Assessment of Health Vulnerability from Climate Change for Oxford County, Elgin County, and the City of St. Thomas

Prepared by:
Waterloo Climate Institute – University of Waterloo

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Table of Contents

About This Report

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Abbreviations

CIW - Canadian Index of Wellbeing

COPD - Chronic obstructive pulmonary disease

CSWB - Community Safety and Well-being Plan (Aylmer-Elgin-St. Thomas)

ED - Emergency department

GCMs - Global climate models

GIS - Geographic Information Systems

HEPP - Healthy Equity and Priority Populations

IPCC - Intergovernmental Panel on Climate Change

LGBTQ2S+ - Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, and Two-spirit

LGS - Low German Speaking Mennonite Communities

LIM-AT - Low-income measure after tax

NAPS - National Air Pollution Surveillance

NbS – Nature-based solutions.

NFB - Nutritious Food Basket

OHIP - Ontario Health Insurance Plan

PHO - Public Health Ontario

PTSD - post-traumatic stress disorder

RGI - Rent-geared-to-income

SPCO - Social Planning Council of Oxford County

SSP - Socio-economic pathway

SWPH - Southwestern Public Health

UV/UVR - Ultraviolet radiation

How to Read This Document

This report describes several key areas of the assessment of climate change and health vulnerability to support the development of adaptation options for Oxford County, Elgin County, and the City of St. Thomas.

The report is structured according to three goals. First, it begins by outlining the current landscape of the Southwestern Public Health (SWPH) region. This includes past climate impacts, demographics, and the existing built, social, and economic landscapes. Additionally, the report summarizes adaptation planning and practices from the literature and other public health units in Ontario to identify important trends, gaps and lessons learned. Second, it provides an overview of localized climate projections that are anticipated to impact the SWPH region. With a focus on addressing equity, vulnerable populations within the SWPH region are identified with information that elucidates how climate change exacerbates their vulnerabilities. Third, the report incorporates input from both internal (to SWPH) and external advisory groups, and evidence-based activities from the literature, to present recommended actions for health resilience and climate adaptation. These recommendations are organized into two groups: activities for SWPH to consider; and, activities for external partners and organizations to consider.

The authors encourage partners to use the evidence presented in this report to further support the development of climate change adaptation and mitigation initiatives and consider how the health impacts of climate change can be reduced through appropriate community actions.

Executive Summary

In the past two decades, climate science established with high confidence that the rise in global temperatures, as highlighted by the Intergovernmental Panel on Climate Change (IPCC), has contributed to a changing climate. As a result, a wide array of rapid-onset extreme weather events such as forest fires, severe storms, and floods, have increased in intensity and frequency. Alongside these events, there is also an increase in slower-onset natural hazards including the spread of disease vectors, droughts, and elevated temperatures.

These accelerated changes in the climate system have intensified impacts on communities and are expected to continue to pose significant risks to human health and well-being. Public health units play a critical role in reducing climate-related health risks, and addressing these risks requires a focus on enhancing the resilience of communities and systems through adaptation strategies. To better understand these risks and vulnerabilities specific to health, public health agencies across Canada and the world are conducting climate change and health vulnerability assessments. The data and evidence in these reports help to inform public health action.

Climate change projections and climate-related health impacts in southern Ontario

Southern Ontario has already witnessed notable climate changes over the past two decades, including an increase in the average annual air temperature in the province of between 1 to 1.5°C over the past century (Ministry of the Environment, Conservation, and Parks, 2023).

Given these changes to the regional and global climate, and the resulting impacts the region is already experiencing, and which will intensify, SWPH in collaboration with the University of Waterloo's Climate Institute, has conducted an assessment of the vulnerability of communities in the region to the health impacts of climate change. This report summarizes this assessment, which drew on a comprehensive review of existing climate change health vulnerability assessments in the province, academic literature, partner engagements, and expert contributions to analyze and present recommendations.

The report outlines various projected climate change impacts in the region, including extreme temperatures, extreme weather events, vector-borne diseases, air quality, and ultraviolet radiation. For example, a recent review by SWPH indicates that by the 2080s, Oxford and Elgin Counties and the City of St. Thomas can expect a significant increase in the number of days surpassing 32°C, which pose serious heat-related risks to the community, underscoring the need for prevention and preparedness in the region. Rising temperatures and shifting precipitation patterns have already led to an increase in the frequency of forest fires during the summer months and to seasonal changes in air quality.

Moreover, the likelihood of winter floods, slippery conditions, and flash freeze events is expected to rise due to increased precipitation during the colder months, particularly in heavy rainfall events. It is projected that Oxford and Elgin Counties and the City of St. Thomas could experience an increase in extremely wet days, from the baseline of 8 days to 11 days by the 2080s, heightening the risk of flooding and its impacts on communities.

Additionally, indirect climate-associated changes, such as the increased presence of vector-borne and zoonotic diseases, are anticipated to pose risks to public health in the region, leading to an increase in diseases like Lyme disease and West Nile Virus (WNV).

A growing body of knowledge and experience is showing that climate change is impacting psychosocial health, including creating anticipatory fear before disasters and through post-disaster trauma, and a growing sense of loss, sorrow, grief and abandonment (Van Susteren, L., and Al-Delaimy, 2020; Miller et al., 2023). New evidence has also shown other harmful outcomes, including direct links between increased high temperatures and the number of suicides (Lawrance et al., 2021). These impacts and the approaches to addressing them are an important focus of this assessment.

Vulnerable populations

These climate change-associated hazards and environmental changes present a series of health risks, particularly affecting vulnerable populations. The impacts of climate-related health risks are not experienced equally by all populations. The report identifies vulnerable populations in the SWPH region such as Amish communities, immigrants, Indigenous communities, older adults, those experiencing homelessness, and others, who may experience heightened susceptibility to climate-related health risks. This is due to a combination of factors, such as elevated levels of exposure from working conditions, limited access to health resources and advice in different languages, age or structural barriers which have historically left populations vulnerable to the different impacts.

Adaptive Actions

SWPH has already initiated actions to address climate-related health impacts and reduce risks through strategic collaboration with a wide array of partners across the public, private, and non-profit sectors. Collaborations with groups such as Health Equity Partners, the Social Determinants of Health Nurses Group, and the Low German Speaking Mennonite Community of Practice aim to reach individuals living in vulnerable conditions in the region. Furthermore, the implementation of initiatives, such as tracking heat and cold-related emergency visits and hospitalizations, as well as the establishment of RAVE Alerts, an early warning system, demonstrates a proactive approach to protect vulnerable residents.

Recognizing the importance of social connectivity in building social capital, SWPH actively participates in local community and neighbourhood groups, councils, and coalitions to enhance social connections. Efforts are underway to develop a Priority Populations Engagement Strategy focusing on specific populations, such as older adults, to address health inequities.

Actionable recommendations

Considering climate change projections for the region and the growing intensity of changes already taking place, there is a pressing need for further action. Through a review of provincial health assessments, a series of stakeholder engagements, and contributions from experts, several recommendations were identified that can strengthen coordination internally as well as externally to improve communication and strategically support climate action.

Seven recommendations were mapped, with a list of over 100 concrete activities, to chart the course for action for SWPH and local partners for the implementation of climate adaptation strategies and approaches aimed at reducing health risks from a changing climate.

1. **Develop a comprehensive and co-produced risk reduction and prevention strategy for extreme weather conditions**. The strategy would encompass all climate-related natural hazards, including extreme heat and cold temperatures. It would incorporate a specific inventory of everyday actions to reduce health risks for vulnerable populations. It would also outline a partnership roadmap and objectives to support action plans.

2. **Review and enhance coordination mechanisms with area municipalities on land use planning**. SWPH would undertake a systematic and rigorous assessment to determine where enhanced coordination would be most beneficial to support climate-related objectives. This analysis can build on the risk reduction and prevention strategy for extreme weather and serve as an avenue to pilot solutions that will help strengthen and refine intra-organizational coordination mechanisms.

3. **Build and strengthen partnerships with agencies, organizations, and individuals beyond jurisdictional boundaries**. SWPH would seek to leverage a broader range of skill sets, capacities, and resources at the municipal, regional, provincial, and federal levels. These partnerships can accelerate progress on actions outlined in this report, particularly in the context of tools, expertise, technology sharing, advocacy for policy change, and harmonizing relevant policies.

4. **Create a communications plan to share up-to-date data on health risk information with recommendations**. SWPH would develop a comprehensive communication plan for the public to protect against health impacts from climate change. This includes air quality data and warnings, beach pollution data and warnings, and, heat and cold weather warnings. Communication is best when targeted and accessible, taking into account language considerations and different population sub-groups.

5. **Establish a monitoring and evaluation framework to assess the impact of climate actions and interventions**. This framework would include the establishment of baseline data on health impacts in the region and link to data on climate-related hazards. It would outline ongoing monitoring of a series of indicators that would be used to, understand risk and opportunities, track progress, and make evidence-based decisions. The framework would establish routine monitoring and evaluation with the community, including vulnerable groups, to assess impact and ensure equitable participation in climate action.

6. **Promote and advocate for social capital building activities**. SWPH would promote and advocate for activities that build the social capital of local organizations and communities to support the implementation of actions that will address many of the health risks associated with climate change, including psychosocial dimensions such as worry, anxiety, and concern for the future.

7. **Develop a climate-compatible sustainable food system strategy**. SWPH can support integrated community action toward a more resilient food system. The strategy may

include but is not limited to, developing a climate change food supply and disaster risk management plan, reducing food waste (household, schools, and community settings), supporting sustainable diets in community settings, providing knowledge exchange opportunities for community partners on the impact of climate change on food systems, and advocating for local and provincial-level policies to support sustainable food systems.

These recommendations emphasize the need for a strong focus on knowledge sharing and translation to enhance equitable climate adaptation solutions. They also highlight the importance of expanding the scope of partnerships to harness complementary skills, resources, and capacities and emphasizing the value of utilizing available tools to inform evidence-based decisions within SWPH.

This report underscores the urgency of addressing climate change impacts on health, particularly for vulnerable populations, and emphasizes the importance of proactive measures to enhance resilience and promote equity. Overall, the report serves as a vital resource for understanding and mitigating the health risks posed by climate change in the SWPH region, guiding policymakers, public health and partners in implementing effective adaptation and resilience strategies to safeguard community well-being.

I. Introduction

According to the IPCC sixth Assessment Report, the rise in global temperatures is causing an increase in the “magnitude and frequency of extreme hot events and decreased magnitude and frequency of extreme cold events”, and that the frequency of these unprecedented extreme events will rise with increasing global warming (Seneviratne et al., 2021). This has resulted in various rapid-onset extreme weather events such as forest fires, severe storms and floods, and an increase in slower-onset natural hazards such as increasing vectors of disease, droughts, and high temperatures (Seneviratne et al., 2021). This increase of climate change-associated natural hazards has resulted in more local disasters and climate related impacts, and contributed to a surge in health-related risks and morbidity rates, including heat-related illnesses, vector-borne diseases, food and waterborne illnesses, respiratory ailments from air pollution, and mental health issues stemming from extreme weather events (World Science Council, 2021; Berry et al., 2022).

Between 2003 and 2012, Ontario experienced over twenty 'disaster-level’ extreme weather events, including floods, thunderstorms, tornadoes, and winter storms (PHO 2015). According to a study in southwestern Ontario there was an overall 22% increase in emergency department visits between 2002 and 2019 when temperatures reached 33 degrees (Wilk et al., 2021). The study also identified a 35% increase in emergency department visits from gastrointestinal diseases, and hand, foot and mouth disease, predominantly among children, linked to the impact of higher temperatures.

The accelerated changes in the climate have amplified impacts on communities and will continue to pose significant risks to human health and well-being. These changes require a focus on increasing the resilience of communities and systems through adaptation strategies. Adaptation and building resilience are multi-sector challenges, and local public health agencies can play a critical role in helping communities adapt due to their embeddedness and insight into the local context of the region. Public health, alongside all levels of government, community organizations, and key partners will need to design future adaptation measures collaboratively to support broader regional resilience. This vulnerability assessment will provide a foundation to guide decision-making, planning, and implementation for the challenges faced by public health from climate change.

Purpose and Objectives:

This report aims to communicate the results of an assessment of the health vulnerability of the SWPH region to the impacts of climate change. It provides an understanding of the baseline vulnerabilities to climate change in this region, focuses on a range of climate-related health impacts on vulnerable populations, and compiles existing actions and future recommendations for SWPH to consider. Specifically, it has four main objectives:

1. Outline climate associated health risks facing SWPH region.
2. Highlight vulnerable populations in the SWPH region and the potential impacts of climate change.
3. Describe ongoing climate action undertaken by SWPH.
4. Propose recommendations to plan for future climate change impacts.

This climate change and health vulnerability assessment will help identify policies and programs that can increase the resilience of the communities, with a particular focus on those who are most vulnerable to these impacts. Additionally, the assessment and subsequent recommended actions identify a need to address the challenges that climate change poses in exacerbating social and environmental determinants of health, widening health inequities, and resulting disparities.

According to the Healthy Environments and Climate Change Guideline (Ministry of Health and Long-term Care, 2018), vulnerability assessments enhance public health capacity to address risk factors in the environment, including the impacts of climate change. This assessment will help SWPH identify opportunities to incorporate climate change action into existing functions and to develop new programming where necessary to prevent and reduce the severity of future climate-related health risks.

This report, and associated recommended actions, are a critical step in taking proactive measures to mitigate and adapt to climate change and should serve as a tool for planning with community partners to enhance resilience, promote equity, and ultimately safeguard the well-being of individuals and communities now and for future generations.

Through a better understanding of regional vulnerabilities, targeted risk reduction and climate adaptation strategies can be developed. This proactive approach is crucial for building resilience and ensuring a sustainable future for the region in the face of climate change.

Climate changes in Southern Ontario:

Southern Ontario, including the southwestern municipalities of Elgin County, Oxford County and the City of St. Thomas, has already experienced significant changes in the climate over the past two decades, resulting in a range of impacts (Douglas, A.G. and Pearson, D., 2022). While this report primarily addresses the impacts and vulnerabilities of climate change on the southwestern region of Ontario, there is limited climate data available at this scale. As a result, much of the data provided in this section is at the broader scale of southern Ontario that stretches from Windsor-Essex in the southwest, to Manitoulin Island in the north, and east to Ottawa.

Extreme weather events

The average annual air temperature in southern Ontario has increased between 1 to 1.5°C over the past century (Ministry of the Environment, Conservation, and Parks, 2023). With rising air temperatures, precipitation patterns have shifted, resulting in more rain than snow during the winter season (Ministry of the Environment, Conservation, and Parks, 2023). In southern Ontario, flooding is one of the most significant risks to the population and economy. Floods have been documented as the most frequent and costly hazard to communities and municipalities (Douglas, A.G. and Pearson, D., 2022). In 2023, parts of Ontario grappled with an unprecedented flood season, resulting in insured losses exceeding $340 million (IBC, 2023). This included a cold front in southwestern Ontario that triggered severe thunderstorms and produced tornadoes accompanied by sizable hailstones and heavy downpours, and leading to widespread flooding, causing over $30 million in insured damages (IBC, 2023). Similarly, in 2022, a fast-moving severe

thunderstorm hit southern Ontario, Quebec, and New England, causing 12 fatalities and more than $1 billion in insured losses (Pope, 2023).

In addition to the damage to the landscape from these hazards, these events contribute to increased risk of mental health impacts from climate change associated disasters such as increased anxiety, nervousness, depression, panic disorders, and post-traumatic stress disorder in the weeks and months after the disaster occurred (Steeves, 2018).

Vector-borne diseases and waterborne bacteria

In addition, slow onset events such as higher temperatures and prolonged heat waves in the region lead to favorable conditions for increases in certain vector-borne diseases and waterborne bacteria. One example includes the increase in the incidence of Lyme disease in Ontario. Cases have increased from an annual average of 313 between 2012 and 2016; to 1,756 in 2021 and 1,490 in 2022 (Public Health Ontario, 2024; Public Health Agency of Canada, 2019).

Similarly, higher temperatures can lead to an increase in algae growth and cyanobacteria blooms, which can lead to the production of toxins in freshwater sources (Berry et al., 2014), causing symptoms such as abdominal pain, nausea, vomiting, diarrhea, sore throat, and dry cough. Over the past decade, Western Lake Erie has had an increase in the intensity of harmful algal blooms due to warmer water temperatures (NCCOS, 2024).

Wildfires

The incidence of forest fires in the province has risen significantly. In 2011, approximately 120 forest fires were reported in northern Ontario, prompting the evacuation of eight First Nations communities due to smoke inhalation, food shortages, and insufficient food storage capacity (OCCIAR, 2015). According to data from the Ministry of Natural Resources and Forestry (2022), Ontario typically experiences an average of 690 fires per year over a 10-year period. In 2023, this number surged to 741 fires. This increase presents higher risk for communities and possible health impacts. In southern Ontario, the 2023 wildfire season led to decreases in air quality from wildfire smoke. This exposure can cause symptoms such as headaches, dizziness, wheezing, and heart palpitations (Public Health Agency of Canada, 2023a).

Public health considerations

The climate-related changes in southern Ontario have precipitated a cascade of challenges, including escalating flood risks and the recurrence of extreme weather events. These events take a heavy toll on not only the region's economy, but also on public health by exacerbating mental health issues and increasing the incidence of waterborne and respiratory illnesses.

As southern Ontario navigates this evolving landscape of climate-related hazards, proactive measures and comprehensive adaptation strategies will be imperative to mitigate risks, safeguard communities, and foster resilience. In the next sections, this report will present specific details on the projected climate-associated impacts and health risks for the most vulnerable populations in the SWPH region, as well as provide a series of recommendations to outline an action plan for SWPH and their partners.

II. Methodology

This section outlines the research methods utilized to conduct the assessment. It includes details on project governance, the literature review, baseline health and adaptation data, and the process for engaging key partners to provide input on the assessment.

Project Governance

SWPH works with municipalities, community agencies, health and social services, schools, and other local partners to ensure the health of the residents of Oxford County, Elgin County, and the City of St. Thomas. SWPH programs respond to public health emergencies; promote healthy lifestyles; help prevent injuries, morbidity, and disease; and promote positive change and social conditions that improve health for everyone. SWPH delivers mandated programs under the Ontario Public Health Standards and is regulated by the Ontario Health Protection and Promotion Act. SWPH is one of 34 public health units serving the province of Ontario. SWPH is funded by the Ontario Ministry of Health and local municipalities and is governed by a Board of Health.

SWPH partnered with the University of Waterloo's Climate Institute to undertake a vulnerability assessment aimed at identifying and addressing specific health vulnerabilities associated with climate change in the SWPH region. The project team and expert researchers from the University of Waterloo combined efforts with representatives from SWPH to oversee the creation of this assessment. This partnership is an example of combining capacity and expertise through interdisciplinary collaboration to better understand climate-related health risks and develop evidence-based recommendations for addressing these risks and contributing to broader climate change adaptation and mitigation strategies.

The assessment gathered data and insights to draft a roadmap for informed decision-making in addressing climate-related health challenges. The research design and assessment process included: a comprehensive review of existing health vulnerability assessments in the province, an academic literature review, a series of facilitated discussions with SWPH staff and regional representatives, and expert contributions to the analysis and recommendations presented in the report.

Literature review

A comprehensive literature review was conducted, including a review of existing climate change and health vulnerability assessment reports, grey literature, and scholarly peer-reviewed articles. The peer-reviewed literature was scrutinized for examples of climate change adaptation activities undertaken in similar jurisdictions. The climate change impacts review involved a high-level systematic examination of academic literature, public health data, and climate change datasets to investigate the current climate change and health impacts in Ontario, with a particular focus on southwestern Ontario. The review aimed to establish an understanding of the key climate change hazards affecting the region and their associated health impacts.

A total of 13 climate change and health vulnerability assessments were reviewed, encompassing 20 health units within Ontario. The publication dates for the reports assessed ranged from 2012 to 2022 (See Appendix B for a summary of this analysis).

Climate projections for this assessment were informed by the SWPH Climate Science Report (See Appendix A), which was compiled through a separate project conducted by SWPH. Projections were collected for the regions of Oxford County, Elgin County, and the City of St. Thomas for extreme temperature, precipitation, air quality, and ultraviolet radiation in May 2023.

Internal and External Advisory Committee Engagement

In addition to the literature review, this report was informed by an internal and external advisory committee involving representatives from various local organizations and staff from SWPH working in climate change-relevant program areas. To facilitate discussion, the results of the literature review and existing vulnerability assessments in Ontario were shared, along with climate projection data for the region. The internal and external advisory committees provided input and feedback on possible actions, identified vulnerable populations, and informed the final recommendations. A total of 22 individuals from different local organizations participated in the multiple sessions (See Appendix E and F). A list of activities was generated through input from the advisory committee and through reviews of the scientific literature and best practices. The facilitated discussion also helped to identify priorities and gaps that would inform the development of an overarching series of recommendations.

The process was guided by three main criteria used to evaluate the actions, including:

- suitability (or fit) of the action for the region;
- how well the action addresses local needs; and
- the potential impact of the action on reducing vulnerability.

The engagement process emphasized the need for a strong commitment to equity, the importance of considering inequities in addressing climate change vulnerability and identifying recommendations that are actionable and tangible.

Expert Review and Contributions

Academic experts in climate change adaptation, disaster risk reduction and public health were enlisted to provide expert review and contribute specialized knowledge to ensure the robustness and accuracy of the assessment. These experts provided insights, validated findings, and contributed their expertise to enhance the overall quality of the report.

Limitations

This report has taken an evidence-based approach. There are some limitations to the report that should be taken into consideration when reviewing its contents.

Literature review limitations

The climate change and health vulnerability assessments that were reviewed do not include all vulnerability assessments conducted in Ontario, as the collection of assessments relied on the availability of documents and willingness to share if assessments were not public.

Internal and external advisory committee engagement limitations

While the external advisory group represents various organizations relevant to the natural, economic, social, and built environments of the SWPH region, and individuals who work in climate change-relevant areas, the number of committee members is limited, due to the timeframe of the project.

In addition, not all committee members were able to attend all meetings. To address this, opportunities were provided for committee members to provide feedback via email.

During the second meeting with both the internal and external committees, recommendations were collected on a virtual platform that remained open for 48 hours after the meeting to allow for input from those not present. All recommendations were inputted anonymously, and as such, ideas cannot be attributed to specific participants.

Data limitations

The information presented in this report captures the best available data present at the time of writing and therefore should be taken into consideration while reading. Health data does not always capture data directly related to climate hazards. Yearly data and trends from health data help illustrate impacts experienced from climate-related health risks. In addition, health data was not always present for the exact geographic location covered by SWPH. Larger databases for the province and area help to inform the findings of this report.

III. Impacts and Health Risks of Projected Changes in the Climate

The Climate Science Report prepared for SWPH in 2023 (Abedin, 2023) outlines in detail the changes projected in the region over the next several decades. These include shifts in temperature, precipitation patterns, and extreme weather events.

This section summarizes the main changes in the climate in southwestern Ontario (for a full description of these changes, the reader is directed to the SWPH Climate Science Report (Abedin, 2023)). In addition, this section presents the risks and human health-related impacts posed by climate change.

Extreme Temperatures

Extreme heat

The global surface temperature has risen by an average of 0.06 C per decade since the 1850s and accelerated three times as fast (0.20C) per decade (NOAA, 2022). The Climate Science Report indicated it is expected, that by the 2080s, Oxford County, Elgin County and the City of St. Thomas, will experience a significant rise in the number of days surpassing 32C. By the 2080s it is expected that Oxford County will have 55 annual days surpassing 32C, which is 52 more days than the baseline of 3 days experienced now. Similarly, Elgin County and the City of St. Thomas will have 51 days surpassing 32C, which is 49 days more than the baseline of 2 days. These findings emphasize the importance of readiness and preparedness in the study region, as it needs to adapt to a future where sustained extreme high temperatures will become increasingly regular during the summer.

Extreme heat can be experienced both temporally and spatially, therein increasing exposure and associated health risks. Examples include:

- heat waves: comprising of multiple days of extreme heat in succession.
- urban heat island profile: attributable to a large excess in heat from the rapidly heating urban surfaces consisting of buildings, asphalt, bare-soil and short grasses.
- extreme heat: temperature thresholds for heat warnings in southern Ontario are 31 degrees C during the day, and 20 to 21 degrees C in the evening for two or more consecutive days (Public Health Ontario, 2023).

Rising temperatures have an impact on air pollution, water security, and the spread of vector-borne diseases across geographical areas (Berry et al., 2022). High temperatures can significantly influence various health consequences, including heat-related morbidities/illnesses, and can occur as a result of both local environmental changes and global climate change. Heat-related morbidities can develop quickly, have a negative impact on long-term health, and even be fatal (Mora, 2017).

Extreme heat can worsen pre-existing medical conditions like cardiovascular and respiratory diseases, raise the risk of stroke, and make people more vulnerable to infectious diseases (Smoyer-Tomic and Rainham, 2001; Health Canada, 2020). Prolonged exposure to excessive heat can cause dehydration, heat exhaustion, heat stroke, heat edema, reduced coordination, fatigue, nausea and worsen respiratory morbidities/illnesses (Gauer and Meyers, 2019). Moreover, extreme temperatures are associated with deteriorating mental health and an upsurge in violent incidents.

Extreme cold

As described in the Climate Science Report prepared for SWPH in 2023, the occurrence of extreme cold days with minimum temperatures below -15C is declining (Abedin, 2023). Across Oxford County, Elgin County and the City of St. Thomas, the total number of extreme cold days is expected to decrease in all three emission scenarios from 2040 to 2099. Extreme cold days in Oxford County will decline to 0 days by the 2080s, which is 14 days less than the baseline. Similarly, Elgin County and the City of St. Thomas will have zero days in the 2080s with minimum temperatures below -15C (Abedin, 2023).

Similarly, the number of frost days (minimum temperatures below 0C) are expected to decline by up to 70 days by the 2080s under the emission scenarios in Oxford County and decline by 73 days to 55 days in Elgin County and the city of St. Thomas respectively, from the baseline of 128 days. Frost and ice days help in understanding the patterns of freezing and thawing in each region and the risks involved, such as the likelihood of accidents and injuries brought on by icy conditions, including traffic collisions.

While extreme cold days will become less frequent in the coming years, it remains crucial to prepare for and manage the potential health impacts associated with extreme cold conditions. Extreme cold can result in frostbite, hypothermia, and the potential aggravation of pre-existing medical conditions.

Declining cold temperature days (and increased temperatures overall) could result in increased tick population survival and spread, and related spread of tick-borne diseases, as tick activity period lengthens along with increases in tick reservoirs and hosts, and increased length of human exposure periods (Bouchard et al., 2019).

Extreme Weather Events

Ontario is subject to extreme weather events such as storms, floods, and droughts. The SWPH Climate Science Report refers to an extreme weather event as a meteorological occurrence that surpasses the typical range of activity, and is rare in a particular place and season, such as a severe storm, hailstorm, tornado, heatwave, or flood (Abedin, 2023).

It is expected that in Ontario there will be an increase in total precipitation annually by the 2080s. Most of this increase will take place during the spring, fall and winter seasons and it will decrease in summer. By the 2080s, it is anticipated that Oxford County's baseline average of 914 mm will increase to between 991 mm and 1018 mm (Abedin, 2023). The Elgin County and City of St.

Thomas baseline average of 915 mm is predicted to rise to between 1000 mm and 1024 mm by the 2080s, indicating that both regions will see an increase in total precipitation (Abedin, 2023).

In Oxford County, one-day accumulations of precipitation are projected to increase from the baseline of 41.1mm to 49.4mm by the 2080s, while five-day accumulations are expected to increase from the baseline of 69.6mm to 83.5mm. Elgin County and the City of St. Thomas are also anticipated to experience an increase in the maximum five-day events from a baseline of 71.3 mm to 77mm in the 2050s and 84.2 mm in the 2080s (Abedin, 2023).

The possibility of winter floods, slippery conditions, and flash freeze events is expected to rise due to increased precipitation during the colder months, especially heavy rainfall events. This will lead to extremely wet days when total precipitation (rain and snow) is equal to, or more, than 20 millimeters. It is anticipated that for the SWPH region, extremely wet days will increase from the baseline of 8 days to 11 days by the 2080s (Abedin, 2023).

The direct impacts on health from extreme weather events can include non-communicable diseases such as, respiratory, and cardiovascular diseases, and mental health impacts, as well as injuries, and mortality (Berry et al., 2022). Severe flood events can increase the risk of disease outbreaks linked to contaminated drinking water as runoff and storm water overflow can increase contaminants in surface water (Gosselin et al., 2022). Outbreaks of food and water-borne illnesses are more likely to increase as a result of the combination of hotter, drier summers and intense precipitation events (Berry et al., 2022).

Poor Air Quality

Air quality measurements conducted in Canada and Ontario over the past few decades have shown notable decreases in harmful air pollutants attributed to emissions from vehicles and industries. However, air quality is subject to fluctuations on an annual basis due to multiple factors including, pollutant emissions, weather conditions, extreme events such as forest fires, and the transport of air pollutants from the United States and other regions.

Despite relatively lower pollution levels in Ontario, air pollution continues to place a heavy burden on disease, highlighting the significance of addressing this issue. An estimated total of 15,300 premature mortalities occurs in Canada each year, out of which approximately 6,600 occur in Ontario, as a result of the presence of three major air pollutants: fine particulate matter (PM2.5), ozone, and nitrogen dioxide, with an economic cost of $114 billion (Egyed et al., 2022; Health Canada, 2021). It is recognized that being exposed to significant air pollutants, such as ozone and PM2.5, increases the risk of many adverse health effects. These outcomes can range from respiratory symptoms to the development of diseases and premature mortality, and may be impacted by changes in the climate, especially from increases in ozone and wildfire smoke.

Ultraviolet Radiation

Ultraviolet (UV) radiation exposure causes sunburn, eye cataracts, aging skin, and skin cancer and is influenced by both the length of time spent in the sun and its intensity, as measured by the UV Index (Environment and Natural Resources Canada, 2021). The impact of climate change will

not have a worsening effect on the relationship between ozone depletion and exposure to ultraviolet radiation (UVR), and there is currently limited certainty that climate change will significantly affect the factors that influence UVR exposure (Bais et al., 2019). A high UV index during the summer, spring, and autumn seasons is a cause for concern as people spend more time outside in these seasons.

Projected warmer than average temperatures due to climate change will increase the days people will spend outdoors, which increases their overall exposure to UVR.

Risk from Vector-borne and Zoonotic Diseases

According to Public Health Ontario (2024), vector-borne and zoonotic diseases are those "caused by viruses, bacteria or parasites that are transmitted to humans from animals or insects. Some diseases that originate in animals must be transmitted through a 'vector', for example a mosquito or tick to infect a human." As temperatures rise, a more suitable environment for vectors to thrive is created, causing concern for human health (Ogden et al., 2022).

In recent years, the SWPH region has become a favorable habitat for mosquito species that can transmit West Nile virus to humans and for tick species capable of transmitting Lyme disease. In addition to these 2 diseases, public health is monitoring for other emerging vector-borne diseases. An example of this is the addition of 3 new tick-borne diseases to the list of Diseases of Public Health Significance, in 2023 (Public Health Ontario, 2023) As the projected average temperature during winter months increases, new species of vectors capable of transmitting diseases to humans are expected to become established in the SWPH region. Some of these diseases can cause serious illness and even death (Lindsay, L.R, 2016).

Avian Influenza is a contagious viral infection that mainly affects birds but can, on occasion, infect humans and other mammals. Human infections with Avian Influenza are rare and usually occur after close contact with infected birds or highly contaminated environments. These viruses can cause severe disease in humans and have the potential for genetic mutation (Public Health Agency of Canada, 2023b). In the context of climate change, where migration routes and seasons are changing, previously separate migratory bird populations are now encountering one another, increasing the probability that new virus variants will emerge (Sharif and Wichtel, 2022).

Psychosocial Impacts of Climate Change

Climate change is increasing the risks to the psychosocial health of Canadians, which can impact the way people think, act, feel, and interact. In a scoping review of literature that explored risks, impacts and vulnerabilities related to climate change and health, mental health outcomes included: post-traumatic stress disorder (PTSD), anxiety, depression, complicated grief, survivor guilt, recovery fatigue, and suicidal ideation from extreme weather events (Hayes et al., 2019).

Psychological impacts also include weakened social ties, increased stress levels, substance misuse, aggression and violence related to resource scarcity (Hayes et al., 2019). There is also a rise in ecoanxiety, specifically looking at emotions such as worry, anxiety, and feelings of

impending doom which are becoming a growing concern for communities and individuals (Hayes et al., 2019).

The impacts of climate-related distress are rising among all age groups and regions, requiring further understanding on how climate impacts, environmental racism and structural determinants of health intersect to shape health and wellbeing (Majeed and Lee, 2017). Climate stress among vulnerable populations is varied, long-lasting and affects many domains of life (e.g., livelihoods) (White et al., 2023).

Populations who are land-vulnerable (dependent upon land and natural resources for livelihoods) are particularly susceptible as the impacts and threats of climate change to their livelihood lead to significant consequences such as anxiety, depression and solastalgia which is a loss of connection to land, and a sense of place (White et al., 2023). A global integrative review on mental health impacts of climate change suggests that land-vulnerable populations, Indigenous persons, children, older adults and climate migrants are disproportionately affected by climate change and mental health impacts (White et al., 2023).

The frequency and intensity of extreme weather events can lead to the loss of home, loved ones, and other challenges which are linked to an increase in anxiety, depression, and post-traumatic stress (Clayton, 2021). The Climate Atlas of Canada (2023) describes three pathways in which climate change can impact mental health: experiences of extreme weather events, experiences of environmental change, awareness and exposure to climate change information.

The Canadian Index of Well-being uses environmental indicators such as the ecological footprint, absolute greenhouse gas emissions, residential energy use, ground level ozone, primary energy production, viable metal reserves index, total farmland (hectares), annual water yield in southern Canada to provide warning signs about how Canadians are using the environment to better the wellbeing of people (Smale and Hilbrecht, 2010).

City policies for climate change mitigation that focus on reducing greenhouse gas emissions are likely to have impacts on the wellbeing of populations (Hiscock et al., 2014). For example, industrial policies that encourage cleaner industries lead to less emissions of air pollutants in the city (Hiscock et al., 2014). Cleaner air can have an impact on health and well-being, and may also have indirect impacts on social capital, productivity, accessibility, and unemployment (Hiscock et al., 2014).

IV. Climate Impacts on the Most Vulnerable Populations

Certain population subgroups and communities in Canada are more severely affected by climate change because of varying exposure, sensitivity, and ability to take protective measures against hazards (Berry et al., 2022). In the results of the existing climate and health vulnerability assessments, the Waterloo Region, Wellington County, Dufferin County, and the City of Guelph report (Buset et al., 2022) highlighted that intersectional features of individual and group identities (e.g., race/ethnicity, sex/gender, education, employment, etc.) may lead to different psychological and ill-health outcomes, as well as the lack of ability to adapt during periods of exposure to climate change impacts. Intersectionality recognizes how systems of oppression (e.g., racism, sexism, homophobia) interact to influence the individual and structural determinants of health (NCCDH, 2022).

Vulnerable populations may experience multiple forms of discrimination and disadvantage, influenced by systemic forms of stigmatization, discrimination, or oppression that may influence the political, social and cultural marginalization of certain communities (Buse et al., 2022; NCCDH, 2022). They experience health vulnerability as they are exposed to multiple layers of overlapping marginalization that increase risks to health (NCCDH, 2022). These unequal distributions of inequities interact with the social determinants of health, rendering them health detriments.

The climate change and health impacts relevant to each vulnerable population were identified through the comprehensive review of vulnerability assessments. It is recognized that in the Climate Science Report, there is a section listed as populations who are deemed vulnerable by Health Canada (2022). However, the following list was compiled through the external and internal advisory committee consultations to be more specific for what is currently a concern and a priority population in the region.

Amish Communities

The Amish Communities are not directly identifiable in the Census. In the SWPH region there are two Amish settlements, estimating a population of approximately 1,500. Amish are an Anabaptist religious group that believe in adult baptism, are pacifist and lead a low-tech life which relies on community for all their physical and emotional needs. They diligently pay their taxes, but they do not use government services such as the Ontario Health Insurance Plan (OHIP) to access healthcare services.

From the review, the Amish were not identified as a standalone population. However, the Amish population may have a unique population concern for extreme temperatures because of their lower reliance on mechanical heating/cooling, high involvement in the agriculture industry, and a high degree of outdoor exposure. However, it was noted that this community may also be more equipped to adapt due to their existing familiarity with local weather patterns and behavior towards helping neighbors and community connections. Specifically, more information is required to

understand how vulnerable this group would be to the impacts of extreme temperature, extreme weather events, and psychosocial impacts to understand this population's resilience.

Low-German Speaking Mennonite Communities

The Low German Speaking (LGS) Mennonite Community has been identified as a population of importance in Elgin and Oxford with an approximate estimate from 2002 that suggests 500 reside in Oxford County, and 12,000 reside in Elgin County (Haile and Funk, 2019). The LGS community represents a range of religious values and perspectives which vary in their level of religious conservatism.

They work predominantly in the agricultural sectors, with increasing numbers of LGS Mennonites migrating and settling in Ontario (Haile and Funk, 2019). Regarding healthcare access, LGS Mennonites opt to not have Ontario Health Insurance Plan (OHIP) coverage and do not access private health insurance. Families are paying out of pocket for many health care services. (Haile and Funk, 2019).

Like the Amish communities from our review, the LSG Mennonites were not identified as a standalone population. However, they 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. More information is still required to understand the vulnerabilities of this population group.

Immigrants

Statistics Canada defines immigrants as "persons who are, or who have ever been, landed immigrants or permanent residents" (2021). Compared to Ontario (30%), the proportion of immigrants in the SWPH region is much lower at 11.4% in Oxford County, and 11.7% in Elgin-St. Thomas (Statistics Canada, 2021).

Since the Canadian census is conducted once every five years, recent immigrants are usually referred to as immigrants from the last five years, which in the most recent census is from 2016 to 2021. The proportion of recent immigrants in the SWPH region is lower than Ontario (4.2%), with 1.1% in Oxford County, and 0.8% in Elgin-St. Thomas (Statistics Canada, 2021).

In the region, immigrants are most commonly from Mexico, the United Kingdom, the Netherlands, the United States and Germany, while recent immigrants (since 2016) are most commonly from India, Mexico, the United States, Jamaica and the Philippines (Statistics Canada, 2021).

While immigrants may have better health than Canadians due to the "Healthy Immigrant Effect," immigrants may find themselves to experience poor health due to discrimination (MacLeod and Hussain, 2019a). The Healthy Immigrant Effect refers to the phenomenon that recent migrants are in better health than the non-migrant populations in the host country (Ichou and Wallace, 2019).

Indigenous communities

According to the SWPH Understanding the Community Report, individuals who hold indigenous identity include people who identify as First Nations, Metis, or Inuik (Inuit) and/or people who have membership in a First Nation or Indian band. The proportion of people who identify as Indigenous in the region is 2.3% respectively, however, the proportions from the census may underestimate the reality of Indigenous populations. Indigenous peoples often experience a disproportionate burden of ill health compared to non-Indigenous people.

Indigenous peoples have confronted numerous historical discriminatory measures, leading to persistent health disparities within their populations (NOCCH, 2022). These communities are made vulnerable by geographic isolation, which contributes to many direct impacts such as extreme heat, susceptibility to extreme weather events, and indirect impacts such as access to services and food (NOCCH, 2022). Events related to the loss of land may also carry a significant cultural impact to their physical, psychosocial, and socioeconomic wellbeing, including their livelihood (e.g. dietary shifts due to availability and quality of traditional foods, identity, and cultural practices) (NOCCH, 2022). The potential impact on the Indigenous community's connection to the land is substantial, with an increased sensitivity to the mental health impacts of climate change such as substance misuse, increased rates and severity of mental illness, loss of intergenerational knowledge, and suicidal ideation (Buse et al., 2022).

LGBTQ2S+ community

Sexual orientations and gender identities that are not heterosexual or cisgender are often described by the acronym LGBTQ2S+. LGBTQ2S+ is an acronym that stands for Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, and Two-Spirit.

The Waterloo Region, Wellington County, Dufferin County, and the City of Guelph Climate Change and Health Vulnerability Assessment (2022) reported that people who identify as LGBTQ2S+ have elevated risks of suicide and self-harm, which is particularly important when taking future actions on the mental health impacts of climate change. Like other identified groups of people who live in marginalizing conditions in SWPH region, the LGBTQ2S+ community are more likely to live and work in risk-prone areas due to social, economic, and structural factors that limit their economic opportunities.

The experiences of LGBTQ2S+ people in accessing care and utilization of care are preexisting disparities that influence further exposures to poor air quality, more susceptible psychosocial health impacts from climate events and more likely to develop comorbidities due to weakened immune systems (Mann et al., 2023). Existing socioeconomic disparities may hinder their willingness to seek medical care during and immediately after severe weather events and impact their ability to engage in adaptive protective behaviors such as the ability to afford air conditioning and air purifiers (Mann et al., 2023).

Infants and Young Children

Climate change poses threats to human health, safety, and security, and children are uniquely vulnerable to these threats (Paulson et al., 2015). According to the World Health Organization, children under five suffer the most from the consequences of climate change, with over 88 % of climate-related disease burden occurring in this age group in both developed and developing countries (Zhang et al., 2007). Heat exposure can have broad child health effects that begin in the prenatal period (Ahdoot et al., 2024). Evidence shows that higher temperatures increase the risk of adverse pregnancy outcomes, particularly preterm birth and stillbirth, with risks rising by about 5% per 1 °C increase and preterm birth occurring up to 16% more often during heatwaves (Chersich et al., 2020).

Extreme heat affects infants and young children more than most adults because their smaller bodies heat up more quickly, they have a reduced capacity for heat adaptation and sweating, they experience higher exposure per unit body weight, and they often spend more time outdoors (Sheffield & Landrigan, 2011; Early Childhood Scientific Council on Equity and the Environment, 2023). Besides, children, especially infants, have a higher heart rate than adults, which may result in their vulnerability to extreme temperature (Xu et al., 2012). In addition, Children's immune systems are relatively under-developed, and children are less prone to self-care; therefore, they may experience relatively more thermal stress than adults at the same temperature conditions (Kim et al., 2017). Associated conditions to heatwave exposure in children include fever, electrolyte disturbances, renal diseases, chronic respiratory diseases including asthma and vector borne diseases (Xu et al., 2012).

The brain and neurological system of infants and children are still developing and are more vulnerable to environmental influences than in adults (Wright et al., 2025). Children and adolescents are less able to regulate their emotions and behaviors, are more prone to impulsive behaviors and are less likely to take adaptive measures compared to adults, which can increase the risk for mental health illness during periods of high temperatures (Santillanes et al., 2020).

International Agricultural Workers

The Temporary Foreign Worker Program allows employers in Canada to hire international agricultural workers (IAWs) to fill jobs when qualified Canadians are not available (Government of Canada, 2023). IAWs workers come to the region on an annual basis from Barbados, Eastern Caribbean, Jamaica, Mexico, Trinidad, and Tobago (F.A.R.M.S., 2024). Although IAWs return to their country of origin after harvest, while in Canada, they face an array of issues that may result in increased vulnerability. They are often isolated (separated from their families and communities), work long hours and face barriers such as language, poor housing conditions, mobility problems, and cultural differences which exacerbate social exclusion and vulnerability (ST-ELIP, 2012).

While IAWs were not specifically named as a vulnerable population in vulnerability assessments from other health units, they face similar vulnerabilities as outdoor agricultural workers. IAWs are exposed to extreme heat, extreme weather events, poor air quality, and ultraviolet radiation due to working in outdoor conditions. In Colorado, US, researchers linked heat effects and clinic visits

among migrant and seasonal farm workers (Zhang et al., 2016). They are particularly vulnerable to the health impacts of extreme heat due to poverty, an aging population, and limited health insurance coverage (Zhang et al., 2016). Additionally, other researchers argue that while there is very little research on the vulnerability of migrant workers to climate change impacts, the nature of their work classifies them as communities who are made vulnerable by systems of oppression, exacerbated by poor housing and a lack of social networks (Montz et al., 2011).

IAWs who live in vulnerable conditions are also exposed to vector-borne diseases. Additionally, due to low utilization of health services, diagnosis and treatment for vector-borne diseases may be delayed (Danis et al., 2013).

Furthermore, food insecurity is particularly prevalent among migrant and seasonal farm workers in the US (Kiehne and Mendoza, 2015). Researchers in Georgia, US, found low socio-economic status to partially account for the difference in rates of food insecurity between migrant and seasonal farm workers, and the general population (Hill et al., 2011). They also found that some migrant and seasonal farm workers lack access to household amenities (e.g., proper food preparation and storage facilities) (Hill et al., 2011), which may also exacerbate vulnerabilities to food-and-water-borne illnesses.

IAWs face unique challenges related to psychosocial health as they are more likely to be exposed to precarious employment, language barriers, employer discrimination, lack of social support, and lack of knowledge on the local health system (Doki et al., 2018; Hall et al., 2019; Koseoglu Ornek, 2022). A systematic review revealed that they are exposed to poor interpersonal relationships, a lack of workers' rights, and low income, which all exacerbate negative psychosocial health outcomes (Koseoglu Ornek, 2022).

Older Adults

As demographics continue to shift, understanding the age composition of populations becomes increasingly vital for healthcare planning and resource allocation. Statistics Canada categorizes age into three general groups: (1) 0 - 14 years, (2) 15 - 64 years, (3) and 65 years and over. In this section, older adults are categorized as those who are 65 years or older.

Compared to Ontario (18.5%), the proportion of adults aged 65 and over is higher in Oxford County (20%), Elgin County (20.4%), and the City of St. Thomas (21.3%) (Statistics Canada, 2021). Also, the population of older adults is expected to increase from 40,673 people to 49,697 from 2019 to 2025 (MacLeod and Hussain, 2019b).

Older adults may face increased risk of poor health outcomes. For example, those aged 65 years and older are more likely to develop invasive pneumococcal disease, which is an infection of the ears, sinuses, or lungs (MacLeod and Hussain, 2019b). Older adults are also particularly vulnerable to extreme heat events and extreme weather events.

Outdoor workers/Outdoor farm workers

Compared to Ontario, Oxford and Elgin County have a higher proportion of people employed in the sectors of agriculture, forestry, fishing and hunting and construction (Table 12). Outdoor workers (e.g., construction, agriculture, forestry, and similar work environments) are more

exposed to extreme temperatures and its associated health risks (Berry et al., 2022).

Between 2005 and 2010 in Los Angeles County, California, researchers found strong associations between rates of heat-related emergency room visits and hospitalizations, and the proportion of residents working in outdoor conditions during heat events (Riley et al., 2018). In Canada, from 2001 to 2016, each 1°C increase in the maximum daily summer temperature also increased the number of daily heat-related morbidities claims due to occupational health and safety compensation agencies by 28% to 51% in Quebec, Ontario, Manitoba, Saskatchewan, and Alberta (Adam-Poupart et al., 2021). Furthermore, outdoor workers are vulnerable to extreme weather events, vector-borne diseases (e.g., Lyme disease and West Nile virus), poor air quality, and ultraviolet radiation due to increased exposure. While the long-term health impacts of poor air quality exposure are still unknown, increasingly poor air quality exacerbated by climate change (e.g., wildfire smoke and excessive ozone) pose significant health risks to those who work outdoors (Bice et al., 2024). Additionally, with extended time spent outdoors, outdoor workers often exceed recommended levels of UV exposure, leading to higher risks to developing skin cancer (Modenese et al., 2018).

Agricultural workers who are in contact with animals and livestock may be vulnerable to food-and-water-borne illnesses as they may be at a higher risk of exposure to pathogens (York Region, 2020). Additionally, they may be more vulnerable to food-and-water security impacts as seasonal variability may affect agricultural production (City of Ottawa, 2022).

Since climate change affects resource-based industries, certain outdoor workers may be more at risk of psychosocial health impacts of climate change as they may experience emotional distress related to job insecurity (Berry et al., 2022). For example, in Alberta, workers report severe emotional distress as they contemplate the collapse of the traditional sectors (Mouallen, 2015).

People experiencing homelessness

The Canadian Observatory on Homelessness defines ‘homelessness’ as the “situation of an individual, family, or community without stable, safe, permanent, appropriate housing, or the immediate prospect, means, and ability to acquire it. People experiencing homelessness are particularly vulnerable due to a lack of structural safety, poverty, stigmatization, and may also have pre-existing conditions, such as loss of employment.

People experiencing homelessness can be found across urban and rural areas, where they find themselves living temporarily with friends, families or in emergency shelters. SWPH’s health priorities include access to high-quality, safe, and affordable housing as it can impact health and well-being. SWPH’s Community Profile Report (2023) also identifies affordable housing as spending not more than 30% of before-tax-income on shelter. In the SWPH region, about 1 in 10 households live in unsuitable, inadequate or unaffordable housing (cannot afford a suitable alternative due to their income) with approximately 17% of the people spending 30% or more of their income on shelter costs. In Elgin County and St. Thomas, there is a wait time of 7 to 10 years for a one-bedroom and two-bedroom rent-geared-to-income (RGI) unit. RGI housing is a unit for which the tenants pay no more than 30% of their household income in rent. In Oxford County, the wait time is 3 to 5 years.

The lack of adequate shelter can compound the health risks of climate change impacts as people who are homeless are the most exposed to weather events. Geographic locations (including locations of homeless encampments) are key factors increasing exposure and vulnerability to multiple climate hazards (Ministry of the Environment, Conservation and Parks (MECP), 2023). The climate risk score for the unhoused population in the southwest region (calculated based on census data for Essex) in Ontario is classified as high with projections in the 2050s and 2080s as very high (MECP, 2023). People experiencing homelessness may have also been indirectly impacted through climate economy impacts such as loss of local employment sectors (i.e., changes in agriculture) (MECP, 2023). This can have cascading impacts related to the number of people experiencing housing insecurity.

Exposure to extreme heat, water insecurity, UVR, etc., have greater prevalence in weather-exposed populations such as people experiencing homelessness as they may be inadequately able to protect themselves due to material disadvantages (Kidd et al., 2023). These risks influence outcomes of morbidity, mortality, injury, violence exposure and mental health issues which are further exacerbated by traumatic events (Kidd et al., 2022). Homelessness is also associated with migration (planned vs unplanned) and climate shocks can influence rural-urban migration, and urban-urban migration due to climate-change related events, which can lead to psychosocial burdens (Kidd et al., 2022).

People living below the poverty line

SWPH's Community Profile Report (2023) identifies a population as low-income through the low-income measure after tax (LIM-AT) which is defined by Statistics Canada as a fixed percentage (50%) of median adjusted after-tax income of households observed at the person level, where 'adjusted' indicates that a household's needs are taken into account (Statistics Canada Website). In the SWPH region, 8.8% of the proportion of the population is considered low-income but it is recognized that this may not capture the accurate proportion of the population that are struggling to make ends meet. Because the LIM-AT is a relative measure, a household can be in the top 50% of incomes in the region, but still not be making a living wage and still not be able to make ends meet. SWPH's Understanding of our Communities Health Report (2019) operationally calculates individuals living below the living wage. The living wage calculation uses many data sources and includes Housing Affordability Data from the 2016 census. In 2015, about 1 in 10 people (9.3%) living in the SWPH region were living in poverty. The living wage was calculated for Oxford County, Elgin County and the City of St. Thomas ($18.85), which was higher than the current minimum provincial wage ($15.65). Low income is a strong predictor for poor health outcomes, and the existing vulnerability is exacerbated to climate variability with its impacts to their livelihoods.

Research has identified that the health of individuals living with low income may be linked to the impacts of climate change as they may have poor housing conditions and shelter (SMDHU, 2017). In events related to flooding and post-flooding living conditions, people living under the poverty line may not have flood insurance in their rental home or low-income housing which may also experience exposure to mold (WECHU, 2019). Individuals living below the poverty line will have the highest rates of household food insecurity due to the impacts to the contamination and availability of food and water, which influence the increased food pricing due to changes in global

food production (SMDHU, 2017).

Additionally, the occurrence of hotter and more humid days for extreme heat events may also result in changes to community services such as the cancellation or postponement of public events and closures to buildings that do not have adequate air conditioning (e.g., daycares, churches, schools) (City of Ottawa, 2022). These changes have disproportionate impacts on low-income individuals and families who rely on low cost/free outdoor community activities to build social connections (City of Ottawa, 2022).

Women, especially single-parent households

Gender refers to an individual's personal and social identity as a man, woman or non-binary person (Statistics Canada, 2021). "Women+" in the Census data includes women, girls, and some non-binary persons. In the SWPH region, 50.1% of the population identify as women+.

More specifically, pregnant people are particularly vulnerable to the impacts of climate change due to increased sensitivity to hazards (Berry et al., 2022). To start, extreme temperatures may impact community services (e.g., a decrease in outdoor recreation and the temporary closure of buildings that do not have air conditioning such as daycares and schools), which may disproportionately impact women, children, and infants (City of Ottawa, 2022).

Furthermore, pregnant people are more sensitive to the impacts of extreme weather events as these events can cause stress during pregnancy, and prolonged effects on essential services may also have consequences for the unborn child (Berry et al., 2022).

Pregnant people are also more sensitive to adverse health outcomes of vector-borne diseases, for example, Zika virus can lead to birth defects (Grazel and Harris-Haman, 2018).

Similarly, pregnant people are more vulnerable to food-and-water-borne illnesses and food-and-water security as they are more sensitive to nutritional deficiencies and morbidities caused by microbial pathogens (Adhikari and Kharel, 2018; Berry et al., 2022). Food-borne illnesses can cause miscarriage, stillbirth, premature delivery, and other neurological effects on the fetus, mother, and the newborn (Adhikari and Kharel, 2018).

Poor air quality is also projected to have disproportionate impacts on pregnant people as research has found associations between maternal exposure to ambient air pollution and adverse birth outcomes (e.g., preterm birth) (Wu et al., 2016).

V. Existing Climate Change Adaptation and Disaster Resilience Actions

SWPH has a range of actions already in place or being planned that support reducing the health-related impacts of climate change. This section outlines what SWPH is doing to address the risks and impacts of climate change on people's health. The information was compiled from a 2024 activity report provided by SWPH and from brief interviews with key SWPH staff.

Partnerships for climate action

Achieving some of the needed outcomes for protecting people and reducing risk from climate change-associated health impacts requires strategic and meaningful collaboration with a wide array of partners across the public, private and non-profit sections. SWPH has established working collaborations with different groups, such as Health Equity Partners, the Social Determinants of Health Nurses Group, and the Low German Speaking Mennonite Community of Practice to reach people who live in vulnerable conditions in the region.

Further, SWPH draws on partners to collect and disseminate data to make better informed decisions around the health of different groups in its communities, including those with low income to ensure its plans and programs are responsive to these community members. For example, SWPH works with the Ontario Dietitians in Public Health Food Insecurity Workgroup to conduct annual Nutritious Food Basket (NFB) data collection. This data will be shared with the Ontario Living Wage Network to determine a regional Living Wage calculation for London-Elgin-Oxford and used to mobilize efforts to support adequate income solutions.

Beyond the data, SWPH has focused on the underlying factors of vulnerability in the region. The health unit works together with local poverty reduction groups to raise awareness and advocate for the living wage payment, which supports creating economic benefits for households and helps strengthen local resilience.

In collaboration with Ontario Dietitians in Public Health, SWPH is conducting research on effective land use planning policies at the municipal level for equitable and sustainable food systems. Evidence from this report will be used to develop food accessibility policy statements that can be used at a local level. Beyond municipalities, SWPH has sought to work with local organizations, community partners, and community members to develop a local food systems network in the region to establish a shared vision to support community food security through the development of a food charter and a food system strategy, including advocating for more climate compatible plant-based diets.

Better understanding of health risks from climate change

In the realm of public health and environmental stewardship, SWPH initiatives aim to address the challenges posed by climate change and safeguard the well-being of communities. Through surveillance and monitoring, SWPH tracks heat and cold-related emergency visits and

hospitalizations with a particular focus on identifying high-risk populations, allowing for targeted interventions and optimized resource allocation. The implementation of an early warning system, called RAVE Alert, ensures timely communication with community stakeholders, issuing warnings and facilitating proactive measures to protect vulnerable residents during extreme temperatures.

Moreover, comprehensive public education campaigns cover both extreme heat and cold responses, and raise awareness of novel vector-borne diseases, like West Nile Virus and Lyme Disease. SWPH conducts water sampling for wells to ensure the safety of private water sources, and the Migrant Farm Worker Education program disseminates vital information in various languages, covering topics ranging from sexual health to infection control practices.

Strengthening good governance of risk

SWPH actively engages with Oxford County, Elgin County and the City of St. Thomas to initiate strategic planning activities that address the localized impacts of climate change and mitigate exposure to environmental health hazards within the community. One key facet of this approach involves reconvening the Health Equity and Priority Populations (HEPP) Committee, an internal group that reviews and provides input into planning activities and supports training on the health equity framework. Embracing a 'train the trainer' methodology, this committee ensures the dissemination of education throughout program teams.

Concurrently, the development and adoption of a Municipal Collaboration Strategy is tailored to the Southwestern Public Health region. This strategy will identify policies, guidelines, standards, processes, and tools to integrate climate change and health equity topics into planning projects within Oxford, and Elgin County and the City of St. Thomas.

SWPH is also actively involved in updating and implementing the Age-Friendly Strategy, which recognizes the interconnection of age-friendly strategies with broader priorities such as climate change and acknowledges the heightened vulnerability of older adults. By focusing on age-friendly communities, the strategy aims to decrease morbidity and mortality from climate-related events. While Oxford County currently lacks a specific age-friendly committee, SWPH is exploring opportunities to integrate the lens of older adults into existing committees or potentially initiate a similar strategy in 2024.

Undertaking disaster preparedness and prevention

SWPH is actively engaged in a multifaceted approach to address various aspects of public well-being. Emphasizing the importance of social connectivity to build social capital, SWPH participates in local community/neighborhood groups, councils, and coalitions to learn about existing initiatives across the region that enhance social connections. By participating in these groups, SWPH gains access to local expertise, resources, and relationships, which enables collaborative efforts to address health disparities, promote preventative measures, and create healthier, more resilient communities, particularly in the context of climate change actions.

Moreover, SWPH is dedicated to developing a Priority Populations Engagement Strategy, utilizing the Community Engagement Planning Toolkit. This strategy aims to identify priority populations

in the region based on health inequities or the burden of disease, focusing on specific populations, such as plans for older adults. Additionally, the organization actively supports community partner collaborators in extreme temperature emergency planning, advocating for accessible and safe heating centers while responding to community partner collaborators' requests for emergency planning support related to extreme temperatures.

In the area of community care and education, SWPH collaborates with organizations delivering fall prevention programs for older adults. By addressing barriers in the community, providing support to increase capacity for fall prevention, and aligning community groups and policies with local organizations' concerns, SWPH promotes well-being for older adults.

Communication with municipalities to eliminate mosquito pools and catch basins, along with adult mosquito trapping and testing, is part of the organization's comprehensive approach to reduce vectors of disease, including West Nile Virus.

SWPH actively responds to adverse drinking water events and conducts air quality monitoring. The health unit runs quarterly social media campaigns addressing various health hazards, such as Radon Awareness Month, Outdoor Air Quality in the Summer, Indoor Air Quality in the Winter, and Hoarding/Pests in the Spring. These campaigns aim to increase awareness of health hazards and inform the community about agencies that can provide support, emphasizing SWPH's role in promoting a safe and healthy living environment.

VI. Recommendations for Action

As this assessment report has outlined in the previous sections, there are important projected changes in the climate system for the SWPH region. These will have important health impacts across the communities and on those identified as particularly vulnerable to different hazards due to their physical exposure or socio-economic characteristics. This section underscores a commitment to equity to support local vulnerable populations living in the southwestern region of Ontario. SWPH has already made important strides to target its interventions with a newly released health equity framework that will serve as a lens through which each of these recommendations can be viewed.

Overall, the recommendations emphasize the importance and value of:

- Strengthening and enhancing coordination both within and outside SWPH with local partners, to improve communication and strategically support climate action, including a strong focus on knowledge translation for equity-through-action solutions;
- Expanding the scope of partnerships to harness complementary skills, resources, and capacities, thereby facilitating the delivery of climate solutions that are relevant to equity; and,
- Utilizing and customizing available tools to inform evidence-based and equity-centered decisions within SWPH.

SWPH advisory groups and staff stressed the importance of concrete and actionable recommendations that provide clear, tangible, and measurable solutions. It is also very important to note that the report writing team found little evidence in the academic and gray literature of evaluated interventions in the context of what SWPH could do. While proof of concept is rare, community needs should drive the action agenda. Monitoring and evaluation should be key components of this, and the recommendations outline that SWPH start building their own evidence base and learn from their own approaches, while working in tandem with communities through their direct participation in the design, implementation, and monitoring of solutions.

The recommendations listed below reflect the input and ideas received through facilitated sessions with the advisory groups. Each recommendation includes specific activities for SWPH to consider as well as activities that could be considered by a range of external organizations, including area municipalities, conservation authorities, community organizations, and others specific. These activities were identified through a combination of scientific literature review, advisory group discussions, and knowledge of best practices.

Activities for SWPH have been grouped into three categories with input from the advisory groups:

- **Quick Wins** - activities that typically require little investment/few additional resources and often capitalize on existing processes that require only minor tweaks to achieve results.
- **Best Buys** - activities that typically require modest investment/some additional resources and produce the greatest returns on investment toward the outcome of interest.

- **Gamechangers** - activities that typically require greater investments/additional resources, including time as well as changes in processes and/or governance procedures in order to undertake activities that are transformative in nature.

Recommendation 1: Develop a comprehensive and co-produced risk reduction and prevention strategy for extreme weather conditions.

Recommendation 2: Review and enhance coordination mechanisms with area municipalities on land use planning.

Recommendation 3: Build and strengthen partnerships with agencies, organizations, and individuals beyond jurisdictional boundaries.

Recommendation 4: Create a communications plan to share up-to-date data on health risk information with recommendations spanning all hazards and health impacts for the region - including the psychosocial dimensions.

Recommendation 5: Establish a monitoring and evaluation framework to assess the impact of actions and interventions.

Recommendation 6: Promote and advocate for social capital building activities.

Recommendation 7: Develop a climate-compatible sustainable food system strategy.

One: Develop a comprehensive and co-produced risk reduction and prevention strategy for extreme weather conditions

The development of a comprehensive risk reduction and prevention strategy would encompass all climate-related natural hazards, including extreme heat and cold temperatures, by incorporating a specific inventory of everyday actions to reduce health risks for vulnerable populations. It would outline a partnership roadmap and objectives to support action plans.

The strategy would include a communications plan that includes the development of infographics, icons and/or photos with specific risk information and recommendations, interactive mapping systems, and an inventory of actions that could be adapted by SWPH and partners to meet local communities' needs. The communication plan should involve developing resources to reach specific vulnerable populations, such as those with English as a second language, farm workers, the elderly, people with disabilities, and/or youth.

Activities for SWPH to consider:

Quick Wins:

- **Co-create inventory of heat stress management practices** with farmers, workers, and vulnerable communities working with community partners such as businesses. Existing knowledge and practices on those communities most affected by heat can provide important insights into heat mitigation for outdoor work.
- **Create and share visuals and infographics of disease vectors, including mapped locations of high-risk areas**, especially to share among most vulnerable populations living in rural settings or limited knowledge of the English language, which would assist in reducing risk on foreign and agricultural workers.
- **Promote prioritizing ice/snow removal along higher-volume pedestrian corridors** and in vulnerable neighborhoods.
- **Provide specific risk information**: On the impacts of adverse air quality events in a proactive manner rather than reactive.

Best Buys:

- **Undertake emergency preparedness and response drills** with public and private organizations to test health units' capacity to address rapid onslaught flash flooding events and extreme weather-related crises.
- **Conduct a vulnerability assessment of future flooding impacts** for populations living near private wells and flood plains.
- **Develop an online Heat Vulnerability Assessment tool** for community partners to identify risks and actions to guide core practices to address heat risk.
- **Develop protocols for small and medium sized businesses** to protect employees' working outdoors, including increasing rest times during heatwaves and extreme heat days.

Game Changers:

- **Develop a Heat Action Plan for and with** local stakeholders, which would identify clear opportunities for partnerships across the public and private sector, seek to leverage existing resources and infrastructure for reducing risk, and highlight concrete practices for addressing long term high heat stress in the southwestern region.
- **Share non-confidential data** and reports on climate risk and impacts on vulnerable populations with community partners to help them develop organizational adaptation, health and wellbeing strategies, protocols, and investments, including with local schools, businesses, and community centers.
- **Create a repository of health equity data tools** that could be used in the development of policies and the implementation and evaluation of programs and services.

Activities for External Partners and Organizations to Consider:

Retrofitting Infrastructure

- **Support infrastructure retrofits:** insulation for households with individuals living with a chronic respiratory condition to support winter needs.
- **Test mist cooling infrastructure for farm fields** during heat waves to reduce the risk of heat stroke or cardiac arrest. This portable or movable infrastructure can be co-located in places of high traffic or target vulnerable hot spots in the community to create cooling corridors.
- **Assess and report on school and public building standards** to ensure these are equipped with heating and cooling infrastructure that comply with the climate risk projected for the region.
- **Place policy directions towards Nature based Solutions** (NbS) such as environmentally friendly infrastructure (i.e., green roof/white roof/solar) which reduce heat islands in urban contexts.
- **Promote a review of access ramps and backup generators** for social housing, multi-story buildings, and elder care facilities to ensure rapid access or exit for communities most at risk of heat stress.

Using technology and customized tools

- **Use flood risk road maps** to identify and learn the geography of flood risk in the region and identify mobility options in case of extended disruptions or in times of emergency response.
- **Utilize mapping technologies (e.g., GIS)** to determine resource allocation for green infrastructure, active transportation networks, and green retrofits.

Building capacities

- **Promote and account for sustainable local forest management practices** (e.g., tree planting) in new projects and as opportunities for community engagement.
- **Explore mobility alternatives for rural transportation** networks designed to meet the needs of those who can't afford a vehicle as well as those who live in rural or remote communities, senior populations, and those who are physically or mentally unable to drive.

Revising operating procedures, policies, and protocols

- **Establish shade cover policies** to ensure protection at playgrounds, sports fields, parks, schools, etc.
- **Develop a tree planting strategy** across different spaces (e.g., school environment) and encourage both forest regeneration and preservation (tree retention).

Two: Review and enhance coordination mechanisms with area municipalities on land use planning

Enhanced coordination on land use planning can support stronger consideration of climate and health-related objectives in policy and design decisions. SWPH should undertake a systematic and rigorous assessment of where enhanced coordination would be most beneficial to support climate-related objectives. This can build on the co-produced risk reduction and prevention strategy for extreme weather and could be an avenue to test and pilot a solutions-approach to strengthening and refining coordination mechanisms. For example, establishing a Municipal Land Use Planner-in-residence within SWPH or a Public Health Municipal Planning Lead in-residence within area municipalities during key periods, such as during Official Plan reviews.

Activities for SWPH to consider:

Quick Wins:

- **Ensure strong communication mechanisms exist between the health unit and municipal planning** staff to strengthen climate-related considerations in local planning decisions.
- **Create a directory of community liaisons** to share information and create a local network for community partner collaborators communications on risk and best practices. Developing a compendium of best practices and preferences (including technologies used to communicate or spaces to gather) drawn from local community partner collaborators can better inform local community strategies.
- **Liaise private sector and public sector environmental, sustainability and health and safety officers** to coordinate and enhance climate-resilience adaptation practices and learning across community networks.

Best Buys:

- **Ensure schools and daycare centers for young children have updated protocols** for climate-related health risks, including extreme heat events, poor air quality, and extreme weather events.
- **Strengthen the data collection processes of the use of heating centers** (through partnership).
- **Use climate impacts-associated patient intake data** to inform strategies to support the community in the long term, including where possible disaggregated data by gender, age, and vulnerable population variables that might exacerbate certain risks.

Game Changers:

- **Develop decision-making tools** to support climate adaptation interventions for vulnerable populations (i.e., tree canopy site selection and planting).

Activities for External Partners and Organizations to Consider:

Retrofitting infrastructure

- **Develop public transport protocols** for local transport authorities to ensure efficient functioning of schedules on days of extreme cold and days of extreme heat, including emergency hydration packages.
- **Identify co-located infrastructure through discussions with site staff** for a shared extreme weather climate control space with low barrier access for different communities to reduce risk from extreme heat and summer to increase public familiarity with the sites.

Three: Build and strengthen partnerships with agencies, organizations, and individuals beyond jurisdictional boundaries

Extending partnerships beyond jurisdictional limits can support more robust climate actions that leverage a broader range of skill sets, capacities, and resources at the municipal, regional, provincial and federal levels. These partnerships can accelerate progress on the strategic plans and actions outlined in this report, particularly in the context of tool sharing, technology sharing, sharing of expertise across units, advocacy for policy change, and harmonization of relevant policies. These can also be done through local community organizations as entry points for wider networks that extend the capacity of SWPH to deliver local solutions.

Activities for SWPH to consider:

Quick Wins:

- **Strengthen partnerships** with local universities, civil society organizations, the private sector and other key community partner collaborator groups to support climate adaptation initiatives.
- **Convene a local advisory group on psychosocial impacts** and provide training resources on climate change impacts and the vulnerable population of the southwestern region.
- **Educate school-aged children** through partnership with school boards (embedding into curriculum).

Best Buys:

- **Engage and empower youth to develop the skills they need** to participate in climate change and health action in partnership with local universities.

- **Plan for learning events series** for different communities, especially those in the most vulnerable classification in partnerships with colleges/universities to discuss risks and the links to different health associated impacts.
- **Strengthen institutional collaboration among health providers** on climate change actions, for example working with local hospitals to support a climate vulnerability assessment.

Game Changers:

- **Engage social housing owners and construction companies** to promote nature-based solutions as central to reducing heat island effects in urban settings. This can be part of a long-term strategy to new green buildings and provide learning opportunities for investment practices informed by health considerations for projected climate impacts.
- **Target emergency response interventions for populations most likely to be severely impacted** (i.e., older adults) by increasing collaboration between SWPH and agencies responsible for developing community regional emergency plans.

Activities for External Partners and Organizations to Consider:

Government partnerships

- **Partner with local disaster management agencies and municipalities to identify high risk flood zones and create clear public signals** of risk, but also include emergency response numbers and identify safe-shelter locations for seasons of increased flood risk.
- **Develop an Extreme Cold Action Plan for community actions** which identifies clear opportunities for partnerships across the public and private sector, seeks to leverage existing resources and infrastructure for reducing risk, and highlights concrete practices for addressing long term high cold stress in the southwestern region.

Community partnerships

- **Partner with local organizations** representing vulnerable populations to identify possible interventions and support needed to address mental health and climate vulnerability.
- **Celebrate wins and highlight real local actions** on specific improvements to our local environment: i.e., the improvement of Lake Erie water quality and related ecosystem health resulting from more environmentally sustainable farming practices that reduce runoff into waterways.

Industry partnerships

- **Develop private-public partnerships for increased heating and cooling centers** in areas of increased vulnerability, including resources to diffuse information among communities pinpointing the locations, and heat protection materials.
- **Partner with retailers** that develop UV protective clothing to increase access and affordability to appeal to a wider audience.

Financial Investments

- **Climate risk informed budgeting** to allocate resources for training and practice to reduce health risk on individuals and key community partner collaborators or clients.

Four: Create a communications plan to share up-to-date data on health risk information with recommendations spanning all hazards and health impacts for the region - including the psychosocial dimensions

A comprehensive communications plan focused on sharing up-to-date data on climate-related health risk information will provide the foundation for engaging vulnerable populations and ensure targeted and specific resources (a mix of printed/social media materials) for these communities. The plan can be part of a partnership strategy with different organizations that represent some of these stakeholders.

The focus should include air quality data and warnings; beach data and warnings; heat stress and cold weather warnings. Communications must be targeted and accessible and address language considerations and different population sub-groups with specific actions, including, for example, children, outdoor workers, pregnant women, seniors, new Canadians, seasonal farm workers, and their caregivers (teachers, day care workers, farm owners, nursing home providers, Chamber of Commerce).

Activities for SWPH to consider:

Quick Wins:

- **Deploy Early Warning Alerts** for extreme weather using the local community channels of communication (Facebook, WhatsApp groups, etc.). and online applications.
- **Provide information about what residents can do** to support improved air quality, types of landscaping at their homes, tree planting, etc.
- **Develop tailored public health education campaigns** about tick/vector-borne bites and prevention.
- **Create a digital infographic archive** with materials that outline the risks and measures to reduce climate impacts on individuals and vulnerable populations. This can be shared with local stakeholders, chambers of commerce and businesses to print and place in visible locations in advance of heat waves.
- **Enhance targeted communication of tangible actions** that can be taken at the community level to enhance resilience and adaptive capacity.
- **Winter weather cardiac incidents:** Communicate with adults and seniors' groups to help them understand that heavier snow leads to higher risk of cardiac incidents and provide possible preventive measures.
- **Launch an awareness raising campaign** with targeted components for the most vulnerable community groups and include key actions for protecting residents of heat waves and peak hot days.

- **Develop a communication campaign about sun protection** (Include: eye health) in a variety of settings (i.e., pharmacies, public, workplace education, middle schools)
- **Analyze SWPH website and social media traffic for beach water quality testing data** to understand who is accessing the information, who is most vulnerable, and if they are accessing the correct information.
- **Provide real-time updates of extreme weather events** through different communication channels prominently used by target communities to ensure these reach the most vulnerable communities with warnings and recommendations for extreme weather events (i.e., flood location, depth of water flow).

Best Buys:

- **Design, in collaboration with mental health professionals and climate experts, an education and awareness campaign** for the general public, target vulnerable populations and healthcare providers across the region to address climate anxiety, promote mental health strategies in response to climate impacts and support science informed mental health literacy in the community.
- **Provide translated key materials for at-risk immigrant and seasonal workers** of the types of services and support for health associated risks.
- **Develop a targeted campaign** for low-cost actions for protecting against heat for older adults (i.e., fridge magnets, critical temperature-marked thermometers with a hotline for high-risk thresholds).
- **Develop a text message alert and targeted communication outreach** based on the levels of air pollution and air quality index.

Game Changers:

- **Provide education and information to invest in communities' understanding** of the health risks of climate change and the projected impacts for the region to ensure individuals make it personal, urgent and relevant for themselves and ultimately the region.

Activities for External Partners and Organizations to Consider:

Using technology and customized tools

- **Provide social media information on real-time updates of extreme weather events** (i.e., flood location, depth of water flow).
- **Implement an Air Quality Health Index (AQHI) alert warning system.**

Community partnerships

- **Increase wellness checks** on the elderly during heatwaves and promote practices that support access to food and social recreation activities in times of extreme weather.
- **Address psychosocial impacts by providing opportunities to hold 'Carbon Conversations'** to educate people and provide a framework to talk about carbon reduction while taking into account the complex emotions and social pressures that make it difficult.

Five: Establish a monitoring and evaluation framework to assess the impact of climate actions and interventions

To assess the effectiveness and impact of climate change and health interventions, SWPH will need to establish a comprehensive monitoring and evaluation framework that includes indicators and measures of success. This framework should include the establishment of baseline data on health impacts in the region linked to data on climate-related hazards, and the ongoing monitoring of a series of indicators that would be used to understand risk and opportunities, track progress and make evidence-based decisions.

This could include developing a participatory community-focused mechanism to support monitoring the impacts of climate change action planning for SWPH that informs the indicators and measures of success for climate change and health interventions. An example of this could be developing partnerships in the community to implement a citizen science program that can generate evidence of new risks and good practices in the region. Linking the monitoring and evaluation framework with the communications plan identified in Recommendation 4 would provide regular information to the public through products such as interactive maps for community partners to inform themselves and their constituents about climate risks.

Activities for SWPH to consider:

Quick Wins:

- **Strengthen disease and incident monitoring** both as active and passive surveillance on vectors capable of transmitting diseases of public health significance. This can include research partnerships to map high risk locations, insect population increases and time of peak risk.
- **Incorporate the use of citizen science** to highlight local climate action successes (e.g., use of a hashtag to see what is being implemented in the community).

Best Buys:

- **Implement annual learning and scientific review dialogues** among health practitioners to share information on the emergence of new vectors of disease associated with a changing climate. Especially those linked to a combination of new environmental factors not previously present in the region in the last decades.
- **Review air quality monitoring data** for the region to communicate clear early warnings to residents. Aggregating communication channels and clear conduits for early warnings will strengthen communications across community stakeholders for communities with high risk of respiratory morbidities, such as elderly, children, and people with pre-existing health conditions.

Game Changers:

- **Evaluate the delivery and impacts of the program** activities over time to support extreme temperature policies. Continue to tailor policies and practices (based on evaluation data) to the needs of the population.

- **Establish routine evaluations** on the delivery and impacts of the activities using consistent indicators to measure success and draw lessons learned from the interventions.

Activities for External Partners and Organizations to Consider:

Using technology and customized tools

- **Draw on research expertise and resources** to make custom assessments, studies, and develop capacities to better understand risk and plan for context relevant actions.

Six: Promote and advocate for social capital-building activities

SWPH can be a catalyst for promoting and advocating for activities that build social capital of local organizations and communities to support actions that will address many of the health risks associated with climate change, including psychosocial worry, anxiety, concern for the future and the future of children and grandchildren. Examples from other jurisdictions that could be considered include the Be a Buddy Program (USA) that has been used to bolster social cohesion by building hyperlocal networks between heat-vulnerable residents, local volunteers and partner community-based organizations. Another example is the expansion of social prescribing initiatives, a practice dedicated to building up communities and fostering social connections in different environments, including the outdoors. This can be done in partnership with the new Canadian Institute for Social Prescribing (https://www.socialprescribing.ca), which can be further enhanced through creating a positive climate/sustainability hashtag and having citizen scientists share good health practices and experiences through the hashtag to bolster more positive thoughts about our climate future.

Activities for SWPH to consider:

Quick Wins:

- **Expand community support programs** for example, “Be a Buddy/Hey Neighbour program” to support check-ins during extreme weather events such as extreme hot days (such as the existing age friendly Program) and to educate the public about the risk of heat on physical and mental health.
- **Communication of local successes and progress towards climate action** to reduce climate anxiety and support community actors undertaking initiatives to mitigate or adapt to climate change. These can include the municipality, local businesses, schools, community organizations and universities.
- **Support social capital formation** by enabling social connection and nourishing a sense of belonging as a health priority for the SWPH region, related to the social determinants of health (e.g., social exclusion).
- **Promote community gardens in local spaces (i.e., schools, neighborhoods, workplaces) and urban agriculture** to enhance local food production and increase community resilience to food supply chain challenges.

- **Promote inclusion of psychosocial dimensions** in SWPH education and training programs for staff.

Best Buys:

- **Use existing information to make evidence-based interventions** to increase social connections (e.g., heyneighbourcollective.ca)
- **Co-create community strategies** around social prescribing and novel approaches to reduce stress, anxiety and depression among local residents.
- **Develop and offer training opportunities** for local community groups and organizations to increase their capacity to design and implement health-related climate adaptation strategies to support their clients, employees and community members directly.

Game Changers:

- **Coordinate with community partner collaborators to support social capital building activities** such as partnerships with existing community-based organizations that have a vision and a mission around social connection and include social capital building efforts (e.g., GenWell Project) in the implementation of programs and strategies such as part of the Community Safety and Well-Being Plan.

Activities for External Partners and Organizations to Consider:

Building capacities

- **Develop a community-based strategy to expand social capita**l to support the development of urban heat island interventions.
- **Invest in capacity building**: Provide heat risk training and response to all employees (e.g., City parks employees, daycares, nursery schools etc.)
- **Support targeted investments to fund psychosocial wellbeing** programs (e.g., Deployment of Mental Health Practitioners in the aftermath of climate-related emergencies).
- **Invest in community and individual mental health support programs for vulnerable people or provide training to those supporting vulnerable populations** during and after climate associated impacts, such as the elderly limited in mobility during heatwaves, foreign temporary workers and field workers, or daycare or social workers overseeing family wellbeing, and young people at risk. Similarly, coordinate with local emergency response services to create an inventory of support services for affected populations after extreme events such as floods and hurricanes in the region.

Revising operating procedures, policies, and protocols

- **Review of the "fees" for community recreation and social spaces**, for example for renting a room, and accessing spaces (community, recreation, etc.) to increase a sense of belonging in the community, including promoting special days and self-organized events for different community partner collaborators.
- **Provide free community recreation and leisure access** (to break the economic barrier).

- **Remove economic and social barriers** to community-based climate adaptation activities.
- **Using social research to identify and create multi-dimensional community spaces that are available 24/7.** These spaces can be used as heating/cooling centres, and they promote community gathering and social connections.
- **Explore the social and economic case for Universal Basic Income** including potential cost-savings and downstream benefits of basic income.
- **Promote good labour practices** to protect the health of seasonal working and outdoor employees during fire events raising risk, including recommendations on the use of safety equipment, and requiring employers to ensure wellness breaks for people working long periods of time outdoors.

Seven: Develop a climate-compatible sustainable food system strategy

A climate-compatible sustainable food system strategy links climate change adaptation and mitigation goals with broader food security efforts to support integrated community action toward more resilient food security and low carbon diets. The strategy may include, but is not limited to, developing a climate change food supply and disaster risk management plan, reducing food waste (household, schools, and community settings), supporting sustainable diets in community settings, providing knowledge exchange opportunities for community partners on the impact of climate change on food systems, and advocating for local- and provincial-level policies to support sustainable food systems. This could also include developing guides for the community on low-carbon and sustainable diets.

Activities for SWPH to consider:

Quick Wins:

- **Educate the public on what the impacts of extreme weather events might be on the safe food and safe water supply** (i.e., impacts on infectious diseases, business, livelihood, etc.)
- **Develop safe-food handling communication campaign** as extended heat waves and weather patterns change towards longer heat days, food safety is central to reducing the risk of disease from food poisoning.
- **Leverage existing knowledge resources and tools to inform the public** on issues related to food security, for example promoting local food maps available in our region which promote locally produced and seasonal foods (outside of public health) e.g., Buy Local, Buy Fresh in Elgin St. Thomas and Oxford Fresh.

Best Buys:

- **Conduct Community Food Assessments** for the SWPH region to determine priority areas and categorize possible interventions/policies.

Game Changers:

- **Look at sustainable diets from a perspective of public health policy** with local establishments.
- **Advocate for specific provincial policies** to provide school food programs to children (e.g., farm to school program).

Activities for External Partners and Organizations to Consider:

Revising operating procedures, policies, and protocols

- **Strengthen food waste reduction programs and policies** at the municipal level (green bin programs, garbage limitations): Prioritize consumer education on sources of food waste (particularly household food waste).
- **Partner to reduce food waste** with local municipalities, farms, school boards, local restaurants to prevent food waste.
- **Develop emergency response plans with local businesses and farmers in the event of food supply chain interruptions** under a short or extended time frame accounting for disruptions during an emergency and crisis abroad.

VII. Conclusion

This report has presented a summary of an assessment of the vulnerability of communities and populations in the SWPH region from the impacts of climate change. It documents a number of changes that are already occurring and impacting the health of the region, and it describes how continued changes in temperature and precipitation patterns will increase the risks of extreme weather, vector-borne and zoonotic disease, and psychosocial health impacts. The overall objectives of this work included:

1. Outlining climate associated health risks facing the SWPH region.
2. Highlighting vulnerable populations in the SWPH region and the potential impacts of climate change.
3. Describing ongoing climate action undertaken by SWPH.
4. Proposing recommendations to plan for future climate change impacts.

The assessment uses and builds on the work of recent vulnerability assessments undertaken by public health units across Ontario, while focusing on the unique demographic and geographic characteristics of the SWPH region. In particular, the recommendations and related activities included in the report are the result of direct input and engagement with staff and leadership of SWPH, and representatives of the broader community, including municipalities, conservation authorities, community organizations and individuals. This important connection has shaped the recommendations and related activities around key principles of equity, knowledge sharing, and partnership, which together create an opportunity to enhance the climate- and health-resilience of the SWPH region in a more systematic and wholistic manner.

Next Steps

An important next step in the adoption of this assessment report and its recommendations includes increasing the overall capacity of SWPH staff, leadership and partners to incorporate climate-related considerations into strategic planning, decision-making, and program design and delivery. Through targeted training and upskilling, including on both foundational climate literacy and more detailed adaptation knowledge and strategies, the region can build the skills and knowledge necessary to reduce the health risks posed by climate change.

While there is overwhelming evidence that the climate is changing, the intensity of impacts and the overall pace of change remains uncertain. As such, it will be important for SWPH to update this assessment at future intervals to ensure changes and associated risks are understood and programs are adapted accordingly. Similarly, as demographic, social and economic characteristics in the region change over time, it will be important to identify changes in vulnerability of communities and populations.

As mentioned in Section 5 of this report, many of the activities and interventions identified in the literature, by the advisory groups, and in other Ontario assessments, are not yet supported by robust evaluative evidence of their efficacy. While this evidence-base is expected to grow in the coming years, it will be important for SWPH and its partners to monitor and evaluate climate-related programs and activities over time to ensure desired outcomes are achieved.

The urgency of addressing climate change is becoming more obvious each day as the impacts become more visible and more severe. Through collaborative and evidence-based actions, SWPH and its community partners can together reduce the health risks of climate change in the region and increase the resilience and equity of its health systems overall. Adapting our communities and our support systems is critical to minimize health impacts, and the suffering and loss by those most vulnerable.

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IX. Appendices

Appendix A: Climate Science Report for the Climate Change and Health Vulnerability Assessment

A copy of the final report can be found on the Southwestern Public Health Website at:

https://www.swpublichealth.ca/en/reports-and-statistics/resources/Evaluations-and-Situational-Assessments/Climate-Science-Report---FINAL-2.pdf

Appendix B: Study Area in Context

Demographics

Southwestern Public Health Unit supports the health of people living in Elgin County, Oxford County and the City of St. Thomas. According to the 2021 census of the population, there were 216,533 people living within the Southwestern Public Health (SWPH) region (Statistics Canada, 2021).

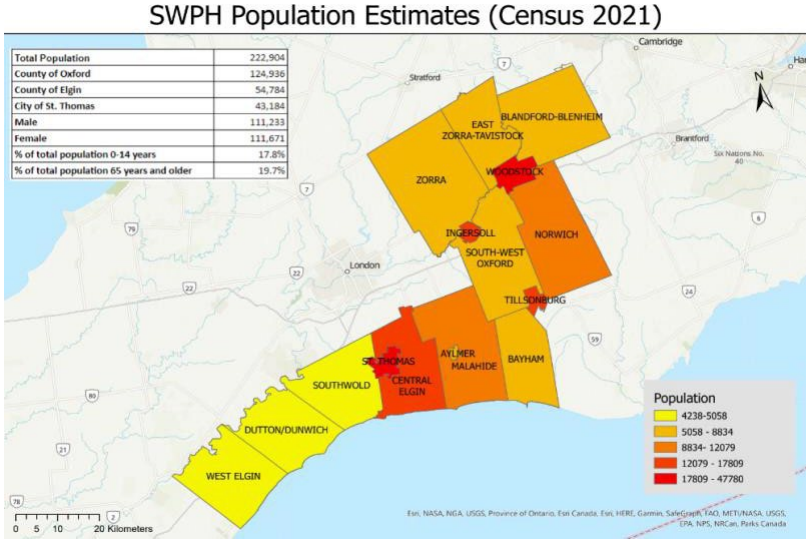


Figure 1: Population Estimates in SWPH (Statistics Canada, 2021).

The population is continuing to grow, with a population increase of 8.4% between 2016 and 2021 (Statistics Canada, 2021) (See population estimates in Figure 2).

When compared to Ontario, SWPH region has a slightly higher proportion of children and youth (0-19 years), and older adults (65+ years) at 23.8% and 20.2% respectively (Statistics Canada, 2021). However, SWPH region has a slightly lower proportion of adults (56%) when compared to Ontario (60%) (Statistics Canada, 2021). Between 2011-2021, the proportion of older adults grew from 16.1% to 20.2%, which indicates an overall aging population (Statistics Canada, 2021).

Table 1: Population (Statistics Canada, 2021)

Age	SWPH Region	Ontario
0-19	23.8%	21.4%
Adults	56%	60%
65+	20.2%	19%

There are some unique aspects of the population of this region. These include the presence of Amish and Low German Speaking (LGS) Mennonite communities, presence of a transient but substantial population of temporary foreign agricultural workers, as well as nearby Indigenous communities.

With respect to the LGS Mennonite community, estimates from 2002 suggest that approximately 500 reside in Oxford County, and 12,000 reside in Elgin County. However, health and social service providers have anecdotally shared their belief that the LGS Mennonite population has increased in these regions over time. With respect to the Amish communities, there are two settlements of Amish in the SWPH region, one in Aylmer and one in Norwich, with approximately 1500 residents combined.

In Oxford County and Elgin County, temporary foreign agricultural workers come to the region on an annual basis (from Barbados, Eastern Caribbean, Jamaica, Mexico, Trinidad and Tobago (F.A.R.M.S., 2024) to work during planting and harvesting seasons on local farms in the region. They are often single males housed in congregate living facilities on operating farms. They return to their country of origin upon completion of relevant paid farming tasks.

The lands of SWPH region were inhabited by the ancestors of Turtle Islands Indigenous people, individuals with direct blood ties to the Anishinaabe, Haudenosaunee and Attawandaron peoples (Supported information by Patricia Marshal-DeSutter, External Advisory Board). In Tillsonburg, we see the remains of the largest Attawandaron settlement in southwestern Ontario. It is noted that relevant data on this population in the SWPH region is not robust. There are three reserves just outside the boundaries of SWPH (Chippewas of the Thames First Nation, Oneida Nation of the Thames and Muncey-Delaware).

In the SWPH Health Status Data Presentation (2023), it was noted that the proportion in the SWPH region that identify as Indigenous (2.3%) is similar to the province (2.9%) in 2021. However, it is noted that Indigenous peoples have a higher prevalence of low income compared to the overall population. The unemployment rate among Indigenous peoples was considerably higher among males (12%) compared to females in Oxford County (3.8%), while in Elgin-St. Thomas, the unemployment rate for males was (9.4%) and females (7.1%) (SWPH Report: Measuring Opportunities for Reducing Health Inequities, 2019).

A majority of people in the SWPH region reported their mother tongue to be an official language (specifically English) (Statistics Canada, 2021). In the SWPH region, 99.4% of people can speak English, with the second most commonly spoken language in the home (excluding official

languages) being Germanic languages at 1.0% in Oxford County, and 3.2% in Elgin-St. Thomas (Statistics Canada, 2021). When excluding official languages, Germanic languages are the most common mother tongue at 3.3% in Oxford County, and 7.7% in Elgin-St. Thomas, compared to 1.2% in Ontario (Statistics Canada, 2021).

Health Assessment of SWPH

The section was primarily informed by the 2019 Population Health Assessment for SWPH, which includes data from the 2016 Canadian census. Data from the 2021 census data was used to supplement data gaps.

Wages

While the minimum wage in Ontario is $16.55, the living wage in London, Elgin and Oxford County is $18.85 (Coleman, 2023). Urban areas in the SWPH region have pockets of residential instability, with more material deprivation, which includes measures of one-parent families, low-income households and poor housing conditions, in urban centres and in the municipalities of Malahide and Bayham. In the SWPH region, 20.4% of people spend 30% or more of their income on shelter costs compared to 27.7% of Ontario residents (excluding farms).

A major indicator of the economic status of a community or neighborhood is the percentage of dwellings in need of major repair as reported in the Canadian census (Harrington and Elliott, 2009). Within the SWPH region, the percentage of occupied private dwellings that need major repair is 4.9% in Oxford County, and 6.1% in Elgin-St. Thomas, compared to 5.7% in Ontario (Statistics Canada, 2021).

Compared to Ontario, the SWPH region has a higher proportion of people with no certificate, diploma or degree (20.4%). The SWPH region also has a lower proportion of people with a bachelor's degree or higher (13.3%). However, the proportion of people with higher education is increasing, between 2016 and 2021, the proportion of people with a postsecondary certificate, diploma or degree increased from 45.4% to 47.3%. There is also a decrease in the proportion of people with a high school education or less by about 5% between 2016 and 2021.

In 2020, the median household income before tax in Oxford County, Elgin-St. Thomas, and Ontario are 87,000, 83,000, and 91,000 respectively (Statistics Canada, 2021). The prevalence of low income (based on the LIM-AT and LICO-AT, after tax) in SWPH is lower than Ontario on average (Statistics Canada, 2021). However, compared to Ontario (16.7%), SWPH (17.5%) has a slightly higher proportion of households that are food insecure. In the 2021 census, the largest industry based on employment is manufacturing at 19.3%, followed by health care and social assistance (12.0%), retail trade (10.1%) and construction (9.2%).

Activity and body health

SWPH has a higher proportion of adults classified as obese (28.7%) compared to Ontario (19.5%). Additionally, SWPH also has a lower proportion of adults considered active or moderately active (63.7%), and a higher proportion of adults considered somewhat active or

sedentary (36.4%) compared to Ontario (69.3% and 30.7% respectively). Youth in Oxford County (351.5 minutes) reported more time traveling in active ways than Ontario (227 minutes), however, youth in Elgin-St. Thomas reported significantly less time (91.6 minutes) than the provincial average.

Pre-existing conditions and chronic diseases

The rates of some pre-existing health conditions such as chronic diseases and mental health are higher in SWPH than Ontario. From 2012 to 2017, the rate of cardiovascular diseases-related hospitalizations was higher in SWPH when compared to Ontario. Similarly, from 2014 to 2017, SWPH also had higher rates of hospitalizations due to diabetes. While the rate of hospitalizations due to chronic obstructive pulmonary disease (COPD) in Oxford County between 2012 to 2016 was similar to Ontario, Elgin-St. Thomas reported higher hospitalizations rates than Ontario. In SWPH, the leading cause of mortality between 2008 and 2012 was ischemic heart disease, with rates of hospitalizations due to ischemic heart disease higher in Oxford County than Ontario from 2013 onwards. From 2015 to 2017, rates of emergency department visits and hospitalizations for suicide and self-harm in SWPH was higher than the provincial rate, with a higher proportion of women reporting depression during pregnancy (13.6%) and postpartum depression during pregnancy (5.4%) than in Ontario.

Substance use

Rates of substance use for smoking and marijuana are higher in SWPH than in Ontario. In SWPH, the rate of current smokers (23%) and daily smokers (16.8%) from 2015 to 2016 were higher than provincial rates (18% and 12.9%). SWPH also has a higher rate of former smokers (29.4%) than Ontario (24%). The proportion of smoke-free homes was higher in Ontario (24%) than SWPH (29.4%). Furthermore, from 2013 to 2017, the rates of impaired driving charges from alcohol and/or drugs were higher in parts of SWPH than the provincial rate. SWPH reported 1.5x the rate of motor vehicle collisions attributable to alcohol when compared to Ontario.

Injuries

Rates of other injuries not attributable to alcohol were also higher in SWPH than Ontario. For example, from 2013 to 2017, SWPH reported higher rates of emergency department visits and hospitalizations for falls, transportation accidents and being struck by or against an object than Ontario. During the same time period, SWPH also reported higher rates of emergency department visits for neurotrauma and a higher five-year average rate of hospitalizations for concussions than Ontario (8.3 versus 4.2 per 100,000, respectively). From 2015 to 2016, SWPH (44.6%) also reported higher rates of sunburn in the past 12 months compared to Ontario (31.7%). In general, people living in the SWPH region had over 2x the rate of unintentional injuries compared to Ontario.

Seasonal illness

Compared to Ontario, SWPH reported lower rates of influenza in the 2016/2017 and 2017/2018

flu seasons. However, SWPH had higher rates of whooping cough (2013 to 2016) and cryptosporidiosis (2013 to 2017) than Ontario. Campylobacteriosis was the most commonly reported enteric disease (between 2013 and 2017), which represents 41.7% of all enteric diseases in SWPH. Vector-borne diseases are considered rare in SWPH (0.37% of all reported infectious diseases).

Summary

In summary, residents of SWPH reported higher rates of chronic diseases (e.g., diabetes, cardiovascular diseases, ischemic heart disease, etc.), mental health disorders (e.g., suicide and self-harm), substance use, and injuries, with lower rates of physical activity and influenza. These findings should be taken into consideration when developing new plans, programs, interventions, including climate change relevant action plans.

Health and Wellbeing of Oxford County and Elgin County and City of St. Thomas

Oxford County

This section of the report was informed by the Profile of Wellbeing in Oxford County.

Defining Wellbeing

In the report 'A Profile Of Wellbeing In Oxford County With Comparisons To Ontario And Canada', wellbeing is defined as "The presence of the highest possible quality of life in its full breadth of expression focused on but not necessarily exclusive to: good living standards, robust health, a sustainable environment, vital communities, an educated populace, balanced time use, high levels of democratic participation, and access to and participation in leisure and culture" (Smale and Gao, 2018, p.4). This report followed the guidance of the Canadian Index of Wellbeing (CIW). The CIW provides a profile of wellbeing through eight domains: community vitality, democratic engagement, education, environment, healthy populations, leisure and culture, living standards, and time use (CIW, 2023).

Community Vitality

Vital communities consist of people, private, public, and non-governmental organizations with strong, active, and inclusive relationships that can adapt and thrive in the changing world. In the southwestern region, for example, Oxford County residents reported a high sense of belonging to their community (70.2%), great feelings of safety (81.0%), and reported low rates of experiencing discrimination (4.1%). However, SWPH residents also reported a low level of community volunteering (52.9%) and reported having five or fewer close friends (49.5%).

Democratic Engagement

Democratic engagement refers to involvement in democracy through political institutions,

organizations, and activities. In Oxford County, voter turnout for the federal election (67.9%) was similar to rates across Canada (68.3%). Rates of voter turnout in Oxford County (51.9%) for the provincial election was also similar to Ontario (51.3%). Challenges exist for regional elections, with a 37.6% voter turnout rate for the last election of regional council, compared to the average of 43.1% in Ontario. However, Oxford County has elected more women to council (40.0%) than other municipalities in Canada.

Education

Similar to rates in the SWPH region overall, Oxford County has lower rates of both high school graduation (78.3%) and people with a university degree (12.9%) than Ontario (86.5% and 28.5% respectively). However, Oxford County public libraries offer more early literacy and learning programs (34 programs per 1,000 children) than Ontario (25.8 programs per 1,000 children). Compared to anywhere else in Ontario (20.7%), Oxford County has the lowest proportion of children (0-4 years old) for whom licensed, centre-based childcare is available (10.1%).

The Environment

The environment is the foundation of wellbeing, as human health and wellbeing depends on the quality of air, soil, and water. Oxford County (55.1%) has better air and water quality than other parts of Ontario. Additionally, SWPH has a higher waste diversion rate, which refers to the percentage of all residential and non-residential waste diverted from landfill, than Ontario (47.3%).

Healthy Populations

The healthy population domain includes physical, mental, and social wellbeing. Oxford County has (65.8%) a smaller proportion of residents reporting very good or excellent mental health compared to Ontario (70.4%), however, there is a higher percentage of residents rating their overall health as very good or excellent (65.8%) compared to Ontario (59.2%). Furthermore, Oxford County (44.8%) also has a high percentage of residents who have gotten their flu shots in the past year, and a very low percentage (0.9%) of teens who smoke compared to Ontario (35.4% and 5.8%).

Leisure and cultural activities contribute to the wellbeing of individuals, communities, and societies through promoting life satisfaction and quality of life. As an indicator of leisure opportunities, Oxford County residents visit libraries more often than almost every other rural and small urban region, and in the province (119.6 in-person visits per year per 1,000 people) (103.2 in-person visits per year per 1,000 people).

Living Standards, Leisure and Culture, and Time Use

Living standards consider economic security through income and wealth. Oxford County ($76,275) has a lower median income than Ontario ($79,531). However, Oxford County has high rates of employment, and lower rates of residents living in low income and in food insecurity (although these living standards are more frequently reported for men). Time use examines how people experience and spend their time. Employees in Oxford County reported long hours at work each week (15.2% of residents are working 50 hours or more) each week with limited flexibility (37.6% of residents reported flexible work hours) and short commute times (36.2 minutes), with a smaller percentage of employees reporting feeling high levels of time pressure (17.4%) than Ontario (14.3%, 46.1%, 53.7 minutes, and 19.8% respectively). Overall, overall life satisfaction is higher in Oxford County (86.8%) than the West Region (86.1%) and Ontario (85.6%), but slightly lower than Canada (87.1%).

Summary

In summary, Oxford County reported strong vital communities (e.g., high sense of belonging to their community, feelings of safety, and lower rates of experiencing discrimination), healthy physical environments (e.g., good air and water quality), and higher rates of employment, with more people rating their overall health as very good or excellent compared to Ontario. However, there are concerns with democratic 13 engagement (specifically for regional elections), rates of education, and mental wellbeing, with less people reporting very good or excellent mental health compared to Ontario.

Elgin County and City of St. Thomas

While Elgin and the City of St. Thomas do not have a profile of wellbeing report, this section uses the 2021 census data to summarize domains of wellbeing with available data in the area.

Democratic Engagement

In the 2022 Ontario municipal elections, the voter turnout rate for Elgin-St. Thomas is 29.1%, ranging from 10.8% in West Elgin to 37.3% in Southwold (Association of Municipalities of Ontario, 2022). Certain municipalities in Elgin-St. Thomas have also elected more women to council than other municipalities in Canada, with 40% female council representation in Bayham and West Elgin, and 33.3% in the City of St. Thomas (Association of Municipalities of Ontario, 2022).

Education

Compared to Ontario (15.3%), Elgin-St. Thomas has a higher proportion (21%) of people aged 15 years and over in private households that have no certificate, diploma or degree. Similarly, Elgin-St. Thomas has a higher proportion (31.5%) of people with a High (secondary) school diploma or equivalency certificate as their highest certificate, diploma or degree compared to

Ontario (27.2%). More people in Ontario (57.5%) have their postsecondary certificate, diploma or degree compared to Elgin-St. Thomas (47.4%), with only 13.1% of people earning a bachelor's degree or higher compared to 29.9% in Ontario.

Living Standards and Time Use

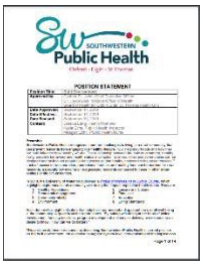
Elgin-St. Thomas (73,500) has a lower median household income (after tax) than Ontario (79,500). Elgin-St. Thomas and Ontario have very similar employment rates at 55.2% and 55.1% and have a lower unemployment rate at 10.3% and 12.2% respectively. Residents of Elgin-St. Thomas also have shorter commute times to work compared to Ontario on average. 39.5% of people in Elgin-St. Thomas reported a commute time of less than 15 minutes, with 4.7% reporting a commute time of 60 minutes or longer. In Ontario, 28.3% of people reported a commute time of less than 15 minutes, with 9.1% reporting a commute time of 60 minutes or longer.

Built, Social, and Economic Environments

The team conducted an overall search of documents related to the development priorities of each community, as well as the inclusion of supporting initiatives that were provided by the advisory board. The environment provides the underlying context within which SWPH populations live, work, and play. The focus of the search was directed to climate actions that were specifically introduced to support overall community wellbeing.

Built Environment

Southwestern Public Health recognizes the built environment and its relationships to healthy living, people's behavior and health status through their 2019 Position Statement. This statement highlights the way that public health supports the design and creation of complete neighborhoods and protected areas for conservation through efficient and equitable land use planning to enhance community health and well-being.



Oxford County

Oxford County's Official Plan provides land use strategies for the County and the municipalities that comprise the County. The Official Plan has a section in Chapter 2 that focuses on the County's Development Strategy, highlighting expected growth and development aspects impacting the built environment. Chapter 4 supports the planning principles by identifying the strategic aim through Growth Management Policies. The principle of the County Council includes public participation as an integral component of all planning decisions.

1. Urban Planning: Aligned with the economic environment, amendments were also made to protect the vitality, viability, and planned functions of the built environment, including:
    - The importance of traditional downtowns and village cores

- Encouragement of a sense of place by promoting well designed built form and cultural planning (including conserving features: heritage resources)
- Statutory and non-statutory exemptions to Development Charge Exemptions (used as incentives to promote development)
- Identifying required growth areas based on forecast growth of population and employment for the County and the Area municipalities.
- Identifying future growth areas for development purposes (i.e., Future Urban Growth Designations)
- Requiring existing land supplies and infrastructure to be efficiently utilized
- Clearly establishing parameters and criteria for development in designated growth areas (zoning of rural and non-farm rural residential lots)
- amendments

2. Housing Initiatives: Focused on Goal 1.1, the County is committed to "100% Housing" as many residents are experiencing challenges in finding housing that meets their needs. The focus is on addressing housing supply and affordability, including working with community partners and other levels of government.
    - Support the creation of diverse housing types and options.
    - Invest capital funds and leverage provincial, federal and partner funding.
    - Lead and support partners in implementing effective integrated solutions for vulnerable and unhoused populations.
    - Continue to advocate for and support long-term care capacity and supports.

3. Transportation Systems and Corridors: Focused on Goal 1.4, the County strategy is "connected people and places". The County is dedicated to developing a safe, efficient, cost-effective and reliable multi modal transportation system that addresses current and projected needs, including protecting planned corridors and major good movement facilities and corridors from development. Amendments were made on the following areas:
    - Network Improvements
    - Efficient use of freight-intensive lands with a focus on rail facilities
    - Supporting active transportation and transit
    - Protecting airports and rail facilities from incompatible land uses and development
    - Promotion of transportation connections between Area municipalities (integrating road, pedestrian, and cycle networks)
    - Rural Cluster Designations (focused on minimal potential for conflicts with agricultural uses, environmental resources and mineral and petroleum resources)

To continue, Chapter three of the Official Plan describes natural resource management policies, with information relevant to climate change and the physical environment. A core message across the region involves the engagement with conservation authorities to protect and prioritize nature. The strategic approach to environmental management as outlined in this Plan consists of three policy initiatives: (1) identifying the County's Natural Heritage System which includes

the Environmental Protection and Open Space designations, (2) general environmental resource protection policies that create opportunities for environmental enhancement and minimize adverse effects of development, and (3) environmental constraints that establish policies to alleviate natural hazards to public health and safety.

Goals as outlined in the Official Plan include the following:

1. Net Environmental Gain
2. Identify And Protect Significant Natural Areas
3. Develop The Natural Heritage System
4. Encourage Naturalization and Maintenance Of Ecological Functions
5. Integrate With Other Systems
6. Groundwater Protection
7. Surface Water Protection
8. Environmental Impact Control
9. Preservation Of Trees
10. Facilitate Safe and Healthy Conditions
11. Energy Efficiency
12. Environmental Monitoring and Reporting

Furthermore, Oxford County's Official Plan Review of Environmental Policies describes key considerations with community planning for natural heritage systems, water resources, open space, soil resources, natural hazards, and climate change mitigation and adaptation.

Suggested environmental policy directions from the official plan.

- Natural heritage system: In Oxford County, 17% of the total land area is covered by natural vegetation, of which approximately 97.8% was determined to be 'ecologically important'. Policy suggestions for Oxford County include identifying a natural heritage system and related policies to protect ecologically important features, as almost all of the remaining natural cover in Oxford is important for sustaining ecological and hydrological functions to support biodiversity and minimize the risks/impacts from a changing climate.
- Groundwater: Oxford County is entirely dependent on groundwater. The Official Plan Review suggests a new policy framework to incorporate a water resource system into the Official Plan, which will build from existing policies and source water protection plans.
- Open space policies are suggested to be updated to encourage the use of master planning and secondary planning for parks and to provide greater emphasis on the role of and planning for trails.
- Soil policies: Existing soil policies should be revised to reflect legislative changes with to 'excess soils', while continuing to protect the high-quality agricultural soils in Oxford County.
- Natural hazards: Policies for natural hazards should be updated to ensure that development is directed away from areas of natural hazards.

- Climate change: New policies should be incorporated to help address and prepare for a changing climate, including updates relating to energy efficiency and air quality.

Additional Reports:

I. 2024 Transportation Master Plan (2024): Developed as a strategic long-term planning document that outlines and defines policies, programs, and infrastructure improvements needed to manage both existing and future transportation demands by 2046. Oxford County is prepared to promote a sustainable multimodal transportation network to move people and goods into and throughout the County.

   - A long-term goal of the county is focused on the Universal Basic Mobility (UBM) to provide sustainable modes of transportation, and provide environmental benefits.

Elgin County

Elgin County's Draft Official Plan (2023) highlights economic development (linked to the built environment) as part of a strategic direction with the following objectives.

Official plan objectives:

- Employment areas: Identify and protect regionally significant employment areas, transportation corridors, and infrastructure facilities.
    - Encouraging standards of high-quality urban design, architecture, and landscape architecture in Strategic Employment Areas to reflect and attract high quality employment opportunities.
- Industrial lands: Ensure that the County has an ample supply of industrial lands to accommodate all forms and scales of industrial uses.
- Agricultural industry: Encourage a strong and vibrant agricultural industry by protecting both agricultural operations and associated facilities and corridors needed for their operation.
- Main streets: Reinforce the function of the County's main streets and downtown areas as cultural, administrative, entertainment, retail, and social focal points.
- Tourist attractions: Preserve and enhance historic, unique, and scenic routes, buildings, and communities that are defining features of the County and important to attracting tourism.
    - This is inclusive of scenic nature of transportation routes that reflects the County's rural and urban character, as well as influences of tourism traffic.

- Communities: Facilitate the creation of compact, complete, and pedestrian-friendly communities that provide equitable access to a range of local economic and social opportunities, centered around a vibrant main street or commercial core

The County recognizes the importance of the Natural System, which includes wetlands, woodlands, species and fish habitat, and water, and the negative social, environmental, and economic impacts that environmental degradation and climate change can have. Elgin County includes 85 km of Lake Erie shoreline, holding significant natural heritage.

The Official Plan outlines 13 policies relevant to the natural system:

1. Identification of the Natural System
2. Watershed Planning
3. Significance and the Natural System
4. Permitted Uses
5. Development In and Adjacent to Wetlands
6. Development in and Adjacent to Other Natural System Features
7. Destruction of the Natural System
8. Development in Fish Habitat and the Habitat of Threatened or Endangered Species
9. Agricultural Uses in the Natural System
10. Surface Water Features
11. Ground Water Features
12. Natural System Policies and Local Official Plan
13. Monitoring Health of the Natural System

City of St. Thomas

The Council of the City of St. Thomas has been working to update the Community Strategic Plan in early 2020, with enhanced public transit that was launched in early 2021. The city is guided by the principles of being an "environmentally responsible community" that "lead from a sustainable perspective". Commitments are focused on building a thriving community, with the goal to invest in the development of planned assets to advance access for people in the community which included:

- Investments to improve roads, bridges, parks and sidewalks.
- Expansion of the city trail system by 3 kilometers
- Expansion of transit hours of service and promotion of greater connectivity
- Creation of a physical concept plan and identifying locations for community and aquatic centers

In the draft Official Plan, the Council has noted several elements to preserve the built environment which include the following:

- Protection of archeological history
- Upgrading of streetscape design/landscape treatments that support "Downtown."

- Consideration of combining transit, paratransit, student busing, and transit for seniors/social services into an integrated community transportation service
- Priority in pedestrian and bicycle movement. Bicycling shall be recognized as a formal alternative mode of transportation.
- Safe and secure transportation systems
- Creation of Community Gardens in City-owned, unused/underutilized/underdeveloped lands, in recognizing that they are a sustainable land use and encourages positive social interaction and provides a connection to nature and the environment.

Furthermore, the City of St. Thomas is located in the Kettle Creek Conservation Authority and the Catfish Creek Conservation Authority. The city is currently updating its Official Plan. The most recent version outlines the following 10 goals relevant to the natural environment:

1. Improve the sustainability and long-term health of St. Thomas' ecosystems.
2. Identify, protect and enhance features, areas and systems of significance.
3. Protect significant natural areas and corridors and encourage the identification and restoration of potential natural corridors.
4. Manage the Kettle Creek valley system as an important resource (environmental and recreational)
5. Reduce the impact of urban drainage on the environment and preserve and enhance the quality and quantity of ground and surface water.
6. Encourage private and public conservation efforts.
7. Promote the conservation and managed use of natural resources.
8. Balance natural heritage protection with the interests of existing land uses
9. Minimize risks to human life and physical property form hazards (e.g., flooding and erosion)
10. Identify opportunities for limited and controlled development on flood plain lands and in proximity to steep slopes following accepted engineering standards.

Social Environment

Oxford County

The Social Planning Council of Oxford County (SPCO) aims to reflect local social realities to inform decision makers. The existing work from the SPCO includes promoting affordable transportation in Tillsonburg, poverty reduction in Oxford County, and promoting affordable housing. The SPCO has released multiple reports relevant to the social environment of the County, recent reports include:

1. Rural Barriers to Accessing Domestic Abuse Services in Oxford County (June 2020)

The SPCO investigated rural barriers to accessing domestic abuse services in Oxford County, and found barriers at the individual, community, and system level, with the most frequently cited

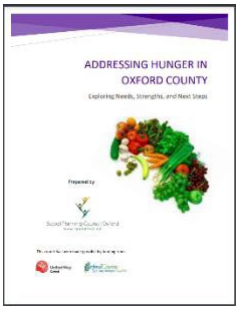
barriers being cultural factors (rural culture), confidentiality/anonymity, and limited availability of services respectively.

2. <u>Human Trafficking: Background Research on a Community Response to in Oxford County</u> (March 2019)

Through interviewing 11 stakeholder agencies, the SPCO found that all interviewed agencies' mandates include providing services to victims of human trafficking. The SPC also highlighted 11 recommendations for a community response to human trafficking:

1. Agree on a common definition of human trafficking including whether or not this definition will extend to all different forms of trafficking.
2. Explore labour trafficking further.
3. Consider the formation of a group or collaborative to determine a community response.
4. Partners agree upon guiding principles if working together to address human trafficking.
5. Map existing support services for victims of human trafficking.
6. Consider the implementation of possible facets of a community response.
7. Include an element of prevention in a community response.
8. Evaluate the community response.
9. Continue to monitor existing human trafficking strategies.
10. Further explore the questions that still remain.
11. Attempt to address larger systemic issues.

3. <u>Addressing Hunger in Oxford County: Exploring Needs, Strengths, And Next Steps</u> (2016)



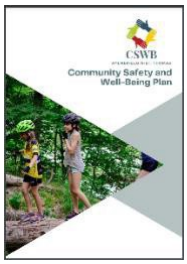
The SPCO evaluated Oxford County's strengths and needs within the food system and provided recommendations to decrease hunger within the community. Through conversations with community members from March to May of 2016, SPCO found community members to report issues with food security, which include issues with the availability, accessibility (physical and economic), adequacy (nutritious, safe, and sustainable), acceptability (culturally), and agency (policies that enable food security) of food.

4. <u>Youth Voice Report: Mental Health and Suicide</u> (September 2016)

The SPCO collected data from Facebook forums to explore issues relevant to suicide, mental health and related topics that are confronted by youth in Oxford County. Themes which emerged include stigma and shame surrounding mental health issues, bullying, a lack of community involvement, and words of support (e.g., encouragement from others online).

Further information on the living wage and wellbeing of residents in SWPH can be found in Section 1.2 summarizing the Population Health Assessment report for SWPH, and the Index of Wellbeing of Oxford County.

Elgin-St. Thomas



An Aylmer-Elgin-St. Thomas Community Safety and Well-being (CSWB) Plan was created with local data to highlight existing issues and future directions. However, it is important to note that the funding may be limited for the follow-up of the plan. The report describes goals and objectives within the following five priority areas relevant to the social environment:

1. Education and Skills Development: 21% of people (age 15 years and older) do not have a high school diploma.
2. Housing Security: 42% of renters face challenges with housing affordability.
3. Mental Health and Wellbeing: 10% of people (age 12 years and older) report fair or poor mental health
4. Public Safety: 4.1% increase in number of incidents (2018-2019)
5. Substance use and Addiction: Increase in emergency department visits for opioid overdose (2013-2018)

Economic Environment

The region's economic vitality and overall environment is situated as one of Ontario's richest areas focused on manufacturing, transportation and warehousing, trade, administrative and agricultural sectors.

Oxford County

According to the Oxford County Strategic Plan 2023-2026, there is an economic shift towards a more sustainable future through their commitment to 100% renewable energy. The County forecasts relatively high levels of net in-migration, along with an increase in employment opportunities. Oxford's community is projected to grow by 47, 000 residents and add approximately 21,000 new jobs by 2046. More than half of the growth is anticipated to occur in the City of Woodstock, and the Towns of Ingersoll and Tillsonburg are expected to account for roughly 25% of the housing and employment growth forecast. Moderate employment growth is anticipated for all five Townships and Oxford remains relatively well-positioned in terms of the suitability of industrial and residential land supply for attracting and accommodating forecasted employment growth.

In Phase 1 of the Comprehensive Review of Oxford County (2020), specific directions for accommodating the economic growth included the establishment of several targets including:

- A minimum target of 15 % of all new residential dwelling units created within the Large Urban Centres shall occur by way of residential intensification over the planning period.
- The County and Area municipalities should begin to consider the actions that may need to be undertaken to maintain a 20-year supply of designated growth land.
- Continue to support economic development initiatives in the County's local municipalities to foster a diverse and prosperous economy.

The County of Oxford Official Plan had several amendments to ensure recognition of generating employment and maintain a business environment that assists existing businesses, attracts new businesses and promotes opportunities to enhance the County's economic competitiveness. Amendments were made to the following area:

- Land supply, resources, infrastructure and public service facilities.
- Redesignation of industrial land
- Preventing conflicts with employment uses by protecting lands designated for agriculture and other employment purposes.
- Promotion of local food and protection of agriculture
- Redevelopment of Brownfield Sites
- Opportunities for energy, supply and climate change (Considerations of the potential negative impacts from a changing climate on the built environment, natural environment and local economy, with potential measures to mitigate such impacts, where feasible)
- Sustainable Tourism Development
- Recognition of Small Business Development (including home businesses)
- Rural employment and economic diversification

Additional Reports:

1. Economic Development Group Recommendations Report No. CS 2023-29: This report responds to the Council direction to report on a set of recommendations that were presented in June 2023 by the Economic Development Group. A committee was created to collaborate on an overall economic development strategy.

Elgin County

The County's Draft Official Plan (2023) shared that the major drivers of economic growth in the County are influenced by manufacturing, processing, the trades, research and development, and distribution and logistics industries. The County is home to several industrial operations including food processing plants and manufacturing, as well as large agricultural and smaller-farm owned operations and farms. Elgin County is a vibrant and diverse place that is rich in economic opportunity, seeing significant population growth due to their proximity to other larger cities. The County's Draft Official Plan (2023) highlights several economic development policies:

- Ensuring an adequate supply of designated and serviced employment lands to accommodate 25 years of employment growth.
- Identifying strategic employment areas to ensure protection from conversion and incompatible development.

- Protecting Strategic Employment Areas (land use permits, appropriate uses of space)
- Priority in protecting the agricultural system (particularly the interconnected elements of agricultural land, farming operations, agriculturally related and agri-tourism operations, food processing, etc.)
- Preserving the agricultural and rural character of the County through rural economic development

Additional Reports:

I. 2024 Transportation Master Plan (2024): Goods Movement Strategy: Supporting the railways is essential to the County's economic health. There is a focus on enhancing rail and truck freight to improve the integration of both systems.

City of St. Thomas

The City Council of St. Thomas's Community Strategic Plan in early 2020 committed to building a vibrant community. The goal was to enhance opportunities for connection and development to promote growth for people and businesses in the city. To support the economic growth of the city, the commitments included:

- Implementation of downtown enhancement projects that incorporated cultural and safety elements.
- Merging of the economic development entities between the City of St. Thomas and the County of Elgin to enrich services and resources.
- Establishment of a formal committee to address education and skilled training needs in the community.

St. Thomas is an area known for manufacturing, warehousing, offices and ancillary retail and cluster services. The Official Plan is still undergoing updates but the economic growth in St. Thomas is expected to be moderate, with a total employment forecast to increase to 23,800 in 2041. There are ongoing proactive public and private efforts to promote the overall city's life, working to rehabilitate and/or redevelop areas characterized by economic instability or deficient land uses. The City's objective is to combine the historic preservation and economic development in local revitalization initiatives. The city will actively support and promote economic development through the implementation of their Economic Development Strategies. The city also has a priority to encourage economic areas in the areas of advanced manufacturing, life sciences, small knowledge-based business, information technology, business services and the environment. In the future, industrial operations are required to implement the Ministry of Environment and Climate Change Guidelines.

Appendix C: Assessment Report Data Extraction Template

The following template was used to extract data from each of the assessment reports reviewed from other regions across Ontario.

Background
Public Health Units (PHUs)
Select all that apply.

- Algoma PHU
- Brant County HU
- Chatham-Kent HU
- Durham Region Health Department
- Eastern Ontario HU
- Grey Bruce HU
- Haldimand-Norfolk HU
- Haliburton, Kawartha, Pine Ridge District HU
- Halton Region Health Department
- Hamilton Public Health Services
- Hastings and Prince Edward Counties HU
- Huron Perth HU
- Kingston, Frontenac, Lennox and Addington PH
- Lambton HU
- Leeds, Grenville and Lanark District Health Unit
- Middlesex-London HU
- Niagara Region PH Department
- North Bay Parry Sound District HU
- Northwestern HU
- Ottawa PH
- Peel PH
- Peterborough Public Health
- Porcupine Health Unit
- Public Health Sudbury and Districts
- Region of Waterloo, PH
- Renfrew County and District HU
- Simcoe Muskoka District HU
- Southwestern PH
- Thunder Bay District HU
- Timiskaming HU
- Toronto PH
- Wellington-Dufferin-Guelph PH
- Windsor-Essex County HU
- York Region PH
- Unsure

Methods

Did the vulnerability assessment collect primary data?

- Yes
- No
- Unsure

If yes, what were the methods of data collection?

Select all that apply.

- Surveys
- Qualitative Interviews (e.g., Key Informant Interviews)
- Focus Groups
- Workshops
- Worksheets
- Unsure
- Other

Who was included in the engagement?

e.g., population subgroups, organizations, businesses, etc. Select all that apply.

- Internal Health Unit Staff
- Public Health Teams
- Regional Board of Health Members
- Regional Departments
- Municipal Staff and Representatives
- Public Members of the Municipalities
- Conservation Authorities
- Healthcare Organizations and Professionals
- Health Canada Staff
- Ontario Climate Consortium Staff
- Provincial Ministries
- Indigenous Groups and Organizations
- Local Educational Institutions
- Environmental Organizations
- Local Planners
- Community Volunteers
- Organizations and Individuals working with vulnerable populations (e.g., Immigrants, people living in insecure housing, etc.)
- Individuals Working or Volunteering with Climate Change-related Activities.
- Non-profit Organizations and Charities
- Religious Organizations
- Unsure
- Other

Objective of Primary Data Collection

Select all that apply.

- Identify climate change impacts of concern.
- Identify likelihood of climate impact
- Identify public perceptions and opinions about climate change and its health impacts.
- Identify expert opinion regarding potential climate change and its health impacts.
- Identify vulnerable populations.
- Identify impacts relevant to vulnerable populations.
- Identify existing data for the study area on climate-related impacts.
- Identify additional datasets that could be considered for the assessment.
- Identify potential data and knowledge gaps.
- Understand community's expectations of the public health unit.
- Identify potential actions/collaborations with community partners related to climate change mitigation and adaptation.
- Identify current knowledge of health unit staff of the connections between climate change and health and existing programs.
- Identify current health and climate change policies and plans in the health region.
- Identify current actions being taken by partners to mitigate and/or adapt to climate change.
- Identify future climate adaptation actions within existing health unit programs.
- Identify options and recommendations for reducing current and future risks to health through adaptation.
- Identify possible consequences and barriers to adaptive actions.
- Introduce the project to task force members.
- Identify priorities in response(s) to the health impacts of climate change.
- Identify sensitivity and adaptive capacity rankings for climate impacts.
- Identify effective avenues for communicating the results of the assessment.
- Identify stories of successful adaptation (e.g., on-going program implementation, public health surveillance activities, community engagement, etc.) to climate-related health risks.
- Unsure
- Other

Did this vulnerability assessment draw on other vulnerability assessments?

- Yes
- No
- Unsure

If yes, which vulnerability assessment?

Select all that apply.

- Chatham-Kent HU
- Grey Bruce HU
- Haliburton, Kawartha, Pine Ridge District HU

- Hamilton Public Health Services
- Middlesex-London HU
- Niagara Region PH Department
- Northern Ontario Climate Change and Health Collaborative
- Ottawa PH
- Peel PH
- Region of Waterloo, Wellington-Dufferin-Guelph PH
- Simcoe Muskoka District HU
- Toronto PH
- Windsor-Essex County HU
- York Region PH
- Unsure

Did this vulnerability assessment draw on other government reports?

- Yes
- No
- Unsure

If yes, which report?

Select all that apply.

- MOHLTC - Ontario Climate Change and Health Toolkit (2016)
- MOHLTC - Ontario Climate Change and Health Monitoring Study (2016)
- MOHLTC - Healthy Environments and Climate Change Guideline (2018)
- Health Canada - Climate Change and Health Vulnerability and Adaptation Assessment: Workbook for the Canadian Health Sector (2022)
- Health Canada - Cities Adapt to Extreme Heat: Celebrating Local Leadership (2016)
- Health Canada - Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity (2008)
- WHO - Protecting Health from Climate change: Vulnerability and Adaptation Assessment guide (2013)
- ICLEI - Canada’s Building Adaptive and Resilient Communities Program (BARC) Protocol
- Water, Air and Climate Change Bureau - Adapting to extreme heat events: Guidelines for assessing health vulnerability (2011)
- Natural Resources Canada - Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (2014)
- Ministry of the Environment and Climate Change - Climate Change Action Plan (2016)
- Environmental Commissioner of Ontario - Facing Climate Change: Greenhouse Gas Progress Report (2016)
- National Center for Environmental Health - Assessing Health Vulnerability to Climate Change: A Guide for Health Departments (2016)
- The Lancet Countdown: tracking progress on health and climate change (2016)
- Intergovernmental Panel on Climate Change Assessment Reports
- Unsure

- Other

What data sources were used to localize climate change trends and projections?

Select all that apply.

Environment and Climate Change Canada Data (e.g., Historical Weather Station Data, Historical Air Pollutant Data, Public Weather Alerts, Past Weather and Climate, Temperature, UV Index, Air Quality Health Index, Tornado Data, etc.)
Public Safety Canada - The Canadian Disaster Database.
Public Health Ontario - Traffic-Related Air Pollution
Public Safety Canada - Floods
Climate Data Canada Portal
Ontario Climate Data Portal
Ministry of the Environment, Conservation and Parks Climate Change Data Portal
Pacific Climate Impacts Consortium Data Portal
Canadian Centre for Climate Services (CCCS) Climate Data Tool
Ontario Climate Consortium (OCC) Assessment
York University Laboratory of Mathematical Parallel Systems (LAMPS) Dataset
University of Wisconsin Dynamically Downscaled Regional Climate Models
Climate Atlas of Canada
Unsure
Other

Time Frames used as Reference for Climate Change

What was the timeframe used to represent baseline conditions?

Select all that apply.

1950-2005
1951-1980
1971-2010
1976-2005
1981-2010
1986-2005
2000-2018
Unsure
Other

What was the timeframe used to represent past conditions?

Select all that apply.

2006-2018
1950-2005
Unsure
Other

What was the timeframe used to represent future conditions?

Select all that apply.

- 2040-2069
- 2011-2040
- 2041-2070
- 2071-2100
- 2070-2099
- 2020-2049
- 2050-2079
- 2080-2100
- 2049-2069
- 2006-2100
- 2020s
- 2050s
- 2080s
- Unsure
- Other

What population subgroups in the health region were mentioned in the vulnerability assessment?

Select all that apply.

- Indigenous Populations
- Recent Immigrants
- Farm Workers (including local and migrants)
- Visible Minorities
- Mennonite Populations
- Low Education (No high school diploma or equivalency certificate)
- Unsure
- Other

If yes, what proportion of the identified population subgroup exists within region?

List out different communities of indigenous populations in the "Indigenous Populations" row under the second column. List out other relevant communities in the "other" row under the second column.

	Proportion of Population (Percentage or Count)
Indigenous Populations	
Recent Immigrants	
Farm Workers (including local and migrants)	

Visible Minorities	
Mennonite Populations	
Low Education (No high school diploma or equivalency certificate)	
Other	

Economy

What are the economic drivers of the region in the vulnerability assessment?

Select all that apply.

- Mining
- Forestry
- Agriculture
- Construction
- Manufacturing
- Accommodation and Food Service Industry
- Unsure
- Other

Geographic Considerations

Close Proximity to:

Select all that apply.

- Lake Ontario
- Lake Erie
- Lake Superior
- Lake Huron
- Lake Simcoe Basin
- Lake St. Clair
- Georgian Bay
- The Niagara Escarpment
- The US Border
- The Oak Ridges Moraine
- The Grand River Watershed
- The Saugeen Watershed
- The Watershed
- The Nottawasaga Watershed
- Maitland Valley watershed
- Thames River
- Sydenham River

Snye River
Unsure
Other

Climate Risks

Extreme Temperatures

Extreme Heat

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Heat Related Health Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- More Hot Days
- More Tropical Nights
- Heat Alert-eligible Events.
- More and Longer Heat Waves
- Urban Heat Island
- Heat Stroke
- Heat Exhaustion
- Heat Rash
- Heat Cramps
- Dehydration
- Cardiovascular Disorders
- Respiratory Illnesses
- Asthma
- Diabetes
- Renal Disease
- Pre-term Birth
- Low Birth Weight
- Infant mortality
- Psychosocial Health
- Heat-related Emergency Department Visits
- Heat-related Hospitalizations.
- Heat-related Mortality.
- Unsure
- Other

Data Sources Employed to Investigate Heat-related Health Impacts

Select all that apply.

- IntelliHealth Ontario: Heat-related illness emergency room visit and hospitalizations.
- IntelliHealth Ontario: Emergency department visits and hospitalization for myocardial infarction
- IntelliHealth Ontario: Emergency department visit and hospitalization rates for hypertension.
- IntelliHealth Ontario: All-cause mortality
- Rapid Risk Factor Surveillance System: Households with/without Air Conditioning
- Rapid Risk Factor Surveillance System: Protective Behaviours
- Rapid Risk Factor Surveillance System: Adults who are unaware of places close to their home where they can go to cool down during hot weather.
- Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Heat-related emergency department visits
- Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Heat-related emergency department visits
- Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Self-harm-related emergency department visits
- Public Health Ontario - Extreme Weather Ontario Health Profile: Rate of Hospitalizations due to Extreme Heat
- Acute Care Enhanced Surveillance (ACES): Emergency department line listings.
- Unsure
- Other

Extreme Cold

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Cold Related Health Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- Decrease in cold days
- Hypothermia
- Frostbites
- Frostnip
- Windburn
- Cardiovascular Disorders
- Respiratory Illnesses
- Bronchoconstriction
- Psychosocial Health
- Decrease in Cold-related Morbidity and Mortality
- Cold-related Emergency Department Visits
- Cold-related Hospitalizations
- Cold-related Mortality
- Unsure

- Other

Data Sources Employed to Investigate Cold Related Health Impacts

Select all that apply.

- IntelliHealth Ontario: Cold-related illness emergency room visit
- Canadian Institute for Health Information: Cold-related illness emergency room visit
- Unsure
- Other

Vulnerable Populations

Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older adults (65+)
- People living in insecure housing
- People living in low-income households
- People with pre-existing health conditions
- Outdoor workers
- Rural communities
- Indigenous peoples
- Pregnant women
- Recent immigrants (within last five years)
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations
- People with cognitive constraints
- Unsure
- Other

Extreme Weather

Extreme Weather

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Hazards Related to Extreme Weather

Select all hazards discussed in the assessment.

- Extreme Precipitation
- Extreme Rainfall
- Extreme Snowfall
- Freezing Rain
- Extreme Winds
- Thunderstorms
- Flooding
- Ice
- Ice Storm
- Winter Storms
- Droughts
- Wildfires
- Tornadoes
- Hurricanes
- Unsure
- Other

Extreme Weather-Related Health Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- Food-and-Waterborne Illnesses
- Power Outages
- Private property damage and loss
- Electrocution
- Carbon Monoxide Poisoning
- Damage to public infrastructure
- Disruption of Health and Social Services
- Water Quality Impacts
- Indoor Air Quality Impacts
- Outdoor Air Quality Impacts
- Infection
- Respiratory Illnesses
- Vector-borne Diseases
- Evacuation and Relocation
- Food safety and Security Impacts
- Psychosocial Health
- Extreme Weather-Related Emergency Department Visits
- Extreme Weather-Related Hospitalizations
- Extreme Weather-Related Injuries
- Extreme Weather-Related Mortality
- Unsure
- Other

Data Sources Employed to Investigate Extreme Weather-Related Health Impacts

Select all that apply.

- Rapid Risk Factor Surveillance System: Emergency preparedness
- Statistics Canada - Discharge Abstract Database: Injury-related hospitalization count
- Canadian Community Health Survey: Drinking status and illicit drug use
- Public Health Ontario: Rate of emergency department visits attributed to extreme weather events
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older adults (65+)
- People with pre-existing health conditions
- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous peoples
- Pregnant women
- Recent immigrants (within last five years)
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorder
- People with mobility limitations
- People with cognitive constraints
- Unsure
- Other

Air Quality

Air Quality

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Pollutants and Allergens

Select all exposures in the assessment.

- Aeroallergens
- Fine Particular Matter (PM0.1)
- Fine Particular Matter (PM2.5)
- Fine Particular Matter (PM10)
- Nitrogen Oxides (NOx)
- Sulphur Dioxides (SO2)
- Carbon Monoxide (CO)
- Ground-level Ozone (O3)
- Traffic-related Air pollution (TRAP)
- Unsure
- Other

Air Quality Related Health Risks and Impacts

Chronic Obstructive Pulmonary Disease (COPD). Select all health risks and impacts discussed in the assessment.

- Asthma
- COPD
- Exacerbating Existing Environmental Allergies
- Respiratory Illnesses
- Difficulty Breathing
- Throat or Lung Irritation
- Psychosocial Health
- Air Quality Related Emergency Department Visits
- Air Quality Related Hospitalizations
- Air Pollution-related Mortality
- Unsure
- Other

Data Sources Employed to Investigate Air Quality Related Health Impacts

Select all that apply.

- IntelliHealth Ontario: Asthma-related emergency department visits
- IntelliHealth Ontario: COPD-related emergency department visits
- IntelliHealth Ontario: Myocardial infarction emergency department visits and hospitalizations
- IntelliHealth Ontario: Hypertension emergency department visits and hospitalizations
- Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Asthma-related emergency department visits

- Rapid Risk Factor Surveillance System: Community and health services
- Health Canada: Non-accidental deaths
- Health Canada: Respiratory deaths
- Health Canada: Air quality related emergency department visits
- Canadian Community Health Survey: Smokers
- Public Health Ontario: At-risk populations living in traffic-related air pollution (TRAP) exposure zones
- The Hospital for Sick Children (SickKids): Ontario Asthma Surveillance Information System
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older Adults (65+)
- People with pre-existing health conditions
- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous people
- Pregnant women
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations
- People with cognitive constraints
- Unsure
- Other

Vector Borne Disease

Mosquito-borne Diseases

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Mosquito-borne Diseases

Select all diseases discussed in the assessment.

- West Nile Virus (WNV)
- Zika Virus
- Eastern Equine Encephalitis Virus
- Jamestown Canyon Virus
- Snowshoe Hare Virus
- Malaria
- Dengue
- Chikungunya
- Yellow Fever
- Unsure
- Other

Tick-borne Diseases

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Tick-borne Diseases

Select all diseases discussed in the assessment.

- Lyme Disease
- Babesiosis
- Anaplasmosis
- Powassan Encephalitis
- Borrelia Miyamotoi
- Amblyomma Americanum (Lone-star Tick)
- Unsure
- Other

Vector Borne Disease Related Health Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- Expanded range and increased survivability of black legged ticks and mosquitoes and their hosts
- Longer warm season (increase in degree days)
- Introduction of new vector insects due to favourable climate conditions
- Longer season for people to be outdoors
- Psychosocial Health

- Vector Borne Disease Related Emergency Department Visits
- Vector Borne Disease Related Hospitalizations
- Vector Borne Disease Related Mortality
- Unsure
- Other

Data Sources Employed to Investigate Vector Borne Disease Related Health Impacts

Select all that apply.

- Public Health Ontario: Infectious disease trends in Ontario
- Public Health Ontario: West Nile Surveillance
- Rapid Risk Factor Surveillance System (RRFSS): Community and Health Services
- iPHIS: West Nile Virus Cases
- iPHIS: Lyme Disease Cases
- Health Unit Surveillance and Monitoring Data: Tick Surveillance
- Health Unit Surveillance and Monitoring Data: Monthly reportable Disease Incidence Reports
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older Adults (65+)
- People with pre-existing health conditions
- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous people
- Pregnant women
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations

- People with cognitive constraints
- Unsure
- Other

Contamination of Food and Water

Water-and-Food-Borne Diseases

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Enteric Diseases

Select all diseases discussed in the assessment.

- Campylobacter Enteritis
- Salmonellosis
- Cholera
- Norovirus
- Verotoxin-producing Escherichiacoli
- Giardiasis
- Cryptosporidiosis
- Listeria
- Shigella
- Unsure
- Other

Water-and-Food-Borne Diseases Related Health Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- Diarrheal Diseases
- Contamination of Drinking Water
- Contamination of Surface Water Source
- Contamination of Groundwater
- Contamination of Private Wells
- Contamination of Recreational Water
- Contamination of Irrigation Water
- Increased Growth and Survival of Pathogens and Pests
- Growth of Blue-Green Algae (Cyanobacteria)
- Algal Blooms
- Increased Dust-borne Contaminants (due to drier conditions)
- Overloaded Water Treatment and Storm Water Managements Systems (due to precipitation)
- Compromised Refrigeration of Food (due to power outages)
- Greater Spoilage Rates of Food (due to higher temperatures)

- Psychosocial Health
- Water-and-Food-Borne Diseases Related Emergency Department Visits
- Water-and-Food-Borne Diseases Related Hospitalizations
- Water-and-Food-Borne Diseases Related Mortality
- Unsure
- Other

Data Sources Employed to Investigate Water-and-Food-Borne Diseases Related Health Impacts

Select all that apply.

- Public Health Ontario: Infectious disease trends in Ontario
- Ministry of Health and Long-Term Care: Water Testing Information System
- iPHIS: Cases of food-and-waterborne illness
- iPHIS: Rates of enteric illnesses
- Health Unit Surveillance and Monitoring Data: Beach Surveillance
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older Adults (65+)
- People with pre-existing health conditions
- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous people
- Pregnant women
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations
- People cognitive constraints

- Unsure
- Other

Water and Food Security

Water and Food Security

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

Water and Food Security Related Health Risks and Impacts

Select all health risks discussed in the assessment.

- Decreased Drinking Water Supplies
- Increased Water Demands
- Increased Growing Seasons
- Decreased Growing Seasons
- Increased Crop Yields
- Decreased Crop Yields
- Increased Food Cost
- Food Insecurity
- Psychosocial Health
- Water and Food Security Related Emergency Department Visits
- Water and Food Security Related Hospitalizations
- Water and Food Security Related Mortality
- Unsure
- Other

Data Sources Employed to Investigate Water and Food Security Related Health Impacts

Select all that apply.

- Statistics Canada: Food insecurity
- Health Unit Surveillance and Monitoring Data: Food Insecurity
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older Adults (65+)
- People with pre-existing health conditions

- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous people
- Pregnant women
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations
- People with cognitive constraints
- Unsure
- Other

Ultraviolet Radiation (UVR)

UVR/Sun Exposure

Was this climate risk included in the vulnerability assessment?

- Yes
- No
- Unsure

UVR/Sun Exposure Related Health Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- Malignant Melanoma
- Non-melanoma cancer
- Cataracts
- Stratospheric Ozone Depletion
- Psychosocial Health
- UVR Related Emergency Department Visits
- UVR Related Hospitalizations
- UVR Related Mortality
- Unsure
- Other

Data Sources Employed to Investigate UVR/Sun Exposure Related Health Impacts

Select all that apply.

- IntelliHealth Ontario: Malignant melanoma
- IntelliHealth Ontario: Melanoma of Skin
- Rapid Risk Factor Surveillance System: Protective behaviours
- Cancer Care Ontario: Ontario cancer registry
- Cancer Care Ontario: Rate of malignant melanoma
- Cancer Care Ontario: Rate of non-epithelial skin cancers
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)
- Children (Ages 6-17)
- Older Adults (65+)
- People with pre-existing health conditions
- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous people
- Pregnant women
- Recent immigrants (within the last five years)
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations
- People with cognitive constraints
- Unsure
- Other

Psychosocial Health

Psychosocial Health Included in Assessment

Was this climate risk included in the vulnerability assessment?

- Yes

- No
- Unsure

Psychosocial Health Related Risks and Impacts

Select all health risks and impacts discussed in the assessment.

- Major Depressive Disorder
- Post-traumatic Stress Disorder
- Fear
- Anxiety
- Ecoanxiety
- Ecoparalysis
- Econostalgia
- Solastalgia
- Trauma
- Loss of Livelihood
- Loss of Sense of Place
- Grief
- Depression
- Anger
- Helplessness
- Loss of Culture
- Substance Misuse
- Distress
- Increased Rates of Hospitalizations
- Suicide
- Unsure
- Other

Data Sources Employed to Investigate Climate Change Related Psychosocial Health Impacts

Select all that apply.

- IntelliHealth Ontario: Emergency department visit rates for Dementia and Alzheimers
- IntelliHealth Ontario: Emergency department visit rates for Depression
- IntelliHealth Ontario: Emergency department visit rates for Suicide and self-harm
- IntelliHealth Ontario: Emergency department visit rates for Post-traumatic Stress Disorder
- Unsure
- Other

Vulnerable Populations

People with pre-existing health conditions include chronic diseases, mental health disorders, mobility limitations, and cognitive constraints. Check all vulnerable populations of this climate risk discussed in the assessment.

- Children (Ages five and under)

- Children (Ages 6-17)
- Older Adults (65+)
- People with pre-existing health conditions
- People living in insecure housing
- People living in low-income households
- Outdoor workers
- Rural communities
- Indigenous people
- Pregnant women
- Recent immigrants (within the last five years)
- People living in areas prone to flooding
- Unsure
- Other

Who was included in people with pre-existing health conditions?

If the vulnerable population of "people with pre-existing health conditions" was checked in the category above, check all of the following that apply.

- People with chronic diseases
- People with mental health disorders
- People with mobility limitations
- People with cognitive constraints
- Unsure
- Other

Discussion

Limitations

What limitations of the vulnerability assessment were identified?

- Limitations in climate projection data
- Limitations in health data
- Limited local information to better understand vulnerabilities
- Limited information on adaptive capacity
- Limited understanding of the linkages between climate variables and health outcomes
- Limitations in timing
- Limitations in primary data collection (engagements do not include all stakeholders)
- Unsure
- Other

Existing Adaptive Actions within the Health Unit

Select all that apply.

- Environmental monitoring of climate risks (e.g., source water monitoring)
- Health and disease surveillance related to climate risks (e.g., Rapid Risk Factor Surveillance System, mosquito and tick surveillance, etc.)

- Disease and Injury prevention (e.g., mental health initiatives to address climate anxiety and stress)
- Population and stakeholder surveys on climate change perceptions
- Population assessment (e.g., identifying at-risk populations)
- Health promotion and education of issues relating to climate change (e.g., social media)
- Emergency preparedness and response planning (e.g., provide public services during emergencies)
- Forecasting and early warning systems/alerts
- Regional plans which support climate change adaptation
- Regional plans which support climate change mitigation
- Health Protection activities (e.g., vehicle idling policies)
- Unsure
- Other

Existing Adaptive Actions Outside of Public Health

Select all that apply.

- Multi-jurisdictional outbreak surveillance
- Inspection of food products and issuing food recalls.
- Management and assessment of local farms to ensure food safety
- Land use planning activities and building code policies
- Data analytics and visualization development of maps for floodplains and potential vulnerable populations
- Strategies and activities for existing water and wastewater systems for addressing extreme weather events
- Drinking water management (e.g., source water protection initiatives, by-laws for water use restriction, etc.)
- Emergency preparedness and response
- Risk messaging and alerts
- Food security programs (e.g., community garden programs)
- Municipal heating and cooling areas
- Tree planning and urban forest strategies
- Unsure
- Other

Recommendations within Public Health

Select all that apply.

- Strengthen health and disease surveillance related to climate risks
- Strengthen environmental monitoring programs (e.g., changes in surface water algae)
- Strengthen early warning systems and disaster risk management
- Strengthen primary health care services
- Strengthen health promotion and education approaches
- Strengthen health protection programs, policies, and measures (e.g., food handler training)

- Support and advocate for local policy and program development related to climate change adaptation
- Explore additional and new datasets related to climate risks and health outcomes
- Mainstreaming climate change into public health policy
- Consider health equity and vulnerable populations in adaptation planning (e.g., targeted messaging for vulnerable populations)
- Strengthen emergency preparedness and response (e.g., focus on vulnerable populations, consider implementing surveys, promote personal preparedness, etc.)
- Strengthen engagement with key stakeholders
- Engage additional population subgroups and experts on climate change and health (e.g., schools and youths)
- Unsure
- Other

Recommendations Outside of Public Health

Select all that apply.

- Develop public health measures in forestry to reduce air quality impacts to local residents from wildfire events
- Tree planning and urban forest strategies
- Cross-sector emergency management planning
- Explore effective built environment interventions (e.g., green infrastructure, cool pavements, cool roofs, air conditioning, etc.)
- Strengthen source water protection
- Review available GIS datasets and maps to inform future extreme weather risk and emergency response
- Review land use planning best practices to reduce climate change health impacts
- Strengthen community connection
- Unsure
- Other

Next Steps Following the Vulnerability Assessment

Select all that apply.

- Develop a regional Climate Change Action Plan
- Develop policies and measures that support climate change mitigation and adaptation
- Develop an inventory of adaptation options to be explored by public health and relevant stakeholders
- Develop a monitoring plan
- Develop indicators for monitoring
- Establish integrated, ongoing climate change and health surveillance
- Develop health promotion activities on climate change health impacts and adaptation measures
- Coordinate programming and collaborating with key stakeholders across sectors
- Integrate climate change considerations into existing public health programs and activities

- Further investigate climate change related impacts on vulnerable populations
- Fill knowledge gaps identified in the assessment
- Fill gaps in current climate change adaptation actions in the health unit
- Continue to strengthen partnerships between the health unit and the community
- Unsure
- Other

Key Takeaways

Key takeaways of the data extractor.

Appendix D: Findings from Comprehensive Review

The following sections present the top 10 results that emerged within each data extraction category of the review of completed climate change and health vulnerability assessments in other health units and jurisdictions.

1.0 Context

Assessments began with a community overview or introduction to the health region. The commonly discussed demographics within this introduction include:

1. Indigenous Populations (n=7)
2. Outdoor workers (n=7)
3. Recent Immigrants (n=6)
4. Older adults (n=7)
5. Children (n=5)
6. Low income (n=5)
7. Visible Minorities (n=4)
8. Homeless/precariously housed (n=3)
9. Pregnant women (n=2)
10. People experiencing social isolation (n=2)

Along with information on the demographics, health units would often mention the economic drivers of the region, which include agriculture (n=7), mining (n=6), forestry (n=6), construction (n=6), manufacturing (n=2), and tourism (including accommodation and food service industry) (n=2).

Reports also discussed geographic considerations of the health unit. Including the region's proximity to the Great Lakes (n=8), other lakes (n=5), rivers and watersheds (n=8), conservation and protection areas (n=3), the Oak Ridges Moraine (n=2), Pelee Island (n=1), the Niagara Escarpment (n=1), and the US Border (n=1). These were often connected to how proximity to such geographic considerations may make the health region more vulnerable to certain exposures (e.g, proximity to water bodies may lead to vulnerability to flooding, and proximity to the US border may lead to vulnerability to air pollution).

Some health units (N=7) collected primary data to inform their vulnerability assessments. The employed data collection methods include workshops (n=4), interviews (n=3), focus groups (n=3), questionnaires (1), external advisory panel (=1), consultations (n=1), worksheets (n=1), and surveys (n=1). Common stakeholders involved in engagement include:

1. Internal Health Unit Staff (n=7)
2. Municipal Staff and Representatives (n=5)
3. Conservation Authorities (n=5)
4. Healthcare Organizations and Professionals (n=4)
5. Health Canada Staff (n=4)
6. Organizations and Individuals working with vulnerable populations (n=4)

7. Individuals Working or Volunteering with Climate Change-related Activities (n=4)
8. Local Educational Institutions (n=4)
9. Provincial Ministries (n=3)
10. Environmental Organizations (n=3)
11. Regional Departments (n=3)
12. Local Planners (n=3)
13. Non-profit Organizations and Charities (n=3)

The common objectives of primary data collection included:

1. Identify expert opinion regarding potential climate change and its health impacts (n=4)
2. Identify climate change impacts of concern (n=4)
3. Identify impacts relevant to vulnerable populations (n=4)
4. Identify current health and climate change policies and plans in the health region (n=4)
5. Identify future climate adaptation actions within existing health unit programs (n=4)
6. Identify vulnerable populations (n=3)
7. Identify potential data and knowledge gaps (n=3)
8. Identify current actions being taken by partners to mitigate and/or adapt to climate change (n=3)
9. Identify options and recommendations for reducing current and future risks to health through adaptation (n=3)
10. Identify likelihood of climate impact (n=3)

Five assessments reference the previously completed vulnerability assessments from Simcoe Muskoka District Health Unit (n=4), Middlesex-London Health Unit (n=4), Peel Public Health (n=2), Toronto Public Health (n=1), and York Region Public Health (n=1).
All assessments also referred to other reports when discussing climate risks. The commonly mentioned reports include:

1. Intergovernmental Panel on Climate Change Assessment Reports (n=9)
2. World Health Organization Protecting Health from Climate Change Vulnerability and Adaptation Assessment guide (2013) (n=4)
3. Health Canada - Human Health in a Changing Climate A Canadian Assessment of Vulnerabilities and Adaptive Capacity (2008) (n=4)
4. Ontario Ministry of Health and Long-Term Care Ontario Climate Change and Health Toolkit (2016) (n=4)
5. Natural Resources Canada Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (2014) (n=3)
6. ICLEI Canada’s Building Adaptive and Resilient Communities Program Protocol (n=3)
7. Ontario Ministry of Health and Long-Term Care Healthy Environments and Climate Change Guideline (n=2)
8. The Lancet Countdown: Tracking Progress on Health and Climate Change (2016) (n=2)
9. Ontario Ministry of Health and Long-Term Care Ontario Public Health Standards (n=2)
10. Natural Resources Canada (From Impacts to Adaptation: Canada in a Changing Climate) (n=2)
11. Canada's Changing Climate Report (2019) (n=2)

Health units outlined local climate projections in their assessments. The common data sources used to inform climate projections include:

1. Environment and Climate Change Canada Data (n=10)
2. Ministry of the Environment, Conservation and Parks Air Quality Ontario (n=5)
3. Public Safety Canada - The Canadian Disaster Database (n=5)
4. Ontario Climate Data Portal Climate Data Canada Portal (n=4)
5. Climate Atlas of Canada (n=2)
6. Ministry of the Environment, Conservation and Parks Climate Change Data Portal (n=2)
7. York University Laboratory of Mathematical Parallel Systems (LAMPS) Dataset (n=2)
8. Natural Resources Canada Data (n=2)
9. Climatedata.ca (n=2)
10. Ontario Climate Change and Health Modelling Study (n=2)

2.0 Climate Health Impacts

2.1 Extreme Temperatures

Extreme temperatures are categorized as extreme heat and extreme cold. Warmer temperature averages are impacting the summer and winter months, with health-related impacts from climate variability.

2.1.1 Extreme Heat

As greenhouse gasses (GHGs) continue to increase rapidly due to anthropogenic emissions, Canada's climate will continue to change in the coming decades (Berry et al., 2022). As a whole, Canada is projected to warm at approximately twice the rate of the global average, with even higher rates of warming in the Northern region (Bush and Lemmen, 2019).

In this systematic review, all 13 assessments mentioned extreme heat as a climate change impact of concern in their respective health units. Health units also discussed the impacts relevant to extreme heat. The most commonly mentioned impacts include:

1. More Hot Days (n=11)
2. Heat-related Mortality (n=11)
3. Heat-related Emergency Department Visits (n=10)
4. Cardiovascular Disorders (n=8)
5. Urban Heat Island (n=8)
6. Heat Stroke (n=8)
7. Heat Exhaustion (n=8)
8. Heat Cramps (n=8)
9. More and Longer Heat Waves (n=8)

10. Respiratory Illnesses (n=7)

The most commonly used datasets to investigate local extreme heat-related health impacts include:

1. Rapid Risk Factor Surveillance System: Households with/without Air Conditioning (n=3)
2. Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Heat-related emergency department visits (n=3)
3. IntelliHealth: Ontario Mortality Data (n=2)
4. Local Health Unit Data: Excess heat-related (n=1)
5. IntelliHealth Ontario: Emergency department visits and hospitalization for myocardial infarction (n=1)
6. IntelliHealth Ontario: Emergency department visit and hospitalization rates for hypertension (n=1)
7. IntelliHealth: Ontario Mortality Data (n=1)
8. IntelliHealth Ontario: All-cause mortality (n=1)
9. Canadian Community Health Survey: heart disease (n=1)
10. Rapid Risk Factor Surveillance System: Adults who are unaware of places close to their home where they can go to cool down during hot weather (n=1)
11. Rapid Risk Factor Surveillance System: Protective Behaviors (n=1)
12. Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Self-harm-related emergency department visits (n=1)
13. Acute Care Enhanced Surveillance: Emergency department line listings (n=1)
14. Local Hospital data: Heat-related illness emergency department (ED) visits (n=1)
15. Local Health Unit: Number of Heat Alerts Issued (n=1)
16. Public Health Ontario - Extreme Weather Ontario Health Profile: Rate of Hospitalizations due to Extreme Heat (n=1)
17. Canadian Institute for Health Information: Discharge Abstract Database (n=1)
18. Statistics Canada: walking or cycling to work as their primary mode of transportation (n=1)
19. Statistics Canada: Types of mechanical cooling by household (n=1)
20. Not included (n=2)
21. Unsure (n=1)

2.1.2 Extreme Cold

While extreme heat events and temperatures are projected to increase, cold extremes and averages are expected to decrease in Canada (Berry et al., 2022; Bush and Lemmen, 2019).

All 13 vulnerability assessments mentioned extreme cold as a climate impact of concern in their respective health units. The most commonly mentioned impacts include:

1. Frostbites (n=10)
2. Hypothermia (n=9)
3. Decrease in cold days (n=9)
4. Cold related mortality (n=8)

5. Cardiovascular disorders (n=6)
6. Decrease in Cold-related Morbidity and Mortality (n=5)
7. Acclimatization to warm weather (n=5)
8. Cold-related Emergency Department Visits (n=5)
9. Windburn (n=4)
10. Cold-related Hospitalizations (n=3)
11. Respiratory Illnesses (n=3)

The most commonly used datasets to investigate local extreme cold-related health impacts include:

1. Canadian Institute for Health Information: Cold-related illness emergency room visit (n=2)
2. IntelliHealth Ontario: Cold-related illness emergency room visit (n=1)
3. Canadian Institute for Health Information: Crude rate of cold-related emergency department visits (n=1)
4. Local Health Unit: Number of Cold Alerts Issued (n=1)
5. IntelliHealth: Ontario Mortality Data (n=1)
6. IntelliHealth: Ambulatory Emergency External Cause (n=1)
7. Public Health Ontario: Ontario Health Profile (n=1)
8. Not included (n=4)
9. Unsure (n=4)

Health units identified vulnerable populations to extreme temperatures. The most commonly mentioned vulnerable populations include:

1. Children (n=12)
2. Older adults (n=12)
3. People living in insecure housing (n=12)
4. People with pre-existing health conditions (n=12)
5. Outdoor workers (n=13)
6. People living in low-income households (n=11)
7. Pregnant women (n=6)
8. People who undertake outdoor activities (n=6)
9. Socially and physically isolated people (n=7)
10. Recent Immigrants (n=4)
11. People who drink alcohol or use illicit substances (n=4)
12. Racialized communities and visible minorities (n=4)
13. People with no air conditioning (n=4)

When discussing people with pre-existing conditions, health units discussed people with chronic diseases, people with mobility limitations, people with cognitive constraints, people with mental health disorders, persons with disabilities, and individuals on particular types of medication.

2.2 Extreme Weather Events

In Canada, climate projections indicate an increase in severe weather events (e.g., precipitation, storms, rainfall, etc.) and hazards (e.g., drought, hurricanes, wildfires, flooding, etc.) (Berry et al., 2022).

In this systematic review, all 13 assessments mentioned extreme weather events as a climate change impact of concern. Health units discussed both the hazards and health impacts relevant to extreme weather events. The most commonly mentioned hazards include:

1. Flooding (n=13)
2. Extreme Precipitation (n=11)
3. Extreme Rainfall (n=11)
4. Tornadoes (n=10)
5. Thunderstorms (n=8)
6. Droughts (n=7)
7. Wildfires (n=7)
8. Extreme Winds (n=6)
9. Freezing Rain (n=6)
10. Hail (n=5)
11. Winter Storms (n=5)

The most commonly mentioned health impacts include:

1. Extreme Weather-Related Injuries (n=11)
2. Power Outages (n=11)
3. Private property damage and loss (n=11)
4. Damage to public infrastructure (n=11)
5. Disruption of Health and Social Services (n=10)
6. Impacts Psychosocial Health (n=10)
7. Extreme Weather-Related Mortality (n=10)
8. Food safety and Security (n=8)
9. Vector-borne Diseases (n=11)
10. Water Quality Impacts (n=7)

The most commonly used datasets to investigate local extreme weather-related health impacts include:

1. Public Safety Canada: Canadian disaster database (n=3)
2. Local Conservation Authority: Flood vulnerable structures and persons (n=2)
3. Rapid Risk Factor Surveillance System: Emergency preparedness (n=2)
4. Public Health Ontario: Rate of emergency department visits attributed to extreme weather events (n=2)
5. Statistics Canada: Population living in high apartment towers (n=1)
6. Statistics Canada: Houses in need of major repair (n=1)
7. Canadian Institute for Health Information - Discharge Abstract Database: Injury-related hospitalization count (n=1)

8. Canadian Institute for Health Information: Discharge Abstract Database (n=1)
9. Canadian Institute for Health Information: Mental health-related emergency department visits (n=1)
10. Canadian Institute for Health Information: Average rate of mental health emergency department visits (n=1)
11. Local Hazard Identification and Risk Assessment (HIRA) (n=1)
12. Local Region Data: Number of low-income individuals residing within a floodplain in by census tract (n=1)
13. IntelliHealth: Ambulatory Emergency External Cause (n=1)
14. Not included (n=2)
15. Unsure (n=3)

When discussing damage to private property, many health units specifically mentioned basement flooding as a concern.

Health units also identified vulnerable populations to extreme weather events. The most commonly mentioned vulnerable populations include:

1. Children (n=11)
2. Older adults (n=11)
3. People living in insecure housing (n=11)
4. People with pre-existing health conditions (n=11)
5. People living in low-income households (n=9)
6. People living in areas prone to flooding (n=6)
7. Outdoor workers (n=4)
8. People who are socially isolated (n=4)
9. Recent immigrants (n=3)
10. Pregnant women (n=3)

Under vulnerability to extreme weather, people with pre-existing health conditions include people with chronic diseases, mobility limitations, cognitive constraints, mental health disorders, disabilities, compromised immune function, sensory impairments, and individuals on particular types of medications.

2.3 Vector-Borne Disease

The presence of infectious diseases, protective behaviors by individuals, and people's sensitivity to pathogens are all affected by climate change (Berry et al., 2022). As the climate continues to warm, Lyme disease, WNV, and other diseases will emerge or spread throughout Canada (Berry et al., 2022).

Health units (N=13) discussed the mosquito-and-tick-borne diseases of concern. All mentioned mosquito-borne diseases include:

1. Disease West Nile Virus (WNV) (n=12)
2. Eastern Equine Encephalitis Virus (n=8)
3. Malaria (n=6)
4. Jamestown Canyon Virus (n=2)
5. Snowshoe Hare Virus (n=2)
6. Dengue (n=5)
7. Chikungunya (n=5)
8. Rift Valley Fever (n=2)
9. Zika Virus (n=5)
10. Yellow Fever (n=1)
11. Rocky Mountain Spotted Fever (n=1)
12. Japanese encephalitis (n=1)
13. La Cross encephalitis (n=1)
14. St. Louis encephalitis (n=1)
15. Culex pipiens mosquitoes (n=1)
16. Culiseta. melanura mosquitoes (n=1)

All mentioned tick-borne diseases include:

1. Lyme Disease (n=12)
2. Babesiosis (n=4)
3. Anaplasmosis (n=4)
4. Powassan Encephalitis (n=5)
5. Amblyomma Americanum (Lone-star Tick) (n=3)
6. Rocky Mountain spotted fever (n=4)
7. Plague (n=1)
8. Borrelia Miyamotoi (n=2)
9. Tularemia (n=2)

The most commonly mentioned health impacts include:

1. Expanded range and increased survivability of ticks, mosquitoes, and their hosts (n=12)
2. Longer warm season (increase in degree days) (n=10)
3. Vector-borne disease related mortality (n=6)
4. Vector-borne disease related symptoms (e.g., fever, headache, neurological signs, etc.) (n=5)
5. Longer season for people to be outdoors (n=4)
6. Introduction of new vector insects due to favorable climate conditions (n=5)

7. Psychosocial Health (n=1)
8. Increased the risk when traveling to endemic areas (n=1)
9. Post-treatment of diseases (n=1)

The most commonly used datasets to investigate vector-borne disease-related health impacts include:

1. Public Health Ontario: West Nile Surveillance (n=5)
2. Public Health Ontario: Infectious disease trends in Ontario (n=4)
3. Health Unit Surveillance and Monitoring Data: Monthly reportable Disease Incidence Reports (n=4)
4. iPHIS: West Nile Virus Cases (n=3)
5. iPHIS: Lyme Disease Cases (n=3)
6. Health Unit Surveillance and Monitoring Data: Tick Surveillance (n=3)
7. Local Region Data: Presence of Culex pipiens and Culex restuans (n=1)
8. Local Region Data: Human Cases of West Nile Surveillance (n=1)
9. Local Region Data: Presence of Culiseta melanura (n=1)
10. Local Region Data: Human Cases of Eastern Equine Encephalitis (n=1)
11. Local Region Data: Presence of black-legged (n=1)
12. Local Region Data: Human cases of Lyme Disease (n=1)
13. Local Region Data: Lyme disease surveillance program (n=1)
14. Local Region Data: West Nile virus activity and accumulated degree days (n=1)
15. Local Environmental Health Department: Mosquitos tested (n=1)
16. Local Health Unit: Number of Positive Mosquito Pools (n=1)
17. Rapid Risk Factor Surveillance System: Community and Health Services (n=1)
18. Public Health Ontario Risk Area Map (n=1)
19. Public Health Ontario - Local Health Unit: Historical Comparisons (n=1)
20. Public Health Ontario: Estimated risk areas for black-legged ticks (n=1)
21. Not included (n=3)

Health units also identified vulnerable populations to vector-borne diseases, with the most commonly mentioned ones being:

1. Children (n=10)
2. Older adults (n=10)
3. Outdoor workers (n=7)
4. People with pre-existing health conditions (n=6)
5. Pregnant women (n=4)
6. People living in low-income households (n=2)
7. People living in insecure housing (n=2)
8. Commuters (n=2)
9. Those who spend time outdoors (n=5)
10. Women (n=2)

Under vulnerability to vector-borne diseases, people with pre-existing health conditions include

people with chronic diseases, mental health disorders, suppressed or developing immune systems, and disabilities.

2.4 Food-and-Water-borne Illness

Related to natural hazards, pathogens can be carried into water bodies following precipitation to cause water-borne disease (Berry et al., 2022). Furthermore, climate change has also been found to have impacts on the occurrence of food-borne diseases due to extreme weather events and changing seasons (Berry et al., 2022).

In this systematic review, all 13 assessments mentioned food-and-water-borne illnesses as a climate change impact of concern in their respective health units. Health units also discussed the enteric disease and health impacts relevant to extreme weather events.

The most commonly mentioned enteric disease include:

1. Verotoxin-producing Escherichiacoli (n=10)
2. Campylobacter Enteritis (n=9)
3. Salmonellosis (n=9)
4. Giardiasis (n=7)
5. Cryptosporidiosis (n=7)
6. Norovirus (n=3)
7. Amebiasis (n=2)
8. Listeria (n=2)
9. Shigella (n=2)
10. Clostridium botulinum (n=1)
11. S. Typhi (Typhoid) (n=1)
12. Yersiniosis (n=1)
13. Hepatitis A (n=1)
14. Clostridium perfringens (n=1)
15. Vibrio (n=1)

The most commonly mentioned health impacts include:

1. Contamination of Drinking Water (n=12)
2. Contamination of Recreational Water (n=12)
3. Algal Blooms (n=11)
4. Greater Spoilage Rates of Food due to higher temperatures (n=9)
5. Increased Growth and Survival of Pathogens and Pests (n=9)
6. Growth of Blue-Green Algae (Cyanobacteria) (n=8)
7. Compromised refrigeration of food due to power outages (n=8)
8. Behavioural changes leading to expanded outdoor eating activities (n=7)
9. Contamination of Surface Water Source (n=7)
10. Contamination of Private Wells (n=7)

The most commonly used datasets to investigate food-and-water-borne illness-related health impacts include:

1. Public Health Ontario: Infectious disease trends (n=4)
2. iPHIS: Cases of food-and-waterborne illness (n=2)
3. iPHIS: Rates of enteric illnesses (n=2)
4. Local Health Unit Surveillance and Monitoring Data: Beach Surveillance (n=2)
5. Local Health Unit: The number of reported campylobacter, salmonella, giardia, Verotoxin-producing Escherichia coli and cryptosporidium infections reported (n=1)
6. Ontario Ministry of Health and Long-Term Care: Water Testing Information System (n=1)
7. Hedgehog database: Bacterial lab analysis of all submitted samples from private drinking wells (n=1)
8. Local Region Data: Reportable diseases (n=1)
9. Local Health Unit: Number of Beaches Closed due to Bleach-Green Algae Blooms (n=1)
10. Local Health Unit: Number of human cases of disease related to pathogens in food or water (n=1)
11. Public Health Ontario: Local Health Unit: Historical Comparisons (n=1)
12. Not included (n=3)

Health units also identified vulnerable populations to food-and-water-borne illnesses. The most commonly mentioned vulnerable populations include:

1. Older adults (n=10)
2. People with pre-existing health conditions (n=9)
3. Children (n=8)
4. People living in low-income households (n=8)
5. Women (n=5)
6. Pregnant women (n=4)
7. low education (n=3)
8. Outdoor workers (n=3)
9. Individuals who get drinking water from a private water system (n=3)
10. Indigenous People (n=2)

Under vulnerability to food-and-water-borne illness, people with pre-existing health conditions include people with chronic diseases, suppressed or developing immune systems, mental health disorders, and disabilities.

2.5 Food-and-Water Security

Climate change has implications on food systems globally and in Canada, with impacts on food production, processing, distribution, preparation, and consumption (Berry et al., 2022).

Food-and-water security was discussed in 12 of 13 assessments. The most commonly mentioned impacts include:

1. Increased Food Cost (n=9)
2. Food Insecurity (n=9)
3. Decreased Crop Yields (n=7)
4. Decreased Drinking Water Supplies (n=6)
5. Increased Growing Seasons (n=3)
6. Food distribution and production disruptions (n=3)
7. Psychosocial Health (n=2)
8. Water and Food Security Related Hospitalizations (n=2)
9. Psychosocial Health (n=2)
10. Threatens fish populations (n=2)
11. Disruption to the local supply of food as a result of extreme weather events (n=2)

The most commonly used datasets to investigate food-and-water security-related health impacts include:

1. Other: Not included (n=4)
2. Nutritious Food Basket (n=2)
3. Nutritious Food Basket: Key measures of food insecurity (n=1)
4. Canadian Community Health Survey: Households classified as moderately or severely food insecure (n=1)
5. Local Health Unit: average weekly cost of a nutritious food basket to feed a family of four (n=1)
6. The Canadian Community Health Survey: Food insecurity (n=1)
7. Statistics Canada: Food insecurity (n=1)
8. Rapid Risk Factor Surveillance System: Percent of households that, because of lack of money, worried that there would not be enough to eat or didn't have enough food to eat or didn't eat the quality or variety of foods that they wanted eat (n=1)
9. Local Region Data: Monthly income compared to monthly rent and food costs for individuals
10. Local Region Data: Monthly income compared to monthly rent and food costs for families
11. Local Region Data: Drinking Water Systems
12. Unsure (n=2)

All mentioned vulnerable populations include:

1. Older adults (n=6)
2. Children (n=5)
3. People with pre-existing health conditions (n=5)
4. Those living close to the land (n=2)
5. People who are food insecure (n=2)
6. Female-headed households (n=2)
7. Pregnant women (n=2)
8. Women (n=1)
9. People living in insecure housing (n=1)
10. Persons living in rooming houses or social housing (n=1)
11. Older adults living alone (n=1)
12. People without air conditioning (n=1)
13. Outdoor workers (n=1)
14. Unemployed persons (n=1)
15. Persons with limited access to social support systems (n=1)
16. Indigenous People
17. Rural communities (n=1)
18. Single parent families (n=1)
19. People with private wells (n=1)
20. Racialized people (n=1)
21. Recreation enthusiasts (n=1)
22. Athletes (n=1)
23. Active transportation and transit user (n=1)
24. Agricultural workers (especially migrants) (n=1)
25. Outdoor food vendors (n=1)
26. Long-term care homes (n=1)
27. People in hospitals (n=1)
28. People who smoke (n=1)

Under vulnerability to food-and-water security-related impacts, people with pre-existing health conditions include people with chronic diseases, suppressed or developing immune systems, mental health disorders, and disabilities.

2.6 Air Quality

Exposure to air pollutants such as fine particulate matter and ozone increases with climate change, with health outcomes ranging from respiratory symptoms to premature mortality (Berry et al., 2022).

In this systematic review, all 13 assessments mentioned air quality as a climate change impact of concern in their respective health units. Health units also discussed the pollutants or allergens of concern, and the health impacts relevant to poor air quality. The most commonly mentioned pollutants and allergens include:

1. Particulate Matter 2.5 (n=10)
2. Ground-level Ozone (n=9)
3. Nitrogen Oxides (n=9)
4. Aeroallergens (n=8)
5. Traffic-related Air pollution (n=6)
6. Particulate Matter 10 (n=5)
7. Particulate Matter 0.1 (n=4)
8. Carbon Monoxide (n=3)
9. Volatile organic compounds (n=2)
10. Transboundary industrial and residential emissions (n=2)

The most commonly mentioned health impacts include:

1. Asthma (n=12)
2. Air Pollution-related Mortality (n=11)
3. Exacerbating Existing Environmental Allergies (n=10)
4. Respiratory Illnesses (n=9)
5. COPD (n=9)
6. Air Quality Related Hospitalizations (n=8)
7. Cardiovascular conditions (n=8)
8. Throat or Lung Irritation (n=7)
9. Air Quality Related Emergency Department Visits (n=6)
10. Cancer (n=6)

The most commonly used datasets to investigate local air quality-related health impacts include:

1. IntelliHealth Ontario: Asthma-related emergency department visits (n=3)
2. Canadian Community Health Survey: Smokers (n=2)
3. IntelliHealth Ontario: COPD-related emergency department visits (n=2)
4. Public Health Ontario: At-risk populations living in traffic-related air pollution (TRAP) exposure zones (n=2)
5. Health Unit Data: Estimated number of excess hospital admissions due to air quality (n=1)
6. Health Unit Data: Population with pre-existing health (n=1)
7. Health Unit Data: Estimated excess mortality (n=1)

8. IntelliHealth Ontario: Myocardial infarction emergency department visits and hospitalizations (n=1)
9. IntelliHealth Ontario: Hypertension emergency department visits and hospitalizations (n=1)
10. IntelliHealth: Selected respiratory Conditions (n=1)
11. IntelliHealth: Age-standardized rate of hospitalizations for asthma and COPD (n=1)
12. IntelliHealth Ontario: rates of emergency department visits for seasonal allergies (n=1)
13. IntelliHealth Ontario: Ontario Mortality Data (n=1)
14. IntelliHealth Ontario: Ambulatory Emergency External Cause (n=1)
15. IntelliHealth Ontario: Population Estimates and Projections (n=1)
16. Rapid Risk Factor Surveillance System: Percent of adults familiar with the Air Quality Health Index (n=1)
17. Rapid Risk Factor Surveillance System: Familiarity of York Region adults with the AQHI (n=1)
18. Rapid Risk Factor Surveillance System: York Region adults familiar with the AQHI who report changing their activities based on the AQHI (n=1)
19. Health Canada: Health impacts of air pollution in Canada: an estimate of premature mortalities (n=1)
20. Canadian Institute for Health Information - Ambulatory Emergency External Cause Database: Asthma-related emergency department visits (n=1)
21. Not included (n=3)
22. Unsure (n=1)

The most commonly mentioned vulnerable populations include:

1. Children (n=11)
2. Older adults (n=11)
3. People with pre-existing health conditions (n=11)
4. Outdoor workers (n=8)
5. People living in low-income households (n=8)
6. People who spend time outdoors (n=5)
7. Those who smoke tobacco (n=5)
8. Pregnant women (n=4)
9. Those living in close proximity to transportation pollution (n=3)
10. Unemployed persons (n=3)

Under vulnerability to air quality-related impacts, people with pre-existing health conditions include people with chronic diseases, mental health disorders, disabilities, and people suffering from asthma or allergies.

2.7 Ultraviolet Radiation (UVR)

Projections on the level and intensity of UVR exposure in future climate scenarios are uncertain, however, it is clear that UVR overexposure can lead to cancers, premature aging of the eye, and immunosuppression (Berry et al., 2022).

Vector-borne diseases were discussed in eight of 13 assessments. The most commonly mentioned UVR related impacts include:

1. Malignant Melanoma (n=8)
2. Non-melanoma cancer (n=8)
3. Cataracts (n=3)
4. Stratospheric Ozone Depletion (n=4)
5. UVR Related Emergency Department Visits (n=2)
6. UVR Related Mortality (n=2)
7. Sunburns (n=5)
8. DNA Damage (n=3)
9. Immune suppression (n=5)
10. Skin cancer (n=3)
11. Skin Damage (n=2)
12. Aging (n=2)

The most commonly used datasets to investigate local ultraviolet radiation-related health impacts include:

1. IntelliHealth Ontario: Malignant melanoma (n=2)
2. Cancer Care Ontario: Ontario cancer registry (n=2)
3. Cancer Care Ontario: Rate of malignant melanoma (n=2)
4. Local Health Unit: Leading types of cancer (n=1)
5. Local Health Unit: Ultraviolet radiation (n=1)
6. Local Health Unit Surveillance and Monitoring Data: Melanoma (n=1)
7. Rapid Risk Factor Surveillance System: Protective behaviors (n=1)
8. Rapid Risk Factor Surveillance System: Proportion of residents who report having been sunburned (n=1)
9. Rapid Risk Factor Surveillance System: Protective behaviors (n=1)
10. IntelliHealth Ontario: Malignant melanoma mortality (n=1)
11. IntelliHealth Ontario: Ambulatory Emergency External Cause (n=1)
12. Canadian Community Health Survey: UVR health risks (n=1)
13. Canadian Community Health Survey: Percent of residents, by age-group, aged 12 and over who took steps to protect themselves from the sun (n=1)
14. Canadian Community Health Survey: Percent of residents aged 12 and over who took steps to protect themselves from the sun (n=1)
15. Cancer Care Ontario: Rate of non-epithelial skin cancers (n=1)
16. Public Health Ontario - Snapshots: Local Health Unit: Incidence and Mortality from Malignant Melanoma (n=1)
17. Not included (n=2)

The most commonly mentioned vulnerable populations include:

1. Children (n=6)
2. Outdoor workers (n=3)
3. Individuals who are fair-skinned (n=3)
4. Individuals with light eyes (blue or green) (n=3)
5. Individuals with blonde or red hair (n=3)
6. Individuals with a family history or genetic disposition to skin cancer (n=2)
7. People with lower levels of education (n=2)
8. People who participate in physical activity outdoors (n=2)
9. Those who do not practice sun-safety behaviour (n=2)
10. People with pre-existing health conditions (n=2)
11. People living in low-income households (n=2)

Under vulnerability to UVR impacts, people with pre-existing health conditions include people with chronic diseases, cognitive constraints, skin conditions, and autoimmune disorders.

2.8 Psychosocial Health

Climate change can exacerbate the risk of mental health conditions for vulnerable people in Canada through exposure to extreme weather events, and knowledge of climate change threats (Berry et al., 2022).

While 10 assessments discussed the psychosocial health impacts of extreme weather events, only two assessments discussed this impact in depth (with its own section within the report). The most commonly mentioned impacts include:

1. Anxiety (n=5)
2. Depression (n=5)
3. Trauma (n=5)
4. Solastalgia (n=3)
5. Stress (n=3)
6. Post-traumatic Stress Disorder (n=2)
7. Loss of Sense of Place (n=2)
8. Grief (n=2)
9. Anger (n=2)
10. Loss of Culture (n=2)
11. Substance Misuse (n=2)
12. Increased Rates of Hospitalizations (n=3)
13. Suicide (n=2)
14. Ecoanxiety (n=2)

The most commonly used datasets to investigate local psychosocial-related health impacts include:

1. IntelliHealth Ontario: Emergency department visit rates for Dementia and Alzheimers (n=1)
2. IntelliHealth Ontario: Emergency department visit rates for Depression (n=1)
3. Canadian Community Health Survey: Key mental health vulnerabilities (n=1)
4. Canadian Institute for Health Information: Ambulatory Emergency External Cause Database (n=1)
5. Not Included (n=8)
6. Unsure (n=2)

All mentioned vulnerable populations include:

1. Indigenous Peoples (n=4)
2. Children (n=3)
3. People with pre-existing health conditions (n=3)
4. Outdoor workers (n=2)
5. Older Adults (n=2)
6. People living in low-income households (n=2)
7. First responders (n=1)
8. People living in insecure housing (n=1)
9. Recent immigrants (n=1)
10. People living in areas prone to flooding (n=1)
11. People with low social connectedness to their community (n=1)
12. Mennonite communities (n=1)
13. Post-secondary students (n=1)
14. Middle-aged men (n=1)
15. 2SLGBTQIA (n=1)
16. People who were temporarily displaced from their homes and residing in evacuation centres (n=1)

Under vulnerability to psychosocial health impacts, people with pre-existing health conditions include people with mental health disorders, and people with pre-existing addictions.

3.0 Limitations, Existing Actions, Recommendations, and Next Steps

Health units discussed the limitations to their vulnerability assessments, with the most commonly mentioned limitations including:

1. Limitations in health data (n=8)
2. Limitations in climate projection data (n=7)
3. Limited understanding of the linkages between climate variables and health outcomes (n=6)
4. Limited local information to better understand vulnerabilities (n=6)
5. Limitations in primary data collection (n=4)

6. Limited information on adaptive capacity (n=3)
7. Limitations in scope (n=3)
8. Limitations in methods (n=3)
9. Covid-19 related limitations (n=3)
10. Limitations in timing (n=2)

Assessments also discussed the existing adaptive actions being taken both within and outside of the health unit. Activities within the health unit include:

1. Environmental monitoring of climate risks (n=10)
2. Health and disease surveillance related to climate risks (n=10)
3. Health promotion and education of issues relating to climate change (n=8)
4. Emergency preparedness and response planning (n=7)
5. Forecasting and early warning systems/alerts (n=6)
6. Regional plans which support climate change adaptation (n=6)
7. Population assessments (n=6)
8. Regional plans which support climate change mitigation (n=5)
9. Health protection activities (n=4)
10. Disease and Injury prevention (n=2)

Activities within the region but outside the health unit include:

1. Multi-jurisdictional outbreak surveillance (n=3)
2. Drinking water management (n=7)
3. Risk messaging and alerts (n=5)
4. Municipal heating and cooling areas (n=5)
5. Land use planning activities and building code policies (n=3)
6. Emergency preparedness and response (n=5)
7. Tree planning and urban forest strategies (n=3)
8. Regional/City plans relevant to climate change (n=6)
9. Environmental monitoring (n=4)
10. Education of issues relating to climate change (n=6)

Similarly, assessments discussed recommendations focused on both within and external to the health unit. Recommendations within the health unit include:

1. Consider health equity and vulnerable populations in planning (n=8)
2. Strengthen health and disease surveillance related to climate risks (n=7)
3. Strengthen engagement with key stakeholders (n=7)
4. Explore additional and new datasets related to climate risks and health outcomes (n=6)
5. Strengthen emergency preparedness (n=6)
6. Engage additional population subgroups and experts on climate change and health (n=5)
7. Strengthen environmental monitoring programs (n=5)
8. Mainstreaming climate change into public health policy (n=4)
9. Strengthen health promotion and education approaches (n=3)
10. Further assessments on vulnerability (n=3)

Recommendations external to the health unit include:

1. Cross-sector emergency management planning (n=6)
2. Strengthen community connection (n=6)
3. Explore effective built environment interventions (n=5)
4. Strengthen education on climate change impacts(n=3)
5. Review land use planning best practices (n=3)
6. Review available GIS datasets and maps to inform emergency response (n=2)
7. Tree planning and urban forest strategies (n=2)
8. Strengthen source water protection (n=2)
9. Strengthen knowledge sharing (n=2)
10. Develop new plans relevant to climate change (n=2)

Health units also discussed next steps following the results of the vulnerability assessments, which include:

1. Communicate results to stakeholders (n=6)
2. Develop a regional Climate Change Action Plan (n=5)
3. Integrate climate change considerations into existing public health programs and activities (n=5)
4. Continue to strengthen partnerships between the health unit and the community (n=5)
5. Focus on health benefits and co-harms of adaptation and mitigation options (n=4)
6. Develop policies and measures that support climate change mitigation and adaptation (n=4)
7. Fill knowledge gaps identified in the assessment (n=4)
8. Establish integrated and ongoing climate change and health surveillance (n=3)
9. Develop health promotion activities on climate change health impacts and adaptation measures (n=3)
10. Further investigate climate change related impacts on vulnerable populations (n=3)
11. Fill gaps in current climate change adaptation actions in the health unit (n=3)

Appendix E: External Advisory Committee Consultations

Reflections from local climate projections included concerns for both human health and ecological health impacts. Specific to the projection of milder winters, participants discussed the impacts of this on emerging vector species that normally would not survive cold winters (e.g., Culex, Japanese Beetle, etc.). Furthermore, there was expressed interest in focusing on ecological health, and not just human health; that is, taking a one health approach. Participants also discussed these projections from a farming perspective, where climate projections may be seen as a positive since there is speculation of opportunities for longer growing seasons hence potential for economic growth.

Reflections from the findings of the environmental scan revealed that participants were not surprised, but concerned of what these impacts may mean for SWPH. For example, Oxford County is reliant on groundwater, which may differ from other health units in Ontario for issues with water security and scarcity. Furthermore, participants expressed the importance of having input from representatives from local agricultural community members to discuss climate impacts.

Participants also discussed next steps in the SWPH vulnerability assessment process. First, there was mention of the importance of inviting Indigenous communities to contribute their viewpoints and knowledge on land stewardship. Participants expressed the importance of assessing vulnerability through an extreme weather and hazards lens, with an emphasis on the usefulness of GIS mapping in preparation and planning for the future.

Relevant data and documents suggested for review include information on the history of Indigenous Peoples and culture in SWPH, Conservation Authority strategic plan, Local municipal plans and policies, a list of environmental societies/groups in Future Oxford, and DMTI spatial resources.

Participants also discussed recommendations for the project, such as conducting a survey of green infrastructure to determine the resiliency of the region to climate change. Others also mentioned how it may be helpful to identify other places experiencing analog climates to the projected future climate states for Oxford, Elgin, and St. Thomas to see impacts on vulnerable populations currently. Overall, there was a strong and consistent focus on equity and addressing inequalities in vulnerabilities and resiliencies.

Vulnerable populations identified included:

1. Homeless populations and those living below the poverty line
2. The Amish communities
3. LGS Mennonite communities (tend to be more transitory with many families traveling back-and-forth between Canada and other areas such as Mexico, Belize, and Paraguay)
4. LGBTQ2S+ community
5. Indigenous communities

6. Outdoor workers (e.g., those working with aggregate who already have high exposure to harmful particles and effects of solar radiation, and agricultural workers where there is a prevalence of human trafficking)
7. Temporary foreign agricultural workers
8. Women, especially single-parent households.

Appendix F: Internal Advisory Committee Consultations

During the presentation, participants reflected on vector-borne illnesses within the SWPH region. Concerns emerged regarding difficulties with monitoring and measuring tick-borne illness, as some ticks are currently not reportable. Participants also discussed further detail on Lyme disease and WNV, including how WNV levels are dependent on the climate of a given year. For example, in summer of 2012, hot weather began in March and continued to get hotter, which created an environment ideal for mosquitos, causing issues for Ontario. However, there has been a steady growth of Lyme disease regardless of weather conditions.

Reflections on the local climate projections for SWPH included discussions on air quality and pollutants. Some participants discussed the economic impact of changing industries within SWPH region. Others also mentioned the importance of considering the location of air quality monitoring stations, with inquiries on the proximity of a monitoring station to accurately measure air quality. Participants also discussed concerns regarding how the current monitoring stations (Kitchener and Port Stanley) may not capture air quality in the 401 corridor. Furthermore, automotive manufacturing is growing in SWPH, which may impact air quality. Recently, air quality has been a concern for residents in SWPH due to visual cues from the Canadian wildfires; this may be useful in motivating people to care about climate change and health.

There were discussions on the importance of including psychosocial health in vulnerability assessments. As noted in the findings section on the scan of existing vulnerability assessments, the inclusion of psychosocial health as an independent climate health impact was limited to assessments conducted after 2022, with all previous assessments incorporating psychosocial health within other sections.

This group also identified aspects of the SWPH region which make it unique, underscoring areas of focus for the vulnerability assessment:

- There is a substantial population of international agricultural workers. These immigrant farm workers are mostly male, work outdoors, and are reliant on their employers, making them a vulnerable population. With thousands of immigrant workers, there are only about 200 premises for accommodations.
- There are LGS Mennonite and Amish communities in SWPH. The needs of these communities differ and have changed over time (e.g., before COVID-19 and after), the first step to addressing their needs should be to start at the community outreach level to understand their reality. LGS Mennonite and Amish communities used to mainly work in agriculture (about 20 years ago), however, with the increase in land prices, other industries such as carpentry, construction, and saw mills are growing. Furthermore, the LGS Mennonite communities within the region are more transient, but this is dependent on many factors. To investigate this, Statistics Canada census data on immigration can be useful to see the percentage of immigrants, where they are coming from, and what language they speak. Regarding healthcare access, the LGS Mennonite community in SWPH are unique to the individual. It is reported that there are no ‘Old Order’ Mennonite communities in SWPH.

- There are Indigenous communities in SWPH, with 2.3% identified in the census data. However, two major reserves declined to participate, so there are likely more individuals who identify as Indigenous within the region. There was a better connection to Indigenous communities in Elgin County when compared to Oxford County, but with the merging of health units, some of those connections have been lost.
- The top employment sectors are manufacturing, social and health care, retail, transportation, and construction. Agriculture only employs 6% of people but people who work on family farms and seasonal workers may not be included in this statistic.
- There are unique vulnerable populations in SWPH which may not have been identified by other health units in Ontario (e.g., older adults, those in insecure housing, low-income individuals). Geographically, urban areas are more prone to mosquitoes, rural areas are more prone to ticks, areas close to the Great Lakes are more prone to flooding, and beaches are more prone to E. coli (beaches in SWPH needed to be closed due to high E. coli levels). There is also a rising homeless population with growing encampments which tend to be in close proximity to Highway 401 or rivers.
- There are also unique factors to consider relevant to rising land prices in SWPH. First, inter-provincial immigration is a big factor for competitive housing (e.g., people from Toronto moving to the region), with Tillsonburg and Woodstock projected as top regions for projected population growth in 2016 and 2021. In Tillsonburg, shelter interventions were recently introduced to accommodate for the opioid crisis and inter-provincial immigration. Further economic changes may also affect land prices, with Toyota present in SWPH, and Volkswagen to come.

Participants were then invited to discuss the priorities of SWPH, with the key topic of discussion centered on health equity. Oxford County has previously conducted a survey of wellbeing (summarized in Section 1.2.2) which offers good baseline data. The County will be redoing this survey with a focus on community vitality and how that can promote community engagement.

When participants were asked to discuss local priorities in the context of health impacts of climate change, there was no question that (health) equity was the foundation of the responses. Participants discussed adaptation actions related to “leveling the playing field.” For example, universal basic income, and food and housing security. Additionally, communal recreation areas should be free to use to promote wellbeing.

Lastly, participants reflected on whether the community in SWPH is aware of climate change as an issue, and its potential health impacts. Participants discussed how the community is likely unaware of climate change-related concerns, but the topic of climate change is difficult to ignore due to news coverage. People know that climate change is happening, but it is difficult to get them to care unless the risks are immediate and personally relevant.

Overall, the vulnerable populations which were discussed by the participants include:

- People experiencing homelessness (encampments locations)
- Those below the poverty line
- Amish/LGS Mennonite Communities
- Males

- Immigrants
- Outdoor Farm Workers
- Indigenous populations
- Older adults