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Extreme Heat Exposure in Southern Ontario: Identifying Vulnerable Populations and Health Risks

Waterloo Climate Institute Technical Brief

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Abstract

Canada is increasingly facing hot summers and heat waves, particularly in urban areas, which contributes to increasing heat-related morbidity and mortality. Health vulnerability to heat is unevenly distributed across and within societies, with disproportionate burdens falling on specific populations due to intersecting physiological, social, and environmental factors. These inequities are of growing concern in Canada, where warming has occurred and is projected to continue at approximately twice the global average rate.

This technical brief helps policy makers and frontline public health agencies identify populations most vulnerable to the health impacts of extreme heat in Southern Ontario, Canada and explains the underlying factors that shape their vulnerability. Specifically, it aims to increase understanding of how extreme heat affects human health, improve community preparedness in reducing health harms associated with extreme heat, and enhance resilience for vulnerable populations and the natural environment in the region. The brief provides a resource for decision makers to prioritize equity-focused climate adaptation policies, guide resource allocation to populations and communities with the elevated need, and support actionable, data-informed responses to extreme heat across health, planning, and climate adaptation sectors.

Keywords: Equitable Heat Resilience, Physical and Mental Health Impacts, Climate Change Impacts.

Key messages

- Extreme heat poses significant physical and mental health risks, but these risks are not experienced equally across all populations in Canada.
- Certain populations are highly vulnerable to extreme heat due to a combination of physical exposure, socioeconomic factors, and systemic inequities.
- Targeted public health strategies and community interventions are needed to reduce heat-related harm, enhance resilience, and protect the most at-risk populations as temperatures continue to rise.

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Background

Extreme heat poses a growing public health concern, particularly in urban areas, where it contributes to increased morbidity and mortality, with projections indicating a substantial future rise in heat-related mortality. Beyond mortality, extreme heat is associated with a wide range of adverse physical health outcomes, including skin conditions, heat fatigue, heat cramps, heat syncope, heat exhaustion, and heat stroke, as well as increased strain on respiratory and cardiovascular systems (WHO, 2004; Crank et al., 2024). Evidence also highlights the impacts of high ambient temperatures on mental health, as individuals with mental illness may experience impaired thermoregulation due to psychotropic medications, underlying illness, and behavioral symptoms (Sun et al., 2021; Wang et al., 2014).

The health impacts of extreme heat in Canada are diverse and often unique to specific communities. Heat vulnerability comprises three key dimensions: exposure, sensitivity, and adaptive capacity. Exposure refers to the degree to which individuals or communities experience elevated ambient temperatures. Sensitivity reflects how strongly they may be affected based on physiological, social, economic and environmental characteristics. Adaptive capacity represents the ability to respond to heat-stress conditions and mitigate their impacts (IPCC, 2007; Qian & Liu, 2025; Zhang et al., 2023; Ellena et al., 2020). Vulnerable populations are frequently exposed to extreme heat, which is becoming more intense due to a combination of climate change and urban-induced warming (Crank et al., 2024). They may also exhibit higher sensitivity or have fewer resources and opportunities to adapt (IPCC, 2007), all of which increase their susceptibility to adverse health outcomes.

Ontario has already witnessed notable climate changes over the past two decades, with mean annual temperature increasing by 1.3°C between 1948 and 2016 (Government of Ontario, 2023). This technical brief focuses on Southern Ontario, the most densely populated area in the country, with a population of about 13.5 million in 2021 and an estimated 15.2 million in 2024, representing approximately 36.8 per cent of Canada’s total population (Statistics Canada, 2022; Federal Economic Development Agency for Southern Ontario, 2025). Using Southern Ontario, as a case study, this technical brief identifies marginalized populations who are at elevated health risk to extreme heat and examines how heat exposure interacts with social and environmental vulnerabilities to shape their physical and mental health outcomes.

As shown in Table 1, groups identified as being at elevated risk, based on regional and national vulnerability assessments[1], include Amish Communities, Low-German Speaking Mennonite Communities, Indigenous Communities, LGBTQ2S+ Community, Women (especially single-parent households), Infants and Young Children, Older Adults, Immigrants, Outdoor workers/Outdoor farm workers, International Agricultural Workers, People living below the poverty line, People Experiencing Homelessness and Socially Isolated Populations. While these assessments also identified other groups at elevated risk, such as people with pre-existing or chronic health conditions, individuals who exercise in the heat and population living in highly urbanized areas with limited natural land cover, this brief primarily focuses on populations experiencing social, economic, cultural or structural marginalization.

Table 1: Heat vulnerability dimensions (exposure, sensitivity, and adaptive capacity) associated with marginalized and vulnerable populations in Canada. *(Source: compiled by the authors).*

Marginalized Populations	Exposure	Sensitivity	Adaptive Capacity
Amish Communities	●	N/A	●
Low-German Speaking Mennonite Communities	●	N/A	●
Indigenous Communities	N/A	●	●
LGBTQ2S+ Community	N/A	●	N/A
Women (especially single-parent households)	N/A	●	N/A
Infants and Young Children	N/A	●	N/A
Older Adults	N/A	●	●
Immigrants	N/A	●	●
Outdoor Workers/Outdoor Farm Workers	●	N/A	●
International Agricultural Workers	●	N/A	●
People Living Below the Poverty Line	N/A	●	●
People Experiencing Homelessness	●	●	●
Socially Isolated Populations	N/A	N/A	●

[1]The SWPH (2024) vulnerability assessment; the Climate Change and Health Vulnerability Assessment for Waterloo Region, Wellington County, Dufferin County, and the City of Guelph; and Health Canada.



Figure 1: Census divisions of Southern Ontario, Canada, as delineated by Statistics Canada (2021).

Marginalized Populations and Health Risks

This brief is grounded in research that integrates environmental exposure data, such as air temperature, relative humidity, wind, and solar radiation, with health records, and includes an analysis of heat-related health vulnerabilities informed by previous research. Understanding the disproportionate impacts of heat on the physical and mental health of people experiencing greater vulnerability is critical for developing targeted interventions to reduce health risks, enhance resilience, and lower health system burdens. The following subsections describe groups identified as being at elevated risk and the factors that shape their vulnerability to extreme heat.

Amish Communities

The Old Order Amish (OOA) are an Anabaptist religious group in North America with Western European origins, living in relatively homogeneous, rural and socially close communities (Miller-Fellows et al., 2018; Blanchet Garneau et al., 2018). Their lifestyle emphasizes involvement in agricultural occupations, high levels of physical

activity, the use of a parochial school system and community-based decision-making, including shared choices regarding the adoption of technology (Blanchet Garneau et al., 2018; Brock & Haden, 2024). These characteristics shape how Amish communities interact with health and social services. For example, some Amish communities may not choose to participate in government-sponsored health insurance programs and instead rely on community-based self-insurance. Transportation practices and distinct approaches to health care and education may also influence access to specialized medical services and health information (Mitchell et al., 2012; Katz et al., 2013).

Despite being identified as a priority population (SWPH, 2024), there is little peer-reviewed research examining how Amish communities in Canada experience climate change, particularly extreme heat. Ontario represents the primary center of the OOA population in Canada, with an estimated 6,230 individuals, the majority of whom (approximately 5,660) reside in Southern Ontario (Young Center for Anabaptist and Pietist Studies, 2025). Given their distinct social, cultural and occupational characteristics, a better understanding is needed of how Amish communities in Southern Ontario experience and respond to extreme heat events, including the factors that may contribute to both vulnerability and resilience, and whether their experiences align with current public health assumptions and perceptions.

Low-German Speaking Mennonite Communities

The Low-German-speaking (LGS) Mennonite communities are another branch of the Anabaptist tradition rooted in the sixteenth-century Reformation in Europe (Kulig & Fan, 2013). Many members of these communities have limited formal education and literacy skills and may face language barriers when accessing services in Canada (Kulig & Fan, 2016). In Southwestern Ontario, early school leaving has been associated with challenges related to literacy, employment opportunities, poverty, housing and linguistic minority status (Brubacher & Wilson-Forsberg, 2017). Some LGS Mennonites have limited English proficiency and may rely on family or community members for translation during interactions with health care providers, which can influence communication and access to health information (Kulig & Fan, 2013). Previous research has also noted the importance of ensuring that health services are delivered in culturally appropriate ways that support meaningful engagement with these communities while reducing stereotypes, stigmatization, and discrimination (Blanchet Garneau et al., 2018).

Today, approximately 60,000 LGS Mennonites live in southwestern Ontario, settling in areas including Essex, Chatham-Kent, Elgin, Oxford, Norfolk and Niagara (Waterloo Wellington Local Health Integration Network, 2016). The total number across Southern Ontario is likely greater; however, consistent data for other areas are not available. The LSG Mennonites face similar problems as the Amish communities as they are also highly involved in the agriculture industry and use limited or no

technology in their day-to-day lives (SWPH, 2024). Although identified as a priority population by Southwestern Public Health (SWPH, 2024), peer-reviewed research directly examining how LGS Mennonite communities experience and respond to extreme heat remains scarce. As a result, there is limited evidence regarding heat exposure, cooling practices, heat-related health outcomes, and community strengths and adaptive capacities in the Canadian context.

Indigenous Communities

Individuals who hold Indigenous identity include people who identify as First Nations, Metis, or Inuk (Inuit) and/or people who have membership in a First Nation or Indian band (SWPH, 2024). Indigenous communities have historically borne the brunt of environmental degradation and colonial policies, creating a legacy of trauma that continues to influence health outcomes (Chapola et al, 2024; King et al., 2009). Climate change compounds these existing challenges, adding layers of stressors such as heightened exposure to repeated and increasingly unpredictable weather events, altered landscapes and disruptions to place attachment, Indigenous cultures, and livelihoods, which can further affect mental health within Indigenous communities (Chapola et al, 2024; Middleton, et al, 2020). Climate change also disproportionately harms the mental health of Indigenous and native communities due to their strong connection with the environment and historical environmental and racial injustices (Chekuri et al., 2024). For example, Inuit communities across northern Canada are experiencing rapid and acute climatic and environmental changes, including declining ice and snow conditions, thawing permafrost, more frequent severe weather events and shifts in wildlife and vegetation patterns. These changes disrupt traditional land-based activities such as hunting, fishing, trapping and travel, which are central to Inuit culture, identity and well-being. As the physical environment changes, Inuit people's connections to place, cultural practices and sense of identity are also being affected, creating significant challenges for individual and community health (Cunsolo et al., 2012).

Socio-economic disparity and increased poverty are another major concern in Indigenous territories, with lower income levels and higher unemployment rates compared to national or provincial averages. Disruptions to traditional economies and kinship structures contribute to housing crises and lack of proper sanitation, healthcare facilities and social services (Chapola et al, 2024). Based on calculations derived from the 2021 Census in Southern Ontario, approximately 1.96 per cent of the population identifies as Indigenous, with about 64.7 per cent of Ontario's Indigenous population residing in the region (Statistics Canada, 2021). While Indigenous communities have been disproportionately affected by climate change and extreme climate events in Canada and globally (Deen et al., 2021), there is limited research examining the specific impacts of extreme heat and rising ambient temperatures on the physical and mental health of Indigenous communities in Canada.

LGBTQ2S+ Community

LGBTQ2S+ is an acronym that stands for Lesbian, Gay, Bisexual, Transgender, Queer or Questioning and Two-Spirit (SWPH, 2024). Like other marginalized groups, LGBTQ2S+ people will, on average, have more exposure to climate change-related disasters, be more susceptible to the adverse impacts of climate change and have fewer resources to recover from climate harm (Mann et al., 2024). Historical and ongoing processes of stigma, violence and discrimination against LGBTQ2S+ communities have created social disparities in their everyday lives that can be exacerbated during disasters and extreme weather events (Goldsmith et al. 2022).

LGBTQ2S+ individuals also experience higher rates of poverty, homelessness and housing insecurity, and are more likely to live and work in risk-prone areas, which increase exposure to extreme heat, reduce access to adequate cooling equipment and heighten susceptibility to heat-related health risks (Mann et al., 2024; Goldsmith et al. 2022; Goldsmith & Bell, 2022). In addition, they may face barriers to accessing medical care due to discrimination, fear and limited access to health insurance, and may experience disruptions to essential sexual and reproductive health services during extreme weather events (Goldsmith & Bell, 2022; Goldsmith et al. 2022).

Limited case examples and research have examined the links between gender norms, roles, relations and the health impacts of climate change. Although recent work has begun to identify the increased vulnerability of LGBTQ2S+ populations in the context of a warming planet (WHO, 2014; Mann et al., 2024), significant research gaps remain globally and in Canada regarding how heat affects their physical and mental health.

Women

According to the United Nations Framework Convention on Climate Change women face higher risks and experience a greater burden of climate change impacts (Chekuri et al., 2024). Females have higher core temperature, skin temperature, heart rates, blood pressure and setpoints for sweating, in comparison to males, and they appear to be less tolerant to heat, which is reflected in mortality numbers during heat waves (Havenith, 2005). Several factors contribute to women's vulnerability to the health impacts of climate change, including higher poverty rates, limited financial independence and land ownership, and reduced access to environmental goods and services, which increase exposure to heat (Chekuri et al., 2024; Global Gender and Climate Alliance, 2016). Women in single-parent households may also face heightened vulnerability to climate change because of their greater risk of energy hardship during temperature extremes and lower adaptive capacity to cope with these conditions (Li et al., 2024). In Southern Ontario, 51.03 per cent of the population identify as women+,

of whom more than 470,000 are single parents (Statistics Canada, 2021).

Women are also disproportionately affected by sexual and gender-based violence, which is linked to higher rates of depression, anxiety, stress disorders and post-traumatic stress disorder (PTSD), especially during and after extreme weather events (Stone et al., 2022; Chekuri et al., 2024). In addition, women are affected differently by both heat-related mental health issues and other heat-related illness at different stages of their reproductive life cycle (Rothschild & Haase, 2023). For pregnant people, exposure to extreme heat is associated with adverse reproductive outcomes, including preterm birth and stillbirth, which can increase psychological distress and negatively affect maternal mental health (Chekuri et al., 2024). Overall, the literature on women's vulnerability to extreme heat, particularly regarding physical and mental health, is well established. However, there is a need for further research within the Canadian context, particularly in Southern Ontario.

Infants and Young Children

Children are uniquely vulnerable to the threats of climate change on human health, safety and security (Paulson et al., 2015). Extreme heat affects infants and young children more than adults because their smaller bodies heat up more quickly, they have a reduced capacity for heat adaptation and sweating, higher exposure per unit body weight, higher heart rate and they often spend more time outdoors (Sheffield & Landrigan, 2011; Early Childhood Scientific Council on Equity and the Environment, 2023; Xu et al., 2012). Children also have underdeveloped immune systems and limited capacity for self-care, making them more vulnerable to heat-related stress compared to adults under similar temperature conditions (Kim et al., 2017).

Health issues associated with heat exposure in children can include fever, electrolyte disturbances, renal diseases, chronic respiratory diseases including asthma and vector borne diseases (Xu et al., 2012). Because their brains and neurological systems are still developing, infants, children and adolescents are also more vulnerable to environmental stressors and less able to regulate emotions or adopt coping strategies, which can increase the risk for mental health problems during periods of high temperatures (Wright et al., 2025; Santillanes et al., 2020). These heat related-mental health outcomes can include anxiety, reaction disorders, bipolar disorders and psychosis (Niu et al., 2023). Exposure to higher temperatures also negatively affects children's sleep quality, cognitive function and educational achievement (Early Childhood Scientific Council on Equity and the Environment, 2023; Ahdoot et al, 2024).

Most research on temperature-related mental health has focused on adults, particularly the elderly, while the effects on children and young adults remain poorly characterized and underexplored in the current literature (Sugg et al., 2019).

Approximately 16.6 per cent of Southern Ontario's population is under 20 years of age (Statistics Canada, 2021). The first Canadian study examining the association between extreme heat events and pediatric hospital admissions was only recently conducted by Kassem et al. (2025), underscoring the limited evidence available in this context, particularly in Ontario.

Older Adults

Older adults (65 years and older) are highly vulnerable to the adverse impacts of climate change on mental and physical health due to age-related physiological changes, multimorbidity, mobility limitations, social isolation and limited access to health and welfare services (Tilstra et al., 2021; Marinova et al., 2025). With advancing age, the body's ability to thermoregulate tends to decrease, which can lead to increased mortality and morbidity numbers during extreme weather events (Havenith, 2005). Elderly patients on antipsychotics for dementia and others being treated for various mental health conditions may also be taking multiple medications to treat underlying health issues, which could also affect the thermoregulatory response (Schmeltz & Gamble, 2017). In Canada, 6.3 per cent of older adults reported mood disorders in 2020, and short-term exposure to extreme heat has been associated with an increased risk of emergency room visits among older adults with psychiatric disorders (Statistics Canada, 2021; Ratnakaran & Barman, 2022)

Mobility limitations may also lead older adults to spend more time at home, where studies show that not leaving home daily or being unable to care for oneself significantly increases the risk of death during a heatwave (Crank et al., 2024; Mayrhuber et al., 2018). This risk is further exacerbated among those without air conditioning or who face barriers to using it, resulting in significantly higher levels of heat stress (Crank et al., 2024). To date, several studies have investigated climate-related health risks in older people living in Canada (Tilstra et al., 2021), including research focused on the mental health consequences of heat exposure in both national and Ontario contexts. Based on calculations derived from the 2021 Census, the population of adults aged 65 and over in Southern Ontario represents 34.77 per cent of all older adults in Canada and 92.57 per cant of those in Ontario (Statistics Canada, 2021), highlighting the urgent need for health adaptation strategies that address their specific vulnerabilities to extreme heat.

Immigrants

Immigrants, as a vulnerable population, can be disproportionately affected by disasters due to their legal and migratory status, which shapes different challenges, needs and possibilities (Dadson et al., 2025). In Canada, this has implications from a public health perspective as immigrants comprised 21.9 per cent of the population in 2016, increasing to 23.0 per cent in 2021, and is projected to increase further

(Tilstra et al., 2021; Statistics Canada, 2017; Statistics Canada, 2022). The health of immigrants may also be impacted by socioeconomic differences, living arrangements, cultural and/or language barriers and occupational exposures (e.g., outdoor) that can exacerbate climate change effects (Tilstra et al., 2021). In addition, limited English proficiency among immigrants have been linked to lower health literacy, difficulty understanding alerts, warnings, public health information and lower utilization of healthcare services (Sharma & Anikeeva, 2025).

Immigrants are also at higher risk of mental health conditions, influenced by income, gender, employment, social support networks and a sense of community belonging (Salami et al., 2017). Periods of extreme heat can exacerbate pre-existing physical and mental health conditions such as psychiatric conditions, renal, cardiovascular and respiratory diseases, particularly for immigrants with limited access to healthcare services and coping resources, such as effective cooling equipment and infrastructure (Sharma & Anikeeva, 2025). As mentioned, in 2021, immigrants comprised 23.0 per cent of Canada's population (Statistics Canada, 2022). In contrast, Southern Ontario has a substantially higher proportion of immigrants at 31.09 per cent (author's calculation based on Statistics Canada, 2021 Census; Statistics Canada, 2021); yet there is very little available literature concerning climate-related health impacts in immigrant populations in this region, reflecting a critical knowledge gap in the field.

Outdoor Workers/Outdoor Farm Workers

The International Labor Organization estimates that more than one billion workers are exposed to high heat episodes, not all of which occur during summer months (Kjellstrom et al., 2019). Outdoor workers, including those employed in agriculture, forestry and fishing, construction, landscaping, mining, electricity, gas and water, and other manual trades, are particularly vulnerable due to high metabolic heat production, high ambient and radiant heat, low air flow, and sometimes high humidity, which add to human heat strain (Varghese et al., 2019; Ebi et al., 2021). Also, studies have shown that municipal workers, particularly those in fleet, public works, underground utilities, parks and recreation and solid waste, are vulnerable to heat as their jobs often require prolonged outdoor exposure (Uejio et al., 2018). Occupational heat stress is a crucial risk factor for a range of heat-related illnesses (Mayrhuber et al., 2018). Approximately a third of workers exposed to occupational heat stress experience negative effects, including increased risk of hyperthermia, cardiovascular failure or collapse and acute kidney disease (Ebi et al., 2021).

High ambient temperatures can increase the risk of occupational injuries due to physical discomfort, fatigue, reduced alertness and decreased psychomotor performance arising from heat exposure (Varghese et al., 2019). Occupational heat exposure is also associated with mental health problems including stress, anxiety, mental disorders and burnout (Florez-Acevedo et al., 2025). Based on calculations

derived from the 2021 Census, Southern Ontario has a slightly lower proportion of people employed in the sectors of agriculture, forestry, fishing, hunting and construction (4.49 per cent) compared to Ontario (4.52 per cent) and Canada (5.14 per cent) (Statistics Canada, 2021); however, these sectors still represent a meaningful share of the workforce and include workers who are highly exposed to heat. Although research has examined the health impacts of heat exposure among outdoor workers, there remains a significant gap in understanding how such exposure affects their mental health, particularly within the context of Canada and Southern Ontario.

Figure 2: Illustration of the interaction of different occupational factors that can increase heat stress.



(Source: World Health Organization and World Meteorological Organization (2025)).

International Agricultural Workers

At the confluence of the last two vulnerable populations, outdoor workers and immigrants, international agricultural workers including migrant and seasonal farm workers, are more susceptible to heat than other workers because poverty, an aging population, limited health insurance coverage and illegal working authorizations can exacerbate their vulnerability in addition to their physical exposures to heat (Zhang et al., 2016). These challenges are further compounded by the fact that workplace heat is difficult to mitigate in agriculture as artificial cooling or shadowing toward the sun would be detrimental to growth or directly harmful for the plants (Ioannou et al., 2017). In addition, Periods of extreme heat can exacerbate pre-existing physical and mental health conditions such as psychiatric conditions, renal, cardiovascular and respiratory diseases, particularly for migratory seasonal farm and agricultural workers with limited access to healthcare services and coping resources (Sharma &

Anikeeva, 2025). Migrant farm workers often work long days during the hot summer months, have limited control over their work schedule and job tasks and are not properly trained in heat-stress preventive measures (Kjellstrom et al., 2019). They also generally live in housing with no or inadequate cooling facilities, increasing their susceptibility to heat stress (Zhang et al., 2016; Sharma & Anikeeva, 2025).

In addition, immigration status may increase vulnerability to labor abuses, while language barriers, discrimination, lack of knowledge and poor social support contribute to precarious employment (Zhang et al., 2016; Ornek et al., 2022). Some studies show an association between precarious employment and physical health problems such as musculoskeletal issues, cardiovascular diseases, occupational accidents and Injury. It also has an influence on mental health problems, including depression, anxiety, stress, suicidal ideation, sleep issues and burnout (Ornek et al., 2022). In Canada, over 77,000 temporary foreign workers were employed in agriculture and agri-food sectors in 2025 (Statistics Canada, 2026); however, comparable data on international agricultural workers are not available for Southern Ontario. The literature on immigrant farm workers' vulnerability to extreme heat is well established; however, there remains a need for further research specifically investigating the mental health impacts of heat on immigrant farm workers in Canada, particularly in Southern Ontario.

People Living Below the Poverty Line

Poverty, defined as the lack of resources, means, choices, and power to maintain a basic standard of living and participate fully in society, is a key factor that increases individuals' and households' vulnerability to climatic shocks and stresses (Government of Canada, 2018; Leichenko & Silva, 2014). Poorer individuals often live in socially and materially disadvantaged areas with higher exposure to heat and humidity, rely on climate-sensitive sectors (e.g., agriculture, forestry, fishing, pastoralism) or low-income informal or hourly jobs, have fewer assets and alternative livelihood options, less access to adaptation knowledge, and limited protection against climate-related employment disruptions (Bélanger et al., 2014; Leichenko & Silva, 2014). Lower socioeconomic status is also linked to poorer-quality housing, lack of air-conditioning and other risk factors for heat-related mortality (WHO, 2004).

Poverty also increases the risk of mental illness through heightened stress, social exclusion, decreased social capital, malnutrition, violence, and trauma, while mental illness can increase the likelihood of remaining in poverty through reduced productivity, health expenditures, stigma, and job loss (Lund et al., 2011). Globally, research has demonstrated that low-income populations are more exposed to and less equipped to cope with climate-related risks, including extreme heat. However, there remains a significant research gap in understanding how heat exposure specifically affects the physical and mental health of individuals living below the poverty line.

Based on calculations derived from the 2021 Census, in Southern Ontario 8.37 per sent of the population is considered to live in poverty, which is slightly higher than in Ontario (8.29 per cent) and Canada (8.07 per cent) (Statistics Canada, 2021). Given this context, further research is needed to assess how rising temperatures and extreme heat exacerbate health challenges among low-income populations in this region.

People Experiencing Homelessness

Homelessness encompasses a range of living situations, including rough sleeping, shelter residence, and insecure or inadequate housing. These conditions place people experiencing homelessness (PEH) among the populations most exposed to weather conditions and the social and economic impacts of climate change (Kidd et al., 2021). Evidence suggests that individuals without stable housing experience unique vulnerabilities during extreme heat events due to prolonged exposure to outdoor environments, limited access to cooling resources and a high prevalence of underlying health conditions, increasing their risk of physical and mental health consequences (Noor et al., 2025; Smith et al., 2026; Kidd et al., 2021). PEH experience a substantial burden of communicable diseases, with studies reporting elevated prevalence of conditions such as tuberculosis, hepatitis C, HIV and other sexually transmitted infections. In addition, chronic health conditions, including diabetes, hypertension, and cardiovascular, respiratory, kidney and endocrine disorders, are common within this population and may further increase vulnerability to adverse health outcomes during periods of extreme heat (Bedmar et al., 2022 & Smith et al., 2026).

Homelessness also amplifies poor mental health. For example, the chronic stress and instability associated with homelessness can exacerbate pre-existing psychiatric conditions and contribute to a range of adverse psychological outcomes, including anxiety, depression, bipolar disorder, post-traumatic stress disorder, fear, sleep disturbances and increased substance use (Diduck et al., 2022 & Canadian Observatory on Homelessness, n.d.). It is important to highlight the reciprocal relationship between homelessness and mental illness, as individuals with psychiatric disorders are more likely to experience housing instability and homelessness (Diduck et al., 2022). Substance use further compounds these challenges, given its high prevalence among homeless populations, with alcohol and heroin reported as the most used substances (Coombs et al., 2024). The interconnected nature of mental illness and addiction is underscored by Canadian evidence indicating that approximately 20 per cent to 25 per cent of people experiencing homelessness live with concurrent disorders involving severe mental illness and substance dependence (Canadian Observatory on Homelessness, n.d.). Moreover, exposure to extreme heat may exacerbate the symptoms of existing mental health conditions while compounding the health risks associated with substance use (Smith et al., 2026).

Although the true extent of homelessness remains difficult to quantify, recent estimates suggest that approximately 318 million people worldwide experience homelessness (UN-Habitat, 2025). Given the growing housing and homelessness challenges across Canada, including in the province of Ontario (Ontario Human Rights Commission, 2025), and the heightened vulnerability of PEH to extreme heat, a better understanding of heat-related health outcomes is required. Research examining the physical and mental health consequences of heat exposure among PEH remains limited, particularly in the Canadian and Southern Ontario contexts.

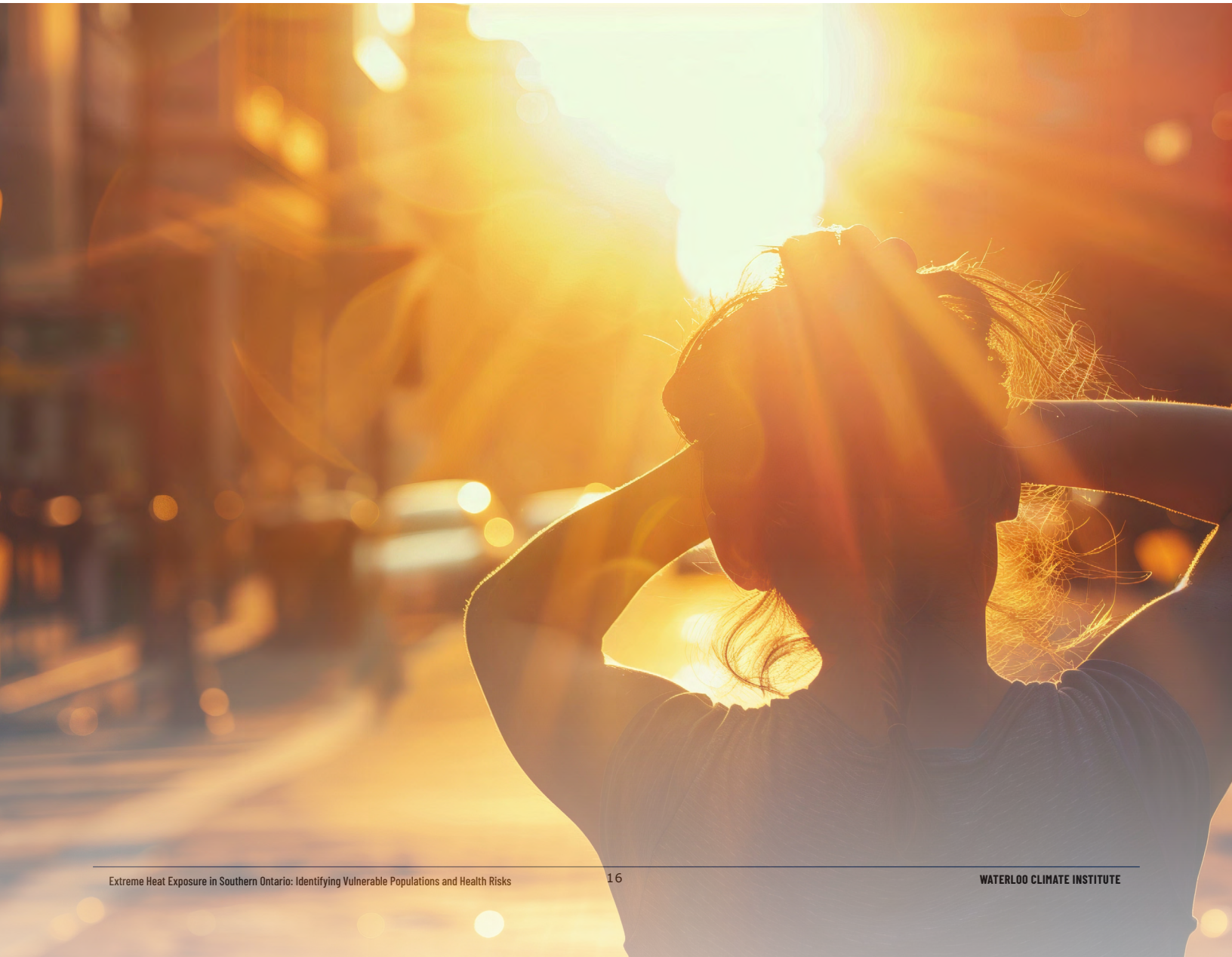
Socially Isolated Populations

Social isolation refers to a lack of connection with social networks and support systems, which can limit access to resources that promote health and protect individuals from health risks (Kafeety et al., 2020). Social isolation has been linked to adverse effects on the cardiovascular, immune and neuroendocrine systems, as well as negative mental health outcomes, including the exacerbation of depression, anxiety and suicidal ideation. These effects can reduce individuals' ability to cope effectively during emergencies (Shankar, 2023; Lubik & Kosatsky, 2019).

Social isolation has been identified as an important risk factor for heat-related morbidity and mortality, with individuals living in conditions of isolation facing heightened vulnerability during periods of extreme temperature (McGeehin & Mirabelli, 2001; Lai-Yi Wong et al., 2025). For example, among heat-related fatalities during the 2003 Paris, France heat wave, social isolation was a prominent characteristic, with most individuals living alone and many having limited family, social or community connections (Poumadère et al., 2005). Another study examining the 1995 Chicago, United States, heat wave found that people, particularly older adults who lived alone and lacked social networks, as well as those with debilitating conditions, were at elevated risk during heat emergencies (Semenza et al., 1996). A more recent study found that higher ambient temperatures were independently associated with increased odds of social isolation among older adults residing in the urban community of Hong Kong (Lai-Yi Wong et al. 2025) .

In Canada, the risk of isolation and social exclusion may be particularly high among populations experiencing other forms of marginalization and vulnerability, including older adults, Indigenous peoples, low-income individuals, people with physical or mental health conditions, newcomers and immigrants, visible minorities, LGBTQ2S+ individuals, those experiencing housing insecurity, and single-parent families (Lubik & Kosatsky, 2019). These groups often face social, economic and structural barriers that can limit social participation and increase isolation (Lubik & Kosatsky, 2019). Data from the 2008/09 Canadian Community Health Survey–Healthy Aging indicated that 12 per cent of Canadians aged 65 years and older experienced subjective social

isolation and 24 per cent had low levels of social participation, with subjective isolation being more prevalent among women than men (Gilmour & Ramage-Morin, 2020). Despite growing evidence on the prevalence and determinants of social isolation, there is limited research examining the health impacts of heat exposure among socially isolated populations in Canada and globally, highlighting a critical knowledge gap in the literature.

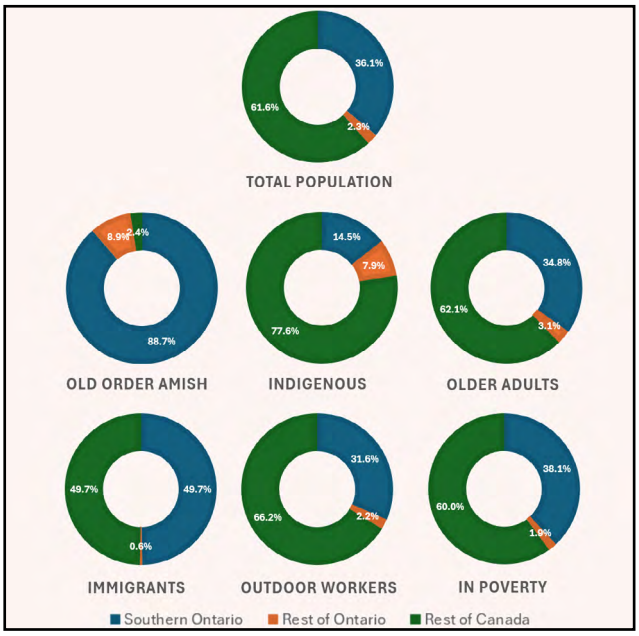


Conclusion

This brief provides a summary of marginalized populations in Southern Ontario who are particularly vulnerable to extreme heat and examines their physical and mental health risks. The review underscores that heat vulnerability is often shaped by overlapping and intersecting factors. Multiple social, demographic, physiological and environmental conditions can interact to compound the health risks associated with extreme heat. Overall, Southern Ontario is home to a significant proportion of populations identified as particularly vulnerable to extreme heat (Figure 3).

This geographic clustering underscores the reality that the impacts of extreme heat are not evenly distributed and are likely to be intensified in Southern Ontario, placing a disproportionate burden on already at-risk communities. To address both decision makers and community facing practitioners, the brief synthesizes evidence to support the identification of heat-related vulnerabilities and inform future planning and decision making. It provides evidence-informed insights that can help stakeholders identify at-risk groups, understand the mechanisms underlying vulnerability, and consider social, physiological, mental health and environmental dimensions when developing future heat interventions and response strategies.

Figure 3: Regional Distribution of Total Population, OOA, Indigenous, Older Adults, Immigrants, Outdoor Workers, and In-Poverty Populations Across Southern Ontario, Rest of Ontario, and Rest of Canada.



Future work

Future research should further explore how extreme heat affects the physical and mental health of vulnerable populations in Canada and identify strategies to enhance resilience and reduce health risks among these groups.

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Supplementary

Amish Population in Canada by Province, Census Division and Settlement, 2025

PROVINCE	CENSUS DIVISION	SETTLEMENT	SETTLEMENT DATE	DISTRICTS	ESTIMATED POPULATION
New Brunswick	Victoria	Perth-Andover/ Carlingford	2015	1	150
Ontario	Algoma	Iron Bridge	2008	1	130
Ontario	Bruce	Kincardine/ Tiverton	1995	2	265
Ontario	Bruce	Lucknow	1973	9	900
Ontario	Elgin	Aylmer	1953	4	670
Ontario	Grey	Chesley	1979	3	315
Ontario	Grey	Chesley/ Desboro/ Owen Sound	1954	4	600
Ontario	Hastings	Eldorado	2018	1	35
Ontario	Hastings	Stirling	2005	2	260
Ontario	Kawartha Lakes	Lindsay/ Cameron	1998	1	60
Ontario	Leeds-Grenville	Mallorytown	2021	1	60
Ontario	Manitoulin	Manitoulin Island	2014	2	60
Ontario	Oxford	Norwich	1954	5	730
Ontario	Parry Sound	Port Loring	2024	1	15
Ontario	Parry Sound	Powassan	2001	1	130
Ontario	Perth	Milverton	1824	12	1350
Ontario	Southwest Middlesex	Wardsville	2023	1	15
Ontario	Timiskaming	Englehart/ New Liskeard	2009	2	235
Ontario	Wellington	Greenbush/ Harriston	1996	2	95
Prince Edward Island	Kings	Cardigan/ Dundas	2016	1	95
Prince Edward Island	Kings	Mt. Stewart/ Montague	2016	2	210

Source: Young Center for Anabaptist and Pietist Studies. (2025). Amish population, 2025. Elizabethtown College. Retrieved from https://groups.etown.edu/amishstudies/files/2025/06/Amish-Pop-2025_by-state-and-county.pdf

Population and Demographic Characteristics of Canada, Ontario and Southern Ontario, 2021 Census

-	Total Population	Men	Women	single-parent women+	Indigenous	19 years and under	65 years and over	Immigrants	Working in agriculture, forestry, fishing and hunting and construction
Canada	36,991,980	18,226,240	18,765,740	1,302,670	1,807,250	8,025,770	7,021,430	8,361,505	1,903,885
Ontario	14,223,945	6,970,855	7,253,085	538,450	406,585	3,053,250	2,637,710	4,206,585	643,235
Southern Ontario	13,367,750	6,545,645	6,822,115	470,275	262,975	2,218,655	2,441,645	4,156,940	600,670

Source: Statistics Canada (2021)

Population and Demographic Characteristics of Southern Ontario by County, 2021 Census

County	Total Population	Men	Women	single-parent woman+	Indigenous	19 years and under	65 years and over	Immigrants	Working in agriculture, forestry, fishing and hunting and construction
Brant	144,770	71,105	73,665	5,975	6,840	33,130	27,925	20,240	7,560
Bruce	73,400	36,355	37,040	1,840	3,210	15,375	19,100	5,505	6,385
Chatham-Kent	104,320	51,370	52,945	4,000	4,565	22,425	24,600	9,245	7,515
Dufferin	66,260	32,775	33,480	2,235	1,395	16,290	10,560	10,515	5,155
Durham	696,990	340,460	356,535	28,895	13,795	168,175	111,080	186,460	33,240
Elgin	94,750	46,735	48,020	3,225	2,045	22,655	19,325	10,920	7,085
Essex	422,860	209,950	212,915	16,980	12,055	94,655	81,620	96,940	20,255
Frontenac	161,780	79,015	82,770	5,675	6,680	31,420	35,330	19,375	6,210

County	Total Population	Men	Women	single-parent woman+	Indigenous	19 years and under	65 years and over	Immigrants	Working in agriculture, forestry, fishing and hunting and construction
Grey	100,905	49,770	51,135	2,980	2,570	20,360	26,630	8,455	8,240
Haldimand-Norfolk	116,875	58,015	58,860	3,545	4,135	25,190	27,585	11,380	9,840
Haliburton	20,570	10,475	10,100	530	700	2,600	7,250	1,640	1,565
Halton	596,640	290,330	306,310	18,295	5,890	152,810	95,485	201,665	20,540
Hamilton	569,350	279,640	289,715	23,985	12,520	123,035	104,290	145,550	24,635
Hastings	145,745	71,870	73,880	5,500	10,640	29,025	35,115	11,310	7,345
Huron	61,370	30,360	31,005	1,550	1,140	13,640	15,870	4,200	7,380
Kawartha Lakes	61,370	30,360	31,005	2,480	2,210	13,965	22,355	6,100	6,140
Lambton	128,155	63,170	64,980	4,350	6,030	26,245	31,455	12,195	9,410
Lanark	75,760	37,045	38,715	2,310	3,245	15,020	19,070	4,940	5,515
Leeds & Grenville	104,070	50,910	53,160	3,330	3,540	19,335	27,615	7,505	6,705
Lennox & Addington	45,180	22,660	22,520	1,475	2,370	8,830	11,125	2,900	2,910
Middlesex	500,565	245,305	255,255	19,115	12,725	111,740	90,625	110,805	23,560
Niagara	477,940	232,715	245,225	19,040	13,960	95,875	111,345	83,005	25,230
Northumberland	89,365	43,805	45,560	2,875	3,095	15,665	26,015	9,260	5,635
Ottawa	1,017,445	496,045	521,405	35,065	26,395	227,305	172,150	259,215	30,535
Oxford	121,780	60,155	61,625	3,770	2,775	28,895	24,390	13,670	9,310
Peel	1,451,025	718,215	732,805	54,755	7,430	333,245	212,630	745,330	50,120
Perth	81,565	40,060	41,505	2,315	1,235	19,185	17,235	7,310	7,935
Peterborough	147,680	71,560	76,120	5,360	7,095	28,410	37,275	12,590	8,130
Prescott & Russell	95,640	47,350	48,290	2,715	795	21,005	19,135	5,335	7,520
Prince Edward	25,700	12,480	13,220	645	795	3,920	8,605	2,510	1,760
Renfrew	106,365	53,180	53,185	3,285	9,045	22,055	24,690	5,690	6,260
Simcoe	533,170	262,935	270,235	19,090	24,545	116,295	105,920	82,290	34,765

County	Total Population	Men	Women	single-parent woman+	Indigenous	19 years and under	65 years and over	Immigrants	Working in agriculture, forestry, fishing and hunting and construction
Stormont, Dundas & Glengarry	114,635	56,500	58,140	4,105	4,940	23,780	27,825	7,770	7,515
Toronto	2,794,355	1,350,865	1,443,490	127,560	22,925	519,105	476,985	1,286,140	85,600
Waterloo	587,165	292,390	294,775	20,165	9,960	137,070	91,295	147,190	27,040
Wellington	241,025	118,460	122,565	7,295	3,810	55,465	42,955	44,765	15,030
York	1,173,335	572,235	601,100	39,395	5,875	267,055	199,185	557,025	51,095

Source: Statistics Canada (2021)

Poverty Statistics in Canada, Ontario and Southern Ontario (2020)

-	Poverty status - applicable (2020)	In poverty (2020)	Poverty rate
Canada	35,838,140	2,895,025	8.07
Ontario	13,977,130	1,158,845	8.29
Southern Ontario	13,180,275	1,103,585	8.37

Source: Statistics Canada. (2023). Table 98-10-0130-01: Low income statistics by census metropolitan area, census agglomeration and economic region. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810011301

Poverty Statistics in Southern Ontario by County (2020)

County	Poverty status - applicable (2020)	In poverty (2020)	Poverty rate
Brant	141,905	8,785	6.2
Bruce	70,725	4,195	5.9
Chatham-Kent	101,765	7,420	7.3
Dufferin	65,490	3,225	4.9
Durham	691,235	36,235	5.2
Elgin	93,420	5,205	5.6
Essex	415,725	30,980	7.5
Frontenac	158,230	13,280	8.4
Grey	99,160	6,540	6.6
Haldimand-Norfolk	114,790	5,460	4.8
Haliburton	20,260	1,395	6.9
Halton	589,770	34,590	5.9
Hamilton	560,915	43,325	7.7
Hastings	140,655	10,340	7.4
Huron	60,245	3,900	6.5
Kawartha Lakes	77,230	4,210	5.5
Lambton	124,175	7,190	5.8
Lanark	74,290	3,620	4.9
Leeds & Grenville	102,365	5,685	5.6
Lennox & Addington	43,125	2,590	6.0
Middlesex	493,335	46,915	9.5
Niagara	469,455	33,755	7.2
Northumberland	86,740	4,375	5.0
Ottawa	1,000,940	82,365	8.2
Oxford	120,265	5,990	5.0
Peel	1,439,075	123,660	8.6
Perth	80,125	4,220	5.3
Peterborough	143,260	10,700	7.5
Prescott & Russell	93,720	4,400	4.7
Prince Edward	25,190	1,340	5.3
Renfrew	103,095	5,740	5.6
Simcoe	523,385	30,345	5.8
Stormont, Dundas & Glengarry	112,235	7,670	6.8
Toronto	2,761,290	348,500	12.6
Waterloo	579,385	45,505	7.9
Wellington	237,925	14,155	5.9
York	1,165,380	95,780	8.2

Source: Statistics Canada. (2023). Table 98-10-0130-01: Low-income statistics by census metropolitan area, census agglomeration and economic region. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810011301