Our Vision:
Healthy People in Vibrant Communities

BOARD OF HEALTH MEETING

Woodstock Location: Oxford County Administration Building
21 Reeve Street, Woodstock, ON N4S 7Y3
Virtual Participation: Microsoft Teams
Thursday, October 26, 2023, at 1:00 p.m.

AGENDA			
ITEM	**AGENDA ITEM**	**LEAD**	**EXPECTED OUTCOME**
1.0 CONVENING THE MEETING			
1.1	Call to Order, Recognition of Quorum • Introduction of Guests, Board of Health Members and Staff	Joe Preston	
1.2	Approval of Agenda	Joe Preston	Decision
1.3	Reminder to disclose Pecuniary Interest and the General Nature Thereof when Item Arises including any related to a previous meeting that the member was not in attendance for.	Joe Preston	
1.4	Reminder that Meetings are Recorded for minute-taking purposes	Joe Preston	
2.0 APPROVAL OF MINUTES			
2.1	Approval of Minutes: September 28, 2023	Joe Preston	Decision
3.0 APPROVAL OF CONSENT AGENDA ***Consent agenda items are routine business items that do not require discussion. Any member of the Board may request an item be moved from the consent agenda to Section 4.0, 5.0, 6.0 or Closed Session (the latter is subject to bylaws governing closed session)***			
4.0 CORRESPONDENCE RECEIVED REQUIRING ACTION			
5.0 AGENDA ITEMS FOR INFORMATION.DISCUSSION.ACCEPTANCE.DECISION			
5.1	Actions to Reduce Alcohol-Related Harms Report for October 26, 2023	Jacqueline Deroo	Decision
5.2	Medical Officer of Health's Report for October 26, 2023	Dr. Ninh Tran	Decision
5.3	Chief Executive Officer's Report for October 26, 2023	Cynthia St. John	Decision
6.0 NEW BUSINESS/OTHER			
7.0 CLOSED SESSION			
8.0 RISING AND REPORTING OF THE CLOSED SESSION			
9.0 FUTURE MEETINGS & EVENTS			

9.1	• Board of Health Orientation: Thursday, November 23, 2023 at Noon
	• Board of Health Meeting: Thursday, November 23, 2023 at 1:00 pm
	  • Location: 1230 Talbot Street, St. Thomas ON
	  • Remote Participation: MS Teams
		Joe Preston	

10.0 ADJOURNMENT			

September 28, 2023

Board of Health Meeting

Minutes

The meeting of the Board of Health for Oxford Elgin St. Thomas Health Unit was held on Thursday, September 28, 2023, in-person at 1230 Talbot Street, St. Thomas, ON, with virtual participation via MS Teams commencing at 1:03 p.m.

PRESENT:

Mr. J. Couckuyt	Board Member
Mr. D. Mayberry	Board Member
Mr. J. Preston	Board Member (Chair)
Mr. G. Jones	Board Member
Mr. L. Rowden	Board Member
Mr. M. Ryan	Board Member
Mr. D. Shinedling	Board Member
Mr. D. Warden	Board Member
Ms. B. Wheaton	Board Member (Vice Chair)
Ms. C. St. John	Chief Executive Officer
Dr. N. Tran	Medical Officer of Health
Ms. W. Lee	Executive Assistant

GUESTS:

Ms. J. Gordon	Administrative Assistant
Mr. P. Heywood	Program Director
Mr. D. McDonald	Director, Corporate Services and Human Resources
Ms. S. MacIsaac*	Program Director
Ms. M. Nusink*	Director, Finance
Ms. M. Cornwell*	Manager, Communications
Mr. I. Santos	Manager, Information Technology
Mr. D. Smith*	Program Director
Mr. Rob Perry*	Aylmer Express
Mr. Robert Northcott	SWPH
Ms. Heather Sheridan*	City of St. Thomas
Mr. Matthew Wilson*	CMHA Thames Valley

**represents virtual participation*

REGRETS:

Mr. J. Herbert	Board Member

1.1 CALL TO ORDER, RECOGNITION OF QUORUM

The Chair recognized and welcomed Davin Shinedling, a new provincial appointee, to the Board of Health.

1.2 AGENDA

C. St. John noted that under *4.0 Correspondence Received Requiring Action,* item 4.1 (Support for Bill C-252) was placed there in error and should be considered as item 3.2 under *3.0 Approval of Consent Agenda*. There were no objections to the adjustment to the agenda.

Resolution # (2023-BOH-0928-1.2)
Moved by D. Warden
Seconded by D. Mayberry

> That the agenda for the Southwestern Public Health Board of Health meeting for September 28, 2023 be approved as revised.

Carried.

1.3 Reminder to disclose Pecuniary Interest and the General Nature Thereof when Item Arises.

M. Ryan declared a conflict or pecuniary interest regarding Item 3.1 Expansion of Publicly Funded Vaccine in Ontario Pharmacies, noting that his wife is currently a partner in a pharmacy business.

J. Preston indicated under those conditions M. Ryan would not need to leave the room although he would not be able to participate in any discussion. M. Ryan noted that he would nevertheless leave during the discussion.

1.4 Reminder that meetings are recorded for minute-taking purposes.

2.0 APPROVAL OF MINUTES

Resolution # (2023-BOH-0928-2.1)
Moved by J. Couckuyt
Seconded by M. Ryan

> That the minutes for the Southwestern Public Health Board of Health meeting for June 22, 2023 be approved.

Carried.

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3.0 CONSENT AGENDA

M. Ryan excused himself from the room at 1:05 pm.

M. Ryan returned to the room at 1:06 pm after the resolution was moved, seconded, and carried.

Resolution # (2023-BOH-0928-3.1)
Moved by D. Warden
Seconded by B. Wheaton

> That the Board of Health for Southwestern Public Health receive and file consent agenda items 3.1 – 3.2.

Carried.

4.0 CORRESPONDENCE RECEIVED REQUIRING ACTION

As noted in the review of the agenda for September 28, 2023, the item originally noted as 4.1 is now listed as Consent Agenda Item 3.2.

5.0 AGENDA ITEMS FOR INFORMATION.DISCUSSION.DECISION

5.1 Regulated, Quasi-regulated, and Unregulated Residential Facilities Report for September 28, 2023.

Peter Heywood presented the staff report.

P. Heywood recognized Robert Northcott as the primary author and researcher of the report and acknowledged the contributions of Heather Sheridan from the City of St. Thomas, Matthew Wilson from Canadian Mental Health Addiction Services Thames Valley (CMHA-TV), and Amy Pavletic and Susan MacIsaac from Southwestern Public Health (SWPH).

At the conclusion of the report, J. Couckuyt thanked P. Heywood for the presentation, noting it was an excellent report. J. Couckuyt indicated he thoroughly supported the report's recommendations.

J. Couckuyt inquired about the 26 people who were moved from the unregulated housing in St. Thomas due to multiple infractions and health and safety concerns and were then temporarily relocated to the Joe Thornton arena. P. Heywood noted that the residents were all successfully relocated to a variety of homes, and some returned to their families via the support of CMHA-TV and the City of St. Thomas and to the best of his knowledge they are still there.

L. Rowden commended the report as excellent. He noted that the need for regulation could identify many buildings that do not meet current health and safety standards and notes the need for further consideration of alternative housing options should such places be closed. He

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noted that without thoughtful consideration, putting regulations and standards in place could result in further homeless scenarios. P. Heywood concurred, noting it is an important element to consider in advocating for regulatory standards of practice for unregulated homes.

G. Jones asked if unregulated facilities have an economic advantage over regulated homes since they do not have to adhere to specific standards of practice. P. Heywood noted he did not have information regarding profit margin percentages for these homes. P. Heywood indicated there are some excellent operators of unregulated facilities that support their residents in the community; however, the intent of the report is to identify the harms to health outcomes when such facilities are poorly maintained and operated because they are unregulated.

D. Warden asked if public health involvement would be complaint driven. P. Heywood noted SWPH is mandated to respond to and investigate complaints in the manner of assessing for health hazards (i.e., conditions of the facility, food handling, etc.). He noted as well that if public health is aware of unregulated group homes or facilities, there will be more proactive outreach in accordance with the Ontario Public Health Standards such as annual inspections. However, there is currently no means of maintaining a current and comprehensive list of unregulated homes and facilities.

D. Warden asked what the safeguards are in place to ensure that funding for these residents is being used appropriately. L. Rowden noted that funding to clients from agencies such as Ontario Disability Support Program (ODSP) can not be followed up afterward as it is the decision of the client to disburse their funds.

P. Heywood noted that this is a complex matter, wherein the issue lies in the standards of practice and lack of follow-up and application of those standards. There is no agency that follows-up on standards of practice: i.e., Hamilton has by-laws, but their continued enforcement is difficult.

P. Heywood noted that current follow-up is reactive rather than proactive and hopes that through the recommended resolution to the Association of Local Public Health Agencies (alPHa), this will be the first step in advocating for further action regarding this vital issue.

J. Couckuyt noted that municipalities should not be the organizations accountable or responsible for regulating these facilities and is pleased to see that the report recommends local public health units for this purpose.

P. Heywood acknowledged that public health units have developed strong local networks and partnerships that allows them to generate a strong response table that is timely, empathetic, and compassionate.

J. Preston commended the report, referencing the unregulated facility in St. Thomas cited in the report. He acknowledged the complexity of pulling together various enforcement agencies and identifying the various responsibilities and accountable bodies. J. Preston noted that he could see this advocacy move to a level of provincial standards but believes enforcement would still

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occur at the municipal level. J. Preston noted he was happy to move the resolution forward. D. Warden noted that he supports this report strongly.

Resolution # (2023-BOH-0928-5.1)
Moved by M. Ryan
Seconded by M. Peterson

> That the Board of Health for Southwestern Public Health approve the Regulated, Quasi-regulated, and Unregulated Residential Facilities Report for September 28, 2023.

Carried.

R. Northcott, contributor to the report, left the room at 1:36pm.

5.2 Medical Officer of Health Report

Dr. N. Tran reviewed his report.

Dr. Tran noted that Health Canada has just approved a second Covid-19 XBB vaccine product and hopes it will result in greater access for the public and streamline access where desired.

Dr. Tran referenced his questions at the end of his report:

1) How ready are our current municipalities and counties in the SWPH region to respond to these challenges of emergency planning, fall respiratory season, opioids crisis and climate change?
2) How can SWPH support our municipalities and counties with these challenges?

J. Couckuyt thanked Dr. Tran for the report and asked what happens with vaccine access for homebound patients, noting that paramedics are now the only option to provide the vaccine.

Dr. Tran noted that the paramedicine programs in the region have provided phenomenal support that SWPH relies upon in many situations, one of which is they currently facilitate service to homebound patients. There are other services via Homecare, but local paramedics have risen to the challenge. SWPH has yet to hear they do not have capacity to meet these challenges and would plan accordingly if that occurred.

J. Couckuyt noted anecdotally that a client had many issues with accessing service. Dr. Tran asked that board members or their constituents contact SWPH regarding issues such as access to the Covid-19 vaccine and staff will investigate further.

B. Wheaton asked about campfires and backyard fires and their effect on air quality and whether there have been studies on their impact on local air quality. Dr. Tran indicated he would take this question back to staff.

D. Shinedling asked about the general community health effects caused by wildfires in the area over the summer. Dr. Tran noted poor air quality exacerbated pre-existing conditions such as pulmonary issues, asthma, cardiovascular events. When Air Quality Health Indexes (AQHIs) are high (which are not used for wildfires per se, but smog or other pollutants), part of the outreach is to inform the public about these issues. Dr. Tran noted that at the time of wildfires, there was a rise in health complaints.

D. Mayberry noted he looks forward to the coming climate change report. He noted that what public health can do to support municipalities is position itself as a source of unbiased information and scientific data that can be used to support decision-making processes and to offset rumours and unfounded claims.

M. Ryan suggested that C. St. John meet with municipal CEOS and CAOs to ask how SWPH can support municipalities as this would be a more direct line of communication and action. J. Preston agreed with M. Ryan's proposal.

Resolution # (2023-BOH-0928-5.2)
Moved by D. Warden
Seconded by B. Wheaton

> That Board of Health for Southwestern Public Health accept the Medical Officer of Health Report for September 28, 2023.
>
> Carried.

5.1 Chief Executive Officer's Report

C. St. John reviewed her report.

C. St. John noted the alPHa Fall Symposium (November 24, 2023) is open for all board members to join. Of note, C. St. John will be speaking at the symposium of SWPH's merger experience in 2018. Kindly let C. St. John or W. Lee know if any board members would like to attend.

C. St. John highlighted separate meetings that occurred between the alPHa Executive Committee (of which she is a member) and Premier Ford and Deputy Premier and Minister of Health, Sylvia Jones. She noted that both meetings focused on how alPHa and its members, the 34 health units, could work collaboratively with the province on mutual public health priorities to improve the health of Ontarians. C. St. John noted she and Dr. Tran sit at various tables that provide opportunities to bring forward SWPH's small urban/large rural perspective.

Regarding the province's funding announcement of public health at the Association of Municipalities of Ontario (AMO) conference, C. St. John noted that it is uncommon for a ministry to announce a funding increase for a year that they're not in much less three years

(2024-2026). It speaks of a commitment to support local public health agencies in their post-covid work.

C. St. John noted that SWPH received its 2023 funding grant and accountability agreement wherein all of the mandatory programs are funded. Of the 6 business one-time funding requests that were submitted, 3 were approved; however, the business cases for stigma education, collaborative planning with our school boards, and a project manager for the new Woodstock building site were not approved.

M. Nusink was asked to share financial details about the Minister of Health's cost-sharing announcement at the AMO conference, with C. St. John emphasizing that the new arrangement is not a full return to the previous slate of cost-shared programs as there were many programs that were previously 100% funded by the province that were moved to cost-shared models and now remain so. As a result, the new funding formula has increased the cost-shared amount for municipalities.

J. Couckuyt asked what is the standing of the extra funds asked of the municipalities from June.

C. St. John noted that budget was passed in February and then there was the additional investment requested by the Board and presented in June In light of the confirmed funding letter from the province, a letter to municipalities will be sent after the September Board of Health meeting to indicate what the revised levy will be. J. Preston and C. St. John noted SWPH's funding breakdown (i.e. 1% increase from Ministry of Health) is where the board anticipated it would be.

D. Mayberry asks for clarity regarding the cost of moving 100% funded programs to the cost-shared model. M. Nusink indicated that such costs had been covered under mitigation funding and equate to almost one million dollars in difference. D. Mayberry noted ministry funding over the years have not reflected inflation rates, resulting in municipalities covering more public health costs in the region.

In response to C. St. John's commendation of the finance department's work in transcribing audited statements to ministry forms, M. Ryan suggested calling on alPHa to help advocate for the reduction of red-tape processes.

C. St. John called the board's attention to SWPH's intended strategic planning for the fall, wherein the recommendation would be to delay this work in light of the significant changes coming for public health. She noted that SWPH's current strategic plan is still relevant and continues to inform program planning that is already underway for 2024. By delaying strategic planning at this time, SWPH will have updated census data and a refreshed health status report that will inform our strategic planning and priorities, as well as an opportunity to review any revisions to the Ontario Public Health Standards (which are expected to be under review soon).

D. Shinedling asked what timelines have been given regarding the changes coming to public health. C. St. John noted that announcements have indicated these changes are expected to occur during this current provincial mandate.

Resolution # (2023-BOH-0928-5.3A)
Moved by D. Mayberry
Seconded by G. Jones

That Board of Health for Southwestern Public Health approve the second quarter financial statements for the period ending June 30, 2023 for Southwestern Public Health.

Carried.

Resolution # (2023-BOH-0928-5.3B)
Moved by M. Peterson
Seconded by J. Couckuyt

That the Board of Health approve the audited financial statements for the Healthy Babies Healthy Children Program and the Pre and Post Natal Nurse Practitioner program for the period ending March 31, 2023 and that the Board of Health ratify the signing of the Engagement Letter.

Carried.

Resolution # (2023-BOH-0928-5.3C)
Moved by B. Wheaton
Seconded by D. Shinedling

That the Board of Health accept the Amending Agreement between the Ministry of Health and Southwestern Public Health effective January 1, 2023.

Carried.

Resolution # (2023-BOH-0928-5.3D)
Moved by G. Jones
Seconded by L. Rowden

That the Board of Health for Southwestern Public Health ratify the Board of Health Chair and CEO's signing of the 2022 program-based grants annual reconciliation report as noted.

Carried.

Resolution # (2023-BOH-0928-5.3)
Moved by B. Wheaton
Seconded by J. Couckuyt

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That Board of Health for Southwestern Public Health approve the Chief Executive Officer's report for September 28, 2023.

Carried.

7.0 TO CLOSED SESSION

Resolution # (2023-BOH-0928-C7)
Moved by G. Jones
Seconded by B. Wheaton

That the Board of Health move to closed session in order to consider one or more the following as outlined in the Ontario Municipal Act:

(a) the security of the property of the municipality or local board;
(b) personal matters about an identifiable individual, including municipal or local board employees;
(c) a proposed or pending acquisition or disposition of land by the municipality or local board;
(d) labour relations or employee negotiations;
(e) litigation or potential litigation, including matters before administrative tribunals, affecting the municipality or local board;
(f) advice that is subject to solicitor-client privilege, including communications necessary for that purpose;
(g) a matter in respect of which a council, board, committee or other body may hold a closed meeting under another Act;
(h) information explicitly supplied in confidence to the municipality or local board by Canada, a province or territory or a Crown agency of any of them;
(i) a trade secret or scientific, technical, commercial, financial or labour relations information, supplied in confidence to the municipality or local board, which, if disclosed, could reasonably be expected to prejudice significantly the competitive position or interfere significantly with the contractual or other negotiations of a person, group of persons, or organization;
(j) a trade secret or scientific, technical, commercial or financial information that belongs to the municipality or local board and has monetary value or potential monetary value; or
(k) a position, plan, procedure, criteria or instruction to be applied to any negotiations carried on or to be carried on by or on behalf of the municipality or local board. 2001, c. 25, s. 239 (2); 2017, c. 10, Sched. 1, s. 26.

Other Criteria:

(a) a request under the *Municipal Freedom of Information and Protection of Privacy Act*, if the council, board, commission or other body is the head of an institution for the purposes of that Act; or
(b) an ongoing investigation respecting the municipality, a local board or a municipally-controlled corporation by the Ombudsman appointed under the *Ombudsman Act*, an Ombudsman referred to in subsection 223.13 (1) of this Act, or the investigator referred to in subsection 239.2 (1). 2014, c. 13, Sched. 9, s. 22.

Carried.

8.0 RISING AND REPORTING OF CLOSED SESSION

Resolution # (2023-BOH-0427-C8)
Moved by B. Wheaton
Seconded by D. Mayberry

That the Board of Health rise with a report.

Carried.

Resolution # (2023-BOH-0928-C3.1A)
Moved by B. Wheaton
Seconded by M. Peterson

That the Board of Health for Southwestern Public Health approve a revised terms of reference and confirm M. Ryan's membership in the Special Ad Hoc Building Committee.

Carried.

Resolution # (2023-BOH-0928-C3.1)
Moved by D. Mayberry
Seconded by M. Peterson

That the Board of Health for Southwestern Public Health accept the Special Ad Hoc Building Committee Report for September 28, 2023.

Carried.

Resolution # (2023-BOH-0928-C3.2A)
Moved by D. Mayberry
Seconded by D. Warden

That the Board of Health for Southwestern Public Health approve the updated 2023 Risk Register, as presented.

Carried.

Resolution # (2023-BOH-0928-C3.2B)
Moved by D. Warden
Seconded by D. Mayberry

That the Board of Health for Southwestern Public Health approve the 2024 Risk Register, as presented.

Carried.

Resolution # (2023-BOH-0928-C3.2)

Moved by B. Wheaton
Seconded by M. Ryan

That the Board of Health for Southwestern Public Health approve the Chief Executive Officer's Report for September 28, 2023.

Carried.

10.0 ADJOURNMENT

Resolution # (2023-BOH-0928-10)
Moved by B. Wheaton
Seconded by M. Peterson

That the meeting adjourns at 4:42 p.m.

Carried.

Confirmed: _____

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BOARD REPORT

MEETING DATE:	October 26, 2023
SUBMITTED BY:	Peter Heywood, Program Director
SUBMITTED TO:	Board of Health
PURPOSE:	☒ Decision ☐ Discussion ☐ Receive and File
AGENDA ITEM #	5.1
RESOLUTION #	2023-BOH-1026-3.1
Report Title:	Actions to Reduce Alcohol-Related Harms Report

SITUATION

Experts have described alcohol as the most far-reaching and harmful drug. (1,2) It has been classified as a type one carcinogen, within the same group as tobacco and asbestos, since 1988. (3) The main types of cancer that alcohol can cause include breast, colon, rectum, mouth and throat, liver, esophagus and larynx cancer. (4) Moreover, the consumption of alcohol has been linked to 200 different disease and injury conditions, some of which are considered secondary harms that affect people other than those who consume alcohol themselves (i.e. Fetal Alcohol Spectrum Disorder, impaired driving crashes, child abuse, and injuries). (5,6)

Local Concerning Trends

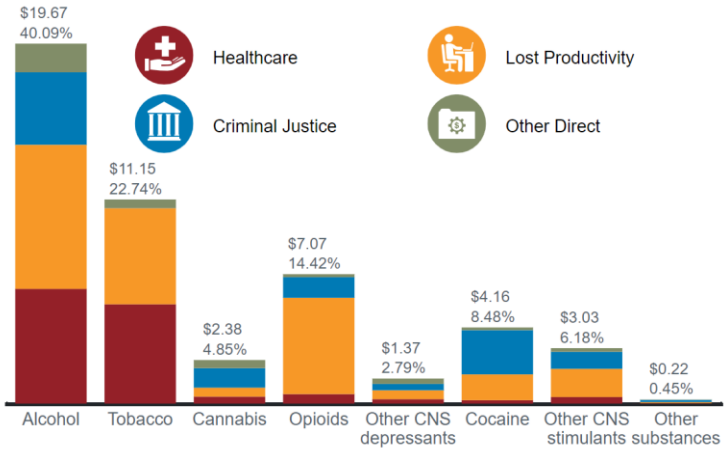
The local alcohol-related mortality rate (with and without drug involvement) increased between 2018 and 2021, whereas the provincial rate decreased during the same time. In 2021, the rate in the Southwestern Public Health Region (SWPH) region surpassed the provincial rate, reaching a high of 3.4 per 100,000 (compared to 2.5 per 100,000 across Ontario). The mortality rate of female SWPH residents also increased consistently during that time, nearly matching the historically higher rate among male residents in 2021 (3.3 per 100,000 versus 3.5 per 100,000, respectively). (7) Also very concerning, there has been an increase in the proportion of women who gave birth reporting any alcohol exposure during pregnancy, increasing from 2.8% in 2018 to 3.7 % in 2022. Data from June of 2023 indicates that this rate continues to increase. (8)
A recent report published by Public Health Ontario estimates the burden of health conditions attributed to alcohol in people older than 15. The Southwestern Public Health (SWPH) region showed an estimated average of 76 deaths, 388 hospitalizations and 3,707 emergency department visits annually. (9)

The Cost of Alcohol-Related Harms

Research shows that when alcohol becomes more available and affordable, the following problems increase: street and domestic violence, chronic diseases, sexually transmitted infections, road crashes, youth drinking, injury (6) and suicide. (10,11) There are also increased costs of health care, lost productivity, criminal justice and other direct costs. (12) Furthermore, this association was examined following the 2015 expansion of alcohol sales to grocery stores in Ontario, and there was an increase in emergency department visits shown to be attributable to alcohol. (13)

In Canada, alcohol is the costliest substance in terms of healthcare, criminal justice, lost productivity, and other direct costs. Despite taxes on alcohol, alcohol creates a deficit of $6.196 billion each year across all sectors. (14,12) Chart 1 below visually demonstrates that the costs and harms to Canadians from alcohol are significant and higher than all substance categories. (12) Generally, alcohol causes injuries and deaths of people at a younger age (considered working ages of under 65 years) (12), and therefore was responsible for more years of productive life lost, which drove costs up for every year studied. Out of all criminal justice costs, alcohol accounts for nearly 40% because of its role in violent and non-violent crime and impaired driving. (12)

Chart 1: Costs (in billions) related to substance use in Canada from 2007 to 2020. (12)



From the Canadian Centre on Substance Use and Addictions and Canadian Institute for Substance Use Research at the University of Victoria LINK

The Alcohol Harm Paradox

It is important to note that the harms due to alcohol are disproportionately shouldered by individuals with low socio-economic status (SES), compared to those of high SES, even though this population consumes the same or less amounts; this phenomenon is described as the alcohol harm paradox. (15,16) The reasons for the alcohol harm paradox can only be theorized at this point, and research has not confirmed the causes. Theories of what causes the alcohol harm paradox are often related to having a lower income. This includes higher stress levels, less social support, fewer resources to cope and other risk factors such as lack of access to healthy foods and opportunities to be active. (16) Furthermore, exposure to higher alcohol-dense environments, choice of alcohol and occurrence of binge drinking may also help to explain the alcohol harm paradox. (15,16) Alcohol policy related to Minimum Unit Pricing, as demonstrated

in Scotland, is an effective intervention for equitable actions that could be taken to address this. (17)

The Canadian Guidance on Alcohol and Health

On January 17, 2023, the Canadian Centre on Substance Use and Addiction (CCSA) released the new *Canadian Guidance on Alcohol and Health* (CGAH) after a two-and-a-half-year process utilizing the best available evidence. The CGAH replaces the 2011 version of the *Low-Risk Drinking Guidelines* and provides the public with information about the range of risk, rather than recommending specific amounts. Everyone has a different risk tolerance, and it provides people with information to make decisions based on their ideas of what is worth the risk. The lowest risk category is based on a one in 1,000 chance of premature death (17.5 years of life lost), which corresponds to one to two drinks a week. A more moderate risk of one in 100 is associated with three to six drinks a week. After seven drinks per week, the risk of premature death is even greater. (4)

Locally, 61% of adult respondents to the Canadian Community Health Survey self-report having no-risk or low-risk alcohol use, while 39% report moderate to high-risk alcohol use, meaning they drink three or more alcoholic beverages per week. (18) It should be noted that self-reported data has been shown through research to underestimate the amount people consume, sometimes by 50-75%, and therefore, the rate of moderate to risky drinking is likely higher. (19)

ASSESSMENT

The actions taken to address alcohol consumption must match the magnitude of the problems it causes. Effective interventions proven to decrease alcohol-related harms have been extensively studied by researchers in Canada and abroad. It is widely recognized that the most cost-effective strategies to reduce the harmful effects of alcohol include:

- Increasing taxes on alcoholic beverages,
- Restrictions on the physical availability of alcohol,
- Restrictions on alcohol advertising and marketing,
- Enforcing drunk driving countermeasures, and
- Implementing screening, brief interventions, referral and treatment. (4,5,16,9,14,13)

Comprehensive tobacco control policies are highly effective in decreasing Canada's smoking rates and lung cancer deaths. (9,12) To control harm, the strategies used for tobacco control should be applied to alcohol. As tobacco regulations have gradually become more robust, alcohol regulation has been dismantled over the past few decades. Furthermore, to reduce alcohol consumption and population-level harms, consideration for alcohol control policies is required across all levels of government.

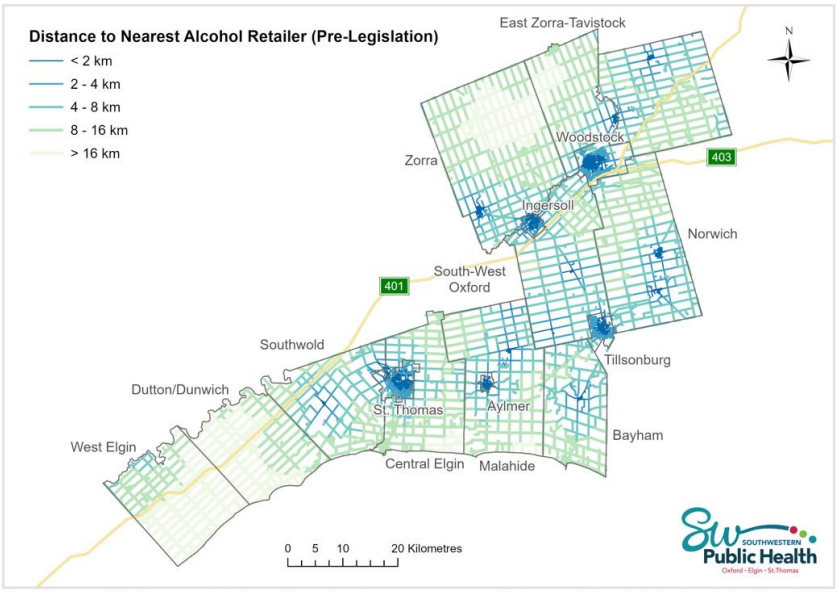
Municipal Level Policy Considerations:

Municipal-level policies can protect people and reduce alcohol-related harm to individuals, families, communities, and neighbourhoods. While most alcohol policy is governed at the provincial and federal level, municipalities can address alcohol-related risk and harm on municipally-owned property through Municipal Alcohol Policies (MAPs) and off municipally-owned property through by-laws, zoning and licensing restrictions as described by the report:

Alcohol Policy Review: Opportunities for Ontario Municipalities provides interventions that can be used at the local level. (20)

In 2022, geographic image system (GIS) maps were created to assist with tracking alcohol patterns in our region. As seen in Images 1 and 2 below, it is possible to see how alcohol availability has increased post-2021, demonstrated by the light-gridded areas suddenly disappearing and shaded areas becoming darker as residents became closer to alcohol outlets. (21)

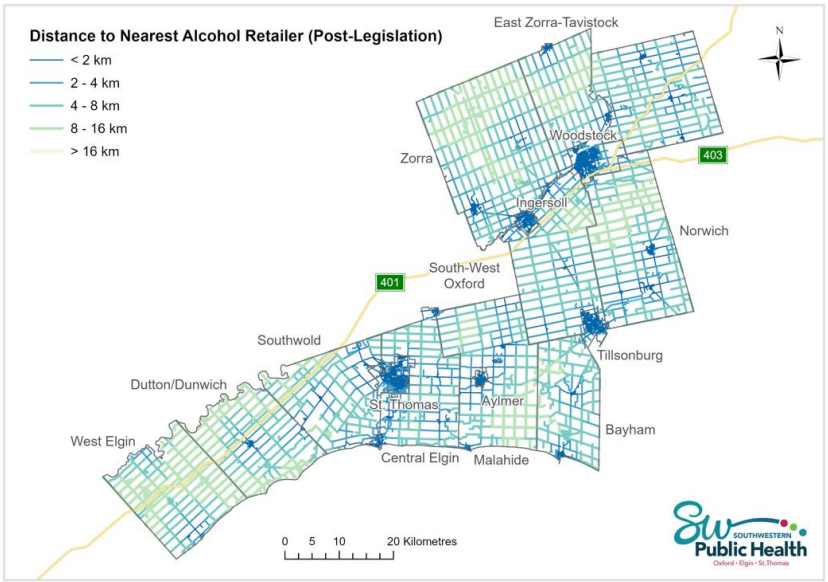
Image 1



Note: In December 2020, the province made changes to liquour license regulations allowing eligible restaurants and bars to include alcohol with food as part of a takeout or delivery order.

Data sources: Alcohol and Gaming Commission of Ontario (2020) Statistics Canada (2021 Census)

Image 2



Note: In December 2020, the province made changes to liquour license regulations allowing eligible restaurants and bars to include alcohol with food as part of a takeout or delivery order.

Data sources: Alcohol and Gaming Commission of Ontario (2020) Statistics Canada (2021 Census)

The GIS maps also illustrate variations across regions, identify potentially disadvantaged areas, and uncover the linkage between population characteristics and accessibility (21). One correlation observed across the SWPH Region was that a moderate to strong negative association was found between lone-parenthood/ socio-economic distress and distance to alcohol and cannabis retailers. This finding suggests that lone parenthood families and communities of socio-economic distress are more exposed to alcohol retailers. When it comes to disadvantaged populations, alcohol tends to create harm at higher rates than those with more advantages, despite equal or lesser amounts of alcohol consumed by those with disadvantages. (15) This correlation shows how, locally, there is increased availability for those who are disadvantaged and lone-parent families, which could contribute to the disproportionate harms previously discussed. (21)

Municipalities can use information from the GIS maps to make informed decisions weighing the costs and benefits of alcohol policy that improves local well-being and decreases alcohol-related harms. Actions of this nature have already been taken by the municipalities of Oshawa and Ajax, where both Durham Region Public Health and the municipalities worked together, using local data, to oppose a convenience store's application for alcohol licensing due to the harm it would cause their citizens. Using local data can assist municipalities in choosing the right policies for their communities based on local needs.

Provincial Level Policy Considerations:

In Ontario, alcohol sales are regulated at the provincial level and consist of a mixed private and government-run retail system. As discussed above, alcohol availability has recently increased due to provincial alcohol policy decisions. In response, the Ontario Public Health Association (OPHA) has prepared and sent a letter outlining effective measures to decrease alcohol-related harms to the Ministry of Finance and the Ministry of Health. The main recommendations provided were:

1. Reduce retail density, especially in low socio-economic status (SES) neighbourhoods.
2. Maintain or decrease hours of sale, with no exceptions.
3. Strengthen Ontario's alcohol pricing policies, including taxation, minimum pricing or other means.
4. Stop further privatization of alcohol sales.
5. Apply a whole of government, health-in-all-policies approach to alcohol modernization.

Federal Level Policy Considerations:

Policy decisions made at the federal level also affect our local citizens. Unlike other substances, alcohol is not regulated under one act. The federal government could regulate alcohol through new legislation, which could include the following policy actions:

- Indexation of excise taxes based on alcohol content.
- Regulations and enforcement systems to control, restrict or ban alcohol marketing, including digital media.
- Enacting mandatory health and safety labelling for alcohol products, including clear standard drink information, health warnings, and nutritional labelling.
- Enacting a national minimum legal drinking age, preferably 21 years of age.

Lack of Public Knowledge of Alcohol Harms

The level of awareness of the harms of alcohol use plays a role in policy change at all levels. While it has become common knowledge that tobacco causes lung cancer, most Canadians do not know that alcohol causes cancer. (22) The evidence in this area shows that as consumers' understanding of the connection between cancer and alcohol increases, they become more supportive of alcohol policy measures controlling pricing, availability and marketing. (23,24) Therefore, SWPH has a role in widely sharing the new *Canadian Guidance for Alcohol and Health* to provide the public with information about alcohol risk to support informed decision-making and to increase support for alcohol control policies.

The Role of the Industry

A structural element at play when considering alcohol policy and effective interventions is the role of the Alcohol Industry itself. A growing amount of information documents how private sector activities affect people's health and chronic disease rates, otherwise known as the Commercial Determinants of Health (CDoH). (25,26,27) Discussion on the CDoH allows us to shift the current thoughts and practice in health from blaming individual behaviours and inadequate environments to the structural elements that keep unhealthy behaviours and environments in place. (27) Evidence on the CDoH has been categorized into four areas:

1. Health behaviours and choices related to risk factors for chronic disease,
2. Social Determinants of Health factors affecting daily living conditions,
3. Corporate political and business practices influencing regulatory environments; and
4. Globalized political and economic environments sanctioning corporate activities. (26)

With a Commercial Determinant of Health lens, we can better understand how the ubiquitous actions of the alcohol industry can affect public health policy in negative ways, thereby harming the public on a grand scale. One documented tactic is how the industry intentionally confuses the public about the harms of alcohol. (28) One Canadian example of Alcohol Industry influence recently played out in 2018, when a Health Canada funded study in the Yukon was altered due to the Alcohol Industry's influence and threats of legal action. Despite their claims having no legal merit, the study was altered because the Yukon Government did not have the funds to fight legal battles with the Canadian Alcohol Industry. The Alcohol Industry successfully halted labels from being put on alcohol bottles that informed the public that alcohol causes cancer. (28,29) The Commercial Determinants of Health should be considered whenever policy or higher-level actions are taken.

RECOMMENDATIONS FOR THE BOARD'S CONSIDERATION

1. Request that the members of the Association of Local Public Health Agencies (alPHa) adopt a resolution developed by Southwestern Public Health that requests the provincial and federal governments to promote comprehensive public education campaigns, stricter regulations on advertising, increasing alcohol taxes, development of a prevention model, and improving access to addiction treatment and support services at the next scheduled Annual General Meeting in June 2024.
2. Send a letter supporting the Ontario Public Health Association's letter regarding modernizing the alcohol marketplace and product sales.
3. Collaborate with local municipalities to review and propose amendments to existing by-laws and alcohol-related policies to address the locations of alcohol retailers through

zoning and distancing with consideration for high-density neighbourhoods, schools and childcare centres. This will be reviewed in tandem with Cannabis and Tobacco Policy.

CONCLUSION

Alcohol causes harm in immeasurable ways, and with consideration of our local data, it is obvious that alcohol is harming our community. The public does not know enough about the harms of alcohol, and the Alcohol Industry distorts or denies the evidence, minimizing the harmful effects of alcohol consumption. Increasing awareness of industry messaging strategies may generate more critical coverage of industry lobbying activities and increase public support for alcohol policies. Evidence indicates that as individuals become aware of the link between cancer and alcohol, their support of alcohol policy increases. (28,24) Education alone is less effective in changing population-level behaviours than policy. However, education has positive impacts when coupled with alcohol policy regulating price, availability, and marketing. (6,10,14) Healthy public policies at the local, provincial, and federal levels are important to create environments that positively influence alcohol consumption and support people who want to consume less alcohol. (12)

Southwestern Public Health has a vital role in supporting our community to grow stronger together, and the evidence exists to guide this effort.

MOTION: 2023-BOH-1026-3.1
That the Board of Health for Southwestern Public Health approve the Actions to Reduce Alcohol-Related Harms Report for October 26, 2023.

Definitions

Alcohol Harm Paradox: Phenomenon observed where harms and hospitalizations due to alcohol are disproportionately shouldered by individuals with Low Socio-economic Status (SES), compared to those of high SES, even though this population consumes the same or less amounts. (15,16)
Commercial Determinants of Health: Commercial determinants of health are the private sector activities that affect people's health, directly or indirectly, positively or negatively. (25)
Health in All Policy Approach: Health in All Policies (HiAP) is an approach to public policies across sectors that systematically considers the health implications of decisions, seeks synergies and avoids harmful health impacts to improve population health and health equity. It improves policy-makers accountability for health impacts at all policy-making levels. It includes an emphasis on the consequences of public policies on health systems' determinants of health and well-being. (30)

REFERENCES

1. Nutt DJ, King LA, Phillips LD. Drug harms in the UK: a multicriteria decision analysis. The Lancet. 2010; 236: p. 1558-1556.
2. Daglish M, Dawe S, Egerton-Warburton D, Karro J, Kim C, Lenton S, et al. The Australian drug harms ranking study. J Psychopharmacol. 2019 July; 33(7): p. 759-768.
3. International Agency for Research on Cancer (IARC). Personal habits and indoor combustions. Volume 100 E: A reveiw of human carcinogens. Lyon, France:, IARC monographs on the evaluation of carcingoenic risks to humans; 2010.
4. Paradis C, Butt P, Shield K, Poole N, Wells S, Naimi T, et al. Canada's Guidance on Alcohol and Health: Final Report. Ottawa, ON: Canadian Centre on Substance Use and Addiction; 2023.
5. World Health Organization. Alcohol: Fact Sheet. [Online].; 2022 [cited 2023 April 28. Available from: https://www.who.int/news-room/fact-sheets/detail/alcohol.
6. Babor T, Casswell S, Graham K, Huckle T, Liningston M, Osterber E, et al. Alcohol: No Ordinary Commodity Research and Public Policy. 3rd ed.: Oxford University Press; 2023.
7. Statistics Canada. Canadian Community Health Survey. ; 2015-2020.
8. (BORN) BORN. Children's Hospital of Eastern Ontario (CHEO); 2018- June 2023.
9. Ontario Health and Ontario Agency for Health Protection and Promotion (Public Health Ontario).. Burden of Health Conditions Attributable to Smoking and Alcohol by Public Health Unit in Ontario. Appendix A: Estimates. Toronto:; 2023. Report No.: 116-117.
10. Stockwell T, Wettlaufer A, Vallance K, Chow C, Giesbrecht N, April N, et al. Strategies to reduce alcohol-related harms and costs in Canada: a review of provincial and territorial policies. Victoria, B.C.: Canadian Institute for Substance Use Research,; 2019.
11. Ontario Public Health Association. OPHA Issue Series: Alcohol Outlet Density. [Online]. [cited 2023 May 9. Available from: https://opha.on.ca/wp-content/uploads/2021/06/Alcohol-Outlet-Density.pdf.
12. Canadian Substance Use Costs and Harms Scientific Working Group. (Prepared by the Canadian Institute for Substance Use Research and the Canadian Centre on Substance Use andAddiction.). Canadian substance use costs and harms 2007–2020. Ottawa, ON.: Canadian Centre on Substance Use and Addiction; 2023.
13. Myran DT, Chen JT, Giesbrecht N, Rees VW. The association between alcohol access and alcohol-attributable emergency department visits in Ontario, Canada. Addiction. 2019 July 1183-1191; 114(7).
14. Naimi T, Stockwell T, Giesbrecht N, Wettlaufer A, Vallance K, Farrell-Low A, et al. Canadian Alcohol Policy Evaluation (CAPE) 3.0 Project. Policy Domain Results Summary (Provincial/Territorial). Victoria, BC: University of Victoria, Canadian Institute for Substance Use Research; 2023.
15. Bloomfield k. Understanding the alcohol-harm paradox: what next? The Lancet: Public Health. 2020 June; 5(6).
16. Canadian Institute for Health Information. Alcohol Harm in Canada: Examining Hospitalizations Entirely Caused by Alcohol and Strategies to Reduce Alcohol Harm. Ottawa, Ontario:, CIHI; 2017.

17. Wyper G, Mackay D, Fraser C, Lewsey J, Robinson M, Beeston C, et al. Evaluating the impact of alcohol minimum unit pricing on deaths and hospitalisations in Scotland: a controlled interrupted time series study. The Lancet. 2023 March; 401(10385).
18. Canadian Community Health Survey (CCHS) data file. Level of risk due to weekly drinking, Southwestern Public Health, 2015 – 2020. 2019-2020. This data was gathered by Southwestern Public Health Foundational Standards Team.
19. Canadian Institute for Substance Use Research. How much do Canadians lowball their drinking? [Online]. [cited 2023 March 2. Available from: https://www.uvic.ca/research/centres/cisur/news/archive/canadians-lowball-their-drinking.php.
20. Liem S. Alcohol Policy Review: Opportunities for Ontario Municipalities. Liem Strategic Integration Inc.; 2018.
21. Gilliland J, Zhong S, Wray A. Mapping and understanding accessibility to alcohol, cannabis, and food retailers in Oxford County and Elgin County, and the City of St. Thomas. GIS Mapping. London, ON: Spatialists Consulting; 2022.
22. Hobin E, Shokar S, Vallance K, Hammond D, McGavock J, Greenfield T, et al. Communicating risks to drinkers: testing alcohol labels with a cancer warning and national drinking guidelines in Canada. Can J Public Health. 2020 October; 111(5): p. 716-725.
23. Giesbrecht N, Wettlaufer A, Vallance K, Hobin E, Naimi T, Price T, et al. Why Canadians deserve to have mandated health and standard drink information labels on alcohol containers. Canadian Journal of Public Health. 2023 May.
24. Weerasinghe A, Schoueri-Mychasiw N, Vallance K, Stockwell T, Hammond D, McGavock J, et al. Improving Knowledge that Alcohol Can Cause Cancer is Associated with Consumer Support for Alcohol Policies: Findings from a Real-World Alcohol Labelling Study. International Journal of Environmental Research and Public Health [Internet]. 2020 Jan 7;17(2):398. 2020 January; 17(2).
25. World Health Organization. Commercial Determinants of Health: fact sheet. [Online].; 2023 [cited 2023 06 26. Available from: https://www.who.int/news-room/fact-sheets/detail/commercial-determinants-of-health.
26. Maani N, Petticrew M, Galea S. The Commercial Determinants of Health New York, NY: Oxford University Press; 2023.
27. Mialon M. An overview of the commercial determinants of health. Global Health. 2020; 16(74).
28. Stockwell T, Solomon R, O'Brien P, Vallance K, Hobin E. Cancer Warning Labels on Alcohol Containers: A Consumer's Right to Know, a Government's Responsibility to Inform, and an Industry's Power to Thwart. Journal of Studies on Alcohol and Drugs. 2020; 81(2): p. 284-292.
29. Ashley J. Yukon's alcohol label study back on but without a cancer warning. 2018 February 16..
30. World Health Organization. Health in All Policies Training Manual. Training Manual. Geneva:; 2015.

31. Crawley M. How 7-Eleven won liquor licences for nearly all of its Ontario locations. Canadian Broadcasting Company (CBC). 2023 June.

MOH REPORT

Open Session

MEETING DATE:	October 26, 2023
SUBMITTED BY:	Dr. Ninh Tran, MOH (written as of 12:00 Noon, October 17, 2023)
SUBMITTED TO:	Board of Health
PURPOSE:	☐ Decision ☒ Discussion ☒ Receive and File
AGENDA ITEM #	5.3
RESOLUTION #	2023-BOH-1026-5.2

1.0 CLIMATE CHANGE

Climate change is a long-term shift in weather conditions identified by changes in temperature, precipitation, winds, and other indicators. Climate change can involve both changes in average conditions and changes in variability, including, for example, extreme events.

Climate change may have effects on our health and well-being. Some health outcomes may be considered direct results of climate change; however, most will occur through indirect exposures. Some of us are more vulnerable than others to the effects of climate change than others including young children, the elderly, people who are chronically ill, low income and homeless people, disabled people, people living in rural communities, and indigenous peoples.

This is an update to the September 1, 2022 Board of Health Report regarding climate change, providing the BOH with the findings of our Climate Science Report for the Climate Change and Health Vulnerability Assessment (attached in full as well as with an executive summary).

The aim of the climate science report is to provide a summary of climate-related data for the regions of Oxford County, Elgin County, and the City of St. Thomas. The report outlines climate change projections to support the Climate Change and Health Vulnerability Assessment for the Southwestern Public Health (SWPH) region. It is intended to assist in identifying potential risks and vulnerabilities that may affect these areas due to climate change and to inform

stakeholders in the region on how to prepare for the projected health effects of climate over time. The report includes the following climate indices for the study area:

- Temperature
- Precipitation
- Air quality
- Ultraviolet radiation

Greenhouse Gas Emissions Scenarios

The report relies on global climate models (GCMs) from the Intergovernmental Panel on Climate Change's Sixth Assessment Report, using data from the Coupled Model Intercomparison Project (CMIP6). These models incorporate socio-economic assumptions such as population, education, energy use, technology, and other relevant factors to generate scenarios that reflect projected greenhouse gas emissions and their corresponding atmospheric concentrations known as the Shared Socioeconomic Pathways (SSPs). This report focuses on projections for SSP1-2.6 (low), SSP2-4.5 (intermediate) and SSP5-8.5 (very high) as they are available in Climate Data Canada and have levels of Radiative Forcing that are aligned with the three commonly used Representative Concentration Pathways: RCP2.6 (low), RCP4.5 (medium) and RCP8.5 (high).

Data Collection

The Climate Data Canada portal was used for the majority of the data in this report. Additional qualitative data related to freezing rain, air quality, and UV index was gathered from various reports, as these indices were not available in the Climate Data Canada portal.

Timeframes

The report focuses on two projected future timeframes: the 2050s (2040-2069) and the 2080s (2070-2099). The baseline data is from the period between 1986 and 2014 because, for CMIP6, the transition from historical simulation to future SSP occurred in 2014/2015.

Key Findings

Extreme Heat

It is expected that the study area encompassing Oxford County, Elgin County, and the City of St. Thomas will experience significant temperature rises of at least 3°C by the 2050s and 5°C by the 2080s across all seasonal measures, including minimum, average, and maximum temperatures under the SSP5-8.5 emissions scenario. These climate projections also indicate an increased frequency and duration of heat warnings.

Extreme Cold

The climate projections suggest that the study area will have fewer extremely cold days, which refers to a day with minimum temperatures below -15°C, in the future, and winters will generally be milder and wetter.

Precipitation:

It is expected that 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 the summer.

Air Quality

The common air pollutants for the study area are nitrogen dioxide, particulate matter, and ground-level ozone. The air quality has shown improvements for certain air pollutants like sulphur dioxide, nitrogen dioxide, and particulate matter over the past decade in Ontario. However, as ground-level ozone has not improved much, this will remain a concern in the future as well. Plus, climate change and changes in wildfires, can be expected to impact the air quality, notably particulate matter.

Ultraviolet Radiation:

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).

SUMMARY

An overview of the current and future effects of climate change on population health in Oxford County, Elgin County, and the City of St. Thomas is provided in the Climate Science report. Rising temperatures, higher UV radiation levels, more precipitation, and more frequent and severe weather events are some of the effects of climate change that are expected to have a significant short- and long-term impact on the health of the local population.

NEXT STEPS

1) Share this report with external stakeholders.
2) Utilize the findings to inform the Climate Change and Health Vulnerability Assessment that is currently underway.
3) Develop a Climate Change Action Plan for SWPH based on recommendations from the Climate Change and Health Vulnerability Assessment.

2.0 CONSUMPTION AND TREATMENT SERVICES:

Recently, the Province of Ontario paused approvals of new supervised consumption and treatment sites (CTS) as it conducts a review of the CTS model and sites. This will allow the Province ample time to conduct a comprehensive review, ensuring the deployment and operation of such services align with the evolving needs of our communities across Ontario and adhere to the highest standards of safety, accessibility, and efficiency.

Given this development, SWPH will ensure that any findings and recommendations from the Provincial review will be incorporated into our work moving forward. We will be finalizing next steps once the Provincial review has been completed.

On October 17, 2023, Cynthia and I sent letters to both St. Thomas City Council as well as Woodstock City Council to provide this update.

At this time, SWPH will continue to address the opioid crisis in our community by continuing our diligent planning and preparation in each of the four pillars, including Treatment, Harm Reduction, Prevention, Community Safety and Justice.

CONCLUSION

Disparate as they are, climate change and the opioid crisis are significant public health concerns that threaten to disproportionately impact certain populations. Both are complex problems requiring broad local, provincial, and federal initiatives and coordination. SWPH will continue our work on these challenges and continue to bring forward updates to the Board and our local municipalities for discussion and involvement.

MOTION: 2023-BOH-1026-5.2
That the Board of Health for Southwestern Public Health accept the Medical Officer of Health's Report for October 26, 2023.

Executive Summary of the Climate Science Report

For Oxford County, Elgin County, and the City of St. Thomas

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Introduction

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Greenhouse gas emissions scenarios

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The report focuses on two projected future timeframes: the 2050s (2040-2069) and the 2080s (2070-2099). The baseline data is from the period between 1986 and 2014 because, for CMIP6, the transition from historical simulation to future SSP occurred in 2014/2015.

Temperature: Key findings

Extreme heat

- It is expected that the study area encompassing Oxford County, Elgin County, and the City of St. Thomas will experience significant temperature rises of at least 3°C by the 2050s and 5°C by the 2080s across all seasonal measures, including minimum, average, and maximum temperatures under the SSP5-8.5 emissions scenario. These climate projections also indicate an increased frequency and duration of heat warnings.
- In Oxford County, the frequency of extreme heat days (temperature exceeding 30°C) is projected to surge from the baseline of 11 days to 45 days by the 2050s and to 80 days by the 2080s under the SSP5-8.5 scenario. Similarly, in Elgin County, and the City of St. Thomas, the number of extreme heat days is expected to rise from 8 days to 41 days by the 2050s and to 78 days by the 2080s under the SSP5-8.5 scenario.
- The frequency of days with maximum temperatures exceeding 32°C is also expected to increase in the future. Oxford County will have 22 days surpassing 32°C by the 2050s and 55 days by the 2080s, which is 52 days more than the baseline of 3 days. Similarly, Elgin County and the City of St. Thomas will have 17 days surpassing 32°C by the 2050s and 51 days by the 2080s, which is 49 days more than the baseline of 2 days.
- The projected rise in temperature is also expected to result in an increase in the number of tropical nights, defined as nights with temperatures exceeding 20°C. In Oxford County, it is estimated that the number of days with tropical nights will increase from the baseline of 5 days to 25 days by the 2050s, and to 55 days by the 2080s. Similarly, in Elgin County, and the City of St. Thomas, the baseline of 8 days with tropical nights is expected to increase to 32 days by the 2050s, and to 63 days by the 2080s.
- Urban heat islands (UHIs) raise the temperature in urban areas, increasing health risks and exposing residents to the risk of heat-related problems. Ingersoll, Tillsonburg and the City of Woodstock are among the areas slightly more impacted by UHIs. The average annual maximum temperature in these areas can be about 0.5°C higher than it is in the

smaller rural municipalities, such as the Township of East Zorra-Tavistock, and the Township of Zorra.

- Heat-vulnerable groups are older adults, infants and young children, people with pre-existing health conditions such as cardiovascular or respiratory illnesses, people taking certain medications that may exacerbate heat sensitivity, socially disadvantaged people such as individuals with low incomes, homelessness, occupational groups, and physically active individuals (Health Canada, 2011).

Extreme cold

- The climate projections suggest that the study area will have fewer extremely cold days, which refers to a day with minimum temperatures below -15°C, in the future, and winters will generally be milder and wetter. By the 2080s, the number of Extreme Cold Days in Oxford County is projected to decrease to zero days from the baseline of 14 days. Likewise, in Elgin County, and the City of St. Thomas, no days with minimum temperatures below -15°C are anticipated in the 2080s under the SSP5-8.5 scenario from the baseline of 10 days.
- Frost Days, characterized by the potential for frost formation and minimum temperatures below 0°C, are expected to decline in Oxford County by up to 70 days by the 2080s under the SSP5-8.5 scenario, in contrast to the 140-day baseline. Similarly, Elgin County and the City of St. Thomas will also experience a decline in Frost Days to 55 days by the 2080s from the baseline of 128 days.
- While the overall warming trend will reduce the frequency of extreme cold events, the effects of climate change could increase the severity of extreme cold events such as freezing rain or ice storms (Cheng, et al. 2011).

Precipitation: Key findings

- It is expected that 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 the summer. By the 2080s, it is anticipated that Oxford County's baseline average of 914 mm will increase to 991 mm (SSP2-4.5) or 1018 mm (SSP5-8.5). Elgin County and the City of St. Thomas' baseline average of 915 mm is predicted to rise to approximately 1000 mm (SSP2-4.5) or 1024 mm (SSP5-8.5) by the 2080s, indicating that both regions will see an increase.

- Maximum 1-Day Total Precipitation refers to the highest recorded precipitation in a single day, commonly known as the year's wettest day. Maximum 5-Day Precipitation refers to the cumulative precipitation over five consecutive days. In Oxford County, one-day accumulations 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. 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.
- Extremely Wet Days refer to the days when total precipitation (rain and snow) is equal to or more than 20 millimeters. It is anticipated that for both regions, extremely wet days will increase from the baseline of 8 days to 11 days by the 2080s.
- Deaths, injuries, and illnesses can result from extreme weather events such as violent storms, floods, and other hazardous conditions. Due to flooding in particular, these heavy downpours can increase the risk of disease outbreaks linked to contaminated drinking water (Gosselin et al., 2022). Extreme weather can have a pronounced impact on the health of older adults, who may be more susceptible to its effects. Falls are a major concern among this population, and the likelihood of falls can further increase during extreme weather conditions (Buse et al., 2022). The likelihood of outbreaks of food and water-borne illnesses is likely to increase as a result of the combination of hotter, drier summers and intense precipitation events (Berry & Schnitter, 2022).

Air Quality: Key Findings

- The common air pollutants for the study area are nitrogen dioxide, particulate matter, and ground-level ozone. The Port Stanley air quality monitoring site serves as the monitoring station for assessing air quality in Elgin County, and the City of St. Thomas. The Kitchener/London air quality monitoring site is responsible for evaluating the air quality in Oxford County. For this report, the data from the Kitchener station has been used for assessing air quality in Oxford County.
- According to the Air Quality in Ontario 2020 Report, there is a decreasing trend of 18.4% in particulate matter ($PM_{2.5}$) levels in Port Stanley station. Likewise, Kitchener station

reported a significant 20.8% $PM_{2.5}$ reduction over the 2011-2020 period, though its 2020 annual mean of 6.6 µg/m^3 is slightly above Ontario's 6.2 µg/m^3.

- In Port Stanley station, there is a decreasing trend of 19.1% in ground-level ozone 1-hour maximum over the 2011-2020 period, while Kitchener station shows a slight 5.2% decline, indicating no significant trend in ozone concentrations over the same period.
- There has been a significant decrease of 22% in the average annual levels of nitrogen dioxide recorded in the Kitchener station between the years 2011 and 2020.
- It is predicted that ozone concentrations in southwestern Ontario will increase by four to five parts per billion by the year 2050 if anthropogenic emissions remain unchanged (Berry et al., 2014).
- In Oxford County, Elgin County, and the City of St. Thomas, the baseline period from 1971 to 2000 witnessed 2 and 12 days where the 80 ppb of ozone concentration limit was exceeded. However, for the 2050s, Elgin County and the City of St. Thomas are projected to exceed the limit for 14 days and Oxford County is projected to exceed the limit for 3 days. By the 2080s, Elgin County, and the City of St. Thomas are projected to exceed the limit of 15 days of the year, while the count for Oxford County remains unchanged from the 2050s (Gough et al., 2016).
- Older adults are at increased risk for health problems due to poor air quality, especially if they suffer from respiratory or cardiovascular conditions. Short- and long-term exposure to air pollution can have negative effects on children. People who already have cardiovascular (such as heart disease) and respiratory (such as chronic obstructive pulmonary disease and asthma) conditions are more vulnerable to having their pre-existing health conditions aggravated by poor air quality (Buse et al., 2022; Health Canada, 2021).

Ultraviolet Radiation: Key findings

- 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).
- However, high UV index during the summer, spring, and autumn seasons can be a significant concern, as people continue to spend more time outdoors in projected warmer than average temperatures across all seasons.

- Infants and children have vulnerable skin and eyes that make them highly susceptible to long-term UVR exposure. People who work outdoors or individuals engaged in physical activities outdoors may experience higher UVR exposure, increasing the risk of adverse health effects (Gosselin et al., 2022).

Vulnerable populations

Certain populations are more susceptible to the adverse effects of climate change. The following populations are deemed vulnerable by Health Canada (Health Canada, 2022):

- Seniors
- Individuals with chronic diseases and/or weakened immune systems
- Children and infants
- People facing social or economic disadvantages, such as those with low income or housing insecurity
- People who are pregnant
- People with disabilities
- Frontline emergency responders
- People who are immunocompromised and those living with pre-existing illness
- Indigenous Peoples
- Residents of remote communities

Vulnerable populations in the study area include people who are physiologically sensitive to the effects of climate change, people who may be more exposed to these effects because of their occupation or where they live, and people who lack the means to adequately adapt to these changes because of various factors.

Conclusion

An overview of the current and future effects of climate change on population health in Oxford County, Elgin County, and the City of St. Thomas is provided in the Climate Science report. Rising temperatures, higher UV radiation levels, more precipitation, and more frequent and severe weather events are some of the effects of climate change that are expected to have a significant short- and long-term impact on the health of the local population.

References

Bais, A. F., Bernhard, G., McKenzie, R. L., Aucamp, P. J., Young, P. J., Ilyas, M., ... & Deushi, M. (2019). Ozone–climate interactions and effects on solar ultraviolet radiation. Photochemical & Photobiological Sciences, 18(3), 602-640. https://doi.org/10.1039/c8pp90059k

Berry, P., & Schnitter, R. (Eds.). (2022). Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. Ottawa, ON: Government of Canada. https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf

Berry, P., Clarke, K., Fleury, M.D. and Parker, S. (2014): Human Health; in Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, p. 191-232. https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter7-Human-Health_Eng.pdf

Buse C, Brubacher J, Lapp H, Jackson E, Wilson R, Toews J, Cheyne B, Bevis B, Komorowski C, Zentner S, Folkema A, Trotz-Williams L (2022). Climate Change and Health Vulnerability Assessment for Waterloo Region, Wellington County, Dufferin County, and the City of Guelph. Waterloo and Guelph, ON: Region of Waterloo Public Health and Wellington-Dufferin-Guelph Public Health Unit. pp 98-99. https://www.regionofwaterloo.ca/en/health-and-wellness/resources/Documents/Climate-Change-and-Health-Vulnerability-Assessment.pdf

Cheng, C. S., Li, G., & Auld, H. (2011). Possible impacts of climate change on freezing rain using downscaled future climate scenarios: updated for eastern Canada. Atmosphere-Ocean, 49(1), 8-21. https://doi.org/10.1080/07055900.2011.555728

Gosselin, P., Campagna, C., Demers-Bouffard, D., Qutob, S., & Flannigan, M. (2022). Natural Hazards. In P. Berry & R. Schnitter (Eds.), Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. Ottawa, ON: Government of Canada. https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf

Gough, W., Anderson, V. & Herod, K. (2016). Ontario Climate Change and Health Modelling Study, pp. 13-16.

https://www.health.gov.on.ca/en/common/ministry/publications/reports/climate_change_toolkit/climate_change_health_modelling_study.pdf

Health Canada. (2011). Adapting to extreme heat events: Guidelines for assessing health vulnerability. Ottawa: Minister of Health, pp. 6-8. Available online: https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/climat/adapt/adapt-eng.pdf

Health Canada. (2021). Health Impacts of Air Pollution in Canada: Estimates of premature deaths and nonfatal outcomes, pp. 33-34. https://www.canada.ca/content/dam/hc-sc/documents/services/publications/healthy-living/2021-health-effects-indoor-air-pollution/hia-report-eng.pdf

Health Canada. (2022). Climate change and health: Who is most impacted by climate change. https://www.canada.ca/en/health-canada/services/climate-change-health/populations-risk.html#a1

Kriegler, E., Bauer, N., Popp, A., Humpenöder, F., Leimbach, M., Strefler, J., ... & Edenhofer, O. (2017). Fossil-fueled development (SSP5): An energy and resource intensive scenario for the 21st century. *Global environmental change*, *42*, 297-315. https://doi.org/10.1016/j.gloenvcha.2016.05.015

Riahi, K., van Vuuren, D. P., Kriegler, E., Edmonds, J., O'Neill, B. C., Fujimori, S., Bauer, N., Calvin, K., Dellink, R., Fricko, et al. (2017). The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global Environmental Change, 42, 153-168. https://doi.org/10.1016/j.gloenvcha.2016.05.009.

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Climate Science Report for the Climate Change and Health Vulnerability Assessment

For Oxford County, Elgin County and the City of St. Thomas

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Contents

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Glossary

Baseline

A climatological baseline is a reference timeframe, usually spanning three decades (30 years), that is used as a comparison point for the climate variations between different periods. References and reference periods are also known as baselines.

Climate Change

Climate change refers to the long-term changes in the weather due to natural phenomena and increased human activities. This leads to changes in the atmospheric gas's composition due to accumulation of greenhouse gases.

Climate Projections

Climate projections are estimates of how the climate system will likely respond to different greenhouse gas and aerosol emissions or concentration scenarios. These projections rely on the climate change or emissions scenarios, which are developed based on assumptions regarding upcoming socioeconomic and technological advancements that may or may not materialize. Therefore, there is an element of uncertainty.

CMIP6

The Coupled Model Intercomparison Project Phase 6 (CMIP6) global climate models (GCMs) have climate scenarios used in the latest Intergovernmental Panel on Climate Change Sixth Assessment Report. These models provide climate projections that are built upon the Shared Socio-economic Pathway (SSP) scenarios. The CMIP6 projections serve as a foundation for understanding and predicting future climate conditions.

Ensemble Approach

The ensemble approach can be used to determine temperature and precipitation patterns using the average data from all global climate models (GCMs). Studies have shown that using multiple models instead of relying on one produces more accurate predictions of annual and seasonal temperature and precipitation.

Ensemble Mean

Ensemble mean refers to the average value of the climate projections examined in the study.

Extreme Weather Event

This refers to 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. An extreme weather event typically occurs very infrequently or has a probability that is in the bottom 10%.

General Circulation Models

General Circulation Models (GCMs) are mathematical representations of the atmosphere, ocean, land surface and ice caps that are based on physical laws and relationships derived from empirical data. These models are the sole means to consistently estimate climate changes caused by increased greenhouse gases for a wide range of climate variables.

Greenhouse Gas (GHG) Emissions

Greenhouse gases refers to the atmospheric gases, originating from both natural and human activities, that can absorb and release radiation at specific wavelengths within the thermal infrared spectrum. This includes radiation emitted by the Earth's surface, the atmosphere, and clouds. There are six main greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

IPCC

Intergovernmental Panel on Climate Change. The IPCC is an international body under the administration of the United Nations. It was created to evaluate and assess scientific research on climate change, and regularly releases authoritative assessment reports that address various aspects, including the science of climate change, its impacts, and policy options for adaptation and mitigation.

Radiative Forcing

Radiative forcing is the change in the net radiative flux, that represents the difference between incoming and outgoing flux, at the top of the atmosphere due to some changes in an external driver of climate change such as greenhouse gases.

Shared Socioeconomic Pathways (SSP)

The IPCC for its Sixth Assessment Report (AR6) in adopted five trajectories known as Shared Socioeconomic Pathways (SSPs), which represent different greenhouse gas concentration levels.

SSP1-2.6

The projected greenhouse gas concentrations are at a low level, with low challenges to mitigation and adaptation. It indicates a 2.6W/m^2 rise in radiative forcing in the climate system.

SSP2-4.5

The projected greenhouse gas concentrations are at a moderate level, with medium challenges to mitigation and adaptation. It corresponds to a 4.5W/m^2 increase in the radiative forcing on the climate system.

SSP5-8.5

The projected greenhouse gas concentrations are characterized by a heavy reliance on fossil fuels and significant challenges in terms of mitigating climate change, but low challenges to adaptation. It represents an 8.5W/m^2 increase in radiative forcing on the climate system.

U/V index

It is the invisible electromagnetic radiation that has a frequency range between x-rays and visible violet light. While the ozone layer in the atmosphere absorbs majority of the ultraviolet radiation from sunlight, UV-B radiation can result in sunburn and skin cancer, while UV-A radiation can induce photosensitivity reactions and potentially lead to skin cancer.

W/m²

Watts per square meter is a unit that measures the rate at which one watt of heat energy is transferred over a one square meter area. Radiative forcing is calculated using this unit.

Introduction

The aim of the climate science report is to provide a summary of climate-related data for the regions of Oxford County, Elgin County and the City of St. Thomas. The report outlines climate change projections to support the Climate Change and Health Vulnerability Assessment for Southwestern Public Health. It is intended to assist in identifying potential risks and vulnerabilities that may affect these areas due to climate change and to inform the public health stakeholders in the region on how to prepare for the projected health effects of climate over time.

Climate Indices

The table below presents the definition of climate indices. These indices entail a wide range of significant climate variables that have the potential to affect the study area. The Climate Data Canada was used to gather data on temperature and rainfall (excluding freezing rain), as well as the names and descriptions of the climate indices.

Table 1: Climate Indices Definitions

Climate variable	Climate indicator	Definition	Unit
Temperature	Mean Monthly Temperature	The average temperature for a specific month	°C
	Mean Monthly Maximum Temperature	The average monthly maximum temperature	°C
	Mean Monthly Minimum Temperature	The average monthly minimum temperature	°C
	Extreme Heat Days	The number of days where the daytime temperatures exceed 30°C and 32°C	Days
	Extreme Cold Days	The number of days with daily minimum	Days

		temperatures is <-15°C	
	Tropical Nights	The total number of days in a year when the daily minimum temperature exceeds 20°C	Days
	Frost Days	The total number of days with frost potentials (i.e., minimum temperature below 0°C)	Days
	Ice Days	The total number of days suitable for ice formations (i.e., when daily maximum temperature is below 0°C)	Days
	Extended Heat Wave Frequency	The total number of extended heat wave occurrences in a year. An extended heat wave is characterized as three consecutive days with Tmax >31°C and Tmin >20°C	Times/year
Precipitation	Total Precipitation	Total accumulated precipitation	mm
	Maximum Length of Dry Spell	The longest dry period in a year	Days

		corresponds to the highest consecutive number of days when the daily precipitation remains below 1mm	
	1-Day Maximum Precipitation	Annual 1-day maximum precipitation accumulation	mm
	5-Day Maximum Precipitation	Annual 5-day maximum precipitation accumulation	mm
	Very Wet Days (10mm)	The number of days within a specific timeframe where the total precipitation, which includes both rain and snow, exceeds or equals 10 mm	Days
	Extremely Wet Days (20mm)	The number of days within a specific timeframe where the total precipitation, which includes both rain and snow, exceeds or equals 20 mm	Days
	Freezing Rain Events	The average percentage variation in the number of daily freezing rain events	Days

		(≥1 hour, ≥4 hours, and ≥6 hours)	
Air Quality	Ground-level Ozone	The amount of ground level ozone in the air at a given location, which is generated when nitrogen oxides react with a category of air pollutants referred to as 'reactive organic substances' under sunlight	Ppb or as indicated
	Particulate Matter	The quantity of suspended matter (including aerosols, smoke, fumes, dust, fly ash, and pollen) in the air, which can vary in size between PM2.5 and PM10	µg/m³ or as indicated
	Nitrogen Dioxide	The amount of nitrogen dioxide in the air at a given location	Ppb or as indicated
UV radiation	UV index	Strength of sunburn-causing ultraviolet (UV) radiation in a specific location and time	UV index

Data Collection

The Climate Data Canada[1] portal was used for majority of the data collection for this report. Qualitative data related to freezing rain, air quality, and UV index were sourced from diverse reports, as these indices were not accessible on the Climate Data Canada portal. When appropriate, these sources were identified and cited correctly. All data were downloaded from the corresponding links above in May 2023.

Climate Modelling and Downscaling

The data used in the report relies on the global climate models established in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), that were derived from the Coupled Model Intercomparison Project Phase 6 (CMIP6). These models incorporate assumptions about the future changes in population growth, education, energy usage, technological advancements, and other relevant factors for the next century. These assumptions are then combined with mitigation and adaptation efforts in climate change. By integrating socio-economic factors and mitigation goals, these models generate scenarios that reflect projected greenhouse gas emissions and their corresponding atmospheric concentrations, that are known as the Shared Socioeconomic Pathways. Temperature and precipitation projections have been summarized and presented using the Climate Data Canada as sources of data.

Although different methods exist to create climate change scenarios, global climate models are the most comprehensive tools for simulating responses to rising greenhouse gas concentrations, as they employ mathematical representations of atmosphere, ice, ocean, and land surface processes. Climate Data Canada provides historical (1950-2014), and future (2015-2100) climate simulations generated by an ensemble of 24 climate models developed by scientists worldwide.

Greenhouse Gas Emissions Scenarios

As the future emissions of greenhouse gases are influenced by complex and dynamic systems, including factors such as demographic development, socio-economic development, and technological advancement, the emissions are uncertain. Predicting their future trajectory is challenging due to the uncertainty involved. As such, the most recent scenarios utilized for CMIP6

[1] Climatedata.ca is a collaboration between Environment and Climate Change Canada (ECCC), the Computer Research Institute of Montréal (CRIM), CLIMAtlantic, Ouranos, the Pacific Climate Impacts Consortium (PCIC), the Prairie Climate Centre (PCC), and HabitatSeven.

and presented in the IPCC Sixth Assessment Report in 2021 are developed based on a collection of five Shared Socioeconomic Pathways (SSPs). These pathways, namely SSP1-1.9 (very low), SSP1-2.6 (low), SSP2-4.5 (intermediate), SSP3-7.0 (high), and SSP5-8.5 (very high), represent different scenarios of climate change mitigation and adaptation efforts and business-as-usual greenhouse gas emissions in the absence of climate policies. The SSPs five alternative socio-economic futures compromise: sustainable development (SSP1), middle-of-the-road development (SSP2), regional rivalry (SSP3), inequality (SSP4) and fossil-fueled development (SSP5) [(1)(2)]. Scenarios provide alternative representations of future outcomes and serve as crucial tools to determine how driving forces may shape emission patterns and evaluate associated uncertainties.

This report focuses on projections for SSP1-2.6, SSP2-4.5 and SSP5-8.5 as they are available in Climate Data Canada. These scenarios were chosen as they have wide range coverage of possible future climates, incorporate projections from multiple climate models, and have levels of Radiative Forcing that are aligned with the three commonly used Representative Concentration Pathways (RCPs): high (RCP8.5), medium (RCP4.5), and low (RCP2.6). Each emission scenario is described in Table 2, with changes in global surface temperature illustrated in Table 3 and Figure 1 (IPCC, 2021) [(3)] illustrates the projected global warming for each of these three scenarios.

Table 2: SSP Scenario Descriptions

Scenario	Description
SSP1	**Sustainability - Taking the green road (low challenges to mitigation and adaptation)** The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.

SSP2	**Middle of the road - (medium challenges to mitigation and adaptation)** The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Global and national institutions work toward but make slow progress in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.
SSP3	**Regional rivalry - A rocky road (high challenges to mitigation and adaptation)** A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development. Investments in education and technological development decline. Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time. Population growth is low in industrialized countries and high in developing countries. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.
SSP4	**Inequality - A road divided (low challenges to mitigation, high challenges to adaptation)** Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries. Over time, a gap widens between an internationally connected society that

	contributes to knowledge- and capital-intensive sectors of the global economy, and a fragmented collection of lower-income, poorly educated societies that work in a labor intensive, low-tech economy. Social cohesion degrades and conflict and unrest become increasingly common. Technology development is high in the high-tech economy and sectors. The globally connected energy sector diversifies, with investments in both carbon-intensive fuels like coal and unconventional oil, but also low-carbon energy sources. Environmental policies focus on local issues around middle and high income areas.
SSP5	**Fossil-fueled development - Taking the highway (high challenges to mitigation, low challenges to adaptation)** This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.

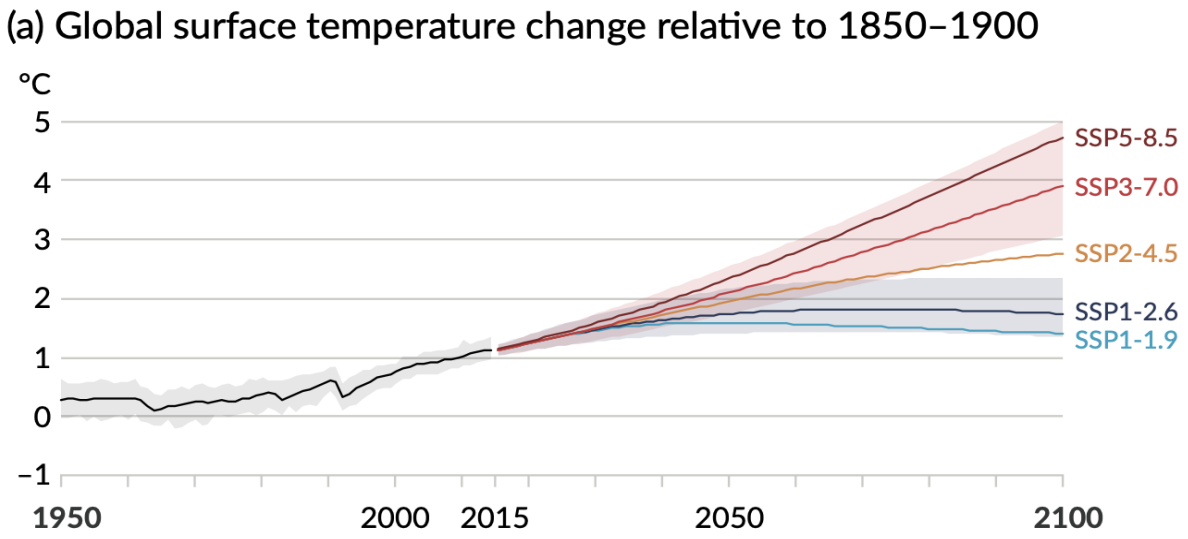
Source: Riahi et al., 2017

Table 3: Changes in global surface temperature for selected 20-year time periods and the five illustrative emissions scenarios considered

	Near term, 2021-2040		Mid-term, 2041-2060		Long term, 2081-2100	
Scenario	Best Estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very like range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.5	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

Source: IPCC, 2021

Figure 1: Shared Socioeconomic Pathway scenarios (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5)

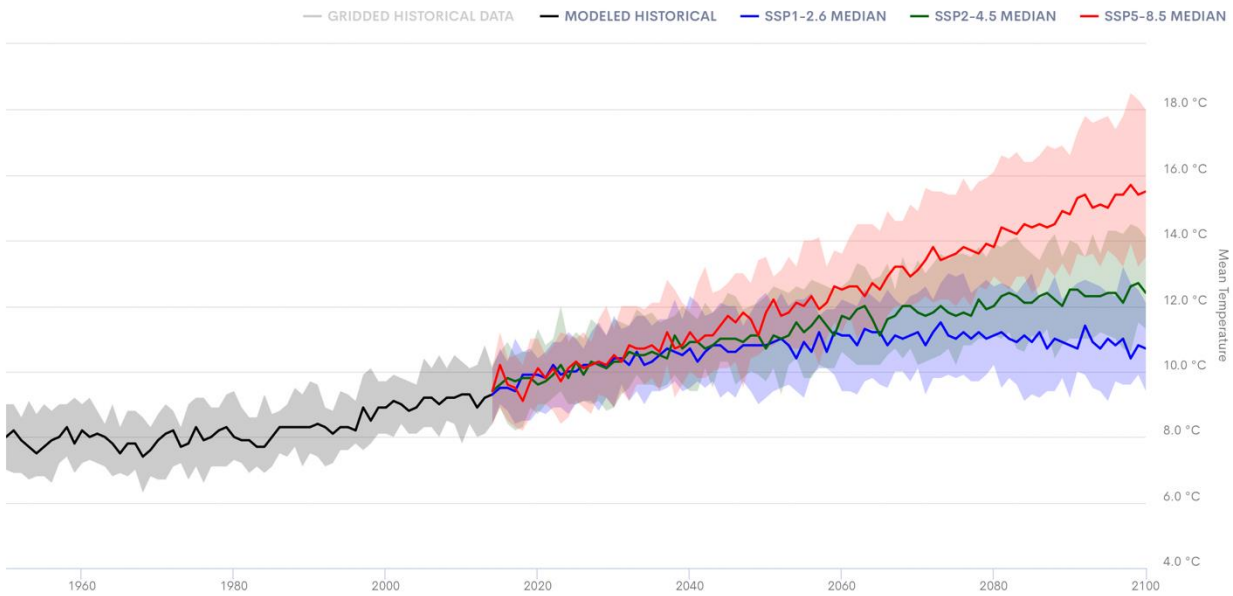


Source: IPCC, 2021

SSP1-2.6 and SSP2-4.5 are presented in the results discussion; however, the primary emphasis is on SSP5-8.5. This scenario is particularly focused on because the impacts of climate change are predicted to be most severe under this scenario across number of important variables. Furthermore, any adaptation strategies created for SSP5-8.5 would likely be sufficient for SSP2-

4.5 and SSP1-2.6. Therefore, the primary goal of highlighting this scenario is to underscore the health risks and their implications for larger populations under higher emissions scenarios. Figure 2 presents Mean Annual Temperature Projections for Elgin County and the City of St. Thomas as an example. The specific emissions path that the future might take remains uncertain. The differences between the SSP1-2.6, SSP2-4.5, and SSP5-8.5 projections highlight the significance of taking into account various emissions scenarios in order to account for a variety of potential future climatic conditions. While the disparity in future projections for various climate indices may not always be as significant as mean annual temperature, in certain cases the differences could be more prominent.

Figure 2: SSP1-2.6, SSP2-4.5, and SSP5-8.5 Mean Annual Temperature Projections for Elgin County and the City of St. Thomas



Source: Climate Data Canada

Timeframes

To effectively compare climate projections with historical patterns, a consistent reference period is established. Climate projections are typically given for specific time periods of 20-30 years. The projected future periods for the data are the 2050s (2040-2069) and the 2080s (2070-2099). The baseline data is from the period between 1986 and 2014 because for CMIP6, the transition from historical simulation to future SSP occurs in 2014/2015.

Certain climate indices such as temperature and precipitation are categorized into different seasons, such as spring, summer, fall, and winter, in addition to providing overall annual measurements or averages. Table 4 outlines the season and its respective months. However, some indices only provide a single value for the year, such as extremes in temperature and other related factors.

Table 4: Seasons and Months

Season	**Months**
Winter	December, January, February
Spring	March, April, May
Summer	June, July, August
Fall	September, October, November

Uncertainty

It is important to recognize that uncertainty is an inherent aspect of studying climate change. Climate change scenarios, models, and data all take uncertainty into account, reflecting the complexity of environmental change and the dynamic relationship between people and the environment. It is not possible to predict climate change with absolute certainty in any specific case. As such, all data must be considered in light of this uncertainty.

One of the primary challenges in quantifying the impacts of climate change lies in the uncertainty of General Circulation Model projections. The use of multiple General Circulation Models in future climate projection studies is considered to be a good practice. Using different models under the same greenhouse gas scenarios helps evaluate uncertainty, although a thorough assessment of uncertainty necessitates taking into account various greenhouse gas scenarios.

There is no established method to determine which models best stimulate the future accurately. However, various methods exist to address the uncertainty associated with future projections. The ensemble mean projections, such as the 50th percentile, are highlighted in this report as a way to present the findings.

Climate Change Impacts on Health

Climate change can impact human health both directly and indirectly through various exposure pathways. The health effects become more significant as global temperatures rise, precipitation patterns change, and extreme weather events occur more frequently and more intensely [(4)].

Human health is directly impacted by climate change, which can lead to the onset and worsening of non-communicable diseases such as respiratory and cardiovascular illnesses as well as effects on mental health. It also contributes to the harm and loss of life brought on by extreme weather conditions such as wildfires, storms, heat waves, floods, and droughts. Climate change affects health indirectly by altering ecosystems, which can help diseases, pathogens, and contaminants spread to humans. For instance, there are increased risks of food insecurity, increased water and air pollution due to rising temperatures, and the spread of vector-borne diseases into new geographical areas [(4)]. Canada has experienced a documented increase in temperatures and changes in precipitation due to climate change. Increased temperatures have led to favorable conditions for the survival and reproduction of ticks and ticks-borne pathogens [(5)].

Some populations are more affected by the consequences of climate change, with Canadians already witnessing its impact on their health. Health Canada highlights specific groups that are particularly vulnerable, including seniors, individuals with chronic diseases or weakened immune systems, infants and young children, pregnant women, individuals facing social or economic disadvantages such as low-income or housing insecurity, Indigenous Peoples, and residents of remote communities. Table 5 further demonstrates the health impacts from climate change, along with the populations at risk due to these impacts.

Table 5: Climate Change related Health Impacts

Health hazard examples	Health outcome indicator examples	Vulnerable populations
Extreme Heat and Cold	• Heat related morbidity and mortality, such as heat stroke, heat exhaustion, heat cramps,	Elderly individuals, infants and young children, outdoor workers, physically active people, and those with heart diseases may face an

	heat edema, heat rash, heat fainting • Cold-related morbidity and mortality such as frostbite, hypothermia, windburn	increased vulnerability to extreme temperatures
Extreme weather events	• Morbidity and mortality from injuries, illnesses, and mental health outcomes from violent storms, floods and ice	People with lack of adequate housing and/or insurance coverage may face increased susceptibility to extreme weather events, leading to increased rates of illnesses and deaths
Vector-borne diseases	• West Nile Virus • Lyme disease • Other vector borne diseases	People who work outdoors or people who are homeless may be at greater risk for exposure
Food- and water-borne illnesses	• Incidences of illnesses or outbreaks from pathogens in water due to flooding and storm events, and pathogens in food due to higher temperatures, driving growth and survival of pathogens	Pregnant women and children are more at risk of food-and water-borne disease outcomes. Minority linguistic communities may encounter limited accessibility to alerts related to outbreaks associated with food and water
Air quality	• Cardiovascular and respiratory health effects from exposure to aeroallergens or degraded air quality, including ground-level	Individuals with pre-existing physical health conditions, such as asthma, heart diseases may face increased vulnerability to respiratory outcomes

	ozone and particulate matter	
UV radiation	• Sunburns, skin damage leading to wrinkling, increased risk of skin and eye cancers, DNA damage, weakened immune system response, cell atrophy, and development of cataracts	Infants and children have vulnerable skin and eyes that make them highly susceptible to long-term UVR exposure, people who work outdoors or individuals engaged in physical activities outdoors may experience higher UVR exposure, increasing the risk of adverse health effects

Source: Health Canada

Temperature Indices

All temperature indices are expected to have significant warming in the study area under a number of different scenarios, including SSP1-2.6, SSP2-4.5, and SSP5-8.5. The minimum, average, and maximum monthly temperatures are all predicted to rise, making this warming trend more obvious. Additionally, there will be more days with extreme heat, while there will be fewer days with extreme cold, according to predictions.

The overall patterns in temperature shifts can be beneficial to understand the potential spread of vector-borne diseases (such as West Nile virus transmitted by mosquitoes), zoonotic diseases (such as water contamination by E. coli bacteria or harmful algal blooms), and health issues associated with related illnesses and deaths. The direct impacts on health can include non-communicable diseases (such as, respiratory and cardiovascular diseases, mental health impacts), and injuries and deaths resulting from extreme weather events [(4)]. High temperatures affect human health and give rise to a range of adverse effects, including heat rash, heat cramps, dehydration, heat fainting, exhaustion, and ultimately, heat stroke [(6)]. Heatwave events can particularly have severe impact on vulnerable groups such as the elderly, infants, and people with pre-existing medical conditions. They face a higher risk of mortality and illness due to heat exposure compared to the general population [(7)].

Seasonal Mean Temperatures

Seasonal baseline mean temperatures for Oxford County are: -4.4, 6.8, 19.9 and 9.8°C for winter, spring, summer, and fall respectively (Table 6). This gives a year-round average temperature of 8.1°C for 1986-2014.

Table 6: Baseline and Projected Mean Temperatures for Oxford County (℃) by Season, SSP1-2.6, SSP2-4.5, and SSP5-8.5

Mean Temperatures (°C)	Baseline 1986 -2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	-4.4°C	-1.8°C	-1.4°C	-0.4°C	-1.6°C	-0.1°C	2.1°C
Spring	6.8°C	8.8°C	9.1°C	9.8°C	9.0°C	10.0°C	12.1°C
Summer	19.9°C	21.8°C	22.3°C	23.0°C	22.0°C	23.2°C	25.7°C

Fall	9.8°C	11.7°C	12.1°C	12.9°C	11.9°C	13.0°C	15.4°C
Annual	8.1°C	10.2°C	10.6°C	11.4°C	10.3°C	11.5°C	13.8°C

Seasonal baseline mean temperatures for Elgin County and the City of St. Thomas are: -3.5, 7.3, 20.3, and 10.5°C for winter, spring, summer, and fall respectively (Table 7) This gives a year-round average temperature of 8.7°C for 1986-2014. In general, the average temperatures in Elgin County and the City of St. Thomas tend to be slightly higher as compared to Oxford County.

Table 7: Baseline and Projected Mean Temperatures for Elgin County and the City of St. Thomas (℃) by Season - SSP1-2.6, SSP2-4.5, and SSP5-8.5

Mean Temperatures (°C)	Baseline 1986 - 2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	-3.5°C	-1.0°C	-0.6°C	0.5°C	-0.8°C	0.7°C	2.8°C
Spring	7.3°C	9.3°C	9.6°C	10.3°C	9.5°C	10.5°C	12.5°C
Summer	20.3°C	22.1°C	22.6°C	23.3°C	22.3°C	23.5°C	26.0°C
Fall	10.5°C	12.4°C	12.8°C	13.6°C	12.6°C	13.7°C	16.1°C
Annual	8.7°C	10.3°C	11.2°C	12.0°C	10.9°C	12.1°C	14.3°C

Maximum and Minimum Temperatures

High temperatures can significantly influence various health consequences, including heat-related illnesses and cold-related injuries. Prolonged exposure to excessive heat can cause dehydration, heat exhaustion, heat stroke, heat edema, reduced coordination, fatigue, nausea and worsen respiratory illnesses [(8)]. Moreover, extreme temperatures are associated with deteriorating mental health and an upsurge in violent incidents. On the other hand, extreme cold can result in frostbite, hypothermia, and the potential aggravation of pre-existing medical conditions. Certain individuals are more susceptible to frostbite and hypothermia in cold weather conditions compared to others. These high-risk groups include homeless people, outdoor workers, individuals living in poorly insulated homes, people with certain medical conditions such as diabetes, peripheral neuropathy, and diseases affecting blood vessels, infants, and older adults [(9)]. Additionally, rapid freezing and winter storms can create hazardous travel conditions, leading to increased illness and death [(10)]. The baseline and projected minimum and maximum

temperatures for each season categorized by SSP1-2.6, SSP2-4.5, and SSP5-8.5 in Oxford County and Elgin County and the City of St. Thomas are listed below.

The 1986-2014 baseline annual average minimum temperatures for Oxford County (Table 8) and Elgin County and the City of St. Thomas (Table 9) were recorded at 3.2°C and 3.9°C respectively. For both regions, projections show a significant increase in minimum seasonal temperatures. It is anticipated that minimum temperatures in these regions will rise by roughly 5.0°C to 5.5°C during different seasons by the 2080s.

Furthermore, it is anticipated that by the 2080s, both Oxford and Elgin County and the City of St. Thomas will experience a minimum of 19.6°C to above 20°C in the summer season under the SSP5-8.5 emissions scenario. In this report, the tropical night refers to the number of days where the lowest temperature during nighttime remains above 20°C. Inadequate nighttime cooling can intensify the stress of hot summer days and heatwaves. The presence of tropical nights can add to the challenge of allowing the body to effectively cool down. This is a serious health risk, especially to the vulnerable populations such as the elderly, homeless individuals, and those residing in residences lacking air conditioning. Their risks increase particularly if these heat events persist for more than a few days. By the 2080s under SSP5-8.5, it is anticipated that minimum temperatures during the winter months will approach 0°C. This change may lead to a rise in the frequency of freeze-thaw cycles, potentially resulting in overland flooding caused by the melting of snow and the formation of ice jams in waterways.

Table 8: Baseline and Projected Average Seasonal Minimum Temperatures for Oxford County – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Seasonal Minimum Temperatures (°C)	Baseline 1986 - 2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	-7.9°C	-5.0°C	-4.5°C	-3.3°C	-4.8°C	-3.1°C	-0.7°C
Spring	1.7°C	3.6°C	3.9°C	4.6°C	3.7°C	4.7°C	6.8°C
Summer	14.1°C	15.8°C	16.3°C	17.1°C	16.0°C	17.2°C	19.6°C
Fall	5.1°C	6.8°C	7.3°C	8.1°C	7.0°C	8.2°C	10.6°C
Annual	3.2°C	5.3°C	5.8°C	6.6°C	5.5°C	6.7°C	9.0°C

Table 9: Baseline and Projected Average Seasonal Minimum Temperatures for Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Seasonal Minimum Temperatures (°C)	Baseline 1986 - 2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	-7.1°C	-4.3°C	-3.8°C	-2.7°C	-4.1°C	-2.4°C	-0.1°C
Spring	2.3°C	4.1°C	4.5°C	5.1°C	4.3°C	5.3°C	7.3°C
Summer	14.6°C	16.3°C	16.8°C	17.5°C	16.5°C	17.6°C	20.1°C
Fall	5.8°C	7.5°C	7.9°C	8.7°C	7.7°C	8.9°C	11.3°C
Annual	3.9°C	5.9°C	6.4°C	7.2°C	6.1°C	7.3°C	9.6°C

The annual average baseline in seasonal maximum temperatures for Oxford County (Table 10) and Elgin County and the City of St. Thomas (Table 11) was 12.9 and 13.4°C respectively. Both the regions are projected to encounter an increase in their maximum temperatures. The average maximum temperatures during summers are anticipated to surpass 30°C for both areas under SSP5-8.5 emissions scenario. Likewise, the average maximum temperatures during winters will also increase ranging between 4.2 to 5.7°C by the 2080s under SSP5-8.5.

Table 10: Baseline and Projected Average Seasonal Maximum Temperatures for Oxford County – SSP1-2.6, SSP2-4.5, and SSP5-8.5

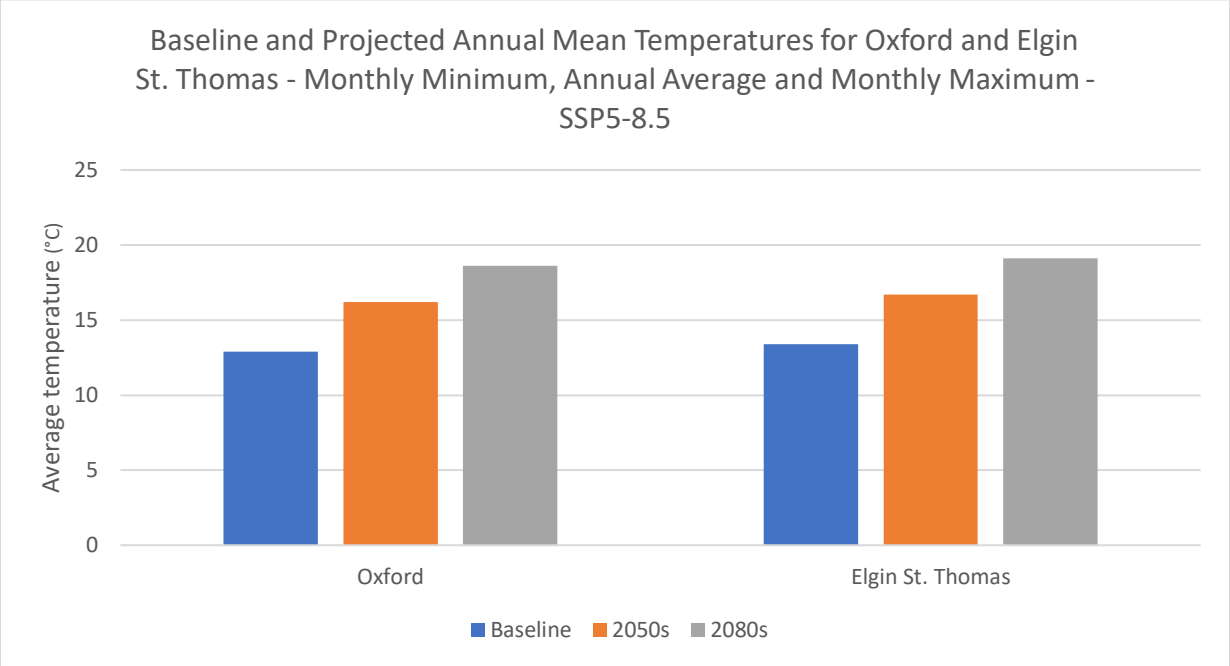
Seasonal Maximum Temperatures (°C)	Baseline 1986 - 2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	-0.8°C	1.3°C	1.7°C	2.7°C	1.6°C	2.9°C	5.0°C
Spring	11.8°C	13.9°C	14.3°C	15.0°C	14.2°C	15.2°C	17.3°C
Summer	25.8°C	27.7°C	28.3°C	29.0°C	28.0°C	29.2°C	31.7°C
Fall	14.6°C	16.6°C	17.0°C	17.7°C	16.7°C	17.8°C	20.3°C
Annual	12.9°C	15.0°C	15.4°C	16.2°C	15.2°C	16.3°C	18.6°C

Table 11: Baseline and Projected Average Seasonal Maximum Temperatures for Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Seasonal Maximum Temperatures (°C)	Baseline 1986 - 2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	0.1°C	2.3°C	2.6°C	3.6°C	2.5°C	3.7°C	5.8°C
Spring	12.3°C	14.4°C	14.8°C	15.5°C	14.7°C	15.7°C	17.7°C
Summer	25.9°C	27.9°C	28.4°C	29.1°C	28.1°C	29.3°C	31.8°C
Fall	15.3°C	17.3°C	17.7°C	18.4°C	17.4°C	18.5°C	21.0°C
Annual	13.4°C	15.6°C	16.0°C	16.7°C	15.7°C	16.8°C	19.1°C

The projected increase in mean temperatures for Oxford County, as illustrated in Figure 3 and for Elgin St. Thomas (Figure 4) for the annual values under the SSP5-8.5 scenario, are also expected to increase for minimum and maximum temperatures.

Figure 3: Baseline and Projected Annual Mean Temperatures for Oxford County and Elgin County and the City of St. Thomas – Monthly Minimum, Annual Average, and Monthly Maximum – SSP5-8.5



Extreme Heat Days and Tropical Nights

A heat warning advisory is issued when notifications are received from Environment and Climate Change Canada's meteorological services when an impending heat event is forecasted for the Southwestern Public Health (SWPH) region. Based on the anticipated duration and intensity of the conditions, SWPH will issue either a Heat Warning or an Extended Heat Warning:

- Heat Warning: This is declared when the forecasted temperatures are expected to reach a minimum of 31°C, with overnight temperatures reaching or exceeding 20°C for two consecutive days, or when the Humidex is forecasted to be at least 40°C for two consecutive days.
- Extended Heat Warning: In the case where forecasted temperatures are anticipated to reach a minimum of 31°C, with overnight temperatures exceeding 20°C for three or more consecutive days, or when the Humidex is at least 40°C for three or more consecutive days, an Extended Heat Warning is issued.

The ClimateData.ca portal provides information on the number of days where the daily maximum temperature is greater than 30°C and 32°C, but it does not provide details for 31°C. Therefore, the inclusion of days with maximum temperatures above 30°C and 32°C in the report intends to

highlight the impact of extreme heat within the local region, both at the present time and in projections for the future.

Based on the SSP5-8.5 scenario, it is expected that by the 2080s Oxford and Elgin County and the City of St. Thomas will experience a significant rise in the number of days surpassing 30°C. As indicated in Table 12, Oxford County will have 80 days, which is 69 days more than the baseline of 11 days. Similarly, Elgin County and the City of St. Thomas is expected to encounter 78 such days, surpassing the baseline of 8 days by 70 days. This highlights that the annual days above 30°C by the 2080s will experience a significant rise when compared with baseline scenarios.

Table 12 : Baseline and Projected Annual Days above 30°C for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Annual Days above 30°C[a]	Baseline 1986 -2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	11	30	37	45	32	48	80
Elgin County and the City of St. Thomas	8	25	33	41	27	45	78

[a]*Data sourced from Climate Data Canada*

The frequency of days with maximum temperatures exceeding 32°C is also expected to increase in the future as illustrated in Table 13. According to the SSP5-8.5 scenario, Oxford County will have 55 annual days with such temperatures, which is 52 more days than the baseline of 3 days. Similarly, Elgin County and the City of St. Thomas will have 51 days surpassing 32°C, 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 days surpassing 32°C will become increasingly normal during summer.

Table 13: Baseline and Projected Annual Days above 32°C for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Annual Days above 32°C[b]	Baseline 1986 -2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	3	12	16	22	13	24	55
Elgin County and the City of St. Thomas	2	9	12	17	9	20	51

[b]*Data sourced from Climate Data Canada*

It is crucial to prepare for situations where people in local areas could endure prolonged periods of high temperatures, especially during heatwaves characterized by Tropical Nights—when the minimum daily temperature stays above 20°C.The baseline period of 1986-2014, the average number of Tropical Nights in Oxford County was recorded at 5 days, whereas Elgin County and the City of St. Thomas experienced an average of 8 days. According to the projections of SSP5-8.5, both regions will experience a significant increase in Tropical Nights by the 2080s. Oxford County will have 55 Tropical Nights, which is an addition of 50 days from the baseline. Similarly, Elgin County and the City of St. Thomas will experience 63 Tropical Nights per year, indicating an increase of 55 days as compared to the baseline. These projections as illustrated in Table 14 and Figure 4, indicate that under the SSP5-8.5 emissions scenario, both regions are likely to experience at least one and a half month of Tropical Nights by the 2080s.

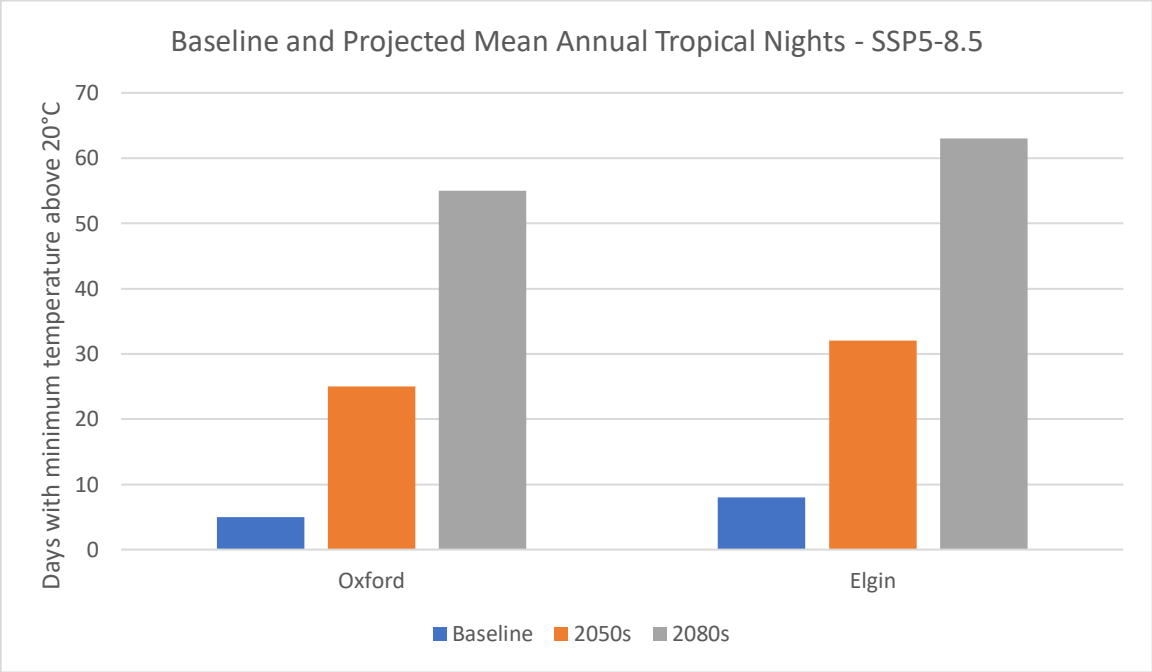
Table 14: Baseline and Projected Annual Mean Tropical Nights for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Tropical Nights (days)[c]	Baseline 1986 -2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5

Oxford County	5	14	19	25	15	26	55
Elgin County and the City of St. Thomas	8	20	25	32	20	33	63

[c]*Data sourced from Climate Data Canada*

Figure 4: Projected Annual Mean Tropical Nights for Oxford County and Elgin County and the City of St. Thomas – SSP5- 8.5



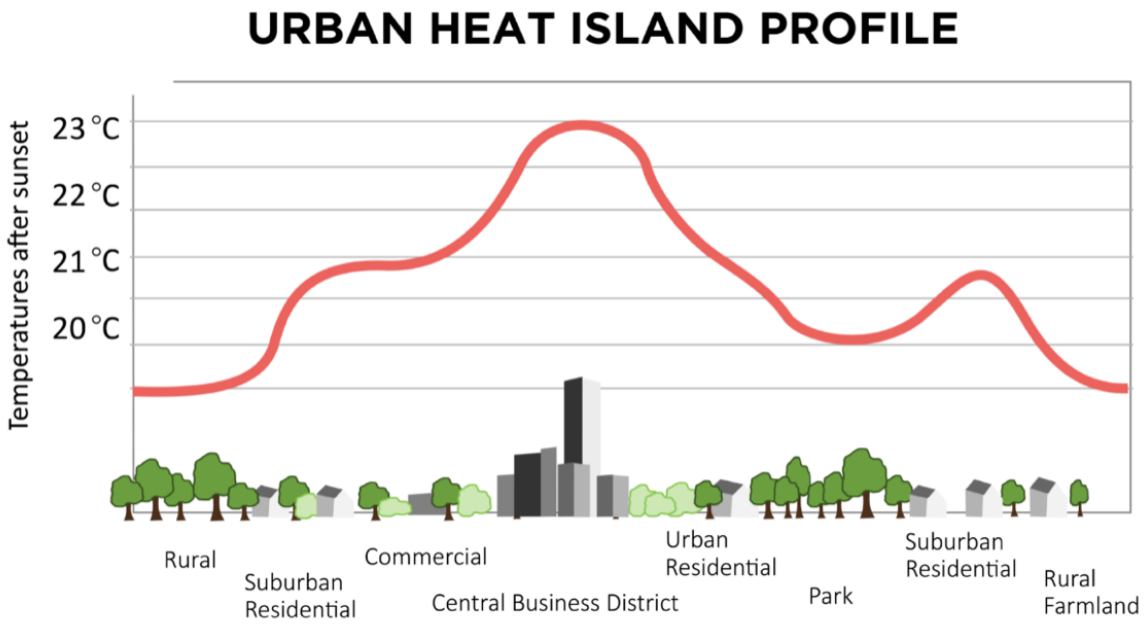
Urban vs. Rural Temperatures

Temperature variations can significantly be influenced by the urban heat island (UHI) effect. Urban and rural lands have different thermal and radiative properties, which leads to UHI. In urban settings, surfaces constructed with materials like roofs, paved roads, and parking lots etc. have lower albedo (i.e., less reflectivity, resulting in higher temperatures) and can capture significant amounts of solar heat, leading to elevated surface and air temperatures [(11)]. The higher air temperatures found in urban areas, particularly at night, can hinder the body's natural cooling process, escalating the health risks linked to extreme heat events. It increases air pollution levels,

exacerbate daytime temperatures, and hinder the nighttime cooling effect. These factors consequently contribute to an increase in heat-related illnesses and deaths, including general discomfort, respiratory issues, heat exhaustion, heat cramps, and heat stroke [12]. UHI also has an effect on the thermal conditions inside of buildings, which include factors such as air temperature, humidity, and air flow. This is especially noticeable in buildings without mechanical ventilation and air conditioners [13].

The lack of vegetation in cities also reduces transpiration and, as a result, the cooling effect it produces. In addition, the high proportion of impervious surfaces in urban areas makes it easier for water to drain quickly through sewage systems, which minimizes heat loss through evaporation. The temperature variations among different developmental areas are illustrated in Figure 5 [14].

Figure 5: Urban Heat Island Profile



Seasonal variations in urban heat islands can be attributed to factors such as changes in solar intensity, ground cover, and weather. As a result, these heat islands usually become more noticeable in the summer. Table 15 shows the average annual maximum temperatures for three urban municipalities and three rural municipalities to represent the contrasting daytime temperatures anticipated between urban and rural areas within the study region. The major urban

municipalities in Oxford County are Ingersoll, Tillsonburg, and Woodstock. Three additional smaller municipalities (characterized by a lower degree of urbanization and a more rural nature) have been randomly chosen: the Township of East Zorra-Tavistock, the Township of Blandford-Blenheim, and the Township of Zorra.

Table 15 shows that the average annual maximum temperature in the study area is about 0.5°C higher in the urban municipalities than it is in the smaller rural municipalities. However, there are exceptions as well, like the Township of Blandford-Blenheim where the temperature trends are similar to the urban municipalities.

Table 15: Annual Maximum Temperatures for Urban vs. Rural Municipalities in Oxford County - SSP5-8.5

Urban vs. Rural	Municipality	Population Size[2]	Historical (2014)	2050	2080[3]
Urban	Ingersoll	13,693	13.5°C	16.1°C	18.0°C
	Tillsonburg	18,615	13.9°C	16.5°C	18.3°C
	Woodstock	46,705	13.4°C	16.0°C	18.0°C
Rural	East Zorra-Tavistock	7,841	13.2°C	15.8°C	17.7°C
	Blandford-Blenheim	7,565	13.5°C	16.0°C	18.0°C
	Zorra	8,628	13.3°C	15.9°C	17.8°C

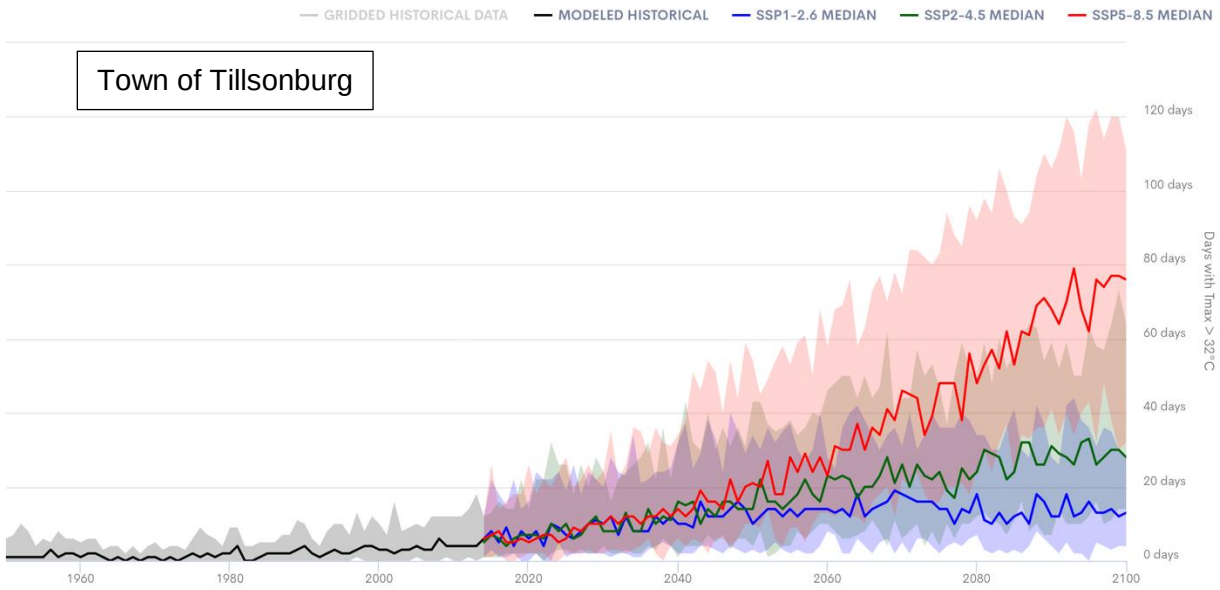
Additionally, larger temperature differences between urban and rural areas have been seen in other temperature variables. For instance, differences between urban and rural municipalities can be up to 6 days when it comes to extreme temperature like the average annual number of days exceeding 32°C. Table 16 and Figure 6 provide more information on these results.

[2] Source: Population statistics collected from Oxford County Community Profile and Statistics, 2021
[3] Data collected from Climate Data Canada

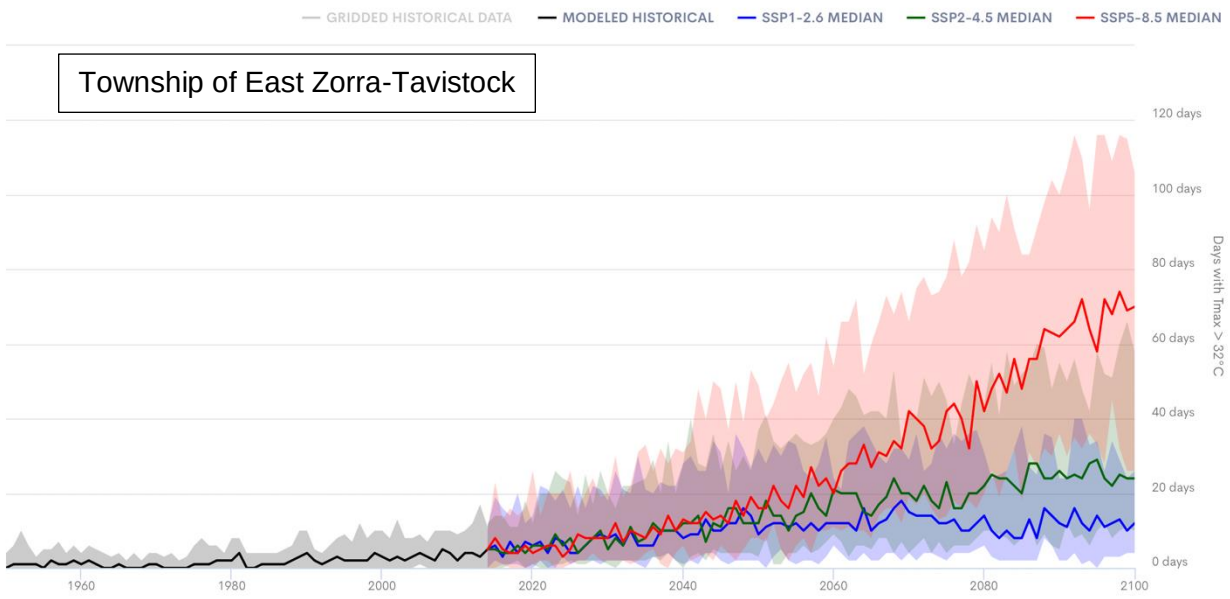
Table 16: Days Above 32°C for Urban vs. Rural Municipalities - SSP5-8.5

Urban vs Rural[4]	Municipality	Population size	Historical (2014)	2050	2080[5]
Urban	Ingersoll	13,693	5	18	45
	Tillsonburg	18,615	6	21	48
	Woodstock	46,705	5	18	45
Rural	East Zorra-Tavistock	7,841	5	16	42
	Blandford-Blenheim	7,565	5	18	46
	Zorra	8,628	4	18	44

Figure 6: Days with TMax >32°C for City of Woodstock and Township of East Zorra-Tavistock – SSP1-2.6, SSP2-4.5, and SSP5-8.5



[4] Source: Urban and rural areas information sourced from Oxford County
[5] Data collected from Climate Data Canada



Source: Climate Change Data

Dehydration, fatigue, and inability to sweat or the body's ability to cool itself are just a few physiological stresses that can arise from prolonged or excessive exposure to high temperatures. Heat-related illnesses can range from heat rashes and cramps to more severe conditions such as heat stroke. In addition, 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 [11][15]. Young children, people with chronic illnesses, outdoor workers such as construction workers, people who are physically active, Indigenous Canadians, the marginally housed or homeless, and elderly people who are socially isolated are some groups who are especially vulnerable to these risks [11].

However, it is important to recognize that that the urban heat island (UHI) effect is not the only factor contributing to high temperatures in a municipality. The Great Lakes, topography, and geographic location are additional factors that can affect the temperature patterns observed in the municipalities.

Heat Waves

Extended periods of extremely hot weather, frequently with higher humidity, are referred to as heat waves. Heat waves depend on the usual weather conditions in a given area and the typical seasonal temperatures. In a cooler area, a temperature that is normal in a hotter area might be referred to as a heat wave. Understanding local climate changes can help in the development of mitigation strategies to lessen the effect on the population, aligning with local customs and behaviors.

A heat warning will be issued to the public if certain conditions are met, including:

- Two consecutive days with predicted daytime temperature is 31°C or higher and predicted 20°C or higher at night, and/or
- Two consecutive days with predicted humidex is of 40°C or higher

The severe effects of extreme heat are mostly felt by the highly vulnerable groups, such as the elderly, children, people with low incomes, and the homeless. In addition, individuals with pre-existing chronic health conditions such as cardiovascular or respiratory disorders, as well as mental or behavioral health issues, face an elevated risk of heat-related illness. Extreme heat events are more likely to occur as a result of both local environmental changes and global climate change, which coincide with an increasing population at risk from heat-related illnesses. Therefore, it is essential to understand efficient methods for anticipating, managing, and preparing for heat waves [(14)].

The heat wave analysis tool by Climate Data Canada enables users to input specific thresholds for local heat wave events. This tool creates personalized heat wave event indicators for various geographic regions in Canada. Data on the frequency of heat waves, specifically the total number of heat wave events that took place during a specific year can be generated.

Specific grid cells within Oxford County and Elgin County and the City of St. Thomas were selected for the number of extended heat events exceeding 3 days in those regions. This information is illustrated in Table 17.

Table 17: Baseline and Projected Annual Frequency of Extended Heat Warning Events for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Heat Wave Frequency	Baseline 1971-2000[6]	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	0.21	0.97	1.40	2.33	0.90	2.47	5.40
Elgin County and the City of St. Thomas	0.27	0.98	1.52	2.52	1.03	2.52	5.37

The frequency of extended heat wave events is projected to increase, particularly as time progresses and emissions rise based on the SSP scenario. The health of people living in the study area will be significantly impacted by these extended periods of extreme heat. Heat-related illnesses can develop quickly, have a negative impact on long-term health, and even be fatal. Children, older adults, people working or doing physical activity outdoors are vulnerable groups that are particularly susceptible to the negative effects of prolonged exposure to high temperatures.

Extreme Cold Days, Frost Days, and Ice Days

The occurrence of Extreme Cold Days, Frost Days and Ice Days is declining. An Extreme Cold Day refers to a day with minimum temperatures below -15°C. Across Oxford County and 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 till 2099. Table 18 shows that the Extreme Cold Days in Oxford County will decline to 0 day by the 2080s, which is 14 days less than the baseline. Similarly, Elgin County and the City of St. Thomas will have no day in the 2080s under the SSP5-8.5 with minimum temperatures below -15°C. However, while the Extreme Cold Days will become less frequent in the coming years, it remains crucial to adequately prepare for and manage the potential health impacts associated with extreme cold conditions.

[6] The heat wave events for the baseline 1971-2000 have been taken from the Ontario Climate Change and Health Modelling Study report, as it was unavailable in the ClimateData.ca portal.

Table 18: Baseline and Projected Extreme Cold Days (<-15°C) for Oxford County and Elgin County and the City of St. Thomas

Extreme Cold Days (<-15°C)[d]	Baseline 1986-2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	14	3	3	1	3	0	0
Elgin County and the City of St. Thomas	10	2	1	0	2	0	0

[d]*Data sourced from Climate Data Canada*

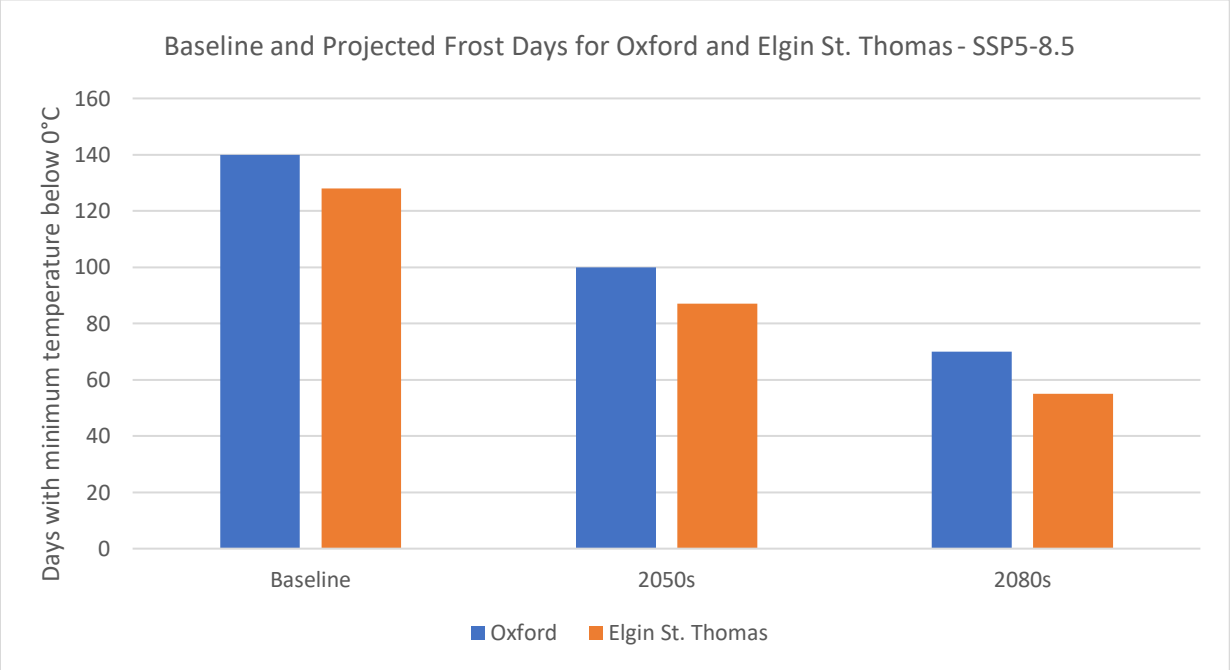
A Frost Day refers to a day where there is a possibility of frost occurring, indicated by a minimum temperature below 0°C. Frost Days are expected to decline by up to 70 days by the 2080s under the SSP5-8.5 scenario in Oxford County according to Table 19 and Figure 7. Similarly, Elgin County and the City of St. Thomas will also experience a decline in Frost Days by 73 days to 55 days, 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.

Table 19: Baseline and Projected Frost Days for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Frost Days[e]	Baseline 1986 -2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	140	117	110	100	114	98	70
Elgin County and the City of St. Thomas	128	104	97	87	101	85	55

[e]*Data sourced from Climate Data Canada*

Figure 7: Baseline and Projected Annual Mean Frost Days for Oxford County and Elgin County and the City of St. Thomas – SSP5-8.5



According to Table 20 and Figure 8, the study also forecasts a decline in the number of Ice Days. Ice Days refer to the total number of days where the maximum temperature remains below 0°C throughout the day. Since ticks can remain active in temperatures above 4°C, according to Alberta Health (2019), this decline in days with below-freezing temperatures may have an impact on tick survival and spread [16]. Warmer winters may extend the period of activity for blacklegged ticks, which can spread the bacteria that causes Lyme disease. Blacklegged ticks are typically most active in the spring and fall seasons [16].

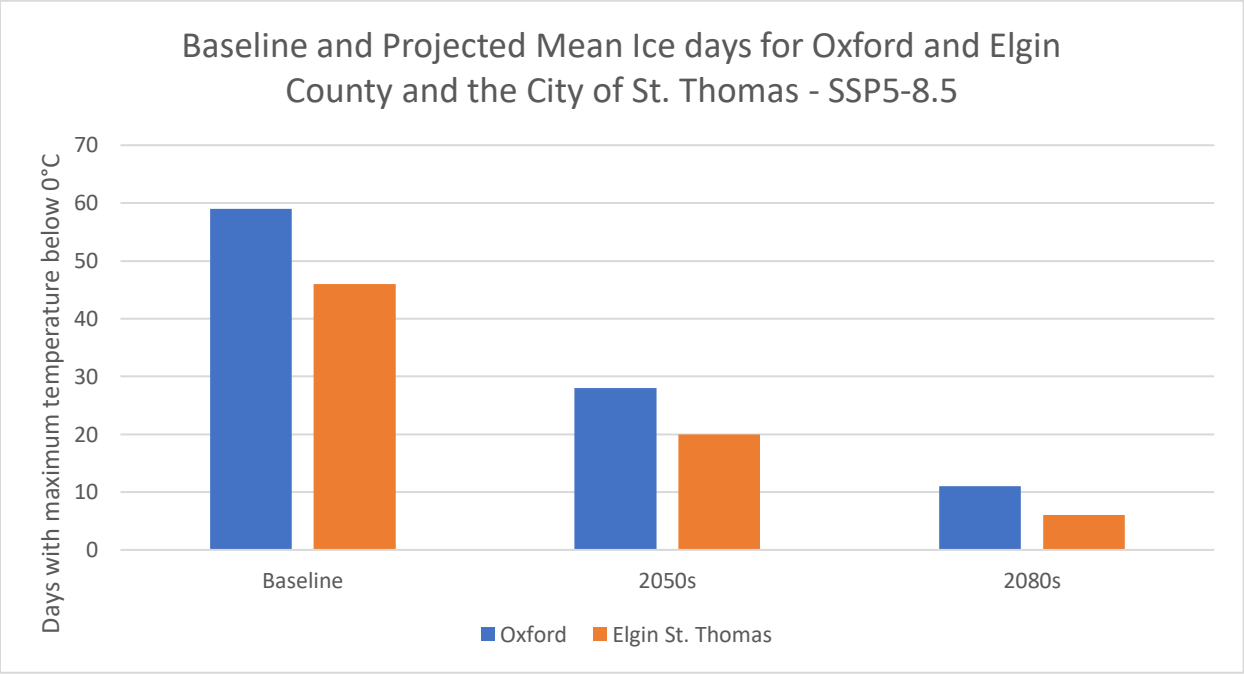
Table 20: Baseline and Projected Ice Days for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Ice Days[f]	Baseline 1986-2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	59	39	36	28	37	27	11

Elgin County and the City of St. Thomas	46	29	26	20	28	18	6

[f]*Data sourced from Climate Data Canada*

Figure 8: Baseline and Projected Annual Mean Ice Days for Oxford County and Elgin County and the City of St. Thomas – SSP5-8.5



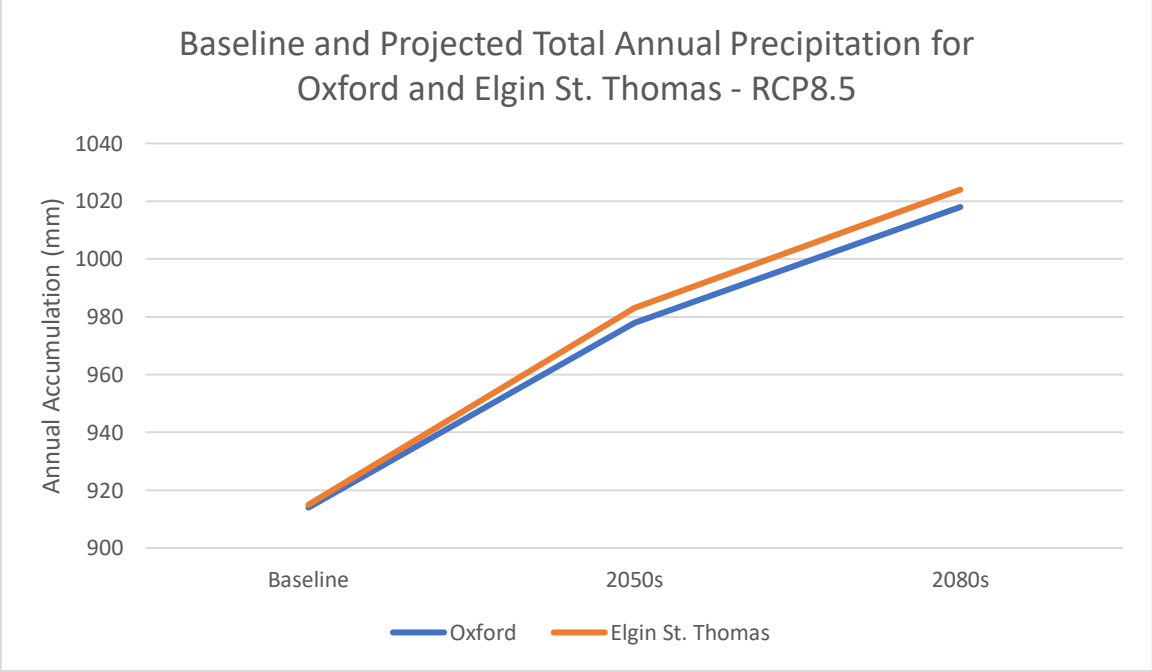
Precipitation indices

This section presents projections for both total precipitation accumulation and extreme precipitation indices.

Total Precipitation

The Total Annual Average Precipitation is expected to experience a slight increase in the coming decades, as illustrated in Figure 9. The changes in precipitation are largely uniform across the study area. By the 2080s, it is anticipated that Oxford County's baseline average of 914 mm will increase to 991 mm (SSP2-4.5) or 1018 mm (SSP5-8.5). Elgin County and the City of St. Thomas' baseline average of 915 mm is predicted to rise to approximately 1000 mm (SSP2-4.5) or 1024 mm (SSP5-8.5) by the 2080s, indicating that both regions will see an increase.

Figure 9: Baseline and Projected Total Annual Precipitation Accumulation for Oxford County and Elgin County and the City of St. Thomas (mm) (SSP5-8.5)



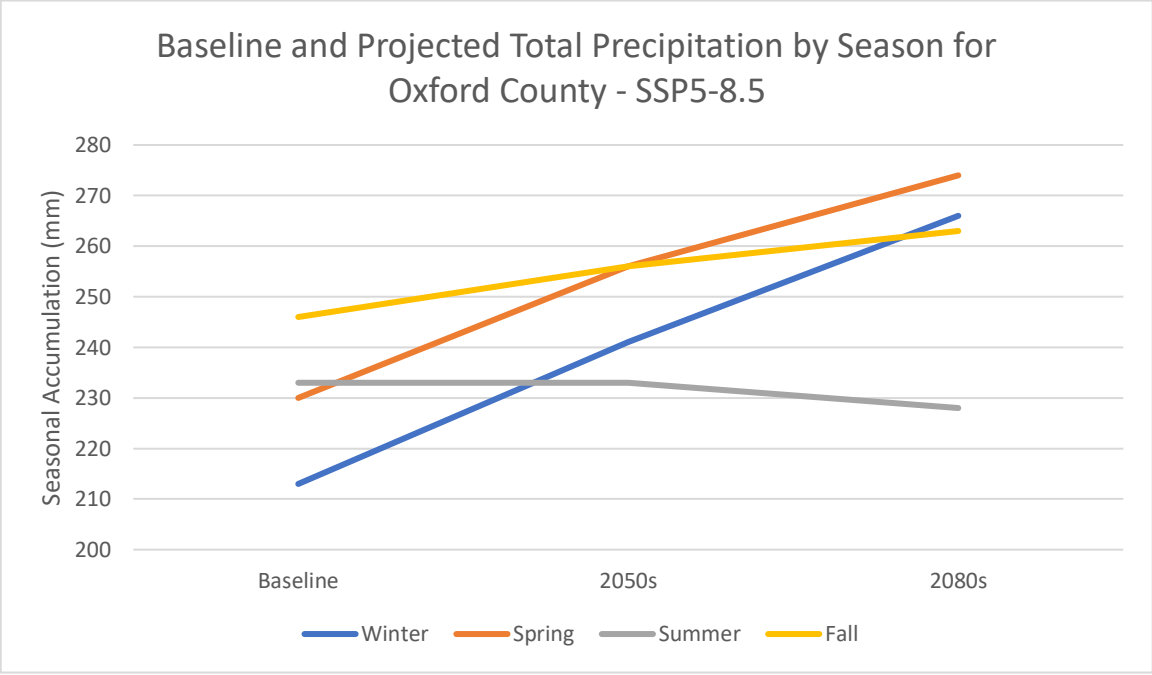
In Oxford County, the projections indicate that by the 2080s, there will be an increase in winter, spring, and fall precipitation accumulations. However, there will be a slight decrease in summer precipitation, although the decrease is not expected to be significant. Table 21 and Figure 10

provide the precipitation accumulation projections for each season in Oxford County based on the SSP1-2.6, SSP2-4.5, and SSP5-8.5 scenarios.

Table 21: Baseline and Projected Total precipitation (mm) by Season for Oxford County – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Total precipitation (mm)	Baseline 1986-2014	Current 2015-2022	2050s			2080s		
			SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	213	110	230	234	241	232	251	266
Spring	230	132	244	255	256	250	257	274
Summer	233	134	235	234	233	239	235	228
Fall	246	113	257	259	256	253	255	263
Annual	914	490	962	973	978	969	991	1018

Figure 10: Baseline and Projected Total Precipitation (mm) by Season for Oxford County (SSP5-8.5)



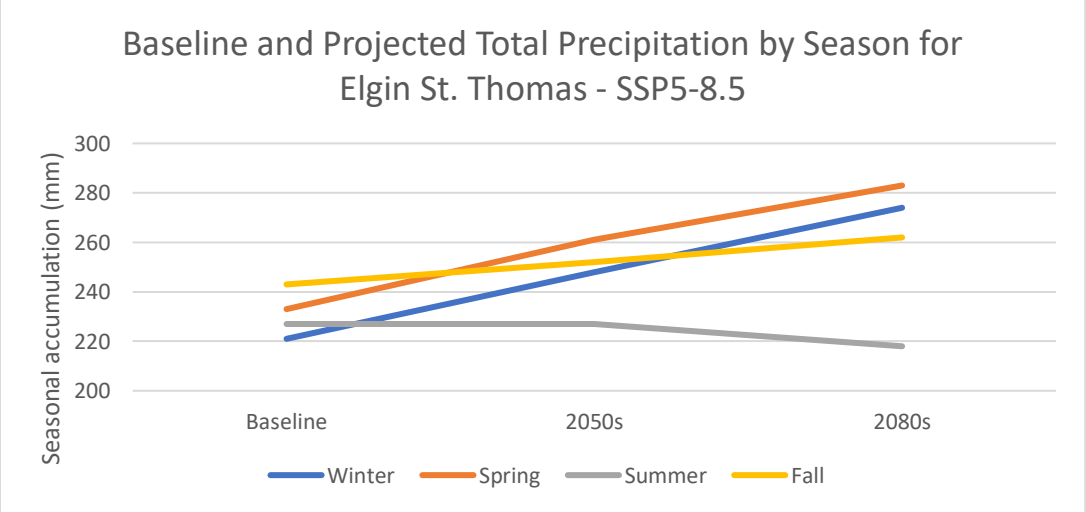
Elgin County and the City of St. Thomas is also expected to have similar seasonal patterns, including higher amounts of rainfall and snowfall in winter, spring, and fall. According to the SSP5-8.5 emissions scenario, winter season will experience most significant increase in precipitation,

with an expected rise from 221mm to 274mm by the year 2080. However, in summer it is expected that there will be a slight decline in precipitation from baseline of 227mm to 218mm by the year 2080 under SSP5-8.5 scenario. Table 22 and Figure 11 illustrate the anticipated changes in precipitation accumulation in Elgin County and the City of St. Thomas across various seasons under the SSP1-2.6, SSP2-4.5, and SSP5-8.5 scenarios. There are noticeable variations in particular seasons, even though the annual precipitation as a whole is relatively stable in comparison to the baseline. Precipitation levels are predicted to be higher in the winter, spring and fall while possibly declining slightly in the summer. These changes in seasonal precipitation contribute to the overall changes observed without substantial deviations from the baseline.

Table 22: Baseline and Projected Total Precipitation (mm) by Season for Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Total precipitation (mm)	Baseline 1986-2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Winter	221	238	242	248	239	259	274
Spring	234	251	260	261	256	263	283
Summer	227	229	225	227	232	229	218
Fall	243	253	254	252	251	253	262
Annual	915	971	976	983	975	1000	1024

Figure 11: Baseline and Projected Total Precipitation (mm) by Season for Elgin County and the City of St. Thomas (SSP5-8.5)



Dry Spells

The number of days in a row with daily precipitation of less than 1mm refers to the lengthiest dry spells in a year. Higher values indicate longer dry periods. According to the projected data, the anticipated longest dry period for the study area will not change significantly. In the 2050s and 2080s, Table 23 shows marginal increases of one day in the longest dry period.

Table 23: Longest Dry Period in a Year (days) for Oxford County and Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Longest Dry Period in a year (Days)	Baseline 1986-2014	2050s			2080s		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	12	11	11	11	11	11	11
Elgin County and the City of St. Thomas	14	14	14	15	14	14	15

Extreme Precipitation

This section provides the forecasts for multiple indices related to extreme precipitation events. The Maximum One-Day and Five-Day precipitation indices measure the amount of rain or snowfall that occurs within a single day or consecutive days. Maximum 1-Day Total Precipitation refers to the highest volume of precipitation events recorded within a single day during the specified timeframe. This index is commonly known as the day with the highest precipitation, often referred to as the wettest day of the year. Maximum 5-Day Precipitation refers to the highest quantity of precipitation accumulated over a span of five consecutive days in a specified time period. Very Wet Days, or Wet Days >=10mm refers to the number of days within the chosen time frame in which the cumulative precipitation, including both rain and snow, reaches or exceeds 10 mm. The number of days during the specified time period when the total precipitation, including both rain and snow, equals or exceeds 20 mm is represented by Extremely Wet Days or Wet Days >=20mm.

The baseline and predicted changes in the Maximum One-Day and Five-Day Precipitation Accumulations, Very Wet Days and Extremely Wet Days for the study region are shown in Tables 24 and 25.

Table 24: Baseline and Projected Extreme Precipitation Indices for Oxford County – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Region	Index	Baseline 1986 - 2014	2050s			2080s		
			SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Oxford County	Maximum One-Day Accumulations (mm)	41.1	44.3	44.8	45.2	43.4	46.9	49.4
	Maximum Five-Day Accumulations (mm)	69.6	75.2	76.1	75.9	74.5	76.7	83.5
	Very Wet Days (days)	28	30	31	31	30	31	33
	Extremely Wet Days (days)	8	8	9	9	9	9	11

Table 25: Baseline and Projected Extreme Precipitation Indices for Elgin County and the City of St. Thomas – SSP1-2.6, SSP2-4.5, and SSP5-8.5

Region	Index	Baseline 1986 - 2014	2050s			2080s		
			SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Elgin County and the City of St. Thomas	Maximum One-Day Accumulations (mm)	40.6	43.3	44.6	44.6	43.1	46.3	49.4
	Maximum Five-Day Accumulations (mm)	71.3	75.7	77.9	77.0	75.7	77.7	84.2
	Very Wet Days (days)	28	30	30	30	30	31	33
	Extremely Wet Days (days)	8	9	9	10	9	10	11

In both regions, the projections indicate that there will be an increase in Very Wet Days and Extreme Wet Days by the 2050s and 2080s under SSP1-2.6, SSP2-4.5, and SSP5-8.5 scenarios. This implies that a higher proportion of precipitation will occur during extreme weather events. Furthermore, the Maximum One-Day and Five-Day events are anticipated to increase in both areas, with the most significant rise expected in Five-Day events. To illustrate, in Oxford County, the projected increase in Maximum Five-Day events is from a baseline of 69.6 mm to 76.1mm by the 2050s and 83.5 mm by the 2080s for SSP5-8.5. Elgin County and the City of St. Thomas is 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.

Figures 12 and 13 show visual representations of the changes in the extreme precipitation indices mentioned above for Oxford County. Figure 14 shows the baseline and projected Very Wet Days for Oxford County and Elgin County and the City of St. Thomas under the SSP5-8.5 emissions scenario.

Figure 12: Baseline and Projected Maximum 1-Day Precipitation Accumulation (mm) for Oxford County

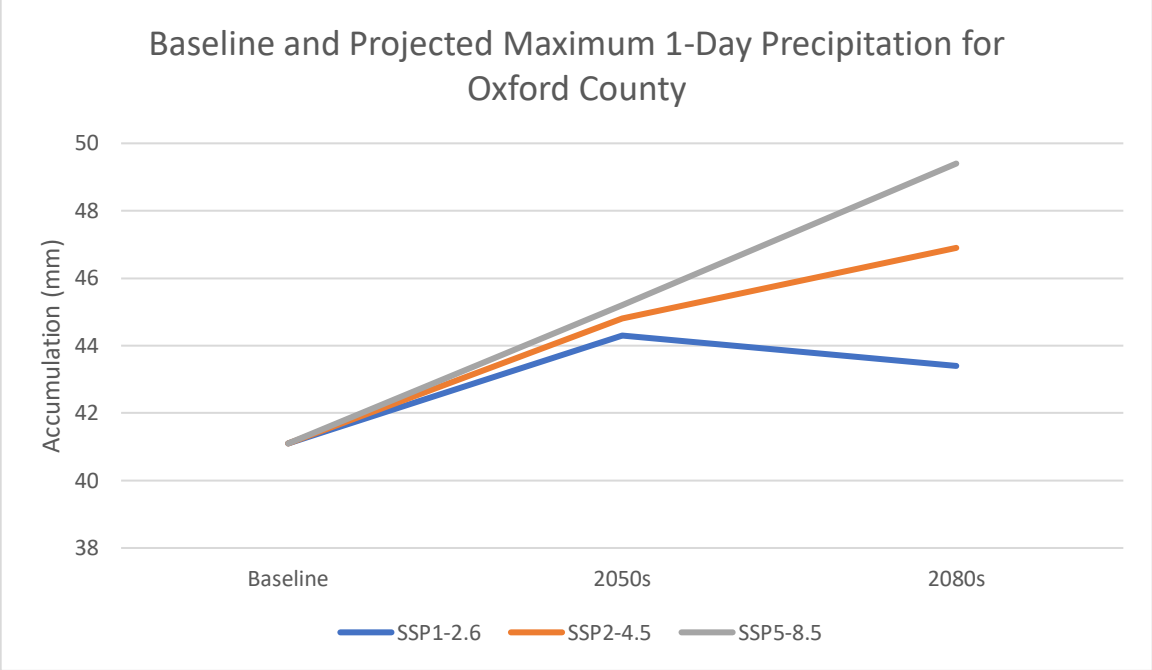


Figure 13: Baseline and Projected Maximum 5-Day Precipitation Accumulation (mm) for Oxford County

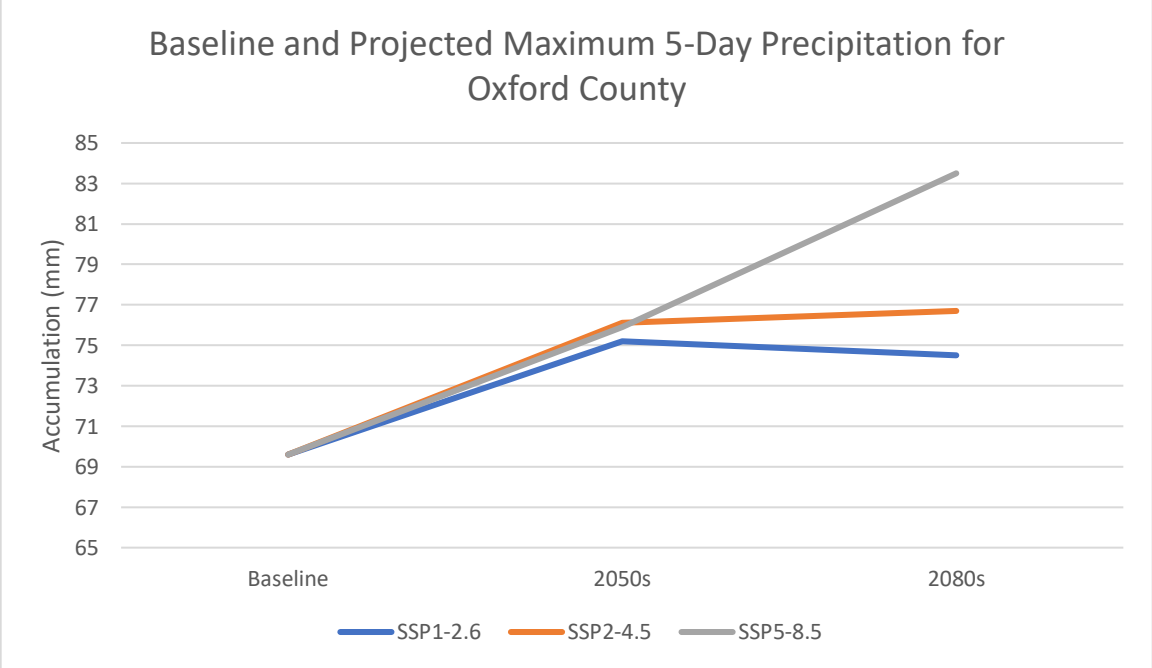
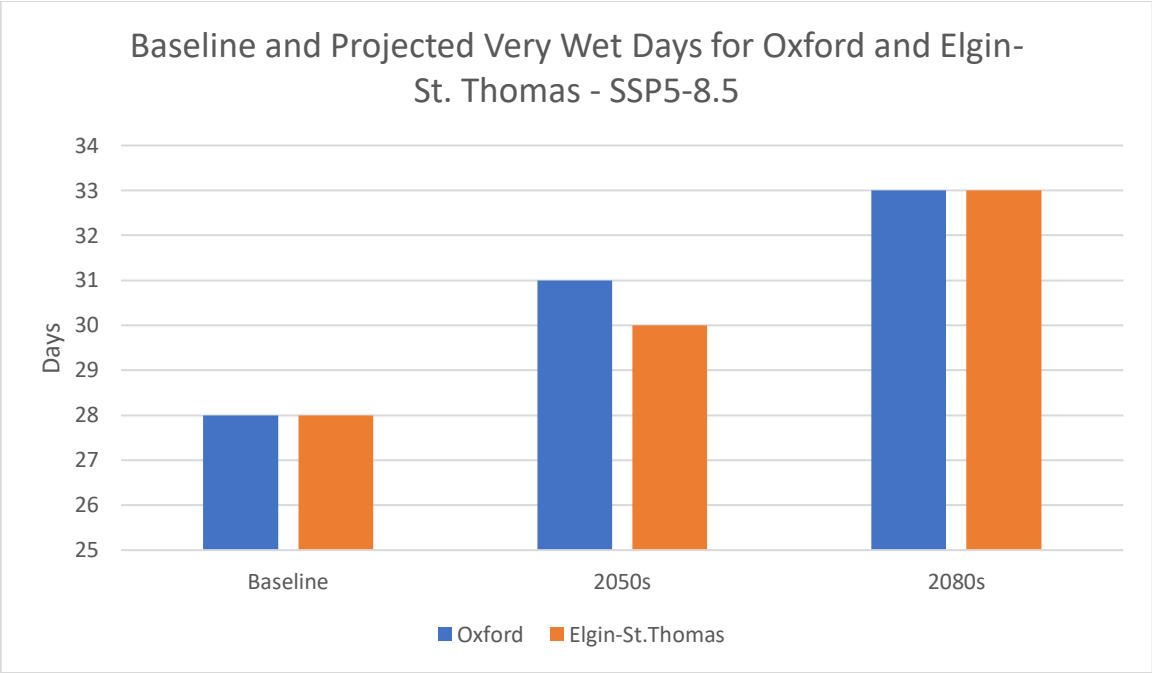


Figure 14: Baseline and Projected Heavy Precipitation Days for Oxford County and Elgin County and the City of St. Thomas - SSP5-8.5



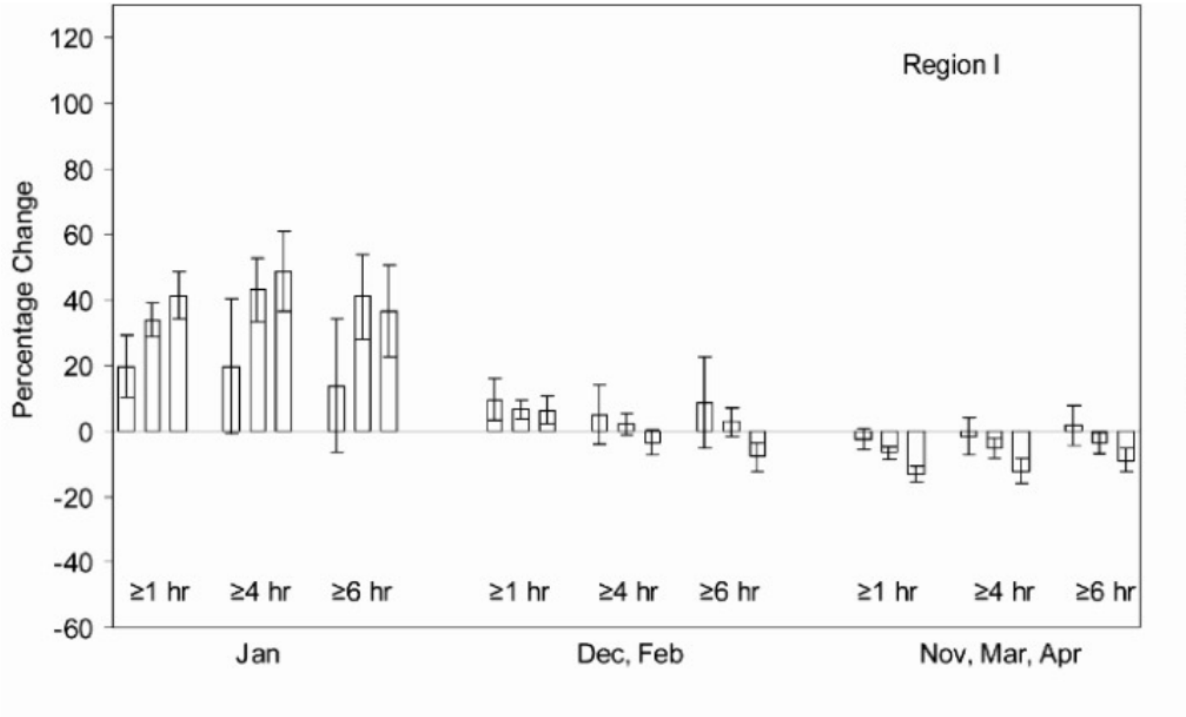
Freezing Rain

The potential effects of climate change on freezing rain in Eastern Canada were conducted in a collaborative study by the Meteorological Service of Canada and the Science and Technology division of Environment and Climate Change Canada. For their analysis, the researchers used downscaled future climate scenarios from the IPCC Fourth Assessment Report.

Region I of the study focuses on a section of Southwestern Ontario, which covers Oxford County and Elgin County and the City of St. Thomas (Table 15). The projected average percentage changes in the frequency of freezing rain events on a daily basis were the main focus of the analysis. The average percentage changes in the number of daily freezing rain events lasting longer than one hour, four hours, and six hours are shown in Figure 15 [(17)].

With minor changes in December and February, and an overall decrease in November, March, and April, the largest percentage increase in freezing rain occurs in January for Region I. Severe freezing rain events lasting over six hours per day are anticipated to rise by up to 30% by the year 2100 [(17)].

Figure 15: The average percentage change in the number of daily freezing rain events (%) for Region I relative to 1957-2007 baseline conditions



Source: Cheng et al., 2011

Air Quality

Ontario ministry in collaboration with the federal National Air Pollutant Surveillance (NAPS) program, actively monitors the real-time ambient air quality in 39 air monitoring stations located in various communities across Ontario. Air quality measurements conducted in Canada and Ontario over the past few decades have shown notable decreases in harmful air pollutants that can be attributed to emissions from vehicles and industries.

Air quality in Ontario is subject to fluctuations on an annual basis due to multiple factors, including pollutant emissions, weather conditions, extreme weather events such as forest fires, and the transport of air pollutants from the United States and other regions. Therefore, as opposed to year-to-year variations, long-term trends offer a more accurate representation of any improvements or deteriorations in air quality over time [(18)].

Between 2011-2020, average sulphur dioxide (SO_2) concentrations decreased by 50%. Furthermore, average nitrogen dioxide (NO_2/NO_x) concentrations decreased by 25%, and particulate matter ($PM_{2.5}$) decreased 17%. Ground level ozone (O_3) decreased approximately 13% as shown in Table 26.

However, even with relatively low levels of air pollution in countries such as Canada, any incremental increase in the concentration of air pollutants is associated with an increased risk of adverse health effects. As a result, despite relatively lower pollution levels, air pollution continues to place a heavy burden on disease, highlighting the significance of addressing this issue. An estimated total of 15,300 premature deaths occurs in Canada each year, out of which approximately 6,600 deaths occur prematurely in Ontario, as a result of the presence of three major air pollutants: fine particulate matter ($PM_{2.5}$), ozone, and nitrogen dioxide, with an economic cost of $114 billion [(19)(20)]. It is recognized that being exposed to significant air pollutants, such as ozone and $PM_{2.5}$, increases the risk of many adverse health effects in the general population. These outcomes can range from respiratory symptoms to the development of diseases and premature mortality. Therefore, addressing these air pollutants is essential for preserving the population's general health in Canada [(19)].

Table 26: Trends in Common Air Pollutants in Ontario, 2011-2020

Pollutant	Concentrations	Emissions
Nitrogen dioxide/ Nitrogen oxides (NO_2/NOx)	-25%	-36%
Fine particulate matter ($PM_{2.5}$)	-17%	-18%
Sulphur dioxide (SO_2)	-50%	-57%
Ground-level ozone (O_3)	-13%	N/A

Source: Air Quality in Ontario, 2020

The Canadian Ambient Air Quality Standards (CAAQS) were introduced in 2013 under the Canadian Environmental Protection Act, creating more stringent targets for pollutants and setting annual standards for ozone and $PM_{2.5}$. Territories and provinces were required to report ambient

air quality measurements in accordance with the CAAQS as of 2015. In 2020, new standards for these pollutants were introduced. The standards for the year 2025 are also given in the table.

The CAAQS sets annual standards of 8.8 ug/m3 and a 24-hour standard of 27 ug/m3 for PM2.5. The 8-hour standard for ozone is set at 62 ppb, while the 1-hour and annual standards for nitrogen dioxide are 60 ppb and 12.0 ppb, respectively. The CAAQS standards for fine particulate matter, ozone, sulphur dioxide, and nitrogen dioxide are shown in Table 27. However, it is crucial to understand that there is still a chance for adverse health effects to occur even when air pollutant concentrations fall within these standards.

Table 27: CAAQS Standards for Fine Particulate Matter, Ozone, Sulphur Dioxide, and Nitrogen Dioxide[7]

Pollutant	Averaging time	Numerical value			Statistical form
		2015	2020	2025	
Fine Particulate Matter ($PM_{2.5}$)	24-hour	28 µg/m^3	27 µg/m^3		The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	Annual	10.0 µg/m^3	8.8 µg/m^3		The 3-year average of the annual average of the daily 24-hour average concentrations
Ozone (O_3)	8-hour	63 ppb	62 ppb	60 ppb	The 3-year average of the annual 4th highest of the daily maximum 8-hour average ozone concentrations
Sulphur Dioxide (SO_2)	1-hour	-	70 ppb	65 ppb	The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
	Annual	-	5.0 ppb	4.0 ppb	The average over a single calendar year of all 1-hour average SO_2concentrations

[7] Source: Canadian Ambient Air Quality Standards

Nitrogen Dioxide (NO_2)	1-hour	-	60 ppb	42 ppb	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
	Annual	-	17.0 ppb	12.0 ppb	The average over a single calendar year of all 1-hour average concentrations

Source: Canadian Ambient Air Quality Standards

The Ontario Ministry of the Environment has established the Ambient Air Quality Criteria (AAQC) in addition to the Canadian Ambient Air Quality Standards (CAAQS). The AAQC defines target concentrations of air pollutants based on the desired levels of protection against adverse health and environmental impacts. In this context, "ambient" refers to overall air quality, regardless of location or specific sources of pollution. The Ontario Ministry of Environment, Conservation and Parks provided the AAQC standards for ozone, fine particulate matter, nitrogen oxide, and sulfur oxide. These standards are shown in Table 28.

Table 28: Ontario's Ambient Air Quality Criteria for Common Air Pollutants

Contaminant	**1-hour** AAQC	**8-hour** AAQC	**24-hour** AAQC	**Annual** AAQC
NO_2	200 ppb	-	100 ppb	-
$PM_{2.5}$	-	-	27 µg/m^3	8.8 µg/m^3
O_3	80 ppb	-	-	-
SO_2	40 ppb	-	-	-

Source: Ontario's Ambient Air Quality Criteria

The Port Stanley air quality monitoring site serves as the monitoring station for assessing air quality in Elgin County and the City of St. Thomas region. The Kitchener/London air quality monitoring site is responsible for evaluating the air quality in Oxford County. For this report, the data from the Kitchener station has been used for assessing air quality in Oxford County. Table 29 shows the annual air pollutant statistics acquired in the Kitchener and Port Stanley Station for nitrogen dioxide, particular matter, and ozone for the year 2021.

Table 29: 2021 Annual Air Pollutant Statistics

AQHI Station	Air pollutants	Maximum 1-hour	Maximum 24-hour	Annual mean
Kitchener	Nitrogen dioxide	44.2 ppb	19 ppb	4.81 ppb
	Particulate matter	57 µg/m^3	36 µg/m^3	7.8 µg/m^3
	Ozone	81 ppb	58 ppb	28.4 ppb
Port Stanley	Nitrogen dioxide	21.3 ppb	6.85 ppb	2.20 ppb
	Particulate matter	66 µg/m^3	28 µg/m^3	7.0 µg/m^3
	Ozone	74 ppb	59 ppb	31.4 ppb

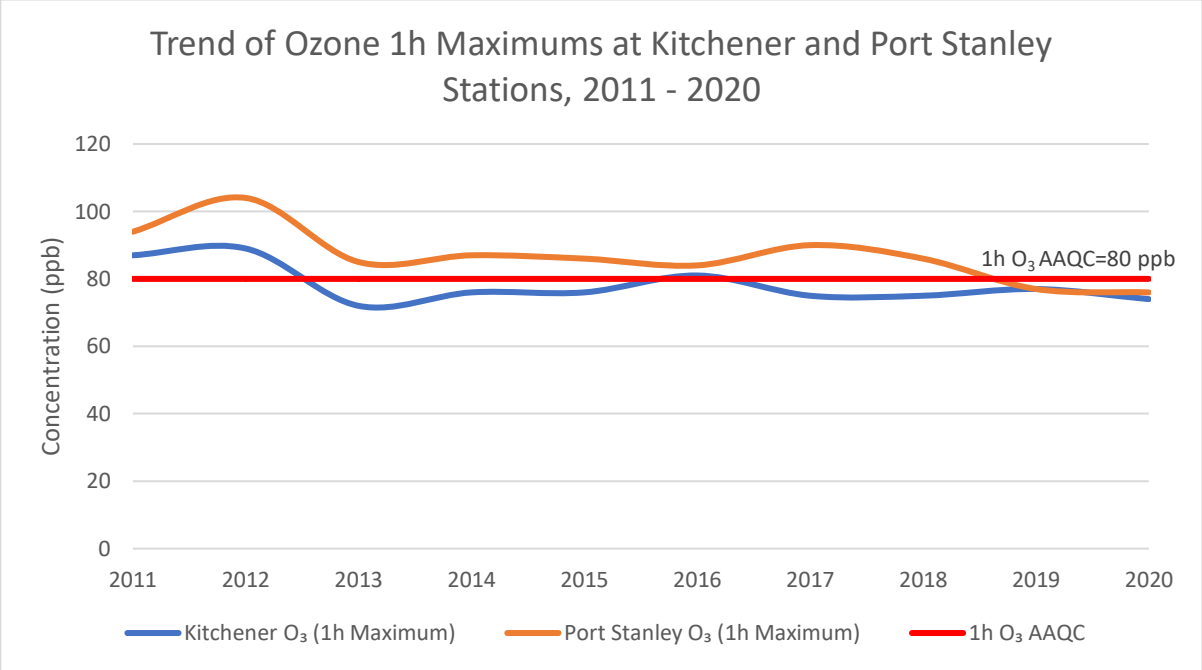
Source: Ontario Annual Air Pollutant Statistics

Ground-level Ozone

Ground-level ozone, a major constituent of smog, is generated when nitrogen oxides (NOx) and volatile organic compounds (VOCs) react in the presence of sunlight. In Ontario, higher ground-level ozone concentrations happen between May and September, when there are more hot, sunny days, primarily during noon to early evening. Unlike NOx emissions, which are almost exclusively the result of human activities related to the burning of fossil fuels, VOCs can come from both anthropogenic (man-made) and natural sources. However, the main sources of both NOx and VOCs are frequently connected to products and infrastructure used in transportation, like road vehicles and solvents.

Ozone is harmful to the respiratory system and can irritate the eyes and respiratory tract. When exposed to ozone, people who are sensitive to it may develop symptoms like wheezing, coughing, and tightness in the chest. Children are particularly vulnerable, especially those who participate in outdoor activities in the summer when ozone levels are at their highest. Individuals who already have breathing problems like asthma or chronic obstructive pulmonary disease are also at risk. Increased hospital admissions and early deaths have been linked to ozone [(21)]. Figure 16 shows that there is a decreasing trend by 19.1% in ground-level ozone 1-hour maximum over the 10 years period in Port Stanley station. On the other hand, the Kitchener station demonstrates a slight decline of 5.2% in the ground-level ozone 1-hour maximum, therefore, no significant trend in ozone concentrations is observed over the 10 years. The summer mean also shows a significant decreasing trend by 12% over the ten-year period. However, there were no significant trends detected for winter ozone mean over this period.

Figure 16: Trend of Annual Ozone Means at Kitchener and Port Stanley Stations, 2011-2020



Source: Air Quality in Ontario, 2020. Data extracted from: https://www.ontario.ca/document/air-quality-ontario-2020-report/10-year-trends-and-annual-results#section-2

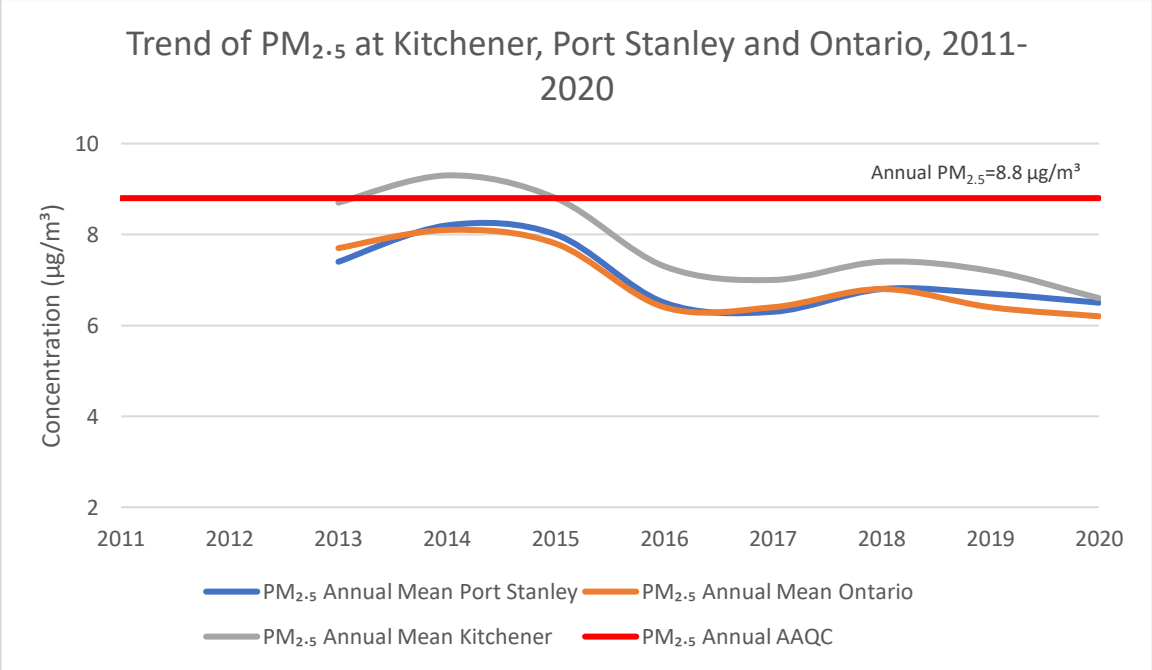
Particulate Matter

Particulate matter is a term used to describe a variety of small particles suspended in the air, including aerosols, smoke, fumes, dust, fly ash, and pollen. Depending on the source, atmospheric conditions, season, and environmental factors, Particulate matter can have a different composition. Particulate matter is frequently categorized based on its diameter because different sizes of particulate matter have different health effects. Of particular importance in discussions about air quality is $PM_{2.5}$, which denotes fine particulate matter with a diameter equal to or less than 2.5 microns. Due to their small size and ease of inhalation, $PM_{2.5}$ particles are frequently used as a general indicator of air quality. $PM_{2.5}$ is directly released into the atmosphere from a variety of sources, including motor vehicles, smelters, power plants, industrial buildings, agricultural burning, and forest fires. Other sources include residential fireplaces and wood stoves, motor vehicles, and industrial facilities [(22)].

Exposure to $PM_{2.5}$ is linked to a range of adverse health effects, including increased hospital admissions, serious health complications, and premature death. These risks are particularly evident in vulnerable groups like children, the elderly, and individuals with lung disorders, asthma,

or cardiovascular diseases. $PM_{2.5}$ can have adverse impacts on public health both in the short term, such as within a single day, and over the long term, with chronic exposure to $PM_{2.5}$ over a period of years or more [20]. Long-term exposure to $PM_{2.5}$ particles increases the risk of adverse respiratory effects, including worsened respiratory symptoms and impairment of lung development in children. It has been connected to cardiovascular effects; particularly affecting health parameters linked to the development of atherosclerosis [19]. New findings suggest that it may also have negative effects on the nervous system, including the development of dementia [19][23], as well as number of other health issues, including metabolic disorders like diabetes and unfavorable pregnancy outcomes like low birth weight [19][24]. Figure 17 illustrates that between 2011 and 2020 period, there has been a 17% reduction in the average annual concentrations of fine particulate matter throughout Ontario. However, although the change over 10 years show a decreasing trend in Port Stanley station by 18.4%, it is slightly higher than the particulate matter annual mean recorded in Ontario in 2020. Similarly, there is a significant decline of 20.8% reduction recorded in Kitchener station for $PM_{2.5}$ over the 10 years, however, the particulate matter annual mean is slightly higher at 6.6 µg/m^3 than that of Ontario at 6.2 µg/m^3.

Figure 17: Trend of Annual $PM_{2.5}$ Means at Ontario, Kitchener and Port Stanley Stations, 2011-2020



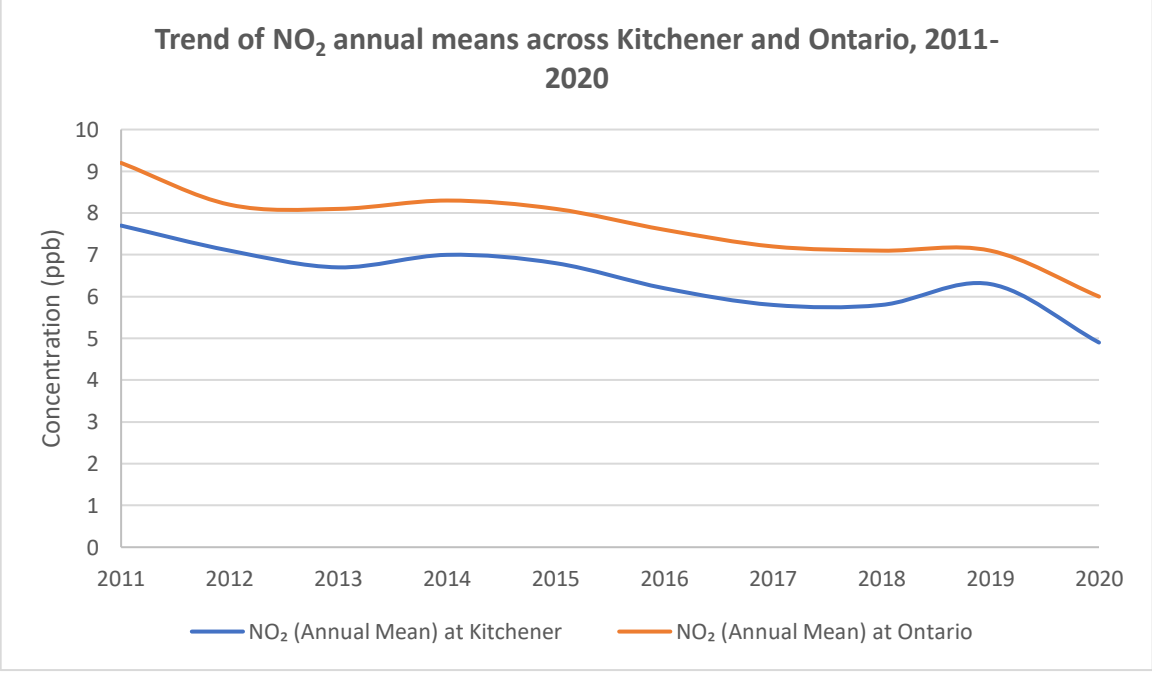
Source: Air Quality in Ontario, 2020. Data extracted from: https://www.ontario.ca/document/air-quality-ontario-2020-report/10-year-trends-and-annual-results#section-1

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a reddish-brown color gas and has a strong odor. When present in the atmosphere, it goes through chemical changes and helps to form nitrates and gaseous nitric acid. It has a significant impact on the atmospheric reactions that result in the creation of ground-level ozone, a crucial element in the formation of smog. In addition, nitrogen dioxide reacts in the air and contributes to the creation of $PM_{2.5}$. According to the Ontario Ministry of the Environment, in 2016, the transportation industry, industrial processes, and the production of electricity are the primary sources of nitrogen dioxide emissions.

Nitrogen dioxide can irritate the respiratory system and reduce the body's ability to fight off infections of the lungs. People who have bronchitis and asthma are especially vulnerable to the effects of nitrogen dioxide [(22)]. According to Figure 18, there has been a significant decrease of 22% in the average annual levels of nitrogen dioxide recoded in the Kitchener station between the years 2011 and 2020. Overall, there has been a 25% reduction in the average annual concentrations of nitrogen dioxide throughout Ontario from the year 2011 to 2020. The average annual mean of nitrogen dioxide is slightly higher in Ontario at 6ppb than in Kitchener at 4.87ppb.

Figure 18: Trend of NO_2 annual means across Ontario, 2011-2020



Source: Air Quality in Ontario, 2020. https://www.ontario.ca/document/air-quality-ontario-2020-report/10-year-trends-and-annual-results#section-0

Projecting Future Air Quality

As per the Ontario Climate Change and Health Modeling Report, it is anticipated that as average temperatures increase, the frequency of air pollution events will also rise [25]. In accordance with the 1-hour AAQC for ozone, the report from 2016 predicted an annual rise in the number of days in Ontario's Public Health Unit jurisdictions that exceeded the 80-ppb threshold. The average ozone concentrations for the baseline period are shown in Table 30 of the report, along with projections for the 2050s and 2080s.

In Elgin County and the City of St. Thomas and Oxford County, the baseline period from 1971 to 2000 witnessed 12 and 2 days respectively where the 80 ppb of ozone concentrations limit was exceeded (Table 30). However, for the 2050s, Elgin County and the City of St. Thomas are projected to exceed limit for 14 days and 3 days for Oxford County. By the 2080s, Elgin County and the City of St. Thomas are projected to exceed the limit 15 days of the year, while the count for Oxford County remains unchanged from the 2050s [25].

Table 30: Changes in number of ozone exceedances (> 80 ppb) count (days per year) by PHU in southern Ontario for the baseline period (1971-2000) and two projection periods (2050s) and (2080s)

Public Health Units	Days above 80 ppb (1971-2000)	Days above 80 ppb (2050s)	Days above 80 ppb (2080s)
Oxford County	2	3	3
Elgin County and the City of of St. Thomas	12	14	15

Source: Ontario Climate Change and Health Modelling Study, 2016

Wildfires have an impact on ozone (O_3) and particulate matter (PM), which are crucial factors affecting air quality, climate change, and human health. Wildfire exposure has been associated with a number of adverse health outcomes, including cardiovascular disease mortality, and acute myocardial disease mortality, higher rates of morbidity (primarily respiratory diseases), mental health disorders, stunted growth in children, decreased lung function, and general worsening of health [26]. Wildfires are predicted to become more frequent and intense under the influence of a changing climate, increasing air pollution both inside and outside in impacted areas [19].

The Human Health Chapter of the 2014 Canada in a Changing Climate Report, simulations of 10 summer seasons are compared between current (2000) and future (2045) air quality in North America. It suggests that under climate change, while keeping anthropogenic air pollutant emissions constant, ozone concentration changes in Canada are generally less severe than the United States, with local increases of 4 to 5 parts per billion by volume (ppbv) observed in certain areas of southern Ontario and 1 to 2 ppbv in various parts in rest of the country as illustrated in Figure 19 (top figure) [27]. The study also explored at the possibility of reduced emissions of anthropogenic air pollutants. Even with the effects of climate change taken into account, Canada could experience significant drops in ozone concentrations of 5 to 15 ppbv.

The same simulations used to analyze ozone concentrations also provide insights into the changes in fine particulate matter ($PM_{2.5}$) levels in North America under climate change. According to the study, these simulations predict relatively smaller increases in $PM_{2.5}$ concentrations across most of North America, typically below 0.2 micrograms per cubic meter ($\mu g/m^3$) (bottom figure) [27].

Figure 19: Visualization of Ten-year Averages for Daily Summer Maximum Concentrations of Ozone (on top) and Fine Particulate Matter (on bottom)

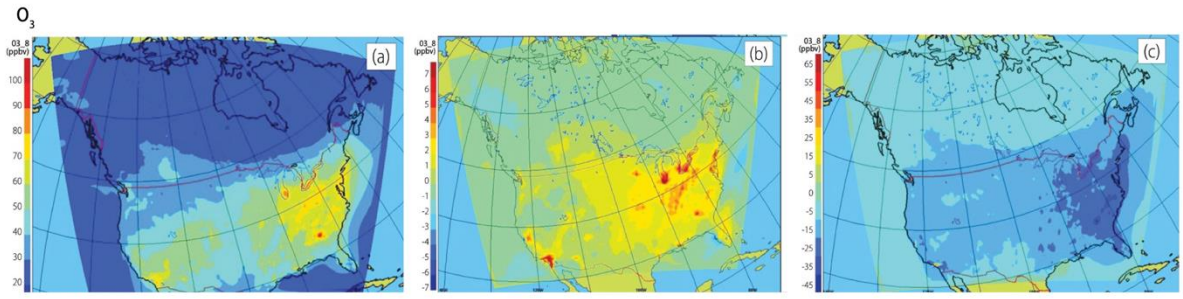


FIGURE 1: **a)** The ten year average "current" mean summer (June-July-August) daily maximum 8-hour average O_3 concentration; **b)** projected changes in the summer average daily maximum 8-hour O_3 between the "current" case and the "future" case with climate change using constant air pollutant emissions; and the **c)** "current" case and "future" case with possible reductions in future air pollutant emissions *(Source: Kelly et al., 2012)*. Note the different contour intervals used in each panel.

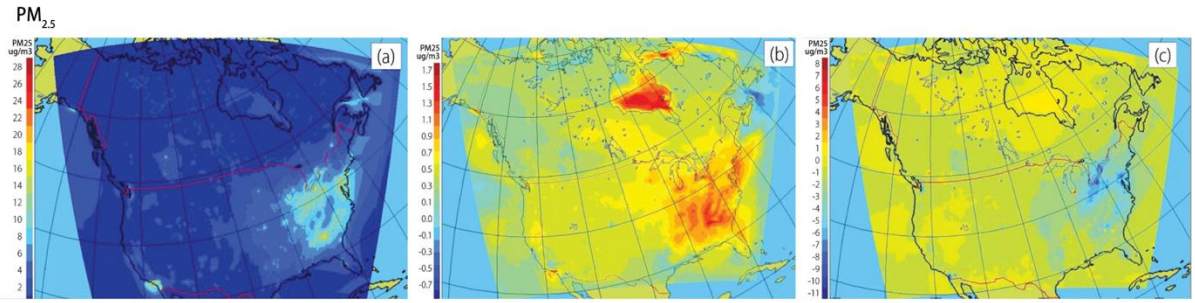
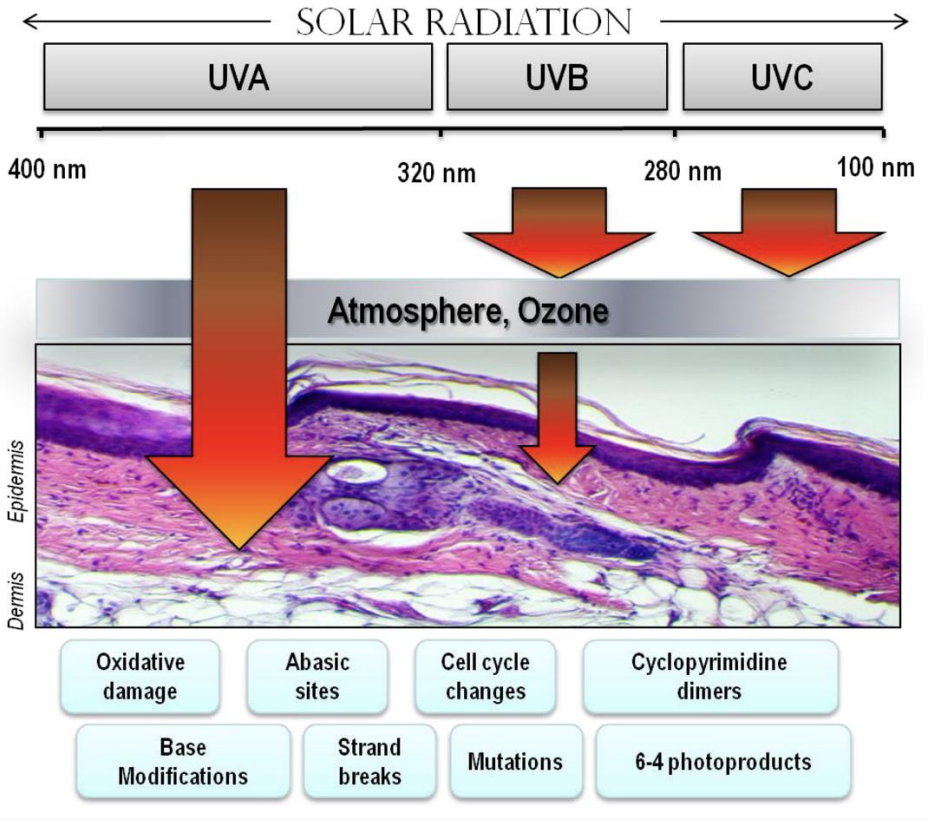


FIGURE 2: **a)** The ten year average "current" mean summer (June-July-August) 24-hour average $PM_{2.5}$ concentration; **b)** projected changes in the summer 24-hour average $PM_{2.5}$ concentration due to climate change with constant air pollutant emissions; and **c)** projected changes to $PM_{2.5}$ for the future with the combined effects of climate change and possible future decreases in air pollutant emissions *(Source: Kelly et al., 2012)*. Note the different contour intervals used in each panel.

UV index

The UV Index, which ranges from 0 to 11+ in Canada, indicates stronger sun rays with higher UV index. To illustrate, the UV index is categorized into five risk levels: Low (0-2), Moderate (3-5), High (6-7), Very High (8-10), and Extreme (11+). Sun safety precautions need to be taken more seriously when the UV index increases. UV 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 [(28)]. Figure 20 illustrates the three types of UV radiation with each having distinct effects on the health of the population [(29)]. UV-A is the least powerful type of UV rays, but it can still cause damage to the skin, leading to sunburn and early aging. However, UV-B rays are stronger than UV-A and are primarily responsible for sunburns and skin damage that can lead to skin cancer [(30)]. In contrast, UV-C rays do not reach the Earth's surface because the ozone layer effectively absorbs them entirely [(29)].

Figure 20: Three Types of Solar UV Radiation and Biologic Effects on the Skin



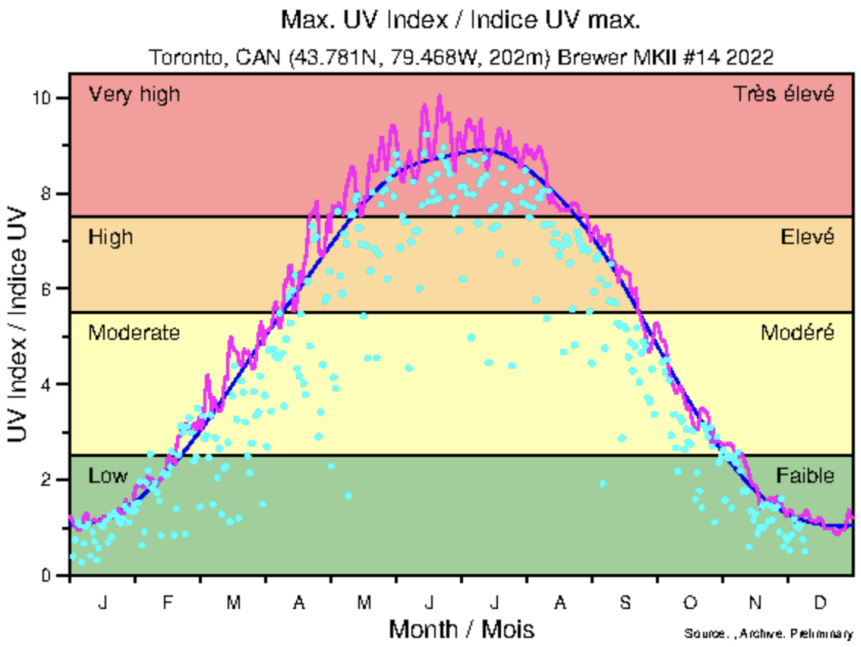
There is no direct relationship between UV radiation and temperature (heat). Unlike infrared radiation, which causes heat to be felt on skin, UV radiation is invisible and cannot be sensed. Along the electromagnetic spectrum, the sun emits different kinds of radiation, and the radiation that produces heat is different from the radiation that causes skin cancer and other health problems [(31)].

The highest levels of UV radiation from the sun occur during solar noon, typically between 12 and 1 p.m. throughout Canada. During this period, the sun's rays have a shorter distance to travel through the atmosphere, intensifying the UV intensity. Generally, between 11 a.m. and 3 p.m., the UV Index in Canada can reach 3 or higher [(32)].

The earth's ozone layer protects against the detrimental UV rays emitted by the sun, safeguarding us from their harmful effects. The ability of the ozone layer to shield the earth from the sun's harmful UV rays has decreased over time due to the thinning of the layer due to the release of

particular chemicals into the environment. As a result, more UV radiation hits the Earth's surface [32]. However, as part of a comprehensive strategy to address this issue, Canada has discontinued the production of ozone-depleting chemicals and control their usage by implementing regulations under the Canadian Environmental Protection Act [32]. Figure 21 shows the average highest UV Index recorded in Toronto for each month of 2022. The highest UV Index values are found in the summer, but elevated levels were also seen in April of that year.

***Figure 21:** Maximum UV Index in Toronto, Canada, 2022*



Source: [Environment and Climate Change Canada, 2022]

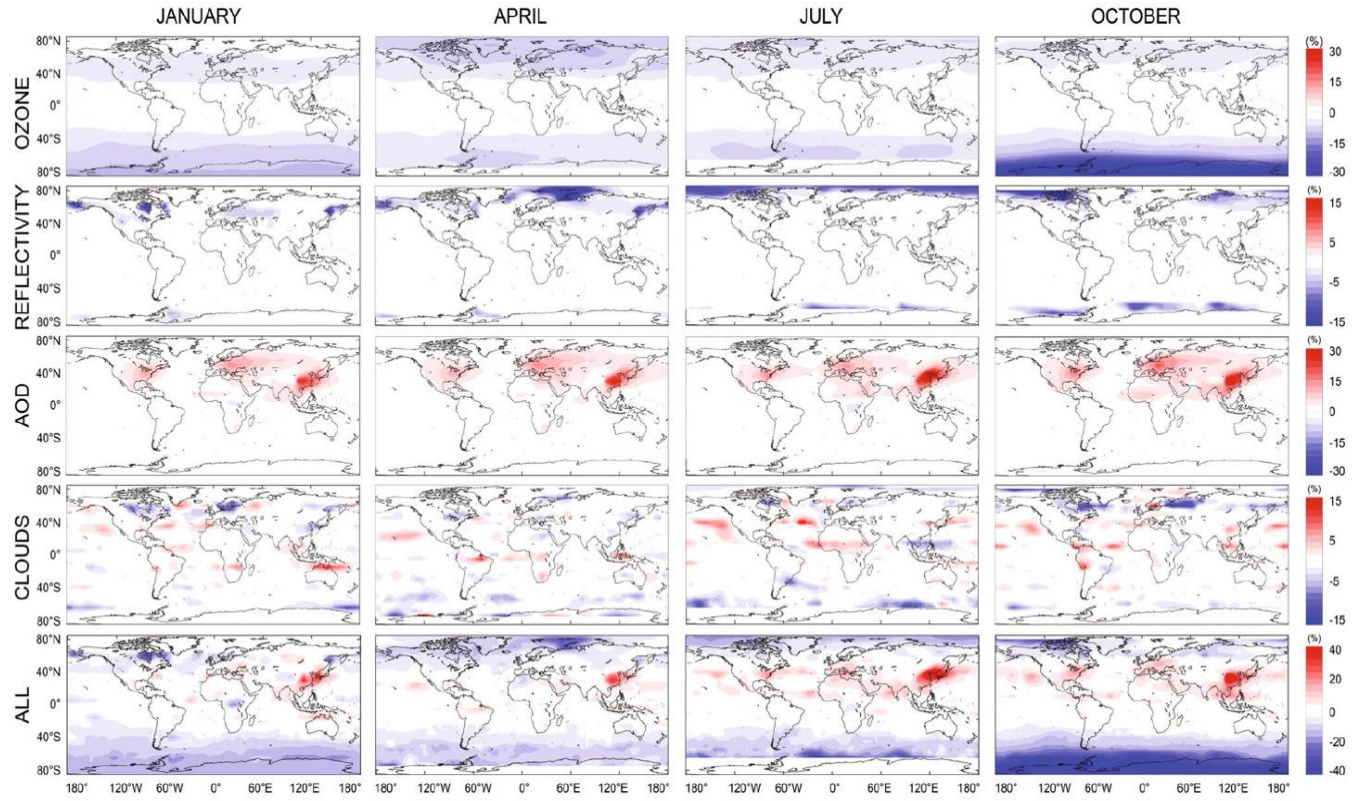
Projecting UV index

Future changes in the levels of solar ultraviolet (UV) radiation reaching the Earth's surface, including UV-B and UV-A, will be influenced by changes in aerosols (particles suspended in the atmosphere), future state of the ozone layer, clouds, and surface albedo (such as snow and ice coverage) [33]. Furthermore, impacts of stratospheric ozone due to the presence of Ozone Depleting Substances can also impact UVI, and climate change can further influence UVI levels through its impact on ozone, cloud cover, aerosols and surface reflectively [34]. Several studies (Bernhard et al., 2023; Lamy et al, 2019) validate the projected reduction in ultraviolet (UV) radiation as a result of the recovery of ozone in the stratosphere, especially in high and polar latitudes, as well as increases in UV radiation due to decreases in aerosol concentrations in

regions with significant urban or industrial activities [35][36]. Furthermore, climate change-related factors such as diminishing ice cover and reduced cloudiness are important drivers leading to regional shifts (decreases and increases, respectively) in surface UV radiation levels [35].

A study conducted in 2019 by Bais et al. examined the potential effects of climate change and ozone depletion on global ultraviolet (UV) radiation levels. The researchers projected the noon Ultraviolet Index (UVI) under clear skies for different climate models using monthly data. These values were calculated using radiative transfer model. The study compared two 10-year periods: the current decade (2010-2020) and the future (2085-2095). Figure 22 illustrates the average differences in noon UVI across multiple models for four selected months. The projected changes in UVI can vary according to latitude and season, and can be attributed to different factors, such as ozone, aerosols, surface reflectivity, and clouds.

Figure 22: Average changes in noon-time UVI between decadal averages for the present day (2010–2020) and at the end of this century (2085–2095)



UVI values are projected to decrease during summer and autumn by 5-15% in the Northern Hemisphere due to reductions in surface reflectivity. However, there can be significant increases in the mid-latitude northern regions with locally reaching 40% higher UVI values. These increases are primarily attributed to projected decreases in aerosols over the most populated areas of the northern hemisphere [37]. The effects of aerosols on UV radiation levels in these regions can be further influenced by decreases in cloudiness, leading to higher UV radiation levels [37].

High Ultraviolet (UV) index levels during the summer and shoulder seasons will continue to be a major concern for Oxford County and Elgin County and the City of St. Thomas region. Although there is less certainty that climate change will increase UV radiation in Canada, ozone-depleting substances (OCDSs) continue to be a long-term source of concern. Because of this, it is essential to continue monitoring efforts and create plans for dealing with high UV index days both now and in the future.

Conclusion

An overview of the current and future effects of climate change on population health in Oxford County, Elgin County and the City of St. Thomas is provided in this report. Rising temperatures, higher UV radiation levels, more precipitation, and more frequent and severe weather events are some of the effects of climate change that are expected to have a significant short- and long-term impact on the health of the local population. The purpose of the report is to create a foundation of the regional climate variables that affect population health both now and in the future. It intends to support Southwestern Public Health's assessment of the vulnerability of the public health system to climate change and its effects.

References

1. Kriegler E, Bauer N, Popp A, Humpenöder F, Leimbach M, Strefler J, Baumstark L, Bodirsky BL, Hilaire J, Klein D, Mouratiadou I. Fossil-fueled development (SSP5): An energy and resource intensive scenario for the 21st century. Global environmental change. 2017 Jan 1;42:297-315. https://doi.org/10.1016/j.gloenvcha.2016.05.015

2. Riahi K, Van Vuuren DP, Kriegler E, Edmonds J, O'neill BC, Fujimori S, Bauer N, Calvin K, Dellink R, Fricko O, Lutz W. The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global environmental change. 2017 Jan 1;42:153-68. https://doi.org/10.1016/j.gloenvcha.2016.05.009.

3. Intergovernmental Panel on Climate Change (IPCC). Summary for Policymakers. Climate Change 2021 – The Physical Science Basis: Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press; 2023. p. 3–32. https://doi.org/10.1017/9781009157896.001.

4. Berry P, Schnitter R, Noor J. Climate change and health linkages. Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. 2022:34-52. Available online: https://changingclimate.ca/health-in-a-changing-climate/chapter/1-0/

5. Public Health Agency of Canada. Tick-borne disease with climate and environmental changes. 2019 Oct 25. https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2019-45/issue-4-april-4-2019/article-2-increased-risk-tick-borne-diseases-climate-change.html

6. Health Canada. Adapting to Extreme Heat Events: Guidelines for Assessing Health Vulnerability. 2011. Available online: https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/climat/adapt/adapt-eng.pdf

7. Liu J, Varghese BM, Hansen A, Zhang Y, Driscoll T, Morgan G, Dear K, Gourley M, Capon A, Bi P. Heat exposure and cardiovascular health outcomes: a systematic review and meta-analysis. The Lancet Planetary Health. 2022 Jun 1;6(6):e484-95. https://doi.org/10.1016/S2542-5196(22)00117-6

8. Gauer R, Meyers BK. Heat-related illnesses. American family physician. 2019 Apr 15;99(8):482-9. https://www.aafp.org/pubs/afp/issues/2019/0415/p482.html

9. Health Canada. Extreme cold. 2018 Jan. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/hl-vs/alt_formats/pdf/iyh-vsv/environ/cold-extreme-froid-eng.pdf

10. Bell JE, Brown CL, Conlon K, Herring S, Kunkel KE, Lawrimore J, Luber G, Schreck C, Smith A, Uejio C. Changes in extreme events and the potential impacts on human health. Journal of the Air & Waste Management Association. 2018 Apr 3;68(4):265-87. https://doi.org/10.1080/10962247.2017.1401017

11. Health Canada. Reducing Urban Heat Islands to Protect Health in Canada; Ottawa, ON, Canada. 2020 March. https://www.canada.ca/content/dam/hc-sc/documents/services/health/publications/healthy-living/reducing-urban-heat-islands-protect-health-canada/Reducing-Urban-Heat-EN.pdf

12. US EPA. Heat Island Impacts. 2022 Sep 2. https://www.epa.gov/heatislands/heat-island-impacts

13. Health Canada. Climate Change and Health. 2009 Nov. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/climat/adapt_bulletin-adapt1/adapt_bulletin-adapt1-eng.pdf

14. Clements BW, Casani J. Disasters and public health: planning and response. Butterworth-Heinemann; 2016 Feb 23. https://doi.org/10.1016/b978-0-12-801980-1.00013-1

15. Smoyer-Tomic KE, Rainham DG. Beating the heat: development and evaluation of a Canadian hot weather health-response plan. Environmental health perspectives. 2001 Dec;109(12):1241-8. https://doi.org/10.1289/ehp.011091241

16. Alberta Health. Lyme disease tick surveillance. 2019. Available: https://www.alberta.ca/lyme-disease-tick-surveillance.aspx

17. Cheng CS, Li G, Auld H. Possible impacts of climate change on freezing rain using downscaled future climate scenarios: updated for eastern Canada. Atmosphere-Ocean. 2011 Mar 1;49(1):8-21. https://doi.org/10.1080/07055900.2011.555728

18. Ontario Ministry of the Environment. Air Quality in Ontario: Key air contaminants. 2022 Dec 21. https://www.ontario.ca/document/air-quality-ontario-2020-report/key-air-contaminants#section-0

19. Egyed M, Blagden P, Plummer D, Makar P, Matz C, Flannigan M, MacNeill M, Lavigne E, Ling B, Lopez DV, Edwards B, Pavlovic R, Racine J, Raymond P, Rittmaster R, Wilson A, & Xi G. Air Quality. In P. Berry & R. Schnitter (Eds.), Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. Ottawa, ON: Government of Canada. 2022: 294-295. https://ftp.maps.canada.ca/pub/nrcan_rncan/publications/STPublications_PublicationsST/329/329522/gid_329522.pdf

20. Health Canada. Health Impacts of Air Pollution in Canada: Estimates of morbidity and premature mortality outcomes. 2021: 20-21. https://www.canada.ca/content/dam/hc-sc/documents/services/publications/healthy-living/2021-health-effects-indoor-air-pollution/hia-report-eng.pdf

21. Ontario Ministry of the Environment. Air Quality in Ontario: Ground-level ozone. 2017. https://www.ontario.ca/document/air-quality-ontario-2017-report/ground-level-ozone

22. Ontario Ministry of the Environment. Air Quality in Ontario: Key air contaminants. 2020. https://www.ontario.ca/document/air-quality-ontario-2020-report/key-air-contaminants#section-0

23. Fu P, Guo X, Cheung FM, Yung KK. The association between PM2. 5 exposure and neurological disorders: a systematic review and meta-analysis. Science of the Total Environment. 2019 Mar 10;655:1240-8. https://doi.org/10.1016/j.scitotenv.2018.11.218

24. Chen H, Burnett RT, Kwong JC, Villeneuve PJ, Goldberg MS, Brook RD, van Donkelaar A, Jerrett M, Martin RV, Brook JR, Copes R. Risk of incident diabetes in relation to long-term exposure to fine particulate matter in Ontario, Canada. Environmental health perspectives. 2013 Jul;121(7):804-10. https://doi.org/10.1289/ehp.1205958

25. Gough W, Anderson V, & Herod K. Ontario Climate Change and Health Modelling Study. 2016. https://www.health.gov.on.ca/en/common/ministry/publications/reports/climate_change_toolkit/climate_change_health_modelling_study.pdf

26. Gao Y, Huang W, Yu P, Xu R, Yang Z, Gasevic D, Ye T, Guo Y, Li S. Long-term impacts of non-occupational wildfire exposure on human health: A systematic review. Environmental Pollution. 2023 Jan 10:121041. https://doi-org.proxy.lib.uwaterloo.ca/10.1016/j.envpol.2023.121041

27. Berry P, Clarke K, Fleury MD, and Parker S. Human Health in Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, 2014: 191-232. https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter7-Human-Health_Eng.pdf

28. Environment and Natural Resources Canada. UV index and sun safety. 2021 Nov 25. https://www.canada.ca/en/environment-climate-change/services/weather-health/uv-index-sun-safety.html

29. D'Orazio J, Jarrett S, Amaro-Ortiz A, Scott T. UV radiation and the skin. International journal of molecular sciences. 2013 Jun 7;14(6):12222-48. https://doi.org/10.3390/ijms140612222

30. Environment and Natural Resources Canada. UV and the ozone layer. 2018 Sep 11. https://www.canada.ca/en/environment-climate-change/services/weather-health/uv-index-sun-safety/ozone-layer.html

31. Cancer Council WA. Skin cancer and outdoor work. A work health and safety guide. 2019. https://cancerwa.asn.au/wp-content/uploads/2022/07/2019-12-13-skin-cancer-and-outdoor-work.pdf

32. Health Canada. Ultraviolet radiation. 2019 Oct 29. https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/types-sources/ultraviolet.html

33. Barnes PW, Williamson CE, Lucas RM, Robinson SA, Madronich S, Paul ND, Bornman JF, Bais AF, Sulzberger B, Wilson SR, Andrady AL. Ozone depletion, ultraviolet radiation, climate change and prospects for a sustainable future. Nature Sustainability. 2019 Jul;2(7):569-79. https://doi.org/10.1038/s41893-019-0314-2

34. Barnes PW, Robson TM, Neale PJ, Williamson CE, Zepp RG, Madronich S, Wilson SR, Andrady AL, Heikkilä AM, Bernhard GH, Bais AF. Environmental effects of stratospheric ozone depletion, UV radiation, and interactions with climate change: UNEP Environmental Effects Assessment Panel, Update 2021. Photochemical & Photobiological Sciences. 2022 Mar;21(3):275-301. https://doi.org/10.1007/s43630-022-00176-5

35. Bernhard GH, Bais AF, Aucamp PJ, Klekociuk AR, Liley JB, McKenzie RL. Stratospheric ozone, UV radiation, and climate interactions. Photochemical & Photobiological Sciences. 2023 Apr 21:1-53. https://doi.org/10.1007/s43630-023-00371-y

36. Lamy K, Portafaix T, Josse B, Brogniez C, Godin-Beekmann S, Bencherif H, Revell L, Akiyoshi H, Bekki S, Hegglin MI, Jöckel P. Clear-sky ultraviolet radiation modelling using output from the Chemistry Climate Model Initiative. Atmospheric Chemistry and Physics. 2019 Aug 12;19(15):10087-110. https://doi.org/10.5194/acp-19-10087-2019

37. Bais AF, Bernhard G, McKenzie RL, Aucamp PJ, Young PJ, Ilyas M, Jöckel P, Deushi M. Ozone–climate interactions and effects on solar ultraviolet radiation. Photochemical & Photobiological Sciences. 2019;18(3):602-40. https://doi.org/10.1039/c8pp90059k

CEO REPORT

Open Session

MEETING DATE:	October 26, 2023
SUBMITTED BY:	Cynthia St. John, Chief Executive Officer (written as of October 19, 2023)
SUBMITTED TO:	Board of Health
PURPOSE:	☒ Decision ☐ Discussion ☒ Receive and File
AGENDA ITEM #	5.3
RESOLUTION #	2023-BOH-1026-5.3

1.0 PROGRAM UPDATES (RECEIVE AND FILE):

1.1 ORAL HEALTH

Dental screening and surveillance will start mid-October this year for the 2023-24 school year. Student demographic data for the 2023-2024 school year has been received from the school boards and private schools and Oral Health staff have been contacting both publicly funded and private schools to schedule their visits.

A dental screening is a short assessment by a dental hygienist that can indicate the need for dental care (however, oral screening is not a replacement for a complete dental examination conducted by a regulated dental professional). Dental screening and surveillance will be provided to all students in Junior Kindergarten, Senior Kindergarten, Grade 2, and Grade 7 (and potentially Grade 4 if necessary, depending on the risk level of the Grade 2 students).

New dental screening and surveillance resources have been developed and co-branded for both Southwestern Public Health (SWPH) and the Middlesex London Health Unit (MLHU). All students attending elementary schools in the Thames Valley District School Board area, the London District Catholic School Board area, and private schools who receive a dental screening will receive similar resources from their local public health unit. These resources include a dental screening announcement, a dental screening report card, and a “sorry we missed you” notification for those that may be absent on the day of dental screening.

1.3. VACCINE PREVENTABLE DISEASES

1.3.1 Fall Vaccination Update

With rising cases and outbreaks of respiratory illness, residents of Oxford, Elgin and the City of St. Thomas are encouraged to seek out publicly funded vaccinations when they become eligible.

Influenza vaccine is currently available in local pharmacies and health care providers for individuals at high risk of infection as prescribed by the Ministry of Health. SWPH has appointments available for children ages 5 years of age and younger (and their families) via appointment on our website. Influenza vaccine will be available to the general public beginning in November through local health care providers and pharmacies.

The new RSV vaccine, Arexvy®, has arrived in very small quantities at public health units in Ontario. This vaccine will only be publicly funded for residents of long-term care homes and retirement homes with dementia care units while select pharmacies will be providing this vaccine for private pay when prescribed by a health care provider. The preliminary cost estimates for the private pay vaccine are estimated to be $270-$300 per dose.

During the week of October 11th, Covid clinics started at SWPH's St. Thomas office (1230 Talbot Street, St. Thomas) and SWPH's Woodstock office (410 Buller, Woodstock) for individuals who met high-risk eligibility as prescribed by the Ministry of Health. Appointments remain available through the Ministry of Health's Provincial Vaccine Booking line by phone (1-833-943-3900) or online at www.ontario.ca/page/covid-19-vaccines. We will continue to monitor the uptake and demand for bookings to determine the length of time that SWPH will offer clinics at these locations. Moderna XBB 1.5 vaccine is currently available at the time of writing of this report with Pfizer XBB 1.5 vaccine expected in larger quantities during the week of October 16th or later to Public Health Units and local community pharmacies.

Cases and hospitalizations have been increasing – the investigation of hospitalized cases has been instrumental in identifying outbreaks that had not yet been reported to public health. For those without access to diagnostic polymerase chain reaction (PCR) tests, rapid antigen test (RAT) distribution is underway, wherein residents can pick up free rapid antigen tests at our local public health unit offices as well as the following local library locations:

- St Thomas library
- Dutton library
- Woodstock Public Library
- All Oxford County library branches

1.3.2 Infectious Diseases

Institutional outbreaks have been steadily increasing since September with the primary pathogen being identified as Covid-19. A program planner is reviewing our internal data tracking for outbreaks to identify methods for meaningful internal reporting of outbreak data.

Communications and resources have been provided to long-term care, retirement homes and congregate settings about outbreak identification and management for the upcoming respiratory virus season. These resources have been posted on the SWPH website. Staff and

resident immunization for influenza and Covid-19 is being promoted as a primary infection prevention and control measure.

2.0 CEO UPDATES FROM THE FIELD (RECEIVE AND FILE):

2.1 STRENGTHENING PUBLIC HEALTH (FOR INFORMATION)

The Ministry of Health has recently formed a Voluntary Merger Key Informant Group (VMKIG) and I was asked to participate as a member. Comprised of leaders from various local health agencies and associations (such as the Association of Local Public Health Agencies (alPHa) and Association of Municipalities of Ontario (AMO)), this temporary group was created to offer guidance on the voluntary merger process that the Ministry of Health is designing.

2.2 ALPHA'S FALL SYMPOSIUM: NOVEMBER 22-24, 2023

The Fall Symposium held by alPHa in November will be a timely event given the ongoing conversations related to public health's role and future in the province's health system. I encourage any interested Board member to attend this virtual conference; kindly reach out and our team will be happy to register you. I will note that I was asked and have accepted an invitation to speak at this conference, providing reflections on SWPH's 2018 merger experience and learnings.

3.0 GOVERNANCE MATTERS (RECEIVE AND FILE):

3.1 OFFICIAL CONFIRMATION OF DAVIN SHINEDLING (FOR INFORMATION)

In follow-up to the email notification provided by the Public Appointee Secretariat of Davin Shinedling's appointment to SWPH's Board of Health, I am pleased to note that we have received official notice of his Order in Council appointment.

As directed by the Board earlier this year, I have continued to inquire as to the status of the two remaining Order in Council appointment renewals. On the Board's behalf, I did reach out to MPP Rob Flack to request an expeditious reply given both Lee Rowden and David Warden's appointments expire later this year and I have not received a reply at this time.

MOTION: 2023-BOH-1026-5.3
That the Board of Health for Southwestern Public Health accept the Chief Executive Officer's Report for October 26, 2023.

Ministry of Health

Office of the Deputy Premier
and Minister of Health

777 Bay Street, 5th Floor
Toronto ON M7A 1N3
Telephone: 416 327-4300
www.ontario.ca/health

Ministère de la Santé

Bureau du vice-premier ministre
et du ministre de la Santé

777, rue Bay, 5e étage
Toronto ON M7A 1N3
Téléphone: 416 327-4300
www.ontario.ca/sante

Ontario

September 26, 2023

Davin Shinedling
18 Sifton Drive
St. Thomas ON N5R 6C6

Dear Davin Shinedling:

Congratulations on your appointment to the Board of Health for the Oxford Elgin St. Thomas Health Unit. I am very pleased that you have taken on this important responsibility.

As serving the people of Ontario is an honour and a privilege, I know you will be committed to the principles and values of public service and I am confident you will perform your duty with integrity.

I have enclosed a copy of the Order in Council which was approved on August 17, 2023, appointing you for the period August 17, 2023 until August 16, 2024.

Again, please accept my congratulations on your appointment. I am confident you will find this experience both interesting and rewarding.

Sincerely,

Sylvia Jones
Deputy Premier and Minister of Health

c: Medical Officer of Health
The Honourable Rob Flack, MPP

Ontario

Executive Council of Ontario
Order in Council

On the recommendation of the undersigned, the Lieutenant Governor of Ontario, by and with the advice and concurrence of the Executive Council of Ontario, orders that:

Conseil exécutif de l'Ontario
Décret

Sur la recommandation de la personne soussignée, le lieutenant-gouverneur de l'Ontario, sur l'avis et avec le consentement du Conseil exécutif de l'Ontario, décrète ce qui suit :

PURSUANT TO subsections 49(3) and 51(1) of the *Health Protection and Promotion Act*, **Davin Shinedling** of St. Thomas be appointed as a part-time member of the Board of Health for the Oxford Elgin St. Thomas Health Unit to serve at the pleasure of the Lieutenant Governor in Council for a period not exceeding one year, effective the date this Order in Council is made.

EN VERTU DES paragraphes 49 (3) et 51 (1) de la *Loi sur la protection et la promotion de la santé*, **Davin Shinedling** de St. Thomas est nommé au poste de membre à temps partiel du conseil de santé de la circonscription sanitaire d'Oxford-Elgin-St. Thomas pour exercer son mandat à titre amovible à la discrétion du lieutenant-gouverneur en conseil, pour une période maximale d'un an à compter du jour de la prise du présent décret.

Recommended: Minister of Health
Recommandé par : La ministre de la Santé

Concurred: Chair of Cabinet
Appuyé par : La présidence du Conseil des ministres

Approved and Ordered:
Approuvé et décrété le : AUG 17 2023

B Bowden

Lieutenant Governor
La lieutenante-gouverneure

O.C. | Décret : 1193 / 2023