.5.3 Children, Youth, and Older Adults

Children, youth, and older adults tend to be at greater risk from the psychosocial impacts of a changing climate because they are more dependent on others to maintain their health and well-being (Lowe et al., 2013; Clayton et al., 2014). Limited evidence suggests that pregnant people exposed to climate change stressors may have children with increased risks of intrauterine growth retardation, low birth weight, and prematurity (Pacheco, 2020). Among other types of long-term adverse effects, climate change may lead to

4 In Western science, sex is typically considered binary (male and female), which overlooks intersex individuals. Gender refers to the socially constructed roles assigned to men and women. In Western science, gender is commonly conflated with sex, and presented as binary (man and woman), overlooking non-binary individuals.



psychosocial impacts, such as attention deficit hyperactivity disorder, autism spectrum disorder, and other neurodevelopmental disorders; cognitive deficits; mood disorders; and schizophrenia (Pacheco, 2020).

Experiences of anxiety and feelings of impending doom related to climate change can also affect children (Tucci et al., 2007; Fritze et al., 2008; Ojala, 2012). A survey of Australian children by Tucci et al. (2007) noted that one in four children were so concerned about the global threat of climate change that they believed the world would end before they reached adulthood. Children may also be at increased risk of long-term trauma and anxiety from extreme weather events (Simpson et al., 2011; Brown et al., 2019; Roberts et al., 2019). The concerns of children and youth over climate change may be more prevalent because they think more about their future, they have less agency and control in their lives and behaviours, and they have more time to focus on the issue (Ojala, 2012; Clayton, 2020).

4.5.4 Low Socio-Economic Populations and the Homeless

People living with low socio-economic status are at higher risk of the health impacts of climate change (see Chapter 9: Climate Change and Health Equity), including effects on mental health. For example, homeless people tend to live in urban and suburban areas where there is greater exposure to extreme temperatures, which can disproportionately affect people with pre-existing mental health conditions who have difficulty with thermoregulation (Dodgen et al., 2016). People who are homeless are at greater risk of vector-borne diseases because they spend large portions of time outdoors in precarious weather and in areas where host vectors may be more prevalent (Dodgen et al., 2016). Vector-borne diseases, such as West Nile virus and Lyme disease, may compound mental health issues for people with pre-existing mental health illness by contributing to cognitive, neurological, and mental health problems (Dodgen et al., 2016). While the current base of research on the mental health implications of climate change among the homeless and those living with low socio-economic status in Canada is limited, socio-economic status is recognized as a predictor of poor mental health outcomes (Hudson, 2005).

4.5.5 People with Pre-Existing Health Conditions

People with pre-existing health conditions, including mental health issues, are at greater risk for the mental health impacts of a changing climate (Cusack et al., 2011; Dodgen et al., 2016). For example, in the U.S., veterans with mental illness were 6.8 times more likely to suffer from exacerbated mental illness after Hurricane Katrina compared to veterans with no pre-existing mental health conditions (Dodgen et al., 2016). Further, people with severe mental illness are extremely vulnerable during climate hazards, and their needs can often be overlooked in emergencies (Jones et al., 2009). Individuals with pre-existing mental health issues are at increased risk for other morbidities and mortality. Mental health care and social resources to support well-being (such as support groups) are required during and after climate hazard exposures among this target population.



4.5.6 Occupational Groups

People whose occupations are primarily outdoors, or whose economic livelihoods depend on the health of the land and environment, are at greater risk for psychosocial impacts of climate change (Fritze et al., 2008; Costello et al., 2009; Berry et al., 2010a; Clayton et al., 2014; IPCC, 2014). Outdoor labourers who tend to be most at risk include fishers, herders, hunters, and trappers, and people in the tourism industry (Fritze et al., 2008; Costello et al., 2009; Berry et al., 2010a; Clayton et al., 2014; IPCC, 2014).

As climate change affects traditional, resource-based industries and workers who rely on these industries for their livelihoods, these workers may experience emotional distress related to job insecurity. There is anecdotal evidence to suggest that people working in resource-based industries in Alberta, for example, are presenting with severe emotional distress as they contemplate the collapse of the traditional sectors in which they have worked (Mouallen, 2015). Limited evidence also suggests that ecoanxiety can affect people working in the fields of climate science, environmental science, and public health (Clayton, 2018; Pihkala, 2020).

Another occupational group that tends to disproportionately experience the psychosocial impacts of a changing climate are first responders who support health response efforts after extreme events (e.g., hurricanes, floods, wildfires) (Carleton et al., 2017). Dodgen et al. (2016) noted that PTSD rates among first responders range from 13% to 18% four years after responding to an extreme weather event.



4.6 Projected Mental Health Risks and Economic Costs

4.6.1 Projected Mental Health Risks from Climate Change

There are no known studies in Canada that project the mental health impacts of climate change. However, one study projected the mental health outcomes of climate change under future climate scenarios, focusing on suicide rates related to warming temperatures in the U.S. and Mexico. Burke et al. (2018) estimated that increased warming by 2050 (under the RCP8.5 scenario) could result in a combined 9000 to 40,000 additional suicides in the U.S and Mexico. For a 1°C increase in monthly average temperatures, mortality by suicide increased by 21% in Mexico and 0.7% in the U.S. (Burke et al., 2018).

In the absence of greater adaptation efforts, the current burden of mental ill health in Canada is likely to rise because many climate-related hazards associated with mental health outcomes are expected to increase in severity and frequency (Bush & Lemmen, 2019; Hayes et al., 2019). As previously noted, the Mental Health Commission of Canada reports that 7.5 million people in Canada experience mental health problems every year (MHCC, 2017). Given the very large number of Canadians who experience mental health problems, the potential increase of illness from future climate change is large.

4.6.2 Projected Economic Costs of Health Impacts

There are no known studies documenting the projected economic costs of the mental health impacts related to climate change in Canada. It is estimated that 500,000 people in Canada miss work every week due to mental health issues, which costs the Canadian economy approximately \$51 billion annually. Psychiatric conditions are the second most expensive health care expenditure in Canada, following closely behind expenditures for cardiovascular disease (CAMH, 2012; PHAC, 2014). Given the high costs of psychiatric conditions to the health system and society, and given the breadth of mental health impacts that can be related to climate change, future costs borne by Canadians are expected to be large as the climate continues to warm.

4.7 Adaptation to Reduce Risks

Adaptation measures can be effective in reducing the mental health impacts of climate change (Dodgen et al., 2016). This section provides an overview of the roles and responsibilities of officials, within and outside the health sector, for enhancing mental health in a changing climate. It discusses current policies and programs to reduce mental health risks, including new and innovative approaches for the monitoring and surveillance of the mental health impacts of climate change, efforts to support youth, and interventions that encourage interactions with nature. Barriers and opportunities for adaptation action are also presented, as well as the co-benefits of addressing climate change that can benefit mental health.

4.7.1 Roles and Responsibilities for Adaptation to Reduce Risks

Adapting to reduce the mental health impacts of climate change requires intersectoral and transdisciplinary actions rooted in integrated and coordinated support and care (Stanke et al., 2012; Hayes et al., 2019). The disciplines that should be involved include a range of health professionals, such as:

- physicians, nurses, mental health specialists (e.g., psychiatrists, psychologists, psychotherapists);
- allied health professionals (e.g., public health workers, pharmacists, social workers, community mental health workers); and
- emergency preparedness professionals (e.g., first responders).

The most effective support for mental health may be through mental health care professionals and formal services such as therapies, counselling, and/or psychotropic medications (Hayes et al., 2018a). For many, mental illness or emotional distress is still highly stigmatized, and people may prefer to support their well-being through informal family or community supports and networks entirely unrelated to formal mental health care (Rodriguez & Kohn, 2008). As a consequence, people may rely on services and supports offered informally, such as exercise, arts-based activities, or groups that provide an enhanced sense of community (Hayes et al., 2018a). There are also a variety of cultural approaches to mental health care that people may rely on – for example, land-based healing practised by many Indigenous Peoples, which brings people out on the land to create, craft, cook, share stories, and connect with the land and with culture (Radu, 2018).

4.7.2 Policies and Programs that Reduce Risks

There are a range of interventions to address the psychosocial impacts of climate change, including policy-level responses, programs, and practices, community-based approaches, and other strategies for providing mental health services and supports (Table 4.2). Psychosocial health refers more broadly to the social and psychological components that shape well-being, and mental health is one aspect of the broader definition of psychosocial health. The following sections highlight the broader range of adaptation interventions supporting psychosocial health (Clayton et al., 2017; Hayes & Poland, 2018; Hayes et al., 2018a).



Table 4.2 Examples of policy and program responses as well as medical interventions and practices to address the psychosocial impacts of climate change

POLICY AND PROGRAM RESPONSES

- Improved access to, or funding for, mental health care
- Economic assistance to reduce economic strain, which is a key stressor for people experiencing climate hazards
- Climate change resilience plans that address psychosocial well-being
- Climate change and health vulnerability and adaptation assessments that include examination of mental health vulnerabilities and adaptation options

MEDICAL INTERVENTIONS AND PRACTICES

- Specific therapies or medications provided by mental health care professionals
- Specific behavioural interventions such as cognitive behavioural therapies, mindfulness-based practices, or ecological grief programs
- Specialized training for community members in psychological First Aid or mental health First Aid
- Mobile mental health interventions
- Walk-in mental health care interventions
- Resource guides for professionals and the public on addressing the mental health outcomes related to climate change

4.7.2.1 Monitoring and Surveillance of Mental Health Impacts

The *Toolkit for Post-Disaster Surveillance of Impacts on Mental Health* developed by the National Institute of Public Health of Quebec provides guidance to public health officials on monitoring the mental health impacts of major disasters during the recovery phase, which can last months to years after an extreme event (Canuel et al., 2019). This toolkit includes specific data collection instruments to evaluate the mental health impacts of exposures to climate-related hazards. In addition, novel approaches have been, and are being, developed in Indigenous communities to gain a better understanding of the psychosocial impacts of climate change (Box 4.3).



Box 4.3 eNuk environment and health monitoring program

It's... making sure that we have, we still have things in the future that we have now and we can still use them the same way. Understanding the fact that things are gonna change, ice is gonna change, weather's gonna warm up, but make sure that we are [protecting our environment], what we can protect now we should continue to protect.

Resident of Rigolet, Nunatsiavut, Labrador

Climatic and environmental changes present major challenges for human health in Inuit Nunangat (Inuit homelands) and Northern Canada (see Chapter 2: Climate Change and Indigenous Peoples' Health in Canada). In particular, because of their close connection to and reliance on the land for sustenance, culture, livelihoods, and well-being, Inuit throughout the North have identified negative impacts on physical and mental health in their communities. While research has uncovered many connections among environment and health outcomes, detecting these outcomes and responding to them is a serious challenge. Community-led, comprehensive, and sustainable surveillance and monitoring systems to assist with climate-health adaptation that can yield timely and usable data, and provide decision-making strategies for communities and governments, are needed.

The Rigolet Inuit Community Government, the Nunatsiavut Department of Health and Social Development, and a team of Inuit and non-Inuit researchers have been working with the community of Rigolet, Nunatsiavut, Labrador, Canada to develop and implement the eNuk program, an Inuit-designed and -developed participatory environment and health surveillance system (The eNuk Program, 2018). Premised on Inuit values, knowledge systems, sciences, and priorities, the eNuk app is designed to track, analyze, and respond to the health impacts of climate change, including impacts on mental health (Sawatsky et al., 2018; Sawatsky et al., 2020).

Inuit can use this app to take pictures and videos, insert text, and document the safety of ice routes and culturally important places for hunting, fishing, and berry picking. App users can also insert health-related information, including mental health indicators related to shifting environmental patterns; impacts on sense of place, cultural continuity, food security, and challenges to identity; emotional responses, such as ecological grief and anxiety; and acute and chronic mental health outcomes. Information from the app will provide information about climate change impacts on mental and physical health, and allow health professionals and decision makers to respond to local needs. The eNuk app is in a preliminary pilot phase (Sawatsky et al., 2018; The eNuk Program, 2018; Sawatsky et al., 2020).



4.7.2.2 Supporting Youth

Youth can be particularly vulnerable to experiences of anxiety, grief, and stress related to climate change, including ecoanxiety and ecogrief. Ray (2020) refers to youth born between the 1990s and the 2000s as “the climate generation,” because of their exposure to the climate crisis over their lives. The *Field Guide to Climate Anxiety: How to Keep Your Cool on a Warming Planet* (Ray, 2020) is aimed at youth and provides a number of resources for dealing with climate change, including:

- tools to address burnout related to climate activism and the climate crisis;
- techniques to make sense of the climate crisis and to find purpose and meaning in addressing it;
- strategies to enhance collective and individual resilience;
- tools to address potentially negative impacts of climate change media coverage; and
- tips on how to infuse climate justice work with joy, humour, and optimism.

The field guide places individual and collective well-being, along with social and environmental justice, at the centre of these actions. Supporting the well-being of children and youth in their efforts to cope with the impacts of climate change has also been the focus of some Indigenous communities and organizations. Box 4.4 highlights how two organizations from three Island Lake First Nations exposed to a wildfire came together to support the well-being of children.



Box 4.4 Ka Pimthatek Pakthehnamoowin, a journey of hope in Island Lake, Manitoba

In August 2017, approximately 3700 people from three Island Lake First Nations were forced from their homes by a 77,000 hectare wildfire. The entire community of Wasagamack First Nation, as well as residents of St. Theresa Point and Garden Hill First Nations, were evacuated by boat and plane to Brandon and Winnipeg, Manitoba, to stay in hotels. While in evacuation centres in the south, children were subject to discrimination, predatory drug dealers, and separation from parents.

Following this experience, Four Arrows Regional Health Authority, a regional organization focused on improving health outcomes for the Island Lake membership, collaborated with Save the Children, a child-rights organization, to support child-focused mental health in response to the fires, and to prepare for future climate extremes and disasters. Through this partnership, the two organizations:

- trained over 100 frontline workers on addressing the unique needs of children in emergencies, helping children in crisis, and implementing psychological First Aid;
- trained over 100 frontline workers on the importance of self-care through “care for caregivers” workshops; and
- distributed emergency backpacks full of supplies to 2000 children to keep them safe during emergencies.

Through this process, it was observed that children were struggling with the wide-reaching implications of climate change and the emotional impacts of the 2017 evacuation. Children were exhibiting increased externalizing behaviours and were also living in challenging contexts of the opioid crisis, theft, domestic violence, and a lack of safe housing.

To support the emotional resilience of children in response to these challenges, the two organizations worked to create an evidence-based psycho-educational program that builds resilience and coping skills in safe small-group settings. The program sought to enhance the resilience of children, adolescents, and their caregivers in St. Theresa Point First Nation in response to, and in preparation for, climate extremes and disasters.

4.7.2.3 Interactions with the Natural Environment

Much of the current literature exploring new and innovative approaches to addressing the psychosocial impacts of climate change highlights the importance of interactions with the natural environment. Interactions that include practices that preserve the natural environment provide people with a sense of stewardship and personal investment that may help overcome feelings of hopelessness, anxiety, and ecoparalysis. One environmental clinic treated “impatiens,” people who were emotionally and physically tired of waiting for legislative interventions on climate change, with “prescriptions” for environmental action (Koger et al., 2011). The clinic provided students with problem-focused coping strategies that increase well-being through environmental activism (Koger et al., 2011).



Spending time in nature has also been linked with enhanced physical and psychosocial health (Ulrich, 1979). A common practice in Japan to reduce stress and anxiety is *shinrin-yoku* (“forest bathing”) – a way of connecting deeply with nature. In a study by Lee et al. (2011), authors found that forest bathing resulted in decreased cortisol levels and pulse rates and significantly increased positive feelings.

Indigenous communities have traditionally found psychosocial enhancement through land-based healing practices (Cunsolo Willox et al., 2012; Cunsolo Willox et al., 2013a; Cunsolo Willox et al., 2013b; Petrusek MacDonald et al., 2015; Cunsolo & Ellis, 2018; Middleton et al., 2020a). Land-based healing provides space and opportunity for community members to come together, to learn and impart knowledge about land-based culture and knowledge, and to enhance a sense of community, all of which increase psychosocial well-being (Kirmayer & Valaskakis, 2009; Radu et al., 2014).

Other proposed approaches to build the human–nature relationship that supports psychosocial well-being include ecopsychology, the branch of environmentalism that integrates psychology to support psychosocial well-being and planetary health, and deep ecology practices, which provide people with opportunities to integrate meditative practices in nature to calm the mind and body while building a relationship with nature (Bragg & Reser, 2012). Many new therapies still need to be evaluated for their effectiveness in reducing the psychosocial impacts of climate change.

4.7.3 Co-Benefits of Addressing Climate Change that Improve Mental Health Outcomes

Greenhouse gas mitigation and adaptation actions to address climate change can produce significant health co-benefits (see Chapter 10: Adaptation and Health System Resilience), including benefits to mental health (City of Toronto, 2019). For example, increasing opportunities in a community for active transportation (e.g., walking, jogging, and biking) have been shown to reduce depression and improve moods (Koger et al., 2011; Whitfield et al., 2017). In addition, community-based environmental stewardship projects that support adaptation and/or efforts to mitigate greenhouse gases can enhance a sense of social cohesion and thus support psychosocial well-being (Koger et al., 2011). Increasing green infrastructure is also an important strategy to mitigate greenhouse gases and adapt to climate change that has been demonstrated to reduce urban heat islands, improve physical health, and support mental well-being (Zupancic et al., 2013; Huang et al., 2017; Health Canada, 2020).

4.7.4 Barriers and Opportunities for Adaptation Actions

Psychosocial adaptation to the effects of climate change is influenced by a number of factors that may be protective of psychosocial health when they are in place and may hinder psychosocial health when they are absent. These include (Hayes et al., 2019):

- social capital;
- sense of community;



- communication and outreach;
- intersectoral and transdisciplinary collaboration;
- community preparedness;
- government interventions;
- access to resources (financial and physical);
- mental health literacy;
- culturally relevant resources and responses;
- health care training; and
- vulnerability and adaptation assessments.

Figure 4.2 presents factors that influence the psychosocial health impacts of climate change, illustrating how these impacts are mediated by the social and ecological determinants of health, response interventions, and the factors previously identified that influence psychosocial adaptation. While specific Indigenous determinants of health such as food insecurity, colonialism, racism and social exclusion, self-determination, and environmental stewardship are not included in this figure, it is recognized that they are integral to understanding the factors that influence the psychosocial health of Indigenous Peoples experiencing the effects of climate change.

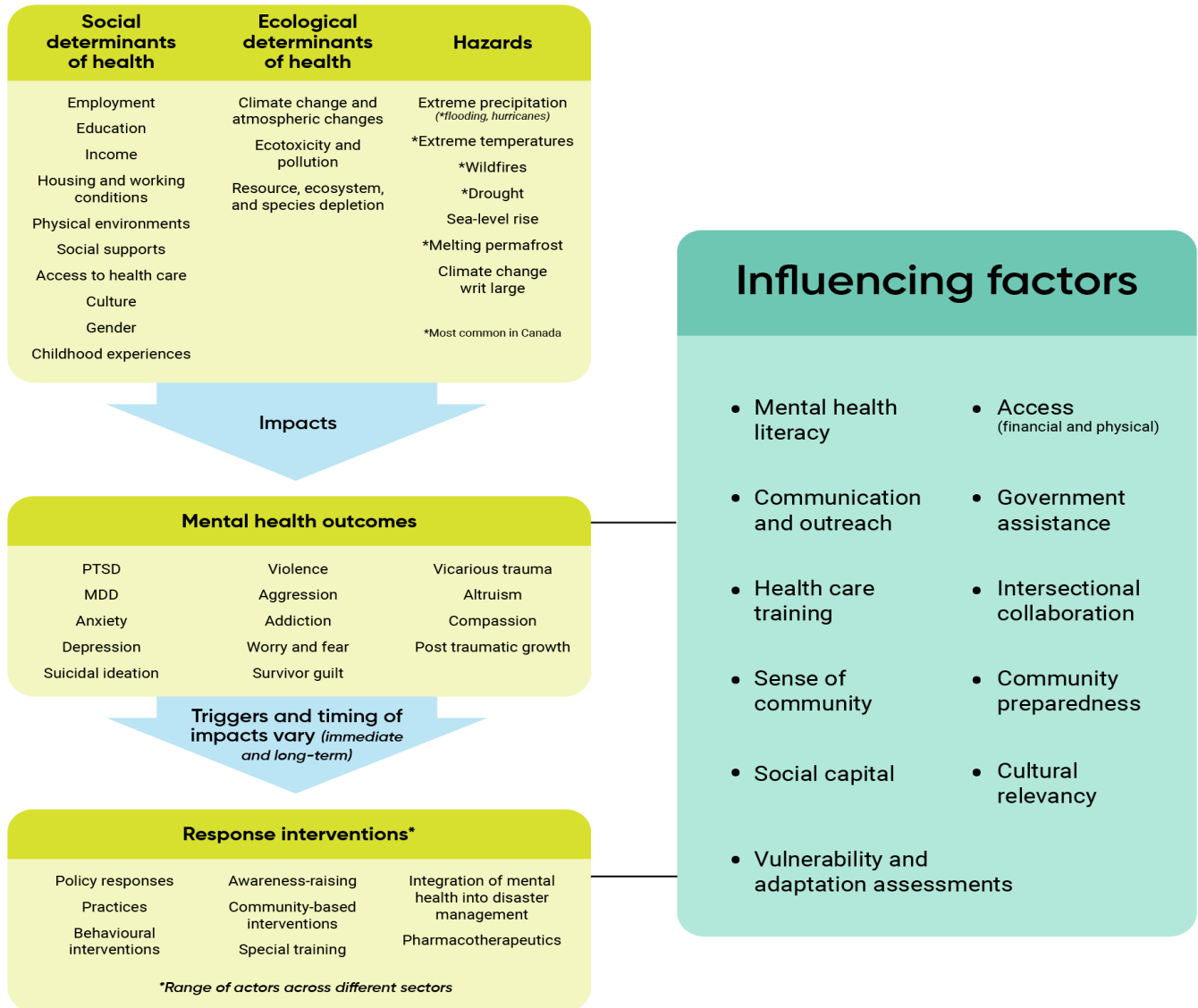


Figure 4.2 Factors that influence the psychosocial health impacts of climate change. Source: Hayes et al., 2019.



4.7.4.1 Social Capital

Social capital refers to the “networks and resources available to people throughout their connections to others” (Aldrich, 2012, p. 172). Two important dimensions of social capital include the structural dimension, in which people engage and interact in activities, and the cognitive dimension, which encompasses perceptions about trust, social cohesion, and reciprocity (e.g., a sense of community) (Berry et al., 2010b; Aldrich, 2012). Essentially, social capital is both the networks and relationships people form to support one another, as well as perceptions about these networks and relationships. Social capital is of paramount importance in post-disaster recovery, even when compared with economic or other types of assistance (Aldrich, 2012).

Social capital may serve as a protective factor for farmers affected by wildfires and drought. The “Hay West” movement, for example, demonstrated how social capital is not bound by a single geographic location but can benefit farm workers across the country. In 2002, drought-affected Prairie farmers received 64,000 hay bales from farmers in Eastern Canada, who understood the plight of those affected by the drought and sought to support one another (Yusa et al., 2015). Social capital was also identified as an important protective factor in decreasing the risk of suicide among adult female farmers during periods of prolonged or worsening drought in Australia (Hanigan et al., 2012).

4.7.4.2 Sense of Community

A sense of community refers to feelings of belonging and is often referred to as the opposite of feeling isolated (Bajayo, 2012). A sense of community is particularly important when addressing the mental health impacts of climate change, because it can provide space to explore and discuss challenging emotions such as ecological grief and ecoparalysis. Resources that enhance a sense of community have been developed to support people experiencing emotions such as ecoanxiety. For example, the “Ecoanxious” website was created to make people feel less alone in their fears about the climate crisis (Malena-Chan & Gatley, 2020). This forum offers people the opportunity to share their stories of ecoanxiety, learn from others’ experiences, and practise guided meditation (Malena-Chan & Gatley, 2020). The website “Is This How You Feel?” provides an online platform for people to explore how climate change makes them feel (“Is This How You Feel?”, 2020). Additionally, the Good Grief Network, which is a 10-step program to support individuals and communities as they explore and address ecogrief, connects people to build “personal resilience while strengthening community ties” (Schmidt & Lewis-Reau, 2020). The network provides specific tools that can help address the negative impacts of ecogrief, including denial, hopelessness, helplessness, activism fatigue, and burnout (Schmidt & Lewis-Reau, 2020). “Climate and Mind” is a U.S.-based online repository of research and resources for addressing climate-related distress, including a listing of mental health professionals who can support people (Bryant, 2020). This site offers guidance on how to host climate cafés or climate circles, which are informal community gatherings that offer people the opportunity to share and explore feelings of ecoanxiety, ecological grief, and climate-related distress while building a community of support (Bryant, 2020). All of these resources emphasize the importance of fostering a sense of community to support psychosocial resilience.



4.7.4.3 Communication and Outreach

It is important that messages about the mental health impacts of climate change include actions to support psychosocial well-being (Clayton & Manning, 2018; King et al., 2018). Messages about impending climate risks alone may invoke more fear and anxiety in people, in particular among those with pre-existing mental health issues, and may contribute to mental health problems (Dodgen et al., 2016). Messages that trigger fear may also increase avoidance behaviours; that is, people may feel so overwhelmed that they disengage and avoid messages about climate change as a way to cope (Stern, 2012). Pairing messages about risks from climate hazards with messages about what, where, and how people can support their well-being may help people to feel more empowered and in control of their wellness (Maibach et al., 2011). Trusted sources for this information include health professionals, meteorologists, climatologists, and governments (Zhao et al., 2014). A good example of a communication product is presented in Figure 4.3. This image highlights that ecological grief and anxiety associated with climate change are increasing and identifies health sector responses that can reduce emotional suffering and build resilience.



Figure 4.3 Ecological grief and anxiety: the start of a healthy response to climate change? Source: Cunsolo et al., 2020; Image credit: Alex Sawatzky.

4.7.4.4 Intersectoral and Transdisciplinary Collaboration

Intersectoral and transdisciplinary collaboration is key to supporting adaptation to the psychosocial impacts of a changing climate (Morrisey & Reser, 2007; Stanke, 2012; Hayes et al., 2019). Mental health care professionals, along with other health and allied health professionals, provide mental health care on the front lines during extreme weather events and disasters. In addition, community groups, faith-based and spiritual institutions, and non-governmental organizations provide a sense of community and support for people experiencing psychosocial outcomes. Emergency preparedness professionals also support adaptation, particularly during these events. The mental health and wellness of these professionals can be seriously affected, as they tend to be more exposed to hazardous events (Carleton et al., 2017). Enhanced collaboration across disciplines and sectors can increase the effectiveness of adaptations to reduce the psychosocial impacts of climate change (Hayes et al., 2020).

4.7.4.5 Government Interventions and Access to Resources

Access to mental health care and social services that support psychosocial health can reduce negative mental health outcomes (MHCC, 2016; Thompson et al., 2018). These resources may include mental health care from medical professionals, or informal support from community-based groups; access to these resources, however, may be affected or disrupted by climate hazards (Hayes et al., 2019).

Government interventions that enhance access (both financial and physical) to psychosocial resources are foundational for enhancing mental health care (Polain et al., 2011; MHCC, 2016; Hayes et al., 2019). Canada's universal, single-payer health system may not cover many mental health care services, and mental health services vary by province, territory, and region (Goldner et al., 2016). Additionally, although many First Nations and Inuit receive a range of mental health services and supports free of charge as part of the Non-Insured Health Benefits Program, many do not have access to them (Government of Canada, 2020).

Provinces and territories provide outpatient physician services (e.g., primary care and psychiatry) and in-patient mental health care at hospitals. Allied professionals (e.g., nurses, social workers, counsellors, psychotherapists) are often provided at no charge during in-patient care; however, these services may include a fee when they are delivered as outpatient services. Many people in Canada, therefore, may need to pay for mental health services directly or through private insurance in order to access such services (Goldner et al., 2016). Some people may not be able to access mental health care due to financial constraints or simply because there are no mental health care facilities to access (Moroz et al., 2020). The unequal access of some populations in Canada to mental health care services increases their vulnerability to climate change impacts. Enhanced and equitable access to mental health care could improve mental health outcomes in a changing climate.

4.7.4.6 Mental Health Literacy and Mental Health Care Training

There is significant stigma surrounding mental ill health and mental health service use in Canada (Tam, 2019). This barrier can reduce the number of people who seek help for their mental health needs related to the effects of climate change. Developing mental health literacy among the general public can help to reduce

this stigma and encourage people who are struggling with the mental health impacts of climate change to seek care (Hayes et al., 2019). Mental health literacy refers to the knowledge of mental health outcomes, factors that influence mental health outcomes, and mental health care management and options (Davis, 2013). psychological First Aid and mental health First Aid can enhance mental health literacy, by providing guidance and training on how to support people experiencing mental distress.

Efforts to reduce the mental health impacts of climate change include training public health and emergency management officials. Training should focus on the activities required following a disaster, advocated by Neira and Shultz (2012):

- promoting a sense of safety;
- calming anxiety and decreasing physiological arousal;
- increasing self-efficacy and collective efficacy;
- encouraging social support and bonding with others; and
- instilling hope to promote a sense of a positive future.

The application of these approaches may enhance mental health literacy and reduce long-term psychosocial impacts from climate change, especially among populations who experience disproportionate health burdens (Neira & Schultz, 2012).

4.7.4.7 Culturally Relevant Resources and Responses

Adaptation efforts that support psychosocial health need to use culturally relevant and locally appropriate resources. For example, in Canada, increased availability of mental health care is needed in rural farming communities to help reduce impacts from drought. Such care should also be provided by individuals with knowledge of, and experience in, agriculture and should be designed with attention to gendered dimensions that create different experiences for farm men and women (Fletcher & Knuttila, 2016).

Reducing the mental health impacts of climate change in First Nations, Inuit, and Métis communities also requires culturally relevant resources (MHCC, 2016). For example, responding to the mental health and cultural safety needs of Indigenous Peoples following community evacuations from floods and fires requires integrating the First Nations Mental Wellness Continuum⁵ among first responders providing assistance to displaced First Nations populations. It also requires cultural competency training for emergency response personnel, law enforcement, and disaster management specialists at provincial and federal levels (Health Canada, 2015). There is also a need to enhance awareness and support of land-based healing practices relevant to Indigenous communities (Polain et al., 2011; Harper et al., 2015). Noting this, the Yukon's Climate Change Secretariat report on adaptation actions identified strengthening mental health resources and building or enhancing programs that support Indigenous Peoples' reconnection to the land as a top priority (Government of Yukon, 2017).

5 The First Nations Mental Wellness continuum is a culturally relevant framework that supports service coordination and delivery of mental wellness services that are relevant to First Nations Peoples in Canada (Health Canada, 2015).



4.7.4.8 Community Preparedness Utilizing Vulnerability and Adaptation Assessments

Community preparedness to support psychosocial health in the aftermath of climate-related hazards, and to prevent the occurrence of impacts in the first place, is highly dependent upon a thorough understanding of the risks and vulnerabilities related to community-level climate hazards and an assessment of adaptation opportunities (Morrissey & Reser, 2007; Hayes et al., 2019). For this reason, many communities throughout Canada have conducted climate change and health vulnerability and adaptation assessments (V&As) (see Chapter 10: Adaptation and Health System Resilience). These assessments, often conducted by local, provincial, and territorial health authorities, or Indigenous communities, increase understanding of current and projected impacts of climate change on health, populations most at risk, and adaptation options.

V&As are useful tools to obtain information needed to address the mental health impacts of climate change; however, few V&As incorporate mental health indicators. Hayes and Poland (2018) provide a set of indicators and measurement tools that can be used to analyze climate change impacts on mental health (Table 4.3).

**Table 4.3 Monitoring and measuring climate change impacts on mental health**

CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
Extreme Heat	<ul style="list-style-type: none"> • People with pre-existing mental health conditions • People taking psychotropic medications that affect thermoregulation • Older adults (who have poor thermoregulation) • People with substance use disorders • People living in urban heat islands • Urban poor without access to air conditioning • People who are homeless • Workers exposed to heat and people active outdoors 	<ul style="list-style-type: none"> • Exacerbated mood or behavioural disorders • Violence • Aggression • Suicide 	<ul style="list-style-type: none"> • Monitor emergency department visits after extreme heat events for an increase in patients reporting mood or behavioural disorders • Monitor mortality statistics following extreme heat events – look for co-morbidities related to mental health and incidents of suicide • Interviews or questionnaires with people who experienced extreme heat events to ask about their mental health in relation to heat events • Review police records following extreme heat events to monitor elevated incidents of violence or aggression



CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
<p>Extreme Weather Event (flood, hurricane, drought, mudslides, etc.)</p>	<ul style="list-style-type: none"> • Gender (women) • Sex (female, particularly pregnant women) • Age (children, infants, older adults) • Race and ethnicity (non-White) • Immigrants • People with pre-existing health conditions • People with low socio-economic status • People who are under- and non-insured (health care and home insurance) • People who are homeless • Outdoor labourers • First responders • First Nations, Inuit, Métis 	<ul style="list-style-type: none"> • Post-traumatic stress disorder (PTSD) • Depression (including major depressive disorders) • Anxiety • Suicidal ideation • Aggression • Substance abuse and addiction • Violence • Survivor guilt • Vicarious trauma • Altruism • Compassion • Post-traumatic growth 	<p>Surveys</p> <ul style="list-style-type: none"> • Self-report surveys of general health. Consider using: <ul style="list-style-type: none"> » General Health Questionnaire (GHQ) • Self-report surveys of mental illness and mental problems. Consider using any, or a combination of: <ul style="list-style-type: none"> » Disaster-PAST » Generalized Anxiety Disorder Scale (GAD-7) » Post-Traumatic Stress Disorder Checklist (PCL) » Center for Epidemiologic Studies Depression Scale (CES-D) » Kessler Psychological Distress Scale (K6; K10) » Brief Trauma Questionnaire • Self-report surveys of affirmative mental health. Consider using: <ul style="list-style-type: none"> » Stress-Related Growth Scale (SRGS) » Post-Traumatic Growth Index (PTGI) » Benefit Finding Scale (BFS) <p>Review patient records</p>



CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
<p>Extreme Weather Event</p> <p>(flood, hurricane, drought, mudslides, etc.)</p> <p>(continued)</p>			<p>Monitor emergency department visits after extreme weather events for an increase in patients reporting mental health problems or illness</p> <p>Review new prescription use for mental health and behavioural disorders after an extreme weather event</p> <p>Interviews</p> <ul style="list-style-type: none"> • Interviews with primary care physicians and mental health care providers about any surges in patients reporting mental health issues following extreme weather events • Interviews with people who experienced an extreme weather event about their perceptions regarding their mental health related to the event
<p>Vector-Borne Disease (VBD) (e.g., Lyme disease, West Nile virus)</p>	<ul style="list-style-type: none"> • People who are homeless • People with pre-existing mental health conditions • Outdoor workers • Recreationalists (hunters, fishers, outdoor enthusiasts) 	<ul style="list-style-type: none"> • VBD disease, particularly Lyme disease or West Nile virus, that can compound mental health problems (e.g., cognitive or neurological impairment, behavioural disorders) 	<ul style="list-style-type: none"> • Interviews or questionnaires with patients who have been diagnosed with VBDs to ask about perceptions of their mental health • Interviews with primary care physicians and mental health care providers about any mental health co-morbidities for patients diagnosed with VBDs



CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
<p>Sea-Level Rise or Melting Permafrost</p>	<ul style="list-style-type: none"> • People who work or live near the ocean (sea-level rise) or in the Arctic • Outdoor labourers • First Nations, Inuit, Métis 	<ul style="list-style-type: none"> • Anxiety, worry, or fear of displacement • Anxiety, worry, or fear of job loss • Loss of place (grief, solace) 	<ul style="list-style-type: none"> • Interviews or questionnaires with residents who have experienced or are experiencing sea-level rise or prolonged drought in their communities. Interview questions may focus on the mental health implications of: displacement, job loss associated with sea-level rise, infrastructure damage, agricultural or resource loss and resource scarcity, as well as food and water safety and security
<p>Climate Change Overall (i.e., awareness of climate change threats to human and planetary health and survival)</p>	<ul style="list-style-type: none"> • People at greater risk from and exposure to climate change • Researchers investigating climate change • Environmental and climate change activists • Environmental studies students • Outdoor recreationalists • First Nations, Inuit, Métis 	<ul style="list-style-type: none"> • Anxiety • Worry • Stress • Fear 	<ul style="list-style-type: none"> • Interviews or questionnaires with people who experience concern, anxiety, worry, related to awareness of climate change threats • Generalized Anxiety Disorder Scale (GAD-7)

Source: Adapted from Hayes & Poland, 2018



4.8 Knowledge Gaps

A number of knowledge gaps currently challenge efforts by public health authorities to develop effective adaptation measures to reduce the mental health impacts of climate change. There are limited population-level studies on climate change impacts on mental health within Canada and globally. Greater information from such studies on the key factors that increase risks of impacts on Canadians would help inform future adaptation efforts. Specific knowledge gaps include:

- the mental health impacts of climate change on specific population groups experiencing health inequities, including people of colour and racialized groups, those discriminated against because of sexual orientation or identity, and those discriminated against based on their mental or physical health;
- the mental health complications of vector-borne diseases in Canada;
- affirmative mental health outcomes, such as psychosocial resilience, altruism, and compassion after experiencing climate hazards, which can enhance our understanding of psychosocial adaptation;
- the mental health impacts of cold temperature climate hazards, such as impacts from a polar vortex;
- projections of the impacts of climate change on mental health under different climate scenarios;
- an evaluation of the economic costs of the mental health impacts of climate;
- the effectiveness of psychosocial adaptation opportunities to a changing climate;
- the availability and effectiveness of psychosocial interventions from a health equity perspective; and
- how awareness and communication activities about the climate change problem affect social-emotional responses, such as anxiety, fear, grief, and worry.

Increased surveillance and monitoring of the impacts of climate change on the burden of mental illness in Canada are also needed. This includes monitoring and surveillance of the mental health implications of acute and slow-onset hazards related to climate change at the local, regional, and national levels.

The literature on adaptation also highlights the importance of traditional ecological knowledge, which is foundational in adaptive management strategies and in supporting Indigenous Peoples' abilities to cope within a changing climate (Tam et al., 2013; Williams et al., 2018). Greater research is needed that highlights the importance of Indigenous wisdom in adapting to the psychosocial impacts of climate change.



4.9 Conclusion

Climate change affects the mental health and well-being of many people in Canada. In particular, climate change disproportionately and inequitably affects the mental health and well-being of specific populations, including those experiencing health inequities based on race, culture, gender, age, socio-economic status, ability, and geographic location. Importantly, there are a number of existing programs, interventions, and policies that can support people in Canada as they adapt to a changing climate as well as factors that can influence and enhance psychosocial adaptation. While further work is needed to build on existing research, programs, interventions, and policies to address knowledge and practice gaps related to mental health in a changing climate in Canada, there are existing tools and programs that can enhance and support psychosocial adaptation.



4.10 References

- AbacusData. (2019). *Public opinion research: Climate emergency polling (Summer 2019)*. National Survey of 2,000 Canadians. Retrieved from <<https://abacusdata.ca/wp-content/uploads/2019/08/Climate-Emergency-Polling-July-2019-RELEASE.pdf>>
- Adlard, B., Donaldson, S. G., Odland, J. O., Weihe, P., Berner, J., Carlsen, A., ... Mulvad, G. (2018). Future directions for monitoring and human health research for the Arctic Monitoring and Assessment Programme. *Global Health Action*, 11(1), 1–4. <<https://doi.org/10.1080/16549716.2018.1480084>>
- Agnew, R. (2012). Dire forecast: A theoretical model of the impact of climate change on crime. *Theoretical Criminology*, 16(1), 21–42. <<https://doi.org/10.1177/1362480611416843>>
- Agyapong, V. I., Hrabok, M., Juhas, M., Omeje, J., Denga, E., Nwaka, B., ... & Chue, P. (2018). Prevalence rates and predictors of generalized anxiety disorder symptoms in residents of Fort McMurray six months after a wildfire. *Frontiers in psychiatry*, 9, 345. <<https://doi.org/10.3389/fpsy.2018.00345>>
- Albrecht, G. (2011). Chronic environmental change: Emerging "psychoterratic" syndromes. In I. Weissbecker (Ed.), *Climate Change and Human Well-being*. New York, NY: Springer.
- Albrecht, G. (2012). Psychoterratic conditions in a scientific and technological world. In P. Kahn, & P. Hasbach (Eds.), *Ecopsychology: Science, Totems, and the Technological Species* (pp. 241-264). MIT Press.
- Albrecht, G. (2017). *Climate change and human responses* (G. Monks, Ed.). Dordrecht, Netherlands: Springer. Retrieved from <<https://link.springer.com/book/10.1007/2F978-94-024-1106-5>>
- Albrecht, G. A. (2019). *Earth Emotions: New Words for a New World*. Ithaca, NY: Cornell University Press.
- Alderman, K., Turner, L. R., & Tong, S. (2012). Floods and human health: A systematic review. *Environment International*, 47, 37–47. <<https://doi.org/10.1016/j.envint.2012.06.003>>
- Alderman, K., Turner, L. R., & Tong, S. (2013). Assessment of the health impacts of the 2011 summer floods in Brisbane. *Disaster Medicine and Public Health Preparedness*, 7(4), 380–386. <<https://doi.org/10.1017/dmp.2013.42>>
- Aldrich, D. (2012). *Building resilience: Social capital in post-disaster recovery*. University of Chicago Press.
- Alston, M., & Kent, J. (2008). The Big Dry: The link between rural masculinities and poor health outcomes for farming men. *Journal of Sociology*, 44(2), 133-147. <<https://doi.org/10.1177/1440783308089166>>
- American Psychiatric Association. (n.d.). *What is mental illness?* Retrieved from <<https://www.psychiatry.org/patients-families/what-is-mental-illness>>
- American Psychiatric Association. (2013). *Diagnostics and statistical manual of mental disorders (DSM-V)* (5th ed).
- Ampuero, D., Goldsworthy, S., Delgado, L. E., & Miranda J, C. (2015). Using mental well-being impact assessment to understand factors influencing well-being after a disaster. *Impact Assessment and Project Appraisal*, 33(3), 184–194. <<https://doi.org/10.1080/14615517.2015.1023564>>
- Anderson, H., Brown, C., Cameron, L. L., Christenson, M., Conlon, K. C., Dorevitch, S., Dumas, J., Eidson, M., Ferguson, A., ... Walker, R. (2017). *Climate and health intervention assessment: Evidence on public health interventions to prevent the negative health effects of climate change*. Climate and Health Techninal Report Series. Centers for Disease Control Centers for Disease Control and Prevention. Retrieved from <https://www.cdc.gov/climateandhealth/docs/ClimateAndHealthInterventionAssessment_508.pdf>
- Anderson, P., & Jané-Llopis, E. (2011). Mental health and global well-being. *Health Promotion International*, 26(1 Suppl), 147–155. <<https://doi.org/10.1093/heapro/dar060>>
- Armenian, P., Campagne, D., Stroh, G., Ives Tallman, C., Zeng, W., Lin, T., & Gerona, R. R. (2017). Hot and Cold Drugs: National Park Service Medication Stability at the Extremes of Temperature. *Prehospital Emergency Care : Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors*, 21(3), 378–385. <<https://doi.org/10.1080/10903127.2016.1258098>>
- Asugeni, J., MacLaren, D., Massey, P. D., & Speare, R. (2015). Mental health issues from rising sea level in a remote coastal region of the Solomon Islands: current and future. *Australasian Psychiatry*, 23(6 Suppl), 22–25. <<https://doi.org/10.1177/1039856215609767>>
- Bajayo, R. (2012). Building community resilience to climate change through public health planning. *Health Promotion Journal of Australia*, 23(1), 30–36. <<https://doi.org/10.1080/00222930400014148>>
- Balbus, J. M., Boxall, A. B. A., Fenske, R. A., McKone, T. E., & Zeise, L. (2013). Implications of global climate change for the assessment and management of human health risks of chemicals in the natural environment. *Environmental Toxicology and Chemistry*, 32(1), 62–78. <<https://doi.org/10.1002/etc.2046>>
- Bard, D. (2017). Les changements climatiques et leurs conséquences sur la sante. *International Journal of Medicine and Surgery*, 4, 7–11. doi:10.15342/ijms.v4.133



- Bardsley, D. K., & Wiseman, N. D. (2012). Climate change vulnerability and social development for remote indigenous communities of South Australia. *Global Environmental Change*, 22(3), 713–723. <<https://doi.org/10.1016/j.gloenvcha.2012.04.003>>
- Barnett, J., Tschakert, P., Head, L., & Adger, W. N. (2016). A science of loss. *Nature Climate Change*. <<https://doi.org/10.1038/nclimate3140>>
- Basu, R., Gavin, L., Pearson, D., Ebisu, K., & Malig, B. (2018). Examining the association between apparent temperature and mental health-related emergency room visits in California. *American Journal of Epidemiology*, 187(4), 726–735. <<https://doi.org/10.1093/aje/kwx295>>
- BC Ministry of Environment and Climate Change Strategy. (n.d). *Addressing climate and health risks in BC*. Retrieved from <https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/health/final_climate_and_health_backgrounder_public_health.pdf>
- Bélanger, D., Gosselin, P., Valois, P., & Abdous, B. (2014). Perceived adverse health effects of heat and their determinants in deprived neighbourhoods: A cross-sectional survey of nine cities in Canada. *International Journal of Environmental Research and Public Health*, 11(11), 11028–11053. <<https://doi.org/10.3390/ijerph111111028>>
- Berry, H. L., Bowen, K., & Kjellstrom, T. (2010a). Climate change and mental health: A causal pathways framework. *International Journal of Public Health*, 55(2), 123–132. <<https://doi.org/10.1007/s00038-009-0112-0>>
- Berry, H. L., Hogan, A., Owen, J., Rickwood, D., & Fragar, L. (2011). Climate change and farmers' mental health: Risks and responses. *Asia-Pacific Journal of Public Health*, 23(2 Suppl), 119S–32. <<https://doi.org/10.1177/1010539510392556>>
- Berry, H. L., & Welsh, J. A. (2010b). Social capital and health in Australia: An overview from the household, income and labour dynamics in Australia survey. *Social Science and Medicine*, 70(4). <<https://doi.org/10.1016/j.socscimed.2009.10.012>>
- Berry, P., Clarke, K.-L., Fleury, M. D., & Parker, S. (2014). Human Health. In F. J. Warren, & D. S. Lemmen (Eds.), *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation* (pp. 19–22). Ottawa, ON: Natural Resources Canada.
- Black, R., Bennett, S. R. G., Thomas, S. M., & Beddington, J. R. (2011). Migration as adaptation. *Nature*. 478, 447–449. <<https://doi.org/10.1038/478477a>>
- Bogic, M., Njoku, A., & Priebe, S. (2015). Long-term mental health of war-refugees: a systematic literature review. *BMC International Health and Human Rights*, 15, 29. <<https://doi.org/10.1186/s12914-015-0064-9>>
- Bonanno, G. A. (2004). Loss, Trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *American Psychologist*, 59(1), 20. <<https://doi.org/10.1037/0003-066X.59.1.20>>
- Bourque, F., & Cunsolo Willox, A. (2014). Climate change: The next challenge for public mental health? *International Review of Psychiatry*, 26(4), 415–422. <<https://doi.org/10.3109/09540261.2014.925851>>
- Bowles, D. C. (2015). Climate change and health adaptation: Consequences for indigenous physical and mental health. *Annals of Global Health*, 81(3), 427–431. <<https://doi.org/10.1016/j.aogh.2015.06.004>>
- Bragg, E., & Reser, J. (2012). Ecopsychology in the Antipodes: Perspectives from Australia and New Zealand. *Ecopsychology*, 4(4), 253–265. <<https://doi.org/10.1089/eco.2012.0085>>
- Brown, M. R., Agyapong, V., Greenshaw, A. J., Cribben, I., Brett-MacLean, P., Drolet, J., & Kitching, D. (2019). After the Fort McMurray wildfire there are significant increases in mental health symptoms in grade 7–12 students compared to controls. *BMC Psychiatry*, 19(1), 18. <<https://doi.org/10.1186/s12888-018-2007-1>>
- Brown, K., & Westaway, E. (2011). Agency, capacity, and resilience to environmental change: Lessons from human development, well-being, and disasters. *Annual Review of Environment and Resources*, 36, 321–342. <<https://doi.org/10.1146/annurev-environ-052610-092905>>
- Bryant, A. (2020). *Climate & mind*. Retrieved from <<https://www.climateandmind.org/about>>
- Bryant, L., & Garnham, B. (2015). The fallen hero: Masculinity, shame and farmer suicide in Australia. *Gender, Place and Culture*, 22(1), 67–82. <<https://doi.org/10.1080/0966369X.2013.855628>>
- Burke, M., González, F., Baylis, P., Heft-Neal, S., Baysan, C., Basu, S., & Hsiang, S. (2018). Higher temperatures increase suicide rates in the United States and Mexico. *Nature Climate Change*, 8(8), 723–729. <<https://doi.org/10.1038/s41558-018-0222-x>>
- Burton, H., Rabito, F., Danielson, L., & Takaro, T. K. (2016). Health effects of flooding in Canada: A 2015 review and description of gaps in research. *Canadian Water Resources Journal*, 41(1-2), 238–249. <<https://doi.org/10.1080/07011784.2015.1128854>>
- Bush, E., & Lemmen, D. (Eds.). (2019). *Canada's changing climate report*. Ottawa, ON: Environment and Climate Change Canada. Retrieved from <<https://changingclimate.ca/CCCR2019>>
- Bussidor, I., & Bilgen-Reinart, Ü. (1997). *Night spirits: The story of relocation of the Dene*. University of Manitoba Press.



- Cameron, E. S. (2012). Securing indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian arctic. *Global Environmental Change*, 22(1), 103-114. <<https://doi.org/10.1016/j.gloenvcha.2011.11.004>>
- Canadian Disaster Database. (2016). *The Canadian Disaster Database*. Retrieved from <<https://www.publicsafety.gc.ca/cnt/rsrscs/cndn-dsstr-dtbs/index-en.aspx>>
- Canadian Mental Health Association (CMHA). (2009). *Rural and northern community issues in mental health*. Retrieved from <<https://ontario.cmha.ca/documents/rural-and-northern-community-issues-in-mental-health/>>
- Canuel, M., Gosselin, P., Duhoux, A., Brunet, A., & Lesage, A. (2019). *Boîte à outils pour la surveillance post-sinistre des impacts sur la santé mentale*. Retrieved from <<https://www.inspq.qc.ca/publications/2523>>
- Carleton, R. N., Afifi, T. O., Turner, S., Taillieu, T., Duranceau, S., LeBouthillier, D. M., Sareen, J., Ricciardelli, R., MacPhee, R. S., Groll, D., Hozempa, K., Brunet, A., Weekes, J. R., Griffiths, C. T., Abrams, K. J., Jones, N. A., Beshai, S., Cramm, H. A., Dobson, K. S., Hatcher, S., ... Asmundson, G. J. G. (2017). Mental disorder symptoms among public safety personnel in Canada. *Canadian Journal of Psychiatry*, 63(1), 54-64. <<https://doi.org/10.1177/0706743717723825>>
- Carleton, T. A. (2017). Crop-damaging temperatures increase suicide rates in India. *Proceedings of the National Academy of Sciences*, 114(33), 8746-8751. <<https://doi.org/10.1073/pnas.1701354114>>
- Centre for Addiction and Mental Health (CAMH). (2012). *Mental illness and addictions: Facts and statistics*. Retrieved from <<https://www.camh.ca/en/driving-change/the-crisis-is-real/mental-health-statistics>>
- Christmas, R. (2013). Multi-track diplomacy and Canada's Indigenous Peoples. *Peace Research*, 44/45(2), 5-30. Retrieved from <<http://www.jstor.org/stable/24429459>>
- City of Toronto. (2019). *Benefits of actions to reduce greenhouse gas emissions in Toronto: Health and health equity*. Retrieved from <<https://www.toronto.ca/wp-content/uploads/2019/06/8f33-Benefits-of-Actions-to-Reduce-Greenhouse-Gas-Emissions-in-Toronto-Health-and-Health-Equity.pdf>>
- Clayton, S. (2018). Mental health risk and resilience among climate scientists. *Nature Climate Change*, 8, 260-261. <<https://doi.org/10.1016/j.janxdis.2020.102263>>
- Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of Anxiety Disorders*, 74, 102263. <<https://doi.org/10.1016/j.janxdis.2020.102263>>
- Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology*, 69, 101434. <<https://doi.org/10.1016/j.jenvp.2020.101434>>
- Clayton, S., & Manning, C. M. (Eds.). (2018). *Psychology and climate change: Human perceptions, impacts, and responses*. Academic Press. <<https://doi.org/10.1016/B978-0-12-813130-5.00012-6>>
- Clayton, S., Manning, C. M., & Hodge C. (2014). *Beyond storms & droughts: The psychological impacts of climate change*. Washington, DC: American Psychological Association, and ecoAmerica. Retrieved from <https://ecoamerica.org/wp-content/uploads/2014/06/eA_Beyond_Storms_and_Droughts_Psych_Impacts_of_Climate_Change.pdf>
- Clayton, S., Manning, C. M., Krygsman, K., & Speiser, M. (2017). *Mental health and our changing climate: Impacts, implications, and guidance*. Washington, DC: American Psychological Association, and ecoAmerica. Retrieved from <<https://www.apa.org/news/press/releases/2017/03/mental-health-climate.pdf>>
- Coppock, V., & Dunn, B. (2009). *Understanding social work practice in mental health*. SAGE Publications Ltd.
- Costello, A., Abbas, M., Allen, A., Ball, S., Bell, S., Bellamy, R., ... Patterson, C. (2009). Managing the health effects of climate change. *Lancet and University College London Institute for Global Health Commission. The Lancet*, 373(9676), 1693-1733. <[https://doi.org/10.1016/S0140-6736\(09\)60935-1](https://doi.org/10.1016/S0140-6736(09)60935-1)>
- Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change*, 8, 275-281. <<https://doi.org/10.1038/s41558-018-0092-2>>
- Cunsolo, A., Harper, S. L., Minor, K., Hayes, K., Williams, K. G., & Howard, C. (2020). Ecological grief and anxiety: the start of a healthy response to climate change? *The Lancet Planetary Health*, 4(7), e261-e263. <[https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196\(20\)30144-3.pdf](https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196(20)30144-3.pdf)>
- Cunsolo Willox, A., Harper, S. L., Edge, V. L., Landman, K., Houle, K., & Ford, J. D. (2013a). The land enriches the soul: On climatic and environmental change, affect, and emotional health and well-being in Rigolet, Nunatsiavut, Canada. *Emotion, Space and Society*. <<https://doi.org/10.1016/j.emospa.2011.08.005>>
- Cunsolo Willox, A., Harper, S. L., Ford, J. D., Edge, V. L., Landman, K., Houle, K., ... Wolfrey, C. (2013b). Climate change and mental health: An exploratory case study from Rigolet, Nunatsiavut, Canada. *Climatic Change*. <<https://doi.org/10.1007/s10584-013-0875-4>>
- Cunsolo Willox, A., Harper, S. L., Ford, J. D., Landman, K., Houle, K., & Edge, V. L. (2012). "From this place and of this place:" Climate change, sense of place, and health in Nunatsiavut, Canada. *Social Science and Medicine*. <<https://doi.org/10.1016/j.socscimed.2012.03.043>>
- Cunsolo Willox, A., Stephenson, E., Allen, J., Bourque, F., Drossos, A., Elgarøy, S., ... Wexler, L. (2014). Examining relationships between climate change and mental health in the Circumpolar North. *Regional Environmental Change*. <<https://doi.org/10.1007/s10113-014-0630-z>>



- Cusack, L., de Crespigny, C., & Athanasos, P. (2011). Heatwaves and their impact on people with alcohol, drug and mental health conditions: a discussion paper on clinical practice considerations. *Journal of Advanced Nursing*, 67(4), 915–922.
- Davis, S. (2013). *Community Mental Health in Canada, revised and expanded edition: Theory, policy, and practice*. UBC Press.
- Decent, D., & Feltmate, B. (2018). *After the flood: The impact of climate change on mental health and time lost from work*. Intact Centre on Climate Adaptation, and University of Waterloo. Retrieved from <<https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2018/06/After-The-Flood.pdf>>
- De Winter, S., Vanbrabant, P., Vi, N. T., Deng, X., Spriet, I., Van Schepdael, A., & Gillet, J. B. (2013). Impact of temperature exposure on stability of drugs in a real-world out-of-hospital setting. *Annals of Emergency Medicine*, 62(4), 380–387.e1. <<https://doi.org/10.1016/j.annemergmed.2013.04.018>>
- Ding, N., Berry, H. L., & Bennett, C. M. (2016). The Importance of Humidity in the Relationship between Heat and Population Mental Health: Evidence from Australia. *PloS One*, 11(10), e0164190. <<https://doi.org/10.1371/journal.pone.0164190>>
- Dixon, P. G., Sinyor, M., Schaffer, A., Levitt, A., Haney, C. R., Ellis, K. N., & Sheridan, S. C. (2014). Association of weekly suicide rates with temperature anomalies in two different climate types. *International Journal of Environmental Research and Public Health*, 11(11), 11627–11644. <<https://doi.org/10.3390/ijerph111111627>>
- Dodd, W., Scott, P., Howard, C., Scott, C., Rose, C., Cunsolo, A., & Orbinski, J. (2018). Lived experience of a record wildfire season in the Northwest Territories, Canada. *Canadian Journal of Public Health*, 109(3), 327–337. Retrieved from <<https://link.springer.com/article/10.17269/s41997-018-0070-5>>
- Dodgen, D., Donato, N., Kelly, A., La Greca, J., Morganstein, J., Reser, J., ... Ursano, R. (2016). Mental health and well-being. In A. Crimmins, J. Balbus, J. L. Gamble, C. B. Beard, J. E. Bell, D. Dodgen, R. J. Eisen, N. Fann, M. D. Hawkins, S. C. Herring, L. Jantarasami, D. M. Mills, S. Saha, M. C. Sarofim, J. Trtanj, & L. Ziska (Eds.), *The impacts of climate change on human health in the United States: A scientific assessment*. Washington, DC: U.S. Global Change Research Program. Retrieved from <<https://health2016.globalchange.gov/mental-health-and-well-being>>
- Doherty, T. J., & Clayton, S. (2011). The psychological impacts of global climate change. *American Psychologist*, 66(265–276), 10–1037. Retrieved from <<https://www.apa.org/pubs/journals/releases/amp-66-4-265.pdf>>
- Donaldson, S. G., Curren, M. S., Adlard, B., Provost, J., Leech, T., Tikhonov, C., ... Shearer, R. (2013). Future human health research directions for the Canadian Northern Contaminants Program. *International Journal of Circumpolar Health*, 72(1), 1–2. <<https://doi.org/10.3402/ijch.v72i0.23049>>
- Durkalec, A., Furgal, C., Skinner, M. W., & Sheldon, T. (2015). Climate change influences on environment as a determinant of Indigenous health: Relationships to place, sea ice, and health in an Inuit community. *Social Science & Medicine*, 136–137, 17–26. <<https://doi.org/10.1016/j.socscimed.2015.04.026>>
- Durocher, L. (2018). *The Long Road Home: Position Paper*.
- Earle, L. (2013). *Understanding chronic disease and the role for traditional approaches in aboriginal communities*. National Collaborating Centre for Aboriginal Health. Retrieved from <<https://www.cnsa-nccah.ca/docs/emerging/FS-UnderstandingChronicDisease-Earle-FN.pdf>>
- Edwards, T., & Wiseman, J. (2011). Climate change, resilience and transformation: challenges and opportunities for local communities. In I. Weissbecker (Ed.), *Climate Change and Human Well-being*. New York, NY: Springer.
- Eisenman, D., McCaffrey, S., Donatello, I., & Marshal, G. (2015). An ecosystems and vulnerable populations perspective on solastalgia and psychological distress after a wildfire. *EcoHealth*, 12(4), 602–610. <<https://doi.org/10.1007/s10393-015-1052-1>>
- Ellis, N. R., & Albrecht, G. A. (2017). Climate change threats to family farmers' sense of place and mental well-being: A case study from the Western Australian Wheatbelt. *Social Science and Medicine*, 175, 161–168. <<https://doi.org/10.1016/j.socscimed.2017.01.009>>
- Fernandez, A., Black, J., Jones, M., Wilson, L., Salvador-Carulla, L., Astell-Burt, T., & Black, D. (2015). Flooding and mental health: A systematic mapping review. *PLoS ONE*, 10(4), 1–21. <<https://doi.org/10.1371/journal.pone.0119929>>
- Ferré, I. M., Negrón, S., Shultz, J. M., Schwartz, S. J., Kossin, J. P., & Pantin, H. (2019). Hurricane Maria's impact on Punta Santiago, Puerto Rico: community needs and mental health assessment six months postimpact. *Disaster Medicine and Public Health Preparedness*, 13(1), 18–23. <<https://doi.org/10.1017/dmp.2018.103>>
- Fletcher, A., & Knuttila, E. (2016). Gendering Change Canadian Farm Women Respond to Drought. In H. Diaz, M. Hurlbert, & J. Warren (Eds.), *Vulnerability and Adaptation to Drought: The Canadian Prairies and South America*. University of Calgary Press.
- Foothills Community Counselling. (2020). Retrieved from <<https://highriver.ca/foothills-community-counselling/>>
- Ford, J. D. (2012). Indigenous health and climate change. *American Journal of Public Health*, 102(7), 1260–1266. <<https://doi.org/10.2105/AJPH.2012.300752>>



- Ford, J. D., Stephenson, E., Cunsolo Willox, A., Edge, V., Farahbakhsh, K., Furgal, C., Harper, S., Chatwood, S., Mauro, I., Pearce, T., Austin, S., Bunce, A., Bussalleu, A., Diaz, J., Finner, K., Gordon, A., Huet, C., Kitching, K., Lardeau, M. P., McDowell, G., ... Sherman, M. (2016). Community-based adaptation research in the Canadian Arctic. *Wiley Interdisciplinary Reviews. Climate Change*, 7(2), 175–191. <<https://doi.org/10.1002/wcc.376>>
- Foresight: Migration and Global Environmental Change. (2011). Final Project Report
The Government Office for Science, London. Retrieved from <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/287717/11-1116-migration-and-global-environmental-change.pdf>
- Fritze, J. C., Blashki, G. A., Burke, S., & Wiseman, J. (2008). Hope, despair and transformation: Climate change and the promotion of mental health and well-being. *International Journal of Mental Health Systems*, 2, 1–10. <<https://doi.org/10.1186/1752-4458-2-13>>
- Galea, S., Brewin, C. R., Gruber, M., Jones, R. T., King, D. W., King, L. A., & Kessler, R. C. (2007). Exposure to hurricane-related stressors and mental illness after Hurricane Katrina. *Archives of General Psychiatry*, 64(12), 1427–1434.
- Gleick, P. H. (2014). Water, Drought, Climate Change, and Conflict in Syria. *Weather, Climate, & Society*, 6(3), 331–340. <<https://doi.org/10.1175/WCAS-D-13-00059.1>>
- Goldner, E. M., Bilsker, D., & Jenkins, E. (2016). *A concise introduction to mental health in Canada*. Canadian Scholars' Press.
- Gosse, K. (2010). Newfoundland begins cleanup of hurricane Igor's path of destruction. *Globe and Mail*. Retrieved from <<https://www.theglobeandmail.com/news/national/newfoundland-begins-cleanup-of-hurricane-igors-path-of-destruction/article1213793/>>
- Government of Alberta. (2013). *Alberta helps families cope with emotional impact of floods*. Retrieved from <<https://www.alberta.ca/release.cfm?xID=3523164740483-D80A-5566-F819A0C841FEDDEA>>
- Government of Canada. (2018). *Social determinants of health and health inequities*. Retrieved from <<https://www.canada.ca/en/public-health/services/health-promotion/population-health/what-determines-health.html>>
- Government of Canada. (2020). *Non-insured health benefits for First Nations and Inuit*. Retrieved from <<https://www.sac-isc.gc.ca/eng/1572537161086/1572537234517>>
- Government of Yukon. (2017). *Yukon 'state of play': Analysis of climate change impacts and adaptation*. Retrieved from <<https://yukon.ca/en/yukon-state-play-analysis-climate-change-impacts-and-adaptation>>
- Green, D., & Minchin, L. (2014). Living on climate-changed country: Indigenous health, well-being and climate change in remote Australian communities. *EcoHealth*, 11(2), 263–272. <<https://doi.org/10.1007/s10393-013-0892-9>>
- Hanigan, I. C., Butler, C. D., Kocic, P. N., & Hutchinson, M. F. (2012). Suicide and drought in New South Wales, Australia, 1970-2007. *Proceedings of the National Academy of Sciences of the United States of America*, 109(35), 13950-13955. <<https://doi.org/10.1073/pnas.1112965109>>
- Harper, S. L., Edge, V. L., Ford, J., Willox, A. C., Wood, M., McEwen, S. A., ... Namanya, D. B. (2015). Climate-sensitive health priorities in Nunatsiavut, Canada. *BMC Public Health*, 15, 605. <<https://doi.org/10.1186/s12889-015-1874-3>>
- Hasket, M. E., Smith Scott, S., Nears, K., Grimmet, M. (2008). Lessons from Katrina: Disaster mental health service in the gulf coast region. *Professional Psychology: Research and Practice*, 39(1), 93–99. <<https://doi.org/10.1037/0735-7028.39.1.93>>
- Hayes, K. (2019). *Mental Health in a changing climate: The Effects on youth, women and newcomers*. Greenbelt Foundation. Retrieved from <<https://www.greenbelt.ca/mentalhealth>>
- Hayes, K., Berry, P., & Ebi, K. (2019). Factors Influencing the Mental Health Consequences of Climate Change in Canada. *International Journal of Environmental Health Research*, 16(9), 1583. <<https://doi.org/10.3390/ijerph16091583>>
- Hayes, K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018a). Climate change and mental health: Risks, impacts and priority actions. *International Journal of Mental Health Systems*, 12(1), 1–12. <<https://doi.org/10.1186/s13033-018-0210-6>>
- Hayes, K., & Poland, B. (2018). Addressing mental health in a changing climate: Incorporating mental health indicators into climate change and health vulnerability and adaptation assessments. *International Journal of Environmental Research and Public Health*, 15(9), 1806. <<https://doi.org/10.3390/ijerph15091806>>
- Hayes, K., Poland, B., Cole, D. C., & Agic, B. (2020). Psychosocial adaptation to climate change in High River, Alberta: implications for policy and practice. *Canadian Journal of Public Health*, 111(6), 880-889. <<https://doi.org/10.17269/s41997-020-00380-9>>
- Hayes, K, Poland, B., Hathaway, M. (2018b). 5 Ways communities are coping with climate anxiety. *YES Magazine*. Retrieved from <<https://www.yesmagazine.org/environment/2018/08/22/5-ways-communities-are-coping-with-climate-anxiety/>>
- Health Canada. (2011). *Extreme Heat Events Guidelines: Technical Guide for Health Care Workers*. Ottawa, ON. Retrieved from <https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/climat/workers-guide-travailleurs/extreme-heat-chaleur-accablante-eng.pdf>



- Health Canada. (2015). *First Nations mental wellness continuum framework*. Ottawa, ON. Retrieved from <https://thunderbirdpf.org/wp-content/uploads/2015/01/24-14-1273-FN-Mental-Wellness-Framework-EN05_low.pdf>
- Health Canada. (2020). *Reducing urban heat islands to protect health in Canada: An introduction for public health professionals*. Ottawa, ON. Retrieved from <<https://www.canada.ca/content/dam/hc-sc/documents/services/health/publications/healthy-living/reducing-urban-heat-islands-protect-health-canada/Reducing-Urban-Heat-EN.pdf>>
- Hetherington, E., McDonald, S., Wu, M., & Tough, S. (2018). Risk and protective factors for mental health and community cohesion after the 2013 Calgary flood. *Disaster Medicine and Public Health Preparedness*, 12(4), 470-477. <<https://doi.org/10.1017/dmp.2017.91>>
- Howard, C., Rose, C., Hancock, T. (2016). *Lancet countdown 2017 report: Briefing for canadian policymakers*. Lancet Countdown: Tracking Progress on Health and Climate Change and Canadian Public Health Association. Retrieved from <https://www.cpha.ca/sites/default/files/uploads/advocacy/2017_lancet_canada_brief.pdf>
- Huang, C., Yang, J., Lu, H., Huang, H., & Yu, L. (2017). Green spaces as an indicator of urban health: Evaluating its changes in 28 mega-cities. *Remote Sensing*, 9(12), 1266. <<https://doi.org/10.3390/rs9121266>>
- Hudson, C. G. (2005). Socioeconomic status and mental illness: Tests of the social causation and selection hypotheses. *American Journal of Orthopsychiatry*, 75(1), 3-18. <<https://doi.org/10.1037/0002-9432.75.1.3>>
- Hutton, D. (2005). *Psychosocial aspects of climate change in Canada: A review of current literature and research recommendations*. Ottawa, ON: Health Canada.
- Is This How You Feel? (2020). Retrieved from <<https://www.isthishowyoufeel.com/>>
- Institute for Environment and Human Security (IEHS). (2015). *5 Facts on Climate Migrants*. United Nations University. Retrieved from <<https://ehs.unu.edu/news/news/5-facts-on-climate-migrants.html>>
- Insurance Board of Canada. (2010). Hurricane Igor causes over \$65 million in insured damage. *CISION*. Retrieved from <<https://www.newswire.ca/news-releases/hurricane-igor-causes-over-65-million-in-insured-damage-546085852.html>>
- Intergovernmental Panel on Climate Change (IPCC). (2014). *Climate change 2014: Impacts, adaptation, and vulnerability. Contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change* (C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White, Eds.). Cambridge, United Kingdom: Cambridge University Press.
- Inuit Tapiriit Kanatami (ITK). (2016). *National Inuit Suicide Prevention Strategy*. Retrieved from <<https://www.itk.ca/wp-content/uploads/2016/07/ITK-National-Inuit-Suicide-Prevention-Strategy-2016.pdf>>
- Jones, L., Asare, J. B., El Masri, M., Mohanraj, A., Sherief, H., & van Ommeren, M. (2009). Severe mental disorders in complex emergencies. *The Lancet*, 374(9690), P654-661. <[https://doi.org/10.1016/S0140-6736\(09\)61253-8](https://doi.org/10.1016/S0140-6736(09)61253-8)>
- Kaiser, D., Lamothe, F., Roy, M., & Racinn- Hamel, S. É. (2019). *Vague de chaleur été 2018 à Montréal : enquête épidémiologique*. Direction régionale de santé publique du CIUSSS du Centre-Sud-de-l'Île-de-Montréal. Montréal, QC: Gouvernement du Québec. Retrieved from <<https://numerique.banq.qc.ca/patrimoine/details/52327/3737294&docref=irDjexzxxNV8AspydEw39w>>
- Kessler, R. C., Galea, S., Gruber, M. J., Sampson, N. A., Ursano, R. J., & Wessely, S. (2008). Trends in mental illness and suicidality after Hurricane Katrina. *Molecular Psychiatry*, 13, 374-384. <<https://doi.org/10.1038/sj.mp.4002119>>
- Kim, Y., Kim, H., Gasparrini, A., Armstrong, B., Honda, Y., Chung, Y., ... Hashizume, M. (2019). Suicide and ambient temperature: A multi-country multi-city study. *Environmental Health Perspectives*, 127(11). <<https://doi.org/10.1289/EHP4898>>
- King, N., Bishop-Williams, K., Beauchamp, S., Ford, J. D., Berrang-Ford, L., Cunsolo, A., & Harper, S. L. (2018). How do Canadian media report climate change impacts on health? A newspaper review. *Climatic Change*, 152, 581-596. <<https://doi.org/10.1007/s10584-018-2311-2>>
- Kirmayer, L. J., Simpson, C., & Cargo, M. (2003). Healing traditions: Culture, community and mental health promotion with Canadian Aboriginal peoples. *Australasian Psychiatry*, 11(1), S15-S23. <<https://doi.org/10.1046/j.1038-5282.2003.02010.x>>
- Kirmayer, L. J., Tait, C. L., & Simpson, C. (2009). The Mental Health of Aboriginal Peoples in Canada: Transformations of Identity and Community. *Healing Traditions: The Mental Health of Aboriginal Peoples in Canada*, 45(7), 607-616. <<https://doi.org/10.2307/2077147>>
- Kirmayer, L. J., & Valaskakis, G. (Eds.). (2009). *Healing Traditions: The Mental Health of Indigenous Peoples in Canada*. Vancouver, BC: UBC Press.
- Klinkenberg, M. (2017). Fort McMurray fire evacuees suffering from PTSD symptoms: study. *The Globe and Mail*. Retrieved from <<https://www.theglobeandmail.com/news/alberta/many-fort-mcmurray-fire-evacuees-suffering-from-ptsd-symptoms-study/article33764936/>>
- Koger, S. M., Leslie, K. E., & Hayes, E. D. (2011). Climate Change: Psychological Solutions and Strategies for Change. *Ecopsychology*, 3(4), 227-235. <<https://doi.org/10.1089/eco.2011.0041>>
- Kumar, U. (Ed.). (2016). *The Routledge international handbook of psychosocial resilience*. Routledge.



- Lambert, S. F., & Lawson, G. (2013). Resilience of professional counselors following Hurricanes Katrina and Rita. *Journal of Counseling & Development, 91*(3), 261–268. <<https://doi.org/10.1002/j.1556-6676.2013.00094.x>>
- Lee, J., Park, B. J., Tsunetsugu, Y., Ohira, T., Kagawa, T., & Miyazaki, Y. (2011). Effect of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health, 125*(2), 93–100. <<https://doi.org/10.1016/j.puhe.2010.09.005>>
- Lowe, D., Ebi, K. L., Forsberg, B. (2013). Factors increasing vulnerability to health effects before, during, and after floods. *International Journal of Environmental Research and Public Health, 10*(12), 7015–7067. <<https://doi.org/10.3390/ijerph10127015>>
- Macyshon, J. (2017). Ravaged by floods in 2011, Manitoba First Nation finally welcomes families home. *CTV News*. Retrieved from <<https://www.ctvnews.ca/canada/ravaged-by-floods-in-2011-manitoba-first-nation-finally-welcomes-families-home-1.3661089>>
- Maibach, E., Nisbet, M., & Weathers, M. (2011). *Conveying the human implications of climate change: A climate change communication primer for public health professionals*. Fairfax, VA: George Mason University Center for Climate Change Communication. Retrieved from <<https://www.climatechangecommunication.org/wp-content/uploads/2016/04/Climate-Communication-Primer-for-Public-Health-Professionals-1.pdf>>
- Malena-Chan, R., & Gatley, K. (2020). *Ecoanxious Stories*. Retrieved from <<https://www.ecoanxious.ca/>>
- Mann, S. C., & Boger, W. P. (1978). Psychotropic drugs, summer heat and humidity, and hyperpyrexia: A danger restated. *American Journal of Psychiatry, 135*(9), 1097–1100. <<https://doi.org/10.1176/ajp.135.9.1097>>
- Mantouraa, P., Robergeb, M.-C., Fournierc, L., & Mantoura, P. (2017). A framework for supporting action in population mental health. *Santé Mentale Au Québec, XLII*(1), 105–123. Retrieved from <http://www.ncchpp.ca/docs/2017_SMP_PMH_ArticleSMQ_En.pdf>
- McCracken, D. (2017). Building citizen capacity. *High River Online*. Retrieved from <<https://www.highriveronline.com/local/building-citizen-capacity>>
- Mental Health Commission of Canada (MHCC). (2016). *Advancing the mental health strategy for Canada*. Retrieved from <https://www.mentalhealthcommission.ca/sites/default/files/2016-08/advancing_the_mental_health_strategy_for_canada_a_framework_for_action.pdf>
- Mental Health Commission of Canada (MHCC). (2017). *Strengthening the case for investing in Canada's mental health system: Economic considerations*. Retrieved from <https://www.mentalhealthcommission.ca/sites/default/files/2017-03/case_for_investment_eng.pdf>
- Mental Health Commission of Canada (MHCC). (2018). *The working mind: The mental health continuum*. Retrieved from <<https://theworkingmind.ca/continuum-self-check>>
- Mental Health Commission of Canada (MHCC). (2020). *Rural and Remote Mental Health in Canada Evidence Brief on Best and Promising Practices*. Retrieved from <https://www.mentalhealthcommission.ca/sites/default/files/2020-05/Rural_remote_mental_health_evidence_brief_eng.pdf>
- Middleton, J., Cunsolo, A., Jones-Bitton, A., Shiwak, I., Wood, M., Pollock, N.,... & Harper, S. L. (2020a). "We're people of the snow." *Weather, climate change, and Inuit mental wellness. Social Science & Medicine, 262*, 113137. <<https://doi.org/10.1016/j.socscimed.2020.113137>>
- Middleton, J., Cunsolo, A., Jones-Bitton, A., Wright, C. J., & Harper, S. L. (2020b). Indigenous mental health in a changing climate: a systematic scoping review of the global literature. *Environmental Research Letters, 15*(5), 053001. Retrieved from <<https://iopscience.iop.org/article/10.1088/1748-9326/ab68a9>>
- Miles-Novelo, A., & Anderson, C. A. (2019). Climate change and psychology: Effects of rapid global warming on violence and aggression. *Current Climate Change Reports, 5*(1), 36–46. <<https://doi.org/10.1007/s40641-019-00121-2>>
- Moroz, N., Moroz, I., & D'Angelo, M. S. (2020, November). Mental health services in Canada: barriers and cost-effective solutions to increase access. In *Healthcare Management Forum* (Vol. 33, No. 6, pp. 282–287). Sage CA: Los Angeles, CA: SAGE Publications.
- Morrissey, S. A., & Reser, J. P. (2007). Natural disasters, climate change and mental health considerations for rural Australia. *Australian Journal of Rural Health, 15*(2), 120–125. <<https://doi.org/10.1111/j.1440-1584.2007.00865.x>>
- Mouallen, O. (2015). The boom, the bust, the darkness: Suicide rate soars in wake of Canada's oil crisis. *The Guardian*. Retrieved from <<https://www.theguardian.com/world/2015/dec/14/canada-oil-production-crisis-suicide-alberta>>
- Naturale, A. (2015). How do we understand disaster-related vicarious trauma, secondary traumatic stress, and compassion fatigue? In G. Quitangon, & M. R. Evces (Eds.), *Vicarious Trauma and Disaster Mental Health* (pp. 93–110). Routledge.
- Neria, Y., & Shultz, J. M. (2012). Mental health effects of Hurricane Sandy: Characteristics, potential aftermath, and response. *JAMA, 308*(24), 2571–2572. doi:10.1001/jama.2012.110700
- Nicholls, N., Butler, C. D., & Hanigan, I. (2006). Inter-annual rainfall variations and suicide in New South Wales, Australia, 1964–2001. *International Journal of Biometeorology, 50*(3), 139–143. <<https://doi.org/10.1007/s00484-005-0002-y>>



- Obradovich, N., Migliorini, R., Paulus, M. P., & Rahwan, I. (2018). Empirical evidence of mental health risks posed by climate change. *Proceedings of the National Academy of Sciences*, 115(43), 10953-10958. <<https://doi.org/10.1073/pnas.1801528115>>
- O'Brien, L. V., Berry, H. L., Coleman, C., & Hanigan, I. C. (2014). Drought as a mental health exposure. *Environmental Research*, 131, 181–187. <<https://doi.org/10.1016/j.envres.2014.03.014>>
- Ojala, M. (2012). How do children cope with global climate change? Coping strategies, engagement, and well-being. *Journal of Environmental Psychology*, 32(3), 225-233. Retrieved from <<https://www.colorado.edu/cumuseum/sites/default/files/attached-files/ojala7.pdf>>
- Orengo-Aguayo, R., Stewart, R. W., de Arellano, M. A., Suárez-Kindy, J. L., & Young, J. (2019). Disaster Exposure and Mental Health Among Puerto Rican Youths After Hurricane Maria. *JAMA Network Open*, 2(4), e192619. <<https://doi.org/10.1001/jamanetworkopen.2019.2619>>
- Osofsky, J. D., Osofsky, H. J., Kronenberg, M., & Hansel, T. (2010). The aftermath of hurricane Katrina: Mental health considerations and lessons learned. In R. P. Kilmer, V. Gil-Rivas, R. G. Tedeschi, & L. G. Calhoun (Eds.), *Helping families and communities recover from disaster*. Washington, DC: American Psychological Association.
- Pacheco, S. E. (2020). Catastrophic effects of climate change on children's health start before birth. *Journal of Clinical Investigation*, 130(2), 562-564. <<https://doi.org/https://doi.org/10.1172/JCI135005>>
- Page, L. A., Hajat, S., Kovats, R. S., & Howard, L. M. (2012). Temperature-related deaths in people with psychosis, dementia and substance misuse. *The British Journal of Psychiatry: The Journal of Mental Science*, 200(6), 485–490. <<https://doi.org/10.1192/bjp.bp.111.100404>>
- Petrasek MacDonald, J., Cunsolo Willox, A., Ford, J. D., Shiwak, I., Wood, M., Wolfrey, C., ... the Rigolet Inuit Community Government. (2015). Protective factors for mental health and well-being in a changing climate: Perspectives from Inuit youth in Nunatsiavut, Labrador. *Social Science and Medicine*, 141, 133-141. <<https://doi.org/10.1016/j.socscimed.2015.07.017>>
- Pihkala, P. (2020). The Cost of Bearing Witness to the Environmental Crisis: Vicarious Traumatization and Dealing with Secondary Traumatic Stress among Environmental Researchers. *Social Epistemology*, 34(1), 86-100. <<https://doi.org/10.1080/02691728.2019.1681560>>
- Pitts, L. (2015). Hurricane Igor: What it was like on the ground during, and after, the storm. *CBC News*. Retrieved from <<https://www.cbc.ca/news/canada/newfoundland-labrador/hurricane-igor-what-it-was-like-on-the-ground-during-and-after-the-storm-1.3234201>>
- Polain, J. D., Berry, H. L., & Hoskin, J. O. (2011). Rapid change, climate adversity and the next "big dry": Older farmers' mental health. *Australian Journal of Rural Health*, 19(5), 239-243. <<https://doi.org/10.1111/j.1440-1584.2011.01219.x>>
- Powers, J. R., Dobson, A. J., Berry, H. L., Graves, A. M., Hanigan, I. C., & Loxton, D. (2015). Lack of association between drought and mental health in a cohort of 45-61 year old rural Australian women. *Australian and New Zealand Journal of Public Health*, 39(6), 518–523. <<https://doi.org/10.1111/1753-6405.12369>>
- Price, K., Perron, S., & King, N. (2013). Implementation of the montreal heat response plan during the 2010 heat wave. *Canadian Journal of Public Health*, 104(2), e96-e100. <<https://doi.org/10.1007/BF03405667>>
- Public Health Agency of Canada (PHAC). (2014). *Economic Burden of illness in Canada, 2005–2008*. Retrieved from <<https://www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/publicat/ebic-femc/2005-2008/assets/pdf/ebic-femc-2005-2008-eng.pdf>>
- Radu, I. (2018). *Land for Healing: Developing a First Nations Land-based Service Delivery Model*. Bothwell, ON: Thunderbird Partnership Foundation. Retrieved from <<https://thunderbirdpf.org/wp-content/uploads/2018/07/Thunderbirdpf-LandforHealing-Document-SQ.pdf>>
- Radu, I., House, L., & Pashagumskum, E. (2014). Land, life, and knowledge in Chisasibi: Intergenerational healing in the bush. *Decolonization: Indigeneity, Education & Society*, 3(3), 86–105. Retrieved from <https://www.chisasibiwellness.ca/wp-content/uploads/2018/12/Radu-et-al_Chisasibi-land-based-healing_2014-1.pdf>
- Ramsay, T., & Manderson, L. (2011). Resilience, spirituality and posttraumatic growth: reshaping the effects of climate change. In I. Weissbecker (Ed.), *Climate Change and Human Well-being*. New York, NY: Springer.
- Ray, S. J. (2020). *A Field Guide to Climate Anxiety: How to Keep Your Cool on a Warming Planet*. Oakland, CA: University of California Press.
- Reser, J. P., & Swim, J. K. (2011). Adapting to and coping with the threat and impacts of climate change. *American Psychologist*, 66(4), 277. <<http://doi.org/10.1037/a0023412>>
- Rhodes, J., & Chan, C. (2010). The Impact of Hurricane Katrina on the Mental and Physical Health of Low-Income Parents in New Orleans. *The American Journal of Orthopsychiatry*, 80(2), 237–247. <<http://doi.org/10.1111/j.1939-0025.2010.01027.x>>
- Rigby, C. W., Rosen, A., Berry, H. L., & Hart, C. R. (2011). If the land's sick, we're sick: The impact of prolonged drought on the social and emotional well-being of Aboriginal communities in rural New South Wales. *Australian Journal of Rural Health*, 19(5). <<http://doi.org/10.1111/j.1440-1584.2011.01223.x>>



- Roberts, S., Arseneault, L., Barratt, B., Beevers, S., Danese, A., Odgers, C. L., ... Fisher, H. L. (2019). Exploration of NO₂ and PM_{2.5} air pollution and mental health problems using high-resolution data in London-based children from a UK longitudinal cohort study. *Psychiatry Research*, 272, 8-17. <<https://doi.org/10.1016/j.psychres.2018.12.050>>
- Rodriguez, J. J., Kohn, R. (2008). Use of mental health services among disaster survivors. *Current Opinion in Psychiatry*, 21, 370-378. <<https://doi.org/10.1186/1471-2458-7-173>>
- Ruskin, J., Rasul, R., Schneider, S., Bevilacqua, K., Taioli, E., & Schwartz, R. M. (2018). Lack of access to medical care during Hurricane Sandy and mental health symptoms. *Preventive Medicine Reports*, 10, 363-369. <<https://doi.org/10.1016/j.pmedr.2018.04.014>>
- Sahni, V., Scott, A. N., Beliveau, M., Varughese, M., Dover, D. C., & Talbot, J. (2016). Public health surveillance response following the southern Alberta floods, 2013. *Canadian Journal of Public Health*, 107(2), e142-e148. <<https://doi.org/10.17269/cjph.107.5188>>
- Sawatzky, A., Cunsolo, A., Gillis, G., Cook, O., Shiwak, I., Flowers, C., ... Harper, S. L. (2018). Profiling the eNuk program: An Inuit-led strategy for monitoring and responding to the impacts of environmental change on health and well-being in Rigolet, Nunatsiavut. *Northern Public Affairs*. Retrieved from <www.northernpublicaffairs.ca/index/volume-5-issue-2-innovations-in-community-health-and-wellness/profiling-the-enuk-program/>
- Sawatzky, A., Cunsolo, A., Harper, S., Shiwak, I., Wood, M., & IMHACC Team. (2019). "We have our own way": Exploring pathways for well-being among Inuit in Nunatsiavut, Labrador, Canada. In C. Flemming, & M. Manning (Eds.), *Handbook of Indigenous Well-being*. Routledge.
- Sawatzky, A., Cunsolo, A., Jones-Bitton, A., Gillis, D., Wood, M., Flowers, C., ... & Harper, S. L. (2020). "The best scientists are the people that's out there": Inuit-led integrated environment and health monitoring to respond to climate change in the Circumpolar North. *Climatic Change*, 1-22. Retrieved from <<https://link.springer.com/article/10.1007/s10584-019-02647-8>>
- Scaramutti, C., Salas-Wright, C. P., Vos, S. R., & Schwartz, S. J. (2019). The Mental Health Impact of Hurricane Maria on Puerto Ricans in Puerto Rico and Florida. *Disaster Medicine and Public Health Preparedness*, 13(1). <<https://doi.org/10.1017/dmp.2018.151>>
- Schmidt, L., & Lewis-Reau, A. (2020). *Good Grief Network*. Retrieved from <<https://www.goodgriefnetwork.org/>>
- Schwerdtle, P., Bowen, K., & McMichael, C. (2017). The health impacts of climate-related migration. *BMC Medicine*, 16(1). <<https://doi.org/10.1186/s12916-017-0981-7>>
- Séguin, J. (Ed.). (2008). *Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity*. Ottawa, ON: Health Canada. Retrieved from <http://publications.gc.ca/collections/collection_2008/hc-sc/H128-1-08-528E.pdf>
- Shiple, M., & Berry, H. L. (2010). Longing to belong: Personal Social capital and psychological distress in an Australian coastal region. *SSRN*, (39). <<https://doi.org/10.2139/ssrn.1703238>>
- Simpson, D. M., Weissbecker, I., & Sephton, S. E. (2011). Extreme weather-related events: Implications for mental health and well-being. In I. Weissbecker (Ed.), *Climate Change and Human Well-being*. New York, NY: Springer.
- Standing Committee on Indigenous and Northern Affairs. (2017). *Breaking point: The suicide crisis in Indigenous communities*. Ottawa, ON: House of Commons.
- Stanke, C., Murray, V., Amlôt, R., Nurse, J., & Williams, R. (2012). The effects of flooding on mental health: Outcomes and recommendations from a review of the literature. *PLoS Currents*, 4, 1-17. <<https://doi.org/10.1371/4f9f1fa9c3cae>>
- Stephen, A., Marion, M., Oluwafemi, A., & Wiggins, S. (1999). The effect of season and weather on suicide rates in the elderly in British Columbia. *Canadian Journal of Public Health / Revue Canadienne de Santé Publique*, 90(6), 418-422. Retrieved from <<https://www.jstor.org/stable/41994174>>
- Stern, P.C. (2012). Psychology: Fear and hope in climate messages. *Nature Climate Change*, 2, 572-573. Retrieved from <https://climateaccess.org/system/files/Stern_Fear%20and%20hope.pdf>
- Tam, B. Y., Gough, W. A., Edwards, V., & Tsuji, L. J. S. (2013). The impact of climate change on the well-being and lifestyle of a First Nation community in the western James Bay region. *Canadian Geographer*, 57(4). <<https://doi.org/10.1111/j.1541-0064.2013.12033.x>>
- Tam, T. (2019). *Addressing Stigma: Towards a More Inclusive Health System*. Ottawa, ON: Government of Canada. Retrieved from <<https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/addressing-stigma-toward-more-inclusive-health-system.html>>
- The eNuk Program. (2018). Retrieved from <<https://enuk.ca/>>
- Thompson, R., Hornigold, R., Page, L., & Waite, T. (2018). Associations between high ambient temperatures and heat waves with mental health outcomes: a systematic review. *Public Health*, 161, 171-191. <<https://doi.org/10.1016/j.puhe.2018.06.008>>
- Toronto Public Health. (2015). *A climate of concern: Climate change and health strategy for Toronto*. Retrieved from <<https://www.toronto.ca/legdocs/mmis/2015/hl/bgrd/backgroundfile-81509.pdf>>



- Trang, P. M., Rocklöv, J., Giang, K. B., Kullgren, G., & Nilsson, M. (2016). Heatwaves and hospital admissions for mental disorders in Northern Vietnam e0155609. *PLoS ONE*, 11(5), 1–20. <<https://doi.org/10.1371/journal.pone.0155609>>
- Tschakert, P., Ellis, N. R., Anderson, C., Kelly, A., & Obeng, J. (2019). One thousand ways to experience loss: A systematic analysis of climate-related intangible harm from around the world. *Global Environmental Change*, 55, 58-72. <<https://doi.org/10.1016/j.gloenvcha.2018.11.006>>
- Tschakert, Petra, Barnett, J., Ellis, N., Lawrence, C., Tuana, N., New, M., ... Pannell, D. (2017). Climate change and loss, as if people mattered: values, places, and experiences. *Wiley Interdisciplinary Reviews: Climate Change*, 8(5), e476. <<https://doi.org/10.1002/wcc.476>>
- Tucci, J., Mitchell, J., Goddard, C. (2007). *Children's fears, hopes and heroes: Modern childhood in Australia*. Australian Childhood Foundation.
- Tunstall, S., Tapsell, S., Green, C., Floyd, P., & George, C. (2006). The health effects of flooding: Social research results from England and Wales. *Journal of Water and Health*, 4(3), 365–380. <<https://doi.org/10.2166/wh.2006.031>>
- Ulrich, R.. (1979). Visual landscapes and psychological well-being. *Landscape Research*, 4(1), 17–23. doi:10.1080/01426397908705892
- United Nations Framework Convention on Climate Change (UNFCCC). (2020). *Report of the executive committee of the Warsaw international mechanism for loss and damage associated with Climate Change Impacts*. Retrieved from <<https://unfccc.int/documents/266453>>
- United Nations International Strategy for Disaster Reduction (UNISDR). (2015). *The human cost of weather related disasters 1995-2015*. Retrieved from <https://reliefweb.int/sites/reliefweb.int/files/resources/COP21_WeatherDisastersReport_2015_FINAL.pdf>
- Usher, P. J. (2003). Environment, race and nation reconsidered: Reflections on aboriginal land claims in Canada. *Canadian Geographer*, 47(4), 365–382. <<https://doi.org/10.1111/j.0008-3658.2003.00029.x>>
- Vestal, C. (2017). 'Katrina brain': The invisible long-term toll of megastorms. *POLITICO*. Retrieved from <<https://www.politico.com/agenda/story/2017/10/12/psychological-toll-natural-disasters-000547/>>
- Vida, S., Durocher, M., Ouarda, T. B., & Gosselin, P. (2012). Relationship between ambient temperature and humidity and visits to mental health emergency departments in Québec. *Psychiatric services (Washington, D.C.)*, 63(11), 1150–1153. <<https://doi.org/10.1176/appi.ps.201100485>>
- Vins, H., Bell, J., Saha, S., & Hess, J. J. (2015). The mental health outcomes of drought: A systematic review and causal process diagram. *International Journal of Environmental Research and Public Health*, 12(10), 13251–13275. <<https://doi.org/10.3390/ijerph121013251>>
- Waite, T. D., Chaintarli, K., Beck, C. R., Bone, A., Amlôt, R., Kovats, S., & Oliver, I. (2017). The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one. *BMC Public Health*, 17(1), 129. <<https://doi.org/10.3390/ijerph121013251>>
- Wang, X., Lavigne, E., Ouellette-Kuntz, H., & Chen, B. E. (2014). Acute impacts of extreme temperature exposure on emergency room admissions related to mental and behavior disorders in Toronto, Canada. *Journal of Affective Disorders*, 155, 154-161. <<https://doi.org/10.1016/j.jad.2013.10.042>>
- Watts, N., Amann, M., Ayeb-Karlsson, S., Belesova, K., Bouley, T., Boykoff, M., ... Costello, A. (2017). The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. *The Lancet*, 391(10120), 581-630. <[https://doi.org/10.1016/S0140-6736\(17\)32464-9](https://doi.org/10.1016/S0140-6736(17)32464-9)>
- Weissbecker, I. (Ed.). (2011). *Climate change and human well-being*. New York, NY: Springer.
- Whaley, A. (2009). Trauma among survivors of hurricane Katrina: Considerations and recommendations for mental health care. *Journal of Loss and Trauma*, 14, 459–476. <<https://doi.org/10.1080/15325020902925480>>
- Whitfield, G. P., Meehan, L. A., Maizlish, N., & Wendel, A. M. (2017). The integrated transport and health impact modeling tool in Nashville, Tennessee, USA: Implementation steps and lessons learned. *Journal of Transport and Health*, 5, 171-181. <<https://doi.org/10.1016/j.jth.2016.06.009>>
- Williams, L., Fletcher, A., Hanson, C., Neapole, J., & Pollack, M. (2018). *Women and Climate Change Impacts and Action in Canada: Feminist, Indigenous, and Intersectional Perspectives*. Canadian Research Institute for the Advancement of Women and the Alliance for Intergenerational Resilience. Retrieved from <https://www.criaw-icref.ca/images/userfiles/files/Women_and_Climate_Change_FINAL.pdf>
- World Health Organization (WHO). (2018). *Mental health: Strengthening our response*. Retrieved from <<https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response>>
- Yusa, A., Berry, P., Cheng, J. J., Ogden, N., Bonsal, B., Stewart, R., & Waldick, R. (2015). Climate change, drought and human health in Canada. *International Journal of Environmental Research and Public Health*, 12(7), 8359-8412. <<https://doi.org/10.3390/ijerph120708359>>



Zakreski, D. (2019). Crystal meth crisis on Saskatchewan First Nation traced to 2015 wildfire evacuation. *CBC News*. Retrieved from <<https://www.cbc.ca/news/canada/saskatoon/montreal-lake-meth-crisis-wildfire-evacuation-1.5134061>>

Zhang, X., Flato, G., Kirchmeier-Young, M., Vincent, L., Wan, H., Wang, X., Rong, R., Fyfe, J., Li, G., & Kharin, V.V. (2019). Changes in Temperature and Precipitation Across Canada. In E. Bush, & D. S. Lemmen (Eds.), *Canada's Changing Climate Report* (pp 112-193). Ottawa, ON: Environment and Climate Change Canada.

Zhao, X., Maibach, E., Gandy, J., Witte, J., Cullen, H., Klinger, B. A., & Pyle, A. (2014). Climate change education through TV weathercasts: Results of a field experiment. *Bulletin of the American Meteorological Society*, 95(1), 117–130. <<https://doi.org/10.1175/BAMS-D-12-00144.1>>

Zupancic, T., Kingsley, M., Jason, T., & Macfarlane, R. (2013). *Green city: Why nature matters to health - an evidence review*. Toronto, ON: Toronto Public Health. Retrieved from <<https://niagaraknowledgeexchange.com/resources-publications/green-city-why-nature-matters-to-health-an-evidence-review/>>

Zwiebach, L., Rhodes, J., & Roemer, L. (2010). Resource loss, resource gain, and mental health among survivors of Hurricane Katrina. *Journal of Traumatic Stress*, 23(6), 751-758. <<https://doi.org/10.1002/jts.20579>>