Assessing perceptions of warming, cooling, and clean air spaces within the broader network of community supports in Waterloo Region: A qualitative study

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

I, Hateem Noor, authored Chapters 1, 2, 3 and 4 under the supervision of Dr. Warren Dodd. These chapters were prepared for this thesis and not for publication.

Dr. Warren Dodd is an Associate Professor at the University of Waterloo and the supervisor of this thesis and research project. He guided this research, co-facilitated the focus group, aided in participant recruitment, data collection, and has contributed to study design and reviewing and revising of the thesis.

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Abstract

Background: As extreme heat, cold, and poor air quality events increase in frequency, the need for appropriate climate change adaptation strategies continues to grow. One strategy is the Waterloo Region, Heat, Cold, and Air Quality network (WRHCAN), which is coordinated by Region of Waterloo Public Health (ROWPH) and includes a network of organizations that offer warming, cooling, and clean air spaces. Waterloo Region also grapples with intersecting issues such as, the housing crisis, unregulated substance use, and demographic shifts that impact the delivery of warming, cooling, and clean air spaces. As such, this study explored the following research question: How do intersecting social and structural issues influence the operations of warming, cooling, and clean air spaces and other community supports in Waterloo Region? Specifically, the study examined: 1) network members' perceptions surrounding the structural factors that influence the operations of warming, cooling, and clean air spaces in Waterloo Region; and 2) network members perceptions on the relationship between warming, cooling, and clean air spaces and other community supports available in Waterloo Region.

Methods: This research was guided by an existing partnership with ROWPH and follows a case study design. Semi-structured interviews (n=13) were conducted with WRHCAN members, with two additional follow up interviews. To triangulate data, focus groups with ROWPH staff members were conducted and fieldnotes were taken at an in-person WRHCAN meeting to gain a contextual understanding on how the network operates. Interview data was transcribed using a naturalized transcription approach and thematically analyzed using a deductive approach.

Results: The WRHCAN provides valuable coordination of warming, cooling, and clean air spaces in Waterloo Region, and resource sharing between various organizations. However, operations of warming, cooling, and clean air spaces is impacted by structural issues such as the housing crisis, unregulated substance use, and rapid demographic shifts in Waterloo Region. Furthermore, the study identified warming, cooling, and clean air spaces as entities in Waterloo Region that exist among a broader system of existing supports tailored to different populations such as people experiencing homelessness, people with substance use and mental health concerns, older adults, and newcomers. Warming, cooling, and clean air spaces provide temporary relief from extreme temperature and poor air quality events. These spaces may contribute to, but are not a solution for, broader systems-level challenges in Waterloo Region.

Contributions: This study was completed at a time where Southern Ontario is facing record high temperatures and frequent poor air quality days, underscoring the need for suitable extreme temperature and poor air quality related adaptation strategies. Findings will contribute to scholarly knowledge in strengthening local and regional health and social service systems and current climate change adaptation strategies. Importantly, examining operations of warming, cooling, and clean air spaces uncovers localized structural issues. Analyzing these issues makes it possible to better meet the needs of individuals disproportionately impacted by extreme temperature and poor air quality events.

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Chapter 1: Introduction

1.1 Overview of Extreme Temperature and Poor Air Quality Events

As climate change intensifies, it will create widespread challenges, including more frequent and severe extreme temperature and poor air quality events. Global temperatures have increased over the last decade, and current climate projections indicate that this trend will persist (A. Y. Chang et al., 2022). Extreme temperature events can result in periods of extreme heat or extreme cold, classified by reaching specific threshold temperatures. In Canada, extreme heat events occur when daily temperature reach minimum thresholds for two or more days, classifying them as heatwaves. Often these events include levels of high humidity and stagnant air mass (Government of Canada, 2026b; Luber & McGeehin, 2008). Environment and Climate Change Canada (ECCC) sends heat alert warnings when temperatures reach 25 °C or higher so that people may appropriately prepare for extreme heat events (Government of Canada, 2026b). Moreover, extreme heat events compound poor air quality issues, a trend reflected in the growing frequency of poor air quality events in recent years (Horton et al., 2016). Depending on the province or territory, warnings are communicated by local, provincial or territorial health authorities (Goulding & Loftus, 2025). Additionally, cold warnings are also issued by ECCC and vary by region. In Canada, winter daytime temperatures typically range from 4 °C to -15 °C, with some northern or interior regions dropping as low as -30 °C to -40 °C (Government of Canada, 2026a).

1.1.1 Health Impacts of Extreme Temperature and Poor Air Quality Events

Aside from their effects on the broader environment, extreme temperature and poor air quality events tremendously affect human health. For instance, short term impacts of extreme heat include dizziness, muscle cramps, dehydration, fever, heat rashes, heat exhaustion and heatstroke, some of which can be fatal if not mitigated (A. Y. Chang et al., 2022; Heal & Park, 2016). Long term exposure to heat can result in cardiovascular, respiratory, and cerebrovascular disease, which is positively correlated with increased mortality rates that are seen amid extreme heat events (Akhanemhe et al., 2025; Taing & Mahadeo, 2021). Effects of extreme cold include an increased risk of frostbite, hypothermia, and respiratory illnesses such as Chronic Obstructive Pulmonary Disease (COPD). Poor air quality events also increase the risk of respiratory diseases such as asthma, lung infections, COPD, and lung cancer (Berg et al., 2023; Tran et al., 2023).

Older adults, newcomers, people experiencing homelessness, people with mental health concerns, and people with substance use concerns are populations that are more susceptible to the impacts of extreme temperature and poor air quality events (A. Y. Chang et al., 2022; Government of Canada, 2026b; Zivin & Shrader, 2016). Older adults are one of the most at-risk groups as they face a higher mortality risk and face higher rates of cardiovascular and respiratory disease (Heal & Park, 2016; Zivin & Shrader, 2016). Older adults are also more at risk for heat related illness and hospitalization such as heat exhaustion, heat stroke and heat syncope. Coupled with

preexisting chronic conditions, the risk of heat related illness in older adults is further amplified. Moreover, older adults have different thermoregulatory pathways that may negatively impact them during extreme heat and cold events. (A. Y. Chang et al., 2022).

Newcomers also face a variety of social barriers during extreme temperature and poor air quality events. Literature on newcomer experiences with extreme temperature and poor air quality are usually amplified by preexisting social conditions or health impacts (Varickanickal & Newbold, 2021). For example, newcomers often live in overcrowded urban conditions, increasing their risk to extreme temperature related illnesses. Furthermore, discriminatory experiences, language barriers, low socioeconomic conditions, and pre-existing mental health and physical health conditions are all compounding stressors that increase their susceptibility to health impacts associated with extreme temperature and poor air quality events (Macdonald et al., 2020; Oghenechovwen, 2025; Varickanickal & Newbold, 2021). To add, many climate action plans and disaster preparedness assume a baseline of familiarity with various community supports. However, newcomers often do not possess knowledge on these supports and specific climate hazards associated with the region they have immigrated to, further increasing their risk of health impacts during extreme temperature and poor air quality events (Oghenechovwen, 2025).

Emerging literature continues to highlight that people experiencing homelessness and those with precarious housing status are a priority population amid extreme temperature and poor air quality events. They are consistently exposed to extreme weather conditions such as heatwaves, extreme cold, and poor air quality while struggling with limited resources and shelter (Akhanemhe et al., 2025). Compared to the general population, people experiencing homelessness face prolonged exposure to the cold as they are often outside or in areas with little to no heat. People experiencing homelessness are also at a greater risk for hypothermic injury due to cold exposure and face compounded risk of illness and death as they are more at risk for comorbidities. Similarly, prolonged outdoor exposure to heat has negative health consequences such as heat stroke, cardiovascular impacts and in extreme cases, death. Heat related morbidity and mortality are common in this group which are further exacerbated by concurrent mental health and substance use concerns (Yoon, Tetzlaff, et al., 2025).

Extreme temperature and poor air quality events also increase the severity of mental health disorders such as PTSD, anxiety, depression and substance misuse (Olayinka & Alemu, 2023). Evidence suggests that people with preexisting mental health disorders are more susceptible to health impacts associated with extreme temperature and poor air quality events. Often, psychiatric medications such as selective serotonin reuptake inhibitors affect thermoregulation and functional impairment that may affect one's ability to cope during these events (Meadows et al., 2024; Ryus & Bernstein, 2022). For instance, Lee and colleagues (2023) explored the 2021 Western North American heat dome and its effect on people with existing chronic conditions. Researchers found the chronic condition most associated with heat-related mortality was schizophrenia (Lee et al., 2023; Yoon, Tetzlaff, et al., 2025). This may be due to symptoms like delusions and a lack of self-awareness commonly experienced by people with schizophrenia (Yoon, Tetzlaff, et al., 2025).

Co-occurring mental health and substance use concerns are common (Ryus & Bernstein, 2022; Yoon, Tetzlaff, et al., 2025). Individuals with substance use concerns often experience reduced responsiveness, drowsiness, lethargy, and impaired awareness (Ryus & Bernstein, 2022). Substance use and extreme heat events contribute to lethargy and an altered mental status that hinder one's ability to remove themselves from hazardous situations. As such, heat exposure and substance use act together to increase morbidity and mortality (Ryus & Bernstein, 2022). Similarly, during an extreme cold event, people with substance use concerns experience impaired judgement and cannot sense cold exposure. This increases the risk of hyperthermia, frostbite, and overdoses (Jhang et al., 2025; Ontario Harm Reduction Distribution Program, 2024).

Climate change adaptation strategies must account for communities facing intersecting issues, such as demographic shifts in aging and newcomer populations, homelessness, substance use, and increased mental health concerns. As these factors occur in tandem, the adverse impacts of extreme temperature and poor air quality events will manifest differently depending on each community's unique profile. As such, it is necessary to consider how intersecting issues impact the use of extreme temperature and poor air quality event related adaptation strategies (Benevolenza & DeRigne, 2019; Kehler & Birchall, 2021).

1.2 Structural Realities and Intersecting Support Needs

Beyond the impacts of extreme temperature and poor air quality events, communities may be facing multiple, intersecting issues simultaneously. Economic crises, housing precarity, climactic risks, and social and structural marginalization are all examples of challenges that may intersect, and require a multi-stakeholder approach to tackle them (Z. Khan et al., 2024; Moore et al., 2021). These challenges span macro level global shifts and climactic events such as extreme temperature and poor air quality events, meso-level community supports and policies, and micro-level individual stressors which all interact with one another in a complex way (Steinfield & Holt, 2020). This study utilizes the socioecological model to analyze how intersecting support needs interact across individual, interpersonal, community, and structural levels, providing a comprehensive lens to examine extreme temperature and poor air quality event related supports.

1.2.1 Homelessness in Canada and Specific Communities

Homelessness has been a growing challenge across Canada over the last 40 years, and continues to intensify (A. Smith & Kopec, 2023). Coupled with overlapping issues spanning macro, meso, and micro level components, homelessness and housing insecurity continues to shape the Canadian landscape. Emergency shelters across Canada are consistently under pressure. Annually, nearly 235,000 Canadians experience homelessness and those using emergency housing shelters ranges from 150,000 to 300,000. However, these numbers most likely underscore the amount of Canadians experiencing homelessness at a given time (Housing, Infrastructure and Communities Canada, 2023; Raphael, 2025). Strategies to tackle issues of homelessness include the National Housing Strategy, supported by Reaching Home which aims to reduce homelessness, nationally, by 50% by 2027. National homelessness strategies also work alongside provincial and

territorial investments such as Ontario's Homelessness Prevention Program, and region specific community based supports to increase homelessness support (Housing, Infrastructure and Communities Canada, 2023; Ontario Ministry of Municipal Affairs and Housing, 2025).

In 2024, 72 communities across Canada participated in Canada's fourth annual Point-in-Time (PiT) Count of Homelessness (Housing, Infrastructure and Communities Canada, 2025). Of those, 72 communities, Waterloo Region also participated. Importantly, a PiT count is the current standard to gain data on people experiencing homelessness. Point-in-Time count survey data is a single-night snapshot obtained by interviewing individuals experiencing homelessness. These surveys allow governments to understand the extent of people experiencing homelessness in a particular region (Schneider et al., 2016). The PiT count in Waterloo Region, conducted in October 2024, identified 2,371 people experiencing homelessness. Conducted surveys also indicated the top five reasons for experiencing homelessness were: not enough income for housing, spousal conflict, landlord conflicts, unsafe housing, and substance use issues (Region of Waterloo, 2024). Overall, homelessness continues to be a national problem but should also be tackled with region and community specific contexts in mind. Researchers continue to emphasize that experiences of homelessness can be shaped by macro-level policy contexts and micro-level community determinants (Baggett & Gaeta, 2021; T. Byrne et al., 2013).

1.2.2 Overlapping Substance Use and Mental Health Concerns

Nationally, one in five Canadians experiences a mental illness yearly. The Canadian Mental Health Association (CMHA) also reports that 20% of people who have a mental illness also have a co-occurring substance use disorder. Correspondingly, people who have a substance use disorder are three times more likely to develop a mental illness (Canadian Public Health Association, 2025; Centre for Addiction and Mental Health, 2019). Concurrent substance use and mental health concerns can occur for a number reasons including genetic predisposition to mental health and substance use disorders, environmental risk factors, psychological risk factors such as previous trauma, and social and structural determinants such as low socioeconomic status (Hendershot & Le Foll, 2025; L. L. Smith et al., 2017). Scholars argue best practice for treating concurrent mental illness and substance use disorders is an integrated strategy wherein both issues are given equal significance (Hendershot & Le Foll, 2025; McKee, 2017). Barriers to accessing integrated care for concurrent mental health and substance use disorders include the siloed nature in which they are addressed driven by separate treatment approaches, different funding streams, and fragmented professional training (McKee, 2017). Furthermore, social and structural determinants such as socioeconomic status and experiences of stigma further compound these challenges in accessing mental health and substance use related supports (Canadian Institute for Health Information, 2026b; Centre for Addiction and Mental Health, 2019; McKee, 2017).

In addition, several communities across Canada are facing high numbers of drug overdose related deaths (Xavier et al., 2025). Overdose related deaths can be attributed to unregulated substance supply which is unknown in type and quantity (Biggar et al., 2021). Opioid overdose

related deaths is an example of unregulated substance use across many jurisdictions in Canada and continues to exacerbate existing challenges related to mental health and substance use disorders. From January 2016 to December 2025, over 55,000 opioid related deaths were reported, with over 50,000 opioid related hospitalizations (Special Advisory Committee on the Epidemic of Opioid Overdoses, 2026). Although, statistics show that reports of opioid related burden is highest in British Columbia, Alberta, Yukon, and The Northwest Territories, each province and region specific policy landscape also greatly impacts the barriers to accessing substance use overdose related supports (Ali, Sprakes, et al., 2025; Belzak & Halverson, 2018; Schmidt et al., 2025). For example, Ontario, along with British Columbia was one of the first provinces to introduce supervised consumption sites wherein individuals have a safe place to use drugs, a strategy initially created to address unregulated drug related toxicity and deaths. Due to changing provincial policies and federal funding cuts, many of Ontario's supervised consumption sites were forced to close. In their place, the Provincial government has placed 27 Homelessness and Addiction Recovery Treatment (HART) Hubs which do not include harm reduction supports such as safer supply programs, supervised consumption services, and needle and syringe programs (Ali, Russell, et al., 2025; Ali, Sprakes, et al., 2025). Safe opioid supply programs also connected individuals to complementary treatments and initiatives such opioid agonist treatments, housing-first initiatives, and social support services (Ali, Sprakes, et al., 2025). Ultimately, national trends surrounding concurrent disorders and escalating unregulated substance use cannot be understood in isolation from local conditions. However, these challenges are further complicated by intersecting issues alongside extreme temperature and poor air quality events that vary by community and point to conducting a deeper analysis on broader macro-level systemic alignments, institutional frameworks, and regional resources.

1.2.3 Demographic Shifts and Overlapping Support Needs in Canada and Waterloo

Nationally, Canada's older adult population is projected to grow by 68% over the next 20 years. At the provincial level, Ontario's older adult population is expected to grow at twice its current rate by 2037. Furthermore, older adults aged 75 or more will have doubled in the next 20 years (Canadian Institute for Health Information, 2026a; Statistics Canada, 2026a). Specifically, Waterloo Region is projected to have 1 in 4 people over the age of 65 by 2041 (Paul, 2025). Significant demographic changes like an aging population will create demand in some social, health, and public services driven by factors such as increased healthcare spending, changes in labour force participation, and increase in social programs for older adults (Jackson, 2017; Marier, 2021). However, each province treats aging in a way that aligns with their specific policies and mandates. For example, Nova Scotia's long-term care for older adults falls under the legislation of social services compared to Canada's other nine provinces in which it falls under the health department (Marier, 2021). An increase in immigration across Canada has also contributed to major demographic shifts in the Canadian landscape. Canadian census data from 2021 highlights that immigrants make up 23% of the Canadian population. Additionally, in 2026, Canada has already welcomed over 80,000 immigrants (Statistics Canada, 2026b, 2026c). Furthermore,

Canadian immigration patterns have changed in the last couple decades. A large portion of Canadian immigrants are racialized, first-generation immigrants. In 2021, 1 in 4 immigrants were from a racialized background (Statistics Canada, 2023). This is significant because immigrants from racialized backgrounds face barriers in integrating to new cultural and social norms, accessing social and health services, language barriers, discrimination and racism, and socioeconomic disadvantage (Karki et al., 2023; Krysa et al., 2019; Liu et al., 2026; Statistics Canada, 2023).

According to Census data, from 2016 to 2022, Waterloo Region's population has grown steadily at a rate of 2.4% and is home to over 145,000 immigrants (Petric et al., 2024; Statistics Canada, 2022; Waterloo Region Immigration Partnership., 2023). With increased immigration, local governments create policies and supports that aid immigrant integration and retention. In a systematic review focusing on 52 municipalities in Ontario, researchers found that supports for immigrants and newcomers ranged from employment support, business development support, educational support, and fostering a deeper understanding of the immigrant experience (Cleave et al., 2023). Waterloo Region also offers several supports to immigrants and newcomers such as settlement, legal, employment, language training, and housing services (Cleave et al., 2023; Immigration Waterloo Region, 2026). Several supports available to immigrants and newcomers across Ontario and Waterloo Region highlight that immigration is not a linear path; it requires effort from newcomers, policymakers, and local governments alike. Immigrants experience structural marginalization face compounding challenges such as language barriers, housing instability, and employment obstacles. These existing barriers are further amplified during extreme temperature and poor air quality events, making it increasingly difficult to seek emergency support and protect overall health (Cleave et al., 2023; Statistics Canada, 2026c). Ultimately, regional demographic shifts characterized by low birth rate, an aging population, and increased rising immigration into Canada dictate policies and supports for immigrant populations but should be considered alongside other regional issues.

1.2.4 Extreme Temperature and Poor Air Quality Events as a Compounding Stressor

A place is characterized largely by endogenous factors such as demographic factors, local issues, and local geography (Lede et al., 2021). As such, extreme temperature and poor air quality events response will be informed by interactions and responses between these factors. There is a considerable amount of literature on climate change as a compounding and interconnected stressor that exists across multiple conditions. Climate change researchers continue to emphasize that the impacts and responses of climactic risks such as extreme temperature and poor air quality events are heavily influenced by the environmental, social, and political landscape in which they occur (Lede et al., 2021; Leichenko & O'Brien, 2019; O'Brien et al., 2007). Furthermore, Lede and colleagues (2021) also outline that multiple societal stressors are deeply interconnected across spatial and temporal dimensions and should be analyzed accordingly even when researching specific place-based issues (Adger, 2010; Lede et al., 2021; O'Brien et al., 2009). Multiple research

studies globally and in the Canadian context have consistently found that climate change impacts such as extreme temperature and poor air quality events are ocurring in tandem with multiple social stressors. For example, Lede et al. (2021), Fawcett et al. (2018), and Huntington et al. (2019) research all found that climactic impacts on Inuit communities are shaped by their local and historical context. Although climate adaptation and mitigation strategies are essential, they must be applied in the context that the community is impacted by climate change stressors.

Similarly, Southern Ontario is facing record extreme heat, cold, and poor air quality days among other stressors several communities are facing. Ontario summers in recent years have been associated with increased rates of heat related illness and mortality and will continue to worsen by the mid-century. Most of those who experienced heat related illness and mortality were older adults, people living in low resource settings, and people with chronic health conditions (Behan, 2020; Ontario Agency for Health Protection and Promotion, 2023). Likewise, extreme cold events contributed to cold related injuries such as frostbite, and hypothermia, and mainly affected people experiencing homelessness, older adults, young children, and people with chronic health conditions (Government of Canada, 2026a; Public Health Agency of Canada, 2024). Poor air quality is also an issue that continues to impact people in Ontario. With an increase in wildfires, and air pollutants linked to air quality, fine particulate matter concentrations have exponentially increased in the last ten years. Improved air quality can decrease risk of heart disease, hospital visits, and contributes to overall health quality (Environment and Climate Change Canada, 2024b; Tran et al., 2023). Despite, extreme temperature and poor air quality events being a global problem, they are uniquely experienced by individuals and communities (Clarke et al., 2022; O'Brien et al., 2009). For example, Waterloo Region faces overlapping challenges, including rising homelessness, substance use and mental health concerns, and demographic shifts that rapidly alter the landscape of available local policies and supports.

1.3 Climate Action Plans and Policies Linked to Extreme Temperature and Poor Air Quality Events across Canada

Federal, provincial, regional, and municipal agencies across Canada utilize various strategies to mitigate the impacts of extreme temperature and poor air quality events. As such, Climate Action Plans (CAPs) are highly valuable because they outline adaptation strategies into concrete actions (Ghoneem, 2016). Since climate change is broad in nature, it requires collaboration across all orders of government which manifests as a nested framework where federal governing bodies supply baseline data and funding, provincial frameworks dictate regional mandates, and municipal agencies handle front line climate adaptation strategy implementation and management (Awuor et al., 2020; Ghoneem, 2016).

1.3.1 Federal Climate Adaptation Plans, Policies, and Strategies

Government Of Canada's Adaptation Action Plan and National Adaptation Strategy

The National Adaptation Strategy (NAS) outlines overarching national goals and targets related to climate change. Nested within the NAS, Government of Canada's Adaptation Action Plan (GOCAAP) provides specific federal actions to meet these goals (Environment and Climate Change Canada, 2024c). Climate change action requires a comprehensive strategy that considers various moving parts involved in climate adaptation strategies. As such, the NAS is centered around five interconnected systems impacted by climate change: Disaster Resilience; Health and Well-being; Nature and Biodiversity; Infrastructure; and Economy and Workers (Environment and Climate Change Canada, 2024c). Among these interconnected pillars, this thesis focuses on the Disaster Resilience and Health and Well-being pillars as it seeks to understand regional responses on the impacts of extreme temperature and poor air quality events. While these federal strategies set national goals, their application and success also rely on provincial and municipal level dissemination (Ghoneem, 2016).

Heat Alert and Response Systems

Specific responses tailored to extreme temperature and poor air quality events by the federal government include the Heat Alert and Response Systems (HARS) which is a federally developed toolkit that outlines a five-step response system to reducing heat related health risks: community mobilization and engagement; the alert protocol; the community response plan; the communication plan; the evaluation plan. First created in 2011 in collaboration with several communities across Canada, the HARS toolkit is consistently updated to respond to an increasing rate of heat events and to identify any gaps and barriers in response (Canadian Institutes of Health Research, 2024; Health Canada, 2024). In March 2025, the National Collaborating Centre of Environmental Health (NCCEH) released a document outlining key updates on the implementation of HARS across communities in Canada. Findings stated that barriers in effective HARS implementation included: funding shortages, staff turnover, language barriers and barriers accessing digital communication materials, lack of cooling spaces, unsafe housing, and data gaps on at-risk populations (Health Canada, 2024; Ontario Agency for Health Protection and Promotion, 2023). The HARS is a highly valuable tool as it provides guidance at the federal level but relies on provincial and regional contexts to disseminate plans, which is in line with current literature supporting the significance of local contexts in disseminating climate adaptation strategies.

Air Quality Health Index

Led by Environment and Climate Change Canada and Health Canada is the Air Quality Health Index (AQHI), a federally led strategy related to extreme temperature and poor air quality events. The AQHI is a scale that ranges from 1-10 and depicts a person's risk to air quality in the area and includes two benchmarks: one for the general population, and another for people at risk such as older adults, children, and people with health conditions (Environment and Climate Change Canada, 2024a). AQHI data is measured by calculating risk to common air pollutants such as ozone, particulate matter, and nitrogen dioxide (Environment and Climate Change Canada, 2024b, 2024a). With an increase in poor air quality days, indicators like the AQHI can be extremely

helpful for not only individuals but provincial and regional municipalities as well so they may mobilize climate adaptation strategies.

1.3.2 Provincial Climate Action Plans, Policies, and Strategies

Healthy Environments and Climate Change Guideline, 2018

Under provincial leadership, regional Public Health Units across Ontario are required to follow guidelines mandated by the province. In January of 2018, right before the Conservative Government came into office, Ontario released a mandate titled Healthy Environments and Climate Change Guideline (Awuor et al., 2020). Under the Ontario Public Health Standards, the Healthy Environments and Climate Change Guideline set baseline standards for local public health units and health boards to budling healthy environments and reduce peoples risks to environmental health risks including impacts of climate change. Overall, this guideline outlines three specific areas of guidelines that public health units must follow: Engaging Municipalities in Healthy Environment Strategies, Climate Change Adaptation, and Environmental Exposures (Ontario Ministry of Health, 2021; Ontario Ministry of Health and Long-Term Care, 2018).

Ontario Provincial Climate Change Impact Assessment, 2023

In 2023, the Government of Ontario released a technical report outlining how Ontario will continue to be impacted by climate change. The report also considers unique local contexts, geographies, economies, and communities that shape various regions in Ontario. The Provincial Climate Change Impact Assessment (PCCIA) is highly comprehensive and analyzes the impacts that climate change will have on numerous societal components such as economy, infrastructure, public health and safety, and ecosystems (Ontario Ministry of the Environment, 2023). The PCCIA is rooted in evidence and data and is used by public health units across Ontario in climate adaptation strategies. With over 3400 risk scenarios mapped within the PCCIA, it is a comprehensive tool that communities across Ontario can use. Importantly, the PCCIA outlines that extreme heat and other temperature related impacts are the most severe climate risks that Ontario faces (Climate Risk Institute., 2023; Ontario Ministry of the Environment, 2023). As such, adaptation strategies in response to extreme temperature and poor air quality events are essential.

Bill 5, Protect Ontario by Unleashing our Economy Act, 2025

Despite evidence outlined in the PCCIA on the significance of unique local contexts, and several bodies of evidence on overall climate impacts, in early 2025, the Ford Government passed Bill 5, Protect Ontario by Unleashing our Economy Act (Legislative Assembly of Ontario, 2025a). Bill 5 allowed for the stripping of environmental protections, repealing Ontario's Endangered Species Act, and introduced 'special economic zones,' which are areas where provincial and municipal bylaws can be bypassed to enhance industry development (Canadian Environmental Law Association, 2025). Bill 5 placed several endangered species at risk and allowed the cabinet to bypass environmental regulation. Bill 5 also allowed for the de-centralization of climate

accountability, leaving municipalities to navigate environmental risks independently (Borts-Kuperman, 2026; Canadian Environmental Law Association, 2025; Crawley, 2025; Sahota, 2025).

Bill 81, Ontario Climate Change Adaptation and Resilience Act, 2025

Explicitly citing evidence laid out in the PCCIA, Bill 81 aims to protect Ontarians from the impacts of climate change such as an increase in heatwaves and air pollution impacts. Bill 81 focuses on building and advancing adaptation and resilience strategies (Legislative Assembly of Ontario, 2025b). The *Ontario Climate Change Adaptation and Resilience Act* has four overarching sections: 1) The Strategic Action Plan which will include 55 actions to reduce impacts of climate change and increase housing, ecosystem, and infrastructure resilience; 2) Climate Adaptation Fund which will fund any climate specific adaptation strategies; 3) Ontario Climate Change Adaptation and Resilience Resource Centre will share information and data on climate change impacts and adaptation strategies; 4) Whole-of-government Adaptation Secretariat will coordinate climate adaptation strategies across relevant governing bodies (Legislative Assembly of Ontario, 2025b; Perry, 2025).While Bill 81 does not cite prior legislation, its introduction by opposing political MPPS may serve as a counterpoint to environmental deregulation caused by Bill 5 (Legislative Assembly of Ontario, 2025b; Sahota, 2025).

1.3.3 Municipal and Regional Climate Action Plans, Policies, and Strategies

Climate Change and Health Vulnerability Assessment

Guided by federal and provincial policy frameworks, municipal public health units are responsible for implementing and disseminating localized climate change action plans (Bassett & Shandas, 2010). To achieve this, regional municipalities across Ontario have developed localized adaptation strategies and community-specific climate health assessments. For instance, a collaborative Climate Health and Vulnerability Assessment was conducted for Waterloo Region, Wellington County, Dufferin County, and the City of Guelph that examined people's vulnerability to climactic risks. Furthermore, the report assesses how social determinants of health and intersecting health inequities interact with climactic events such as extreme temperature and poor air quality events. The report outlines severe impacts of extreme temperature and poor air quality events on community well-being, and also identifies current interventions led by local partners such as TransforWR Climate Action Strategy, Wellington County Climate Change Mitigation Plan, Dufferin County Flood Guidelines, and a network of Warming, Cooling, and Clean Air Places in Waterloo Region which serves as the central case study context for this thesis (Buse et al., 2022; Warming, Cooling, and Clean Air Spaces, 2022).

1.4 Overview of Warming, Cooling, and Clean Air (WCCA) Spaces

An emerging strategy to decrease the impacts of extreme temperature events such as extreme, heat, cold, and poor air quality, are warming and cooling centres. Warming or cooling centres are usually an indoor venue, open to the public that serve as a place of shelter from extreme heat or cold (Dearman et al., 2025). During extreme cold events, venues are warm, and during extreme

heat events, indoor venues are cool. Depending on the jurisdictions, these centres can also be utilized during poor air quality events (Warming, Cooling, and Clean Air Spaces, 2022). Aside from the physiological relief that warming and cooling centres provide, these indoor spaces also provide respite, safety, and social support to those that do not have resources such as at home air conditioning or central heat during extreme temperature and poor air quality events (Quick et al., 2023). Research conducted on warming and cooling spaces emphasize the need to account for marginalization and accessibility. Often, people who are most vulnerable to extreme temperature and poor air quality events face compounding challenges that may limit their access to warming, cooling, and clean air spaces.

A spatial analysis conducted on cooling spaces in highly urban cities such as Toronto, Montreal and Vancouver found that more than 50% of the population in all three locations had a cooling centre within a 15-minute walk. However, the study highlighted that cooling spaces were less accessible in more peripheral and suburban areas of each city (Quick et al., 2023). In addition, a review conducted on municipal warming and cooling spaces found that people experiencing homelessness face a variety of barriers in accessing these resources. Indoor spaces often enforce operational restrictions, such as strict curfews and prohibitions on pets or belonging (Gabbe et al., 2023; Trudeau et al., 2025). People experiencing homelessness may not be willing to part with their items and animals, limiting availability to warming, cooling, and clean air spaces. In addition, staff at warming, cooling, and clean air spaces may be untrained and lack the specific social and health knowledge needed to address the needs of people experiencing homelessness (English et al., 2025). Stigma is also a significant barrier in using services like warming, cooling, and clean air spaces. People experiencing homelessness may avoid warming and cooling spaces due to social stigma and fear of discrimination (Trudeau et al., 2025; Yoon, Belotti, et al., 2025). Similarly, this stigma extends to people with mental health and substance use concerns, underscoring the unequal access to warming, cooling, and clean air spaces among various populations (Trudeau et al., 2025).

Extreme temperature and poor air quality events also outline the need to better understand local needs alongside place-specific social and structural issues. A recent extreme cold event where temperatures dropped below -40 degrees in Regina highlighted the need for a robust plan to aid people experiencing homelessness during extreme temperature and poor air quality events (Kurz, 2025). For example, heated buses that the city provided were used by over 100 people over four nights. However, people experiencing homelessness in Regina has quadrupled since 2015 (Kurz, 2025). These climate change adaptation strategies outline the need for equitable warming, cooling, and clean air spaces that meet the increasing needs of the community. These measures do not exist in a vacuum; they must be understood within the unique social and structural landscape of each place. In Regina, the issue is not simply a lack of warming and cooling initiatives, but a broader societal issue. The number of people experiencing homelessness continues to rise, and this must be examined alongside efforts to expand access to warming and cooling spaces, further highlighting that local context matters.

It is important to understand specific populations needs when disseminating climate change adaptation strategies. Warming, cooling, and clean air spaces appear to be a promising climate change adaptation initiative that are situated within communities. (Dearman et al., 2025; Quick et al., 2023; Widerynski et al., 2017). Nonetheless, literature on warming, cooling, and clean air paces remains thin, specifically in non-urban areas (Nayak et al., 2019; Quick et al., 2023). Given that each region has its own local context, literature on the availability of warming, cooling, and clean air spaces offers valuable guidance. These findings can be adapted and implemented in other jurisdictions by informing and shaping local climate change adaptation strategies and improving community preparedness for extreme temperature and poor air quality events (Quick et al., 2023).

1.5 Case Study Context: Warming, Cooling, and Clean Air Spaces in Waterloo Region and Other Community Supports

Coordinated by the Region of Waterloo Public Health (ROWPH), the Waterloo Region Heat, Cold, and Air Quality Network (WRHCAN) is a collection of local partners in Waterloo Region that collaborate to mitigate health risks associated with extreme temperature and poor air quality events, through the operation of warming, cooling, and clean air spaces (Region of Waterloo, 2026b) Analyzing the perceptions of network members on the functions and operations of warming, cooling, and clean air spaces will be helpful in better understanding broader social and structural issues that can impact delivery of these spaces in Waterloo Region. The presence of intersecting issues in Waterloo Region such as people experiencing homelessness, mental health crises, substance use concerns, and demographic shifts contextualized Waterloo Region as an appropriate setting for this research study (Davis & Fletcher, 2025; Lee et al., 2023).

1.5.1 Waterloo Region-A Community with Diverse Supports

Waterloo Region is characteristic of a place with several community supports ranging from public, private, and non-profit sectors. This thesis will focus on operations of warming, cooling, and clean air spaces as a response to extreme temperature and poor air quality events. Similarly, Waterloo Region has supports for other issues happening in the region. For instance, Waterloo Region has shelter and transitional housing supports such as The Working Centre, Coalition of Muslim Women, and OneROOF youth services among many more (Centre for Mutual Wellbeing., 2026; oneROOF Youth Services, 2026; The Working Centre, 2026). Similarly, community supports for people with substance use and mental health concerns include House of Friendship, harm reduction services offered through the Region of Waterloo, and the Waterloo Region Health Network (House of Friendship, 2026; Waterloo Regional Health Network, 2026). Additionally, Waterloo Region also supports older adults through several community programming services, the Social Development Centre in Waterloo, and older adult specific mental health support through the Canadian Mental Health Association (Canadian Mental Health Association Waterloo Wellington, 2026; Social Development Centre Waterloo Region., 2026). Lastly, immigrants and newcomers are also offered a variety of supports ranging from English as a Second Language classes to housing support through Immigration Services Waterloo (Waterloo Region Immigration

Partnership, 2026). Notably, many of the community support organizations highlighted are also part of the Waterloo Region, Heat, Cold, And Network, highlighting the interconnected nature of community specific supports and warming, cooling, and clean air spaces. Many community support organizations overlap in the supports they provide. For instance, House of Friendship supports housing initiatives as well as substance use and mental health concerns as these issues often overlap. The purpose of outlining diverse supports available in Waterloo Region is to provide a snapshot of Waterloo Region as a place representative of many moving parts, intersecting issues and highlight the importance of existing community supports that act in congruence with broader issues such as extreme temperature and poor air quality events. The following subsections will delve into strategic frameworks Waterloo Region has in place to further contextualize its role as a case study for this thesis.

1.5.2 Waterloo Region Heat, Cold, and Air Quality Network (WRHCAN)

Coordinated by the Region of Waterloo Public Health, the Waterloo Region Heat, Cold, and Air Quality Network is a collection of local partners in the Region of Waterloo (RoW) that collaborate to mitigate health risks associated with extreme heat, cold and poor air quality. The Waterloo Region, Heat, Cold and Air Quality Network consists of partners who run warming, cooling and clean air (WCCA) spaces, as well as front line representatives who have direct contact with community members (Region of Waterloo, 2026b). The WRHCAN aims to promote resilience by appropriately preparing for extreme heat, cold and poor air quality, raise awareness through educating the larger community, and facilitating collaboration through network partners (Region of Waterloo, 2019). The network consists of numerous partners but vary in their level of participation. Some network partners offer municipal and regional government buildings, libraries, and community centres as warming, cooling and clean air spaces. Whilst, other network partners consist of front line representatives who work directly with community members in Waterloo Region (Region of Waterloo, 2026b). Within the network, ROWPH is responsible for overall coordination of the network by maintaining a list of partners, coordinating emergency response plans amid extreme temperature and poor air quality events, ensuring warming, cooling, and clean air space are up to date and sharing health information among network partners.

1.5.3 Implementation and Operations of Warming, Cooling, and Clean Air Spaces

Warming, cooling, and clean air spaces are pre-established indoor locations that exist in various locations across Waterloo Region where people can get temporary relief during an extreme temperature or poor air quality event. Network members who operate warming, cooling, and clean air spaces are encouraged to participate in knowledge exchange with other partners as well as the public, and develop communications and plans to enhance preparedness in the community during an extreme temperature or poor air quality event (Region of Waterloo, 2022). Region of Waterloo also maintains a list of active warming, cooling, and clean air spaces across all cities and townships on their website along with each spaces' operating hours (Region of Waterloo, 2026b). Furthermore, Region of Waterloo has a valuable interactive map of warming, cooling, and clean

air spaces on their website that allows community members to filter for their specific needs (ie., building type, water availability, hours of operation, and nearby bus stops) (Region of Waterloo, 2026b).

1.6 Strategic Frameworks in Waterloo Region

1.6.1 Strategic Housing Frameworks: The Plan to End Chronic Homelessness (PECH)

Alongside the operations of warming, cooling, and clean air spaces, there are several action plans and strategic frameworks tailored to other issues present in Waterloo Region. Published in April 2024, The Plan to End Chronic Homelessness outlines strategies to combat homelessness and housing insecurity in the region whilst considering the complexity and urgency of tackling homelessness. The Plan includes strategies, resources, and timelines on ending chronic homelessness in Waterloo Region, and emphasizes the importance of integrating peoples lived experience in creating this document. The Plan to End Chronic Homelessness outlines 30 concrete actions that should be taken in ending Waterloo Region's chronic homelessness problem. Of the 30 actions, PCEH considers overlapping mental health, substance use, and harm reduction supports. Similarly, the PCEH also outlines action tailored to older adults, and integrating newcomers in battling homelessness. Although briefly mentioned, this plan also recommends an extreme weather events protocol grounded in a human rights approach (Region of Waterloo, 2024). The Plan to End Chronic Homelessness highlights the interconnected nature of localized issues, and in result bring forth the multi-scalar approach they require.

1.6.2 Strategic Social Frameworks: The Community Safety and Wellbeing Plan (CSWP)

The Region of Waterloo's Community Safety and Wellbeing Plan recognizes the significance of taking a systems level approach in combatting several structural issues and requires collaboration across sectors, grassroots organizations, and local governing authorities. Furthermore, the CSWP highlights Waterloo Region as a diverse community with converging priorities that must be addressed concurrently. These priorities include housing costs, low-income communities and poverty, food insecurity, and rising rates of mental health and substance use concerns. The CSWP aims to enhance systemic collaboration with frontline agencies, healthcare providers, and municipal services. Upstream intervention is also a core priority of the CSWP as it aims to address underlying social determinants of health as social outcomes and not merely focus on acute crisis management (Region of Waterloo, 2026a).

1.6.3 Strategic Demographic Frameworks: Waterloo-Wellington Older Adult Strategy and Municipal Newcomer Strategies

Developed by the Research Institute on Aging, the Waterloo Wellington Older Adult Strategy outlines a ten-year strategic roadmap designed to transition regional care for older adults from a fragmented system into a preventative one that collaborates across sectors such as acute care

hospitals, outpatient services, primary care and community health teams, and municipal and social services. The strategy framework also outlines six overarching goals that address needs for individuals across their life course including integrated healthcare to achieve system capacity, empowerment of individuals, quality access to universal supports that are safe and person centered, and enhancing intersectoral collaboration. Rooted in a public health perspective, the Strategy Framework considers social determinants of health specific to older adults such as a sliding scale for services for low-income older adults (Research Institute for Aging, 2018).

To address demographic shifts related to immigration, The Waterloo Region Immigration Strategy is a three-year strategic action plan that aims to support immigrant and refugee integration, economic inclusion, and social wellbeing. Backed by federal funding and rooted in evidence, this is Waterloo Region's sixth iteration of its immigrant strategy where over 1,700 immigrants were interviewed alongside consultations with local partners to propose strategic framework goals. Waterloo Region's immigration strategy is centered around three pillars: Settle, which focuses on housing stability and supporting immigrants as they navigate systems and supports in the region; Work, which aids in skill development and connects individuals to workforce and employment supports; and belong, which focuses on empowering ethno-cultural groups and supporting federal, provincial, and municipal equity, diversity, and inclusion initiatives (Waterloo Region Immigration Partnership, 2025).

1.7 Socioecological Model and Intersecting Issues Amid Extreme Temperature and Air Quality Events

Understanding the broad scope of extreme temperature and poor air quality events in relation to warming, cooling, and clean air spaces requires a systems level approach. First developed by Urie Bronfenbrenner in the 1970's which was later developed as concrete theory in the 1980's, the socioecological model outlines that health is shaped by individual, community, and environment including physical, social, and political systems. Specifically, it views systems as interconnected and always interacting with one another. Many health authorities use this model to inform various health promotion interventions including serving as a theoretical framework for the previously mentioned Community Safety and Wellbeing Plan in Waterloo Region (Kilanowski, 2017; Region of Waterloo, 2026a; Wellington-Dufferin-Guelph Public Health, 2026). The socioecological model is also consistently used in climate change research and has now been trickling into climate change adaptation research as well (Bernhardt & Amiri, 2024a; Hossain et al., 2024; Pan et al., 2019). Hossain et al. (2024) outline that traditional adaptation models are too narrow and focus on climate change impacts in isolation. They argue that change in environmental conditions will create cascading impacts across social, economic, and institutional systems. Furthermore, their argument emphasizes the need to consider socioecological limitations to adaptation planning such as political governance, structural inequities, and localized contexts. Warming, cooling, and clean air spaces are vital adaptation strategies in response to the increasing frequency of extreme temperature and poor air quality events in Waterloo Region. Operating alongside other localized community initiatives, these spaces address distinct local needs. Using a case study approach, the

socioecological model allows each component of the intervention to be situated within its broader, nested context. Specifically, extreme temperature and poor air quality events are analyzed as part of the chronosystem, capturing temporal changes, while Waterloo Region provides the institutional exosystem framework, with warming, cooling, and clean air spaces existing as, microsystems or localized mesosystem environments for the community (Hossain et al., 2024; Kilanowski, 2017; Region of Waterloo, 2026b).

1.8 Study Purpose

Existing literature and localized examples such as Waterloo Region consistently highlight that extreme temperature and poor air quality events are not an isolated occurrence. Instead, they act as part of a network of issues that all interact with one another. Waterloo Region, for example, faces issues such as increasing rates of homelessness, overlapping mental health and substance use concerns, and major demographic shifts including an aging population and increase in immigrants and newcomers, all the while dealing with the impacts of extreme temperature and poor air quality events. However, Waterloo Region and its community also offer a variety of supports to tackle these issues. Supports often overlap because issues such as mental health, substance use, and homelessness impact individuals in congruence. Extreme temperature and poor air quality events are going to grow in frequency and will require comprehensive and interconnected adaptation strategies. However, adaptation strategies still only focus on these climactic issues as univariate events. Waterloo Region's warming, cooling, and clean air spaces are promising strategies to mitigate the health impacts of extreme temperature and poor air quality events, although, literature on their role in the broader structural systems of Waterloo Region remains thin. Representatives that are part of the WRHCAN held a unique viewpoint as some operate warming, cooling, and clean air spaces, and some interact with other network partners and have direct contact with community members. They are all deeply embedded within Waterloo Region's social, health and community services. As such, this study sought out to explore how intersecting social and structural issues influence the operations of warming, cooling, and clean air spaces in Waterloo Region. In particular, the study examined: 1) network members' perceptions surrounding the structural factors that influence the operations of warming, cooling, and clean air spaces in Waterloo Region; and 2) to examine perceptions about the relationship between warming, cooling, and clean air spaces and other community supports available in Waterloo Region.

Chapter 2: Methods

2.1 Ethics

Ethics approval for the proposed study was granted by the University of Waterloo Research and Ethics Board (Approval ID: 40729). Research participants were informed of ethical practices throughout the data collection process. Ethical considerations of anonymity, voluntary participation, privacy and confidentiality were upheld and explained to each participant (Nii Laryeafio & Ogbewe, 2023). Beyond procedural ethics, ethics in practice were also continuously reflected upon in the research process (Pollock, 2012; Shaw et al., 2020a). Furthermore, vulnerability is an important component of ethics research. Inherently, all participants are considered vulnerable due to existing power dynamics between the researcher and participants. However, some populations that have been historically marginalized are more prone to being misled or mistreated in research. As such, more ethical safeguards are required when conducting research directly with groups that are marginalized (Palmer, 2025; Shaw et al., 2020a). Although, I did not directly interview marginalized populations, study participants were individuals who worked directly with community members and often referenced these community members to be from marginalized populations. Questions asked during the interview process ranged from participant reflections on organizational strengths and limitations to participant perceptions on underserved communities. Participants who worked in municipal and governmental roles were hesitant to comment on aspects of the study that may allude to governmental limitations. This reflection is in line with Nani Jiwani & Krachenko's (2014) findings on internal dynamics in governmental organizations and a lack of openness due to the fear of losing one's job when discussing in their official capacities. Nonetheless, ethics in practice was important in these instances, and participants who expressed any concerns were reassured on all confidentiality practices and ethical guidelines, and information they did not want included in the study was omitted.

2.2 Study Location: Waterloo Region

The study took place in Waterloo Region, a mid-sized municipality in Southwestern Ontario which includes the following cities and townships: City of Cambridge, City of Kitchener, City of Waterloo, Township of North Dumfries, Township of Wellesley, Township of Wilmot, and Township of Woolwich (See Appendix A) (Region of Waterloo, 2022).

2.3 Recruitment

2.3.1 Region of Waterloo Public Health and Waterloo Region Heat, Cold, and Air Quality Network

The Region of Waterloo Public Health coordinates the Waterloo Region Heat, Cold and, Air Quality Network, a collection of local partners that aim to reduce health risks associated with extreme temperature events and poor air quality in Waterloo Region (Region of Waterloo, 2026b). WRHCAN members hold a unique and valuable perspective as they interact the most with

populations using warming, cooling, and clean air space. The Waterloo Region Heat, Cold, and Air Quality Network consists of partners from multiple sectors including the public and non-profit sector. Key organizations include, but are not limited to the following: Sanguen Health Centre, The Working Centre, The Salvation Army, Waterloo Region Police Service, Grand River Transit, Cambridge Public Library, and The Unsheltered Campaign (Region of Waterloo, 2026b). Importantly, perspectives from multiple sectors were an important component of this study as it created a holistic view on the diverse supports available in Waterloo Region, while simultaneously accounting for the social, economic, and political context in which the study took place (Pradier et al., 2023; Van Tulder et al., 2016).

2.3.2 Recruitment Strategy

An existing partnership with the Region of Waterloo supported the recruitment strategy. Rooted in trust and rapport, the research team's long-term partnership with ROWPH facilitated in a smooth and supportive research process. Furthermore, ROWPH involvement allowed for a wide range of perspectives, and a deeper understanding on organizational components which were attuned to Waterloo Regions local context. Established trust allowed for deeper, candid organizational analysis and contributed to the research team sharing research insights with ROWPH on an on-going basis (Kothari et al., 2011; Oliver et al., 2014; Vindrola-Padros et al., 2019). Specifically, staff at ROWPH acted as 'gatekeepers' to support recruitment. Gatekeepers are organizations or individuals commonly associated with research participants that control access to an institution (Manohar et al., 2018; Singh & Wassenaar, 2016). Collaboration with gatekeepers ensures autonomy of participating organizations and open conversations regarding access and ethical obligations from a trusted source (Singh & Wassenaar, 2016). Importantly, ROWPH's role was also strategic in nature as staff at ROWPH coordinate the WRHCAN and understood the time constraints that representatives from various organizations had. To avoid time sinks, their role as gatekeepers was beneficial (Manohar et al., 2018; Van Den Brink & Benschop, 2014).

As ROWPH coordinates the WRHCAN, the research team first conducted a focus group with ROWPH staff to gain context on WRHCAN operations, background, and context on the network. Focus groups also provide an opportunity to leverage group dynamics and allowed ROWPH staff to build upon their individual experiences in leading the WRHCAN and provide context on the WRHCAN since its conception (Chand, 2025). After the focus group in January 2025, recruitment began iteratively from February 2025 to May 2025. To begin recruitment, the research team shared a Qualtrics survey with ROWPH staff to share with WRHCAN members to gauge their interest in the research study (Singh & Wassenaar, 2016). Through the responses collected, the team individually emailed any network member that was interested in the research study. Approximately 40 network members were emailed details of the research study, to which we received 10 responses. As most WRHCAN members are busy and are part of the network in addition to their regular roles, targeted email recruitment was then used to facilitate the iterative recruitment process (Kegeles et al., 2005).

The research team was given access to current WRHCAN members contact information wherein the emailing list consisted of a variety of organizations which included community, municipal and regional, non-profit, social services, first responders, and health care organizations across Waterloo Region (Region of Waterloo, 2026b). The research team utilized this information to email organizations whose perspective would be beneficial to the study and to gain a more diverse viewpoint on the various sectors that are part of the WRHCAN. After sending out the Qualtrics link and conducting targeted email recruitment, network members were prompted to book an interview with myself or another graduate student researcher who supported data collection.

Challenges with participant recruitment encouraged the research team to be more critical and reflexive in our recruitment process and conduct targeted outreach. This strategy also allowed the research team to gain more rapport with participating organizations (Kegeles et al., 2005; Manohar et al., 2018; Negrin et al., 2022). One final strategy we employed was to recruit network members in person at the bi-annual WRHCAN meeting in early May 2025. The research team was also given the opportunity to present at this meeting on trends in data collection up to that point to encourage more network members to sign up for a semi-structured interview. In-person rapport and conversation was beneficial as it encouraged two more participants to sign up. In line with Negrin et al. (2022) findings, face to face interaction with participants allowed the research team to establish trust and rapport. In addition, research team participation in the bi-annual WRHCAN meeting provided an opportunity to note broader observations surrounding the functioning of the WRHCAN, which provide helpful context for subsequent data analysis (Negrin et al., 2022).

2.4 Positionality and Reflexivity

Subjectivity is an unchanging part of the research process and supports reflexivity in research (Marguin et al., 2021; Peshkin, 1988). Scholars outline three methods of reflexivity when engaging in qualitative research: researchers' subjectivity, perspectives shaped by a researchers social and biographical identity, and the relationship of power between participants and the researcher (Bourdieu & Nice, 2004; Marguin et al., 2021). With this knowledge, I sought to be reflexive by systematically seeking out subjectivity and continuously reflecting on my positionality throughout the research process (Bourdieu & Nice, 2004; Peshkin, 1988).

When commencing this research, I initially did not believe my personal identity influenced the way I viewed this study (Marguin et al., 2021). I did not grow up in the Waterloo Region; I only went to school here, an experience that was interrupted by the COVID-19 pandemic, much of which I spent at home. Initially, reflexivity and positionality were difficult to reflect on because I was not directly working with populations utilizing warming, cooling, and clean air spaces. However, reflections of power were consistently at the forefront of my mind (Merriam et al., 2001; Muhammad et al., 2015). As someone conducting research wherein homelessness was a common thematic element, I often thought of the concept of 'home' and my ability to stay 'home' during extreme temperature and poor air quality events. This comfort stood in sharp contrast to the data I

was analyzing, leading to a critical point of reflection. Reflections on power further enabled me to examine that I was conducting research where marginalized population such as those experiencing homelessness, those with substance use and mental health concerns, older adults, and newcomers are consistently referenced, despite not interacting with them at all throughout the research process. These reflections brought forth ideas of 'epistemic injustice' as coined by Miranda Fricker wherein marginalized populations are objects of study, and not active contributors to studies that concern them (Kidd et al., 2017; Okoroji et al., 2023).

To actively counter this dynamic during the preliminary phases (see Appendix B) of the research study (i.e., focus group and recruitment), I became highly aware of my social position in seeking out this research. My positionality as a Canadian student researcher working within academia influenced the way I engaged with this research, particularly as it sought out to represent and contribute to the experiences of populations navigating challenges related to extreme temperature and poor air quality events, housing precarity, mental health concerns, and substance use concerns in the Waterloo Region (Region of Waterloo, 2023; Shaw et al., 2020b).

This evolving awareness materialized later in the research study during the bi-annual WRHCAN meeting, and was the recognition of informal warming, cooling, and clean air spaces, such as shopping malls, as places of respite during extreme temperature and poor air quality events. This finding resonated with my own lived experience as an immigrant growing up in Canada, where shopping malls served as accessible spaces of comfort during periods of extreme heat and cold when my family lacked reliable air conditioning and heating. These reflections were critical as they further confirmed my interest in climate research and my intersecting identities that have allowed me to do so. As someone with a Pakistani background, I understand the profound impact climate change has in Pakistan. Due to its geographical location, Pakistan is especially vulnerable to climate change impacts driven by resource depletion, industrial development, and urbanization. Furthermore, Pakistan has a low adaptive capacity and is a low-income country wherein the most marginalized people are deeply impacted by climate change impacts such as floods and droughts (Fahad & Wang, 2020; M. A. Khan et al., 2016; Mohsin et al., 2025). Reflecting on my identity as a Pakistani Canadian researcher was important because I was faced with both my marginalized and privileged identities intersecting: on one hand, I have utilized informal warming, cooling, and clean air spaces in Canada, but only because I had the privilege of immigrating from Pakistan.

The climate crisis has also fundamentally changed the ways in which researchers view their research (Marguin et al., 2021). As Bourdieu highlighted, researchers can continuously be aware of their positionality which goes beyond perceived knowledge (Bourdieu, 2007). However, it is necessary to have an awareness of social systems in truly capturing reflexivity (Marguin et al., 2021). Rather than viewing myself as an outsider in accessing warming, cooling, and clean air spaces as tools to use during extreme temperature and poor air quality events, I was forced to place myself as someone who may use these services one day (Merriam et al., 2001). Reflecting on my own social position as a Canadian immigrant and climate change researcher allowed me to systematically approach data analysis, the final phase of the research process.

Themes identified during data analysis included strengths and limitations of the WRHCAN, interdisciplinary collaboration, and different populations utilizing these spaces. Exercising reflexivity in this phase was essential as reflecting on social systems urged me to view warming, cooling, and clean air spaces as entities in the larger Waterloo Region system and their interactions with other community supports. These reflections led me to conducting two follow-up interviews.

Although, my research questions specifically sought to examine perceptions of warming, cooling, and clean air spaces from WRHCAN members, these reflections enhanced reflexivity in my research as it allowed me to conceptualize climate health research as transcending spatial and temporal dimensions and part of a larger system of networks that are synergistically involved. Once I began viewing reflexivity as more than a methodological tool and placed it within the socio-political context of Waterloo Region, I conducted an even deeper analysis of my research (Von Unger, 2021). Notably, integration of the socio-ecological model aided in this process to analyze findings from a systems lens.

2.5 Theoretical Orientation

2.5.1 Applying the Socioecological Model as a Conceptual Framework

The socioecological model was used as the primary conceptual framework to support deductive data analysis, particularly to analyze network members perceptions of the role of warming, cooling, and clean air spaces in Waterloo Region (Bernhardt & Amiri, 2024b; Kilanowski, 2017). Nested circles in the socioecological model begin with the individual, followed by the mesosystem which is comprised of an in individual's social network. The next circle, the exosystem is made up of community, followed by the macrosystem which includes societal and cultural norms. The largest and final circle is the chronosystem which considers life transitions and major temporal events (Bernhardt & Amiri, 2024b; Bronfenbrenner, 1986).

Unlike traditional applications of socioecological theory that focus on individual behaviour within a broader system, this study employed the framework to examine how multiple, interrelated systems shape the availability and coordination of supports during extreme temperature and poor air quality events (Malakar et al., 2023). The socioecological model provided a lens to explore influences operating across multiple levels, including organizational, community, and policy contexts. Attention was paid to warming, cooling, and clean air spaces and their relationships with other community supports and services within the Waterloo Region. The chronosystem facilitated consideration of the broader temporal context in which these systems operate, including the ongoing housing crisis, unregulated substance use, demographic shifts, and the increasing frequency and intensity of extreme temperature and poor air quality events (Davis & Fletcher, 2025; Region of Waterloo, 2023, 2026b). Individual perceptions of warming, cooling, and clean air spaces and other community supports was also analyzed alongside interactions with other components of the socioecological model. By examining factors across multiple levels of influence, the socioecological model supported an analysis of how warming, cooling, and clean

air spaces are embedded within a broader network of community supports and how these systems interact to address extreme temperature and poor air quality events in Waterloo Region.

The socioecological model directly informed the study's qualitative case study design as they both emphasize exploring and understanding phenomena within systemic contexts (Njie & Asimiran, 2014; Schlüter et al., 2019). While the case study design explores warming, cooling, and clean air spaces within Waterloo Region, the socioecological model provides a structured, analytical framework required to unpack the complexities within that bounded system (Baškarada, 2014). Rather than treating Waterloo Region as a homogenous case, the integration of these two frameworks allowed for a contextualized analysis of how participants' perceptions, community networks, and overarching societal challenges intersect (Baškarada, 2014; Schlüter et al., 2019). Importantly, the levels of the socioecological model served as the operational framework for data analysis, ensuring that the final case synthesis captures not only the available community supports but also the structural and temporal dynamics that dictate their efficacy.

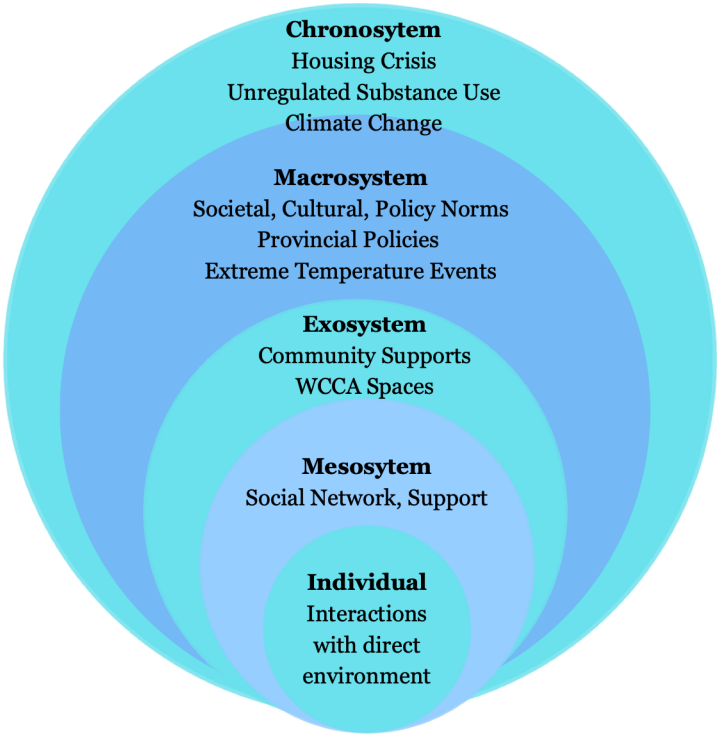


Figure 1: Socioecological Model in the Context of Waterloo Region

2.6 Methodology

2.6.1 Case Study

Community supports within Waterloo Region are shaped by the specific populations using these services. These populations include people experiencing homelessness, people with substance use and mental health concerns, older adults, and newcomers and immigrants. The study employed a case study design to examine participants' perceptions of warming, cooling, and clean air spaces in Waterloo Region. Case study methodology is advantageous as it provides a highly detailed account of a particular context and institutions (Njie & Asimiran, 2014). Case studies also allow a researcher to conduct an intensive analysis on a specific institution whilst contextualizing environmental, societal, and relational factors. One of case study design's main strengths is the researcher's ability to understand participants' experience from an in-depth socio-environmental context (Mitchell et al., 2015). Insights were not simply limited to the operations of warming, cooling, and clean air spaces, but the larger societal systems that affect them internally and externally (Dearman et al., 2025). The case study methodology's ability to consider the surrounding system of a specific context also aligns well with the socioecological framework that was used to guide data analysis as it allows the analysis of Waterloo region as web of interconnected systems (Kilanowski, 2017; Njie & Asimiran, 2014).

2.6.2 Applying Case Study Design

This study uses a case study design to analyze how warming, cooling, and clean air spaces function alongside intersecting societal, political, health, and economic issues in Waterloo Region. (Baškarada, 2014; Njie & Asimiran, 2014). Case study methodology answers "how" and "what" questions appropriately as these questions outlines processes, relationships, and connections between different systems and are not limited to frequencies, incidences, and raw data points (Baškarada, 2014; Yin, 2009). Through participant interviews, I gained insights on questions like "How do warming, cooling, and clean air spaces function as community supports within the broader network of social and health services available in Waterloo Region?", "In what ways do structural challenges shape the day-to-day operations of warming, cooling, and clean air spaces?", and "What has worked well, and what has been more challenging in understanding the role of warming, cooling, and clean air spaces among other social and health supports in Waterloo Region?." Asking questions of this nature placed warming, cooling, and clean air spaces in the specific Waterloo Region context (Baškarada, 2014; Yin, 2009).

2.7 Study Participants

Participants were recruited from an existing pool of network members who are part of the WRHCAN. Network representatives comprised of individuals from government organizations, first responders, community support organizations, and non-profit organizations (Region of Waterloo, 2026b). Not all network members operate warming, cooling, and clean air spaces. Despite not having an operational warming, cooling, and clean air space, these network members

were still interviewed as their reflections on warming, cooling, and clean air space operations and other community supports in Waterloo Region were valuable to achieving study objectives.

2.8 Research Design

The study utilized a one-on-one semi-structured interviews as the primary method of data collection to examine WRHCAN members perceptions on interactions between community supports and warming, cooling, and clean air spaces in Waterloo Region. While primary findings were drawn from interview data, focus group data and observations from the bi-annual, in person WRHCAN meeting provided contextual background. Additionally, these tools were also utilized to continuously refine the interview guide, ensuring primary data collection was highly targeted and relevant.

Prior to interviews, a focus group was done with ROWPH members who lead the WRHCAN to gain background and context on the network and how it functions to be well prepared for interviews. During the interview process, members of the research team also attended WRHCAN's bi-annual meeting to gain further context and note down relevant observations. This approach supports methodological triangulation which provided a rich data set and allowed for a deeper understanding of the proposed study analysis (Bekhet & Zauszniewski, 2012; Donkoh, 2023). Of the 40 partner organizations that are involved in the WRHCAN, 13 agreed to complete an interview with either myself or another student researcher. Interview guide development and data analysis was guided by broader theoretical framing on the socioecological model embedded within a case study research design to evaluate how warming, cooling, and clean air space efforts align within individual micro-level systems and larger societal systems. After initial thematic analysis, themes identified included cross sectoral collaboration as a strength in warming, cooling and clean air spaces, strengths and limitations of the WRHCAN and warming, cooling, and clean air spaces, and system level reflections on the function of warming, cooling, and clean air spaces. To further enrich data analysis, follow up interviews were conducted with two participants to gain insights on the role of warming, cooling, and clean air spaces in the larger Waterloo Region community and their function alongside other supports in Waterloo Region.

All interviews were recorded on Microsoft Teams with a corresponding, automatically generated transcript produced by Microsoft Teams internal software. Interviews were audio recorded and uploaded to OneDrive, along with corresponding transcript documents. Interviews ranged from 30 to 60 minutes in length. Interview transcripts were then transcribed using a naturalized transcription approach uploaded to OneDrive in a password protected document. All research procedures surrounding data collection and storage were conducted in accordance with ethical guidelines.

2.8.1 Interview Guide

Interview guide development was completed in partnership with ROWPH and explored the following topics: strengths and limitations of the WRHCAN, populations who are using warming, cooling, and clean air spaces, system level reflections of warming, cooling, and clean air spaces, and the impact of WRHCAN in the community (see Appendix C). Data collection was shared with another student researcher. Upon initial thematic analysis, the interview guide was reviewed for the follow up interviews that were conducted to gain an understanding on supports that occur simultaneously alongside warming, cooling, and clean air spaces (see Appendix D).

2.9 Data Analysis

2.9.1 Thematic Analysis

Data analysis primarily followed a deductive approach (Azungah, 2018; Braun & Clarke, 2006). Deductive thematic analysis followed Braun and Clarke's (2006) six-stage approach to generate themes: 1) familiarization with the data; 2) generate initial codes; 3) develop themes; 4) review themes; 5) define and name themes; and 6) producing the report (Azungah, 2018; Braun & Clarke, 2006; Proudfoot, 2023). To begin, I reviewed focus group transcripts to gain context on the functions of the WRHCAN, the operations of warming, cooling, and clean air spaces, and coordination led by ROWPH. Next, I formatted and reviewed raw data from interview transcripts to begin familiarizing myself with the data. Data immersion prior to developing codes aided me in identifying information that was relevant to research objectives and provided a focused scope for data analysis (Naeem et al., 2023).

After this stage, I employed the socioecological model alongside a review of Waterloo Region-specific documents such as Waterloo Region's Vital Signs Report and the Community Wellbeing Safety Plan to aid in the production of relevant themes such as "system level reflections on the operations of community supports in the Waterloo Region including warming, cooling, and clean air spaces (Azungah, 2018; Kilanowski, 2017; Proudfoot, 2023; Thomas, 2006)." Document review specific to Waterloo Region highlighted existing policy frameworks and efforts to tackle certain issues such as the housing crisis. Furthermore, the socioecological model was especially beneficial in unpacking broader systems level issues present in Waterloo Region such as housing insecurity, unregulated substance use, an increased aging population, people experiencing mental health concerns, and their interactions with extreme temperature and poor air quality related supports such as warming, cooling, and clean air spaces (Bernhardt & Amiri, 2024b; Kilanowski, 2017). Through the evaluation of the socioecological model and Waterloo Region document review, I was able to meet the overall aim of the study as Waterloo Region document review outlined social and structural issues within the Region. The socio-ecological framework also provided an appropriate conceptual roadmap to placing Waterloo Region specific supports in various circles in the model (i.e., housing crisis in the chronosystem, community supports in the mesosystem). Furthermore, analyzing the overlap of intersecting issues within these documents

emphasized Waterloo Region as an interconnected system. As such, identifying these structural relationships and their interactions served as the basis for generating initial codes.

After this stage, transcripts were reviewed and summarized in a corresponding coding memo (Braun & Clarke, 2006; Morrissey Gleeson & Morrissey, 2025; Proudfoot, 2023). Each coding memo consisted of overarching themes present in transcripts and a general overview of dominant ideas. To gain a rich a data analysis, it is important that codes and themes are in line with research study objectives (Braun & Clarke, 2006; Thomas, 2006). However, once I compared the overarching themes and dominant ideas present in coding memos with the initial codes generated, I found that transcript data was not fully representative of research objectives. To further support the deductive thematic analysis approach, I opted to conduct two follow up interviews with participants whose insights I believed would be beneficial in aiding the data analysis process (Proudfoot, 2023). Participants that agreed to participate in a follow up interview primarily worked with low-income individuals, people experiencing homelessness, and people with substance use and mental health concerns. Their insights provided a clearer outlook on chronosystem level influences on community supports and warming, cooling, and clean air spaces in Waterloo Region (Bernhardt & Amiri, 2024b). After conducting the two follow-up interviews, I revisited Braun and Clarke's six-stage approach to complete stage four through six: 4) review themes; 5) define and name themes; and 6) producing the report (Braun & Clarke, 2006).

Overall, a deductive approach in data analysis wherein I conducted follow-up interviews enhanced reflexivity in my research. Extensive data immersion prior to deductive thematic analysis also provided a great level of depth and engagement in the data analysis process (Braun & Clarke, 2022). To further support reflexivity, I had time away from my data. Distance from the data allowed for reflection and time to conceptualise my thoughts (Braun & Clarke, 2022; Pearson et al., 2025). Reflexivity in thematic analysis highlights the researcher's active role in knowledge production and their own interpretative analysis in generating codes. Instead of finding codes, a reflexive approach allowed me to generate and review codes through an conceptual framework and finding commonalities in the data (Braun & Clarke, 2006; D. Byrne, 2022; Pearson et al., 2025). Reflexivity in my research process allowed me to deepen the analysis and highlight themes beyond logistical functions of warming, cooling, and clean air spaces. Rather than viewing these spaces in isolation, I conceptualized them as interconnected components of a larger synergistic system in Waterloo Region.

Chapter 3: Results

3.1 Participant Overview

Study participants (n=13) consisted of WRHCAN representatives from municipal and regional departments (n=8) and community support organizations (n=5). Importantly, not all participants operate warming, cooling, and clean air spaces. Instead, some participants that hold municipal or regional government roles interact with people using warming, cooling, and clean air spaces within their responsibilities (see Table 1).

Table 1: Categorization of supports provided among study participants (n=13)

Participant	Category	Supports Provided	WCCA Space
1	Community Support	Advocacy supports, particularly for people experiencing homelessness precarity, free tax clinics	NO
2	Regional/Municipal	Library services	YES
3	Regional/Municipal	Housing program, children's programs, resource center	YES
4	Regional/Municipal	Transportation services	NO
5	Regional/Municipal	First responders, working with older adults, people experiencing homelessness	NO
6	Regional/Municipal	First responders, policy planning	NO
7	Community Support	Refugee health, diabetes education, support for older adults, support for people experiencing homelessness, mental health concerns, and substance use concerns, primary health clinic	NO
8	Regional/Municipal	Recreation services,	YES
9	Regional/Municipal	Library services	YES
10	Community Support	Health services for diverse populations: older adults, complex health condition, people with mental health and substance use concerns	YES
11	Community Support	Employment support, support for people experiencing homelessness, clothing donations, food drives etc.	NO
12	Community Support	Childcare support, food banks, parent-child programming	YES
13	Regional/Municipal	Harm reduction supports	NO

3.2 Overview of Findings

Study participants found great value in participating in the WRHCAN, noting that it significantly enhances cross-sectoral collaboration and resource sharing among several organizations. However, participants highlighted the impact of barriers, such as limited hours of operation and different operating policies, which result in a fragmented availability of warming, cooling, and clean air spaces. These challenges prompted broader, system-level reflections on how concurrent supports are delivered across Waterloo Region that may provide relief from extreme temperature and poor air quality events. Participant insights further highlighted intersecting local issues, including homelessness, a growing population of newcomers and older adults, and mental health or substance use concerns experienced by members in the Waterloo Region. Ultimately, the operation of warming, cooling, and clean air spaces must be viewed within a broader structural context through their interactions with other system supports.

3.3 Cross-Sectoral Collaboration and Information Sharing in the WRHCAN.

3.3.1 Information Sharing across Different Network Organizations

Network partners found value in sharing information with other network organizations. Sharing information such as the types of supports each WRHCAN organization provides (e.g., transitional housing supports, emergency responders) across various organizations allowed for knowledge exchange between partners, as one participant noted:

> It really demonstrates that this is our opportunity to engage, network, and share information and resources and it helps break down those silos. A lot of us are either interacting with or working towards programming to support the same groups (Participant 4).

Participants also highlighted the benefit of diverse organizations being part of the network. If a certain organization could not meet the needs of someone looking for relief during an extreme temperature or poor air quality event, some participants felt comfortable referring them to a different organization that might have greater capacity to meet their specific needs.

> So, we have navigators who are my staff on-site during our operating hours that will provide direction in terms of like housing supports or shelter options, phone resource to make phone calls if they need to make phone calls (Participant 5).

Participants also valued opportunities to learn from different organizations at in-person WRHCAN meetings. For instance, Participant 1, who worked largely with people experiencing homelessness presented at a bi-annual WRHCAN meeting on factors one should consider if someone experiencing homelessness arrived at a warming, cooling, and clean air space. These presentations were beneficial as some participants outlined that it may be difficult for frontline staff to engage with some priority populations (i.e., people experiencing homelessness) as they did not have appropriate training to meet the needs of these communities. Overall, participant reflections highlighted that being a part of the WRHCAN was a valuable tool in sharing

information across diverse organizations due to resources such as in person bi-annual meetings and knowledge of the various organizations across Waterloo Region that offer community supports.

3.3.2 Resources Offered and Shared across Different Network Organizations

Multiple participants highlighted that the WRHCAN allowed for resource sharing across network organizations. Partners appreciated that there were several organizations that were able to offer support to people who use warming, cooling, and clean air spaces when their organization is unable to offer supports due to factors such as resource constraints. For example, hours of operation vary across different warming, cooling, and clean air spaces. One participant mentioned that if their warming, cooling, and clean air space was closed, they may be able to refer people to another open space:

> So, for example, we're closed from 12 [un]till 1 for lunch and for staff self-care. And by being part of the WRHCAN, we had the resource list ready to tell somebody I do have to close the doors at noon today. We recognize it's really, really hot out, the humidex factors are off the chart. Here is somewhere that is open right now that you'll be able to receive the same support and services. That was really important for us (Participant 7).

Importantly, not all network partners operated warming, cooling, and clean air spaces. However, some participants provided resources that can direct individuals seeking relief from an extreme temperature or poor air quality event to an appropriate space. For example, Grand River Transit does not operate a formal warming, cooling, and clean air space, but they have the resources to redirect people to an alternate warming, cooling, and clean air space. A participant who worked for Grand River Transit found value in a pocket card that summarizes resources across Waterloo Region:

> So, for example Community Services, the Region's Social Services Group participates in the Extreme Heat and Cold Partnership as well, and they provided these pocket cards that basically summarized food and housing resources. And then in addition to that, they also locate the three region welcome spaces, which are also warming, cooling, and clean air spaces (Participant 4).

Overall, network partners found value in being part of the network as it allowed for resource sharing across organizations. Certain resources that would not be traditionally advertised are also highlighted because of the network such as providing water bottles on hot days and providing blankets to people living in encampments on extreme cold days. For example, a participant from library services also pointed out that that they provided free masks available during poor air quality events.

> And I think also to that effect, we can also be a point of distribution, not just information, but also for things. We still have the masks that were distributed when there was the air

quality issues. So, then it becomes a point where it can be communicated to the public that if you need a mask, come to the library (Participant 9).

Despite operating a library, Participant 9's reflections highlighted that resources traditionally unrelated to library services are offered during extreme temperature and poor air quality events, further cementing various sectors significance in being part of a network aimed to mitigating the impacts of extreme temperature and poor air quality events. Resource sharing was a significant strength of being part of the network as it allowed for people from various sectors to discuss and share information. On a broader level, participants reflected that being a part of the network is an additional resource to already existing resources that various community and regional partners offer.

3.3.3 WRHCAN as a Formal Coordinating Body

Participants appreciated that the WRHCAN acted a coordinating body that formalized an already existing process of collaboration across different organizations in Waterloo Region. Specifically, participants outlined that the explicit focus on heat, cold, and air quality is significant and timely amid frequent extreme temperature and poor air quality events in the Region.

> Respite from the weather, however, what this did for us was not only formalize it, but then it gave us access to other resources in the community (Participant 4).

> I would say a tangible example is that it saves me time having to investigate or find out credible sources of information to relay to the rest of my team and my work colleagues. So, the minute I receive an update from any of the team at the Region, I automatically read it, vet it for what I really need my frontline workers to know, and then I disseminate that information agency wide (Participant 10).

As WRHCAN members are busy and are part of the network in addition to their daytime roles, a coordinated process to receive prompt and credible information on heat, cold, and air quality alerts was beneficial. For example, when members at the Region sent information about a heat alert, Participant 7 was able to focus on prepping the center by purchasing popsicles for their warming, cooling, and clean air space. On-site members felt well-equipped to focus on the individuals walking into their specific warming, cooling, and clean air space. Importantly, a formalized body that is the expert of information regarding extreme temperatures and poor air quality events will be the most reliable and ensure safety of individuals using WHRCAN spaces.

3.4 Challenges that Affect the Operations of Warming, Cooling, and Clean Air Spaces

3.4.1 Limited Hours of Operation

Several challenges shaped how warming, cooling, and clean air spaces functioned. One limitation that participants referenced was limited hours of operation across network organizations.

> I think the biggest thing for us honestly would be some help in figuring out how to provide resources to people who need to access us outside of our open hours, right? (Participant 2).

Of note, many network organizations that operated warming, cooling, and clean air spaces do so during regular business hours, placing a critical barrier for people seeking relief from extreme temperature and poor air quality events outside of these hours. Participants also highlighted that priority populations, such as individuals experiencing homelessness, routinely require relief from these events outside of regular operating hours.

> Because, we aren't operating outside of our regular operating hours in a cold air warning. We're not able to offer overnights where that would actually meet the needs of our most vulnerable populations that we do see come through every single day (Participant 3).

People who require warming, cooling, and clean air spaces the most were unable to access them for large periods of time. Warming, cooling, and clean air spaces act as a place of respite during extreme temperature and poor air quality events. Participant 3 also emphasized the need for warming, cooling, and clean air spaces in emergencies such as cold snaps. Since warming, cooling, and clean air spaces are only operational during business hours, they cannot account for unpredictable extreme temperature and poor air quality events. Priority populations become susceptible to adverse effects of these events during non-business hours, reducing the efficacy of warming, cooling, and clean air spaces.

> I don't think there's any challenges in in participating in the network. The network is great. I think that the challenges are we haven't figured out how the network will tie to the emergency response plans within the region. Should we have a significant event and I'm not overly confident with those plans (Participant 1).

Participant 1 provided an example of an extreme cold event from the winter 2023 wherein Waterloo Region experienced a snowstorm that continued into Christmas and Boxing Day. In addition to limited hours, warming, cooling, and clean air spaces were closed on these holidays. The participant outlined that one individual who required a warming, cooling, and clean air space was unable to access it due to limited hours. These insights point to broader structural issues that Waterloo Region is facing amid extreme temperature and poor air quality events. Although warming, cooling, and clean air spaces exist, the accessibility of these spaces may be limited for some individuals. Participants demonstrated a lack of confidence in the WHRCAN network, especially when considering emergent extreme temperature and poor air quality events, pointing to a lack of standardized protocols across network organizations.

3.4.2 Availability of Warming, Cooling, and Clean Air Spaces

Although warming, cooling, and clean air spaces are open to the public, they may not be accessible to everyone. For example, transportation was an issue raised by one participant, specifically for warming, cooling, and clean air spaces situated in rural townships in Waterloo Region.

> We're in the middle of like houses, right? People might think that all these people, oh, it's fine. You don't need to have, you know, cooling centers or warming centers where there's houses. But they don't necessarily, have good heat. There might be seniors that don't have air conditioning, so there's a whole variety of things. I think that people who are in homes themselves right now--getting the word out to them and giving more access in some of those communities (Participant 12).

Participant 12's sentiments outlined that limited access to heating and cooling within older homes was complicating factor that may make some individuals more vulnerable to extreme temperature events. As Participant 12 notes, residential areas may still need warming, cooling, and clean air spaces because some demographics may have older homes that do not have centralized heating or cooling. This pointed to other considerations of how extreme temperatures and poor air quality events disproportionately affect older adults or those of lower socioeconomic status. Individuals unable to pay for a higher cost of utilities may refuse to increase or decrease the temperature of their homes. Beyond location availability, some participants also outlined the need for more advertising and marketing on warming, cooling, and clean air spaces. Participant 3 indicated that not everyone has access to information about emergent extreme temperature and poor air quality events because of how this information is currently available. It is important to consider the demographics that can quickly access information.

> Do we have people who are sharing this information at encampments or those types of places? Or [is that] reaching folks who are on the streets to let them know of these spaces? (Participant 3).

A common pattern identified among participants was their consideration for different populations and the specific supports they require in accessing information on warming, cooling, and clean air spaces. Participant 3 underscored that people experiencing homelessness often do not have access to the internet, largely where much of the information exists on warming, cooling, and clean air spaces in Waterloo Region.

Even among populations that have access to the internet, participants highlighted how these individuals may encounter additional challenges. Particularly, Participant 7 mentioned the importance of distributing information in multiple languages as language barriers will further impact the awareness and access to community supports such as warming, cooling, and clean air spaces.

> Yeah, the only other thing that I would say that again, I don't know if this is unique to us, but it would be wonderful for us to be able to disseminate this information in a number of different languages so we reach some of the priority populations in our region that may not understand the weather statements (Participant 7).

Information on warming, cooling, and clean, air spaces is readily available on Region of Waterloo's website. However, populations who do not have reliable internet, may not be able to

access this information. Similarly, participants pointed out that older adults may not be proficient in using the internet to find resources online and people whose first language is not English may have trouble accessing this information. The shared challenges that older adults and newcomers face in accessing warming, cooling, and clean air spaces reflect broader systemic issues. Specifically, Waterloo Region is experiencing significant demographic shifts alongside an increase in extreme temperature and poor air quality events.

3.4.3 Operational Alignment across Warming, Cooling, and Clean Air Spaces

Another challenge that participants identified was a lack of operational alignment across warming, cooling, and clean air spaces. As WRHCAN members represent a range of sectors (i.e., municipal and regional services, non-profit community supports, and first responders), not all spaces have the same policies and procedures in place. However, many participants indicated that clearer expectations on what services should be offered during extreme temperature and poor air quality events would be beneficial. Participants also expanded on specific scenarios where the extra direction from ROWPH would be beneficial.

> Who could we contact on a Saturday afternoon of a long weekend? Winter or summer? What resources are there that maybe they don't need to go to the hospital? (Participant 5).

> Are we offering water in those situations, do we have access to warm beverages or things like that? Are we offering a bus ticket to get to the next place? (Participant 3)

> One deep freeze in the winter of 2024 and we were strongly (laughs) voicing our concerns and there was no response created by the region, so our team decided to pull together and work overtime shifts, so we all took turns working extra (Participant 11).

Many participants agreed that coordination of the WRHCAN is highly valuable. However, there are gaps such as a lack of operational alignment, that impact the operations of warming, cooling, and clean air spaces. Although the WRHCAN coordinates warming, cooling, and clean air spaces, they do not provide specific guidance on space specific policies and procedures. These gaps result in fragmented services across warming, cooling, and clean air spaces. Network members emphasized that extreme temperature and poor air quality events are true emergencies, noting that a lack of coordination during these crises creates critical shortages of care and resources for people in Waterloo Region. To add, many participants directly support these populations, including people experiencing homelessness, older adults, newcomers, and individuals facing mental health or substance use challenges. Their experiences highlighted a tight link between everyday social and health services and warming, cooling, and clean air spaces. Ultimately, while Waterloo Region offers a diverse network of warming, cooling, and clean air spaces, these sites do not operate in isolation; they must interact, underscoring a need for operational alignment across these spaces.

3.5 Participant Perspectives on Community Supports Operating Alongside Warming, Cooling, and Clean Air Spaces

Waterloo Region has various community-based social and health supports and services such as the community libraries, the Salvation Army, and Sanguen Health Services. Findings demonstrated that Waterloo Region faces overlapping challenges, with supports distributed across public health, community, and social service organizations. Participants also noted that spaces that are not official warming, cooling, and clean air spaces have been utilized as informal warming, cooling, and clean air spaces.

> For us was just kind of more like a formalized process of doing this. We embed this kind of work from the very beginning as a CHC [Community Health Centre], so you know when it was reaching temperatures that were considered a heat advisory, we always allowed people to sit in our lobbies. We offered water. And just respite from the weather (Participant 7).

> Last summer, for example, we were over at St. John's Church, but it wasn't air conditioned. And we noticed a huge difference in the people that we were serving food to coming into a hot building from outside in the extreme heat and not being able to find that reprieve was an additional challenge (Participant 11).

Ultimately, findings demonstrate that informal warming, cooling, and clean air spaces originally emerged to meet localized population needs. Formalizing these sites through a network like the WRHCAN underscores their significance during extreme temperature and poor air quality events. Importantly, interviews highlighted that these operations run parallel to a broad range of concurrent services. This creates a complex network of diverse actors tackling different regional issues simultaneously. For example, housing initiatives, substance use and mental health services, and support for older adults and newcomers, all intersect with the availability of warming, cooling, and clean air spaces, enhancing the interconnected nature of community care in Waterloo Region.

3.5.1 Overlapping Supports for Different Populations

Findings highlighted that specific populations such as people with substance use concerns required overlapping supports:

> You see the enormous impact on bathroom use as well [in WCCA spaces], which intersects poorly with the fact that people who are living outside need access to bathrooms to be able to use the bathroom, but they also often end up using bathrooms to use their substances because there's no other safe and approved spaces for them to use it (Participant 11).

Participant accounts outlined that people who are experiencing homelessness also needed safe spaces to use substances. However, many participants identified the closure of supervised consumption sites across Ontario as a significant structural barrier for people who use substances. In many instances, people were forced to use the bathrooms of warming, cooling, and clean air spaces to use substances. This created an additional barrier for other community members that needed to use the bathrooms at designated warming, cooling, and clean air spaces. Importantly, networker members emphasized that these individuals frequently face intersecting challenges,

including homelessness, mental health concerns, and substance use concerns. These findings underscore that community members do not experience extreme temperature and poor air quality events in isolation. Instead, they must simultaneously navigate challenges related to substance use concerns, homelessness, and mental health.

Another participant emphasized the unique needs of newcomers in Waterloo Region:

> It's interesting because we have new Canadians coming in as well too. They're a sector of the population that we deal with where they don't have proper winter clothing, proper footwear and things like that (Participant 5).

In line with previous findings, immigrants and newcomers faced compounding barriers when accessing extreme temperature and poor air quality related supports. Beyond system level issues, individual experiences of being a newcomer in Canada shaped the ways in which these populations access warming, cooling, and clean air spaces. Newcomers are getting used to a different climate, facing language barriers and having to navigate a new cultural and social landscape. For example, Participant 2, who oversees the management of all libraries in Waterloo Region discussed the complicated relationships that newcomers must manage when living in more rural areas of Waterloo Region. These findings alluded to experiences of discrimination that many newcomers face when immigrating to Canada. Newcomers, like many populations in Waterloo Region use various supports in Waterloo Region alongside warming, cooling, and clean air spaces. Importantly, these supports are being used simultaneously. Each issue that the region or community members face does not occur in isolation. Instead, they are part of the same system and should be considered as such.

To add, participant insights revealed that despite warming, cooling, and clean air spaces being open to all community members in Waterloo Region, there is a higher prevalence of specific populations utilizing these spaces. Populations often include community members who face more social barriers in accessing supports in Waterloo Region including people experiencing homelessness, people with substance use and mental health concerns, and older adults and newcomers, as highlighted previously.

> I would say generally when things start to get cold, we see an increase of vulnerable people who are on the streets coming in and using the space [WCCA Spaces]. There's also an increase in the summer during the heat events where I've seen older individuals come in. We had an older gentleman who would come every day because there's problems with his air conditioning in his apartment and it wasn't working (Participant 9).

> We are observing key individuals being in the facility for long durations, sleeping in the facility there with their heads down on table sleeping or finding corners of the facility to curl up and sleep, charging their phones, having bags of possessions around them. There are individuals within our facilities that we've observed and therefore have assumed they are unhomed (Participant 8).

Participant accounts on individuals they frequently observe using these spaces further supported the notion that specific populations were using warming, cooling, and clean air spaces at a higher rate than the general population. As there is no tracking data available on which demographics use warming, cooling, and clean air spaces, most participants recounted common patterns they have seen in their spaces. Notably, participants also commented on the ethical issues associated with asking individuals if they are using public spaces as a warming, cooling, or clean air space. For example, Participant 3 reflected on the mistrust that marginalized populations historically have with governmental organizations, citing that adding tracking and check in would be oppressive and not conducive to the mission of warming, cooling, and clean air spaces being welcoming. Conversations regarding marginalization, ethics, and populations that face increased barriers in navigating community supports such as warming, cooling, and clean air spaces point to broader structural issues that impact their operations and the extent to which people of different demographics engage with them.

3.5.2 Tailored supports for community members across different organizations

Participant reflections on overlapping support highlighted that specific demographics require tailored community supports alongside warming, cooling, and clean air spaces. For example, one participant runs free tax clinics for low income and unhoused individuals.

> We do a lot of great stuff on the website. But we also have to appreciate that a lot of individuals, not just the homeless, don't have access to the website. So, I do a lot of work with low-income individuals. I do their tax returns, so I have a good understanding of what they have access to. A lot of them don't have a computer. They might be able to use their phone, but again, they're not always tech savvy, right? (Participant 1).

Participant 1 highlighted that community members often have needs beyond extreme temperature and poor air quality related relief, noting that specific demographics require tailored community supports. Specifically, their organization addressed these intersecting gaps by hosting free tax clinics for individuals that do not have reliable internet access. By expanding to include an in-person tax clinic, their organization was able to provide the support necessary to uniquely reach individuals facing concurrent technology and tax literacy barriers. Since warming, cooling, and clean air space information is largely available online, this finding underscored the need for tailored strategies to reach different populations during extreme temperature and poor air quality events.

Another participant that works with people with substance use concerns outlined that prior to the closure of supervised consumption sites in Ontario, they referred people to the Kitchener Public Library warming, cooling, and clean air space.

> Like the consumption and treatment services site not only offered supervised consumption, but it also offered a space for people who use drugs to go and be. For example, the Kitchener Public Library is super close to the CTS and so that was one of the spaces that

> we kind of said, you know, here's one space that people can access as a heating, cooling and clean air space (Participant 13).

Interview data emphasized the need for population specific supports especially amid extreme temperature and poor air quality related events. Although these events impact all populations, the supports they require vary. As highlighted by participants, people who use drugs required targeted support that allowed them to use substances safely while having respite from extreme temperature and poor air quality events. These reflections echoed a larger sentiment that was present throughout interviews regarding the political and structural nature of warming, cooling, and clean air spaces, as well as other community supports in Waterloo Region. A specific example was the closure of supervised consumption sites which carried significant implications for communities across Ontario. Ultimately, Waterloo Region community supports and warming, cooling, and clean air spaces cannot function on a one size fits all approach. Instead, there is a need to meet individuals in their contexts, rather than expecting them to navigate systemic barriers to reach available community supports.

Furthermore, many participants outlined targeted warming, cooling, and clean air spaces as a potential strategy for common challenges faced by community members using warming, cooling, and clean air spaces. Participant 3 mentioned reflected that having dedicated on site staff or community partners with population specific training would be beneficial at warming, cooling, and clean air spaces.

> We need to have community partners on site who are equipped to manage the issues that are going to also come with that. Security issues, [for instance]. You are also going to manage mental health and addictions crises in those moments—that's just the nature of this...We need to be willing to not shy away from the reality that folks...do not want to acknowledge (Partcipant 3).

These findings illustrated that priority demographics, including individuals experiencing homelessness, substance use concerns, and mental health concerns routinely utilized warming, cooling, and clean air spaces. Furthermore, these populations present distinct needs that could be effectively addressed within these environments, provided the facilities are expanded and adapted to offer broader support. Because community organizations working directly with these groups possess extensive knowledge regarding their specific needs, establishing partnerships with them could allow for warming, cooling, and clean air spaces to significantly enhance their service delivery. However, balancing these diverse needs remains a challenge. Participant 11 noted that while these spaces are intended for the public, they must be carefully tailored; some visitors (i.e, newcomers and older adults) may react negatively to behaviors commonly associated with marginalized groups, such as those experiencing homelessness or substance use challenges. Consequently, these behavioral dynamics can make some individuals feel uncomfortable and distressed in what is meant to be a secure environment, while simultaneously ostracizing other priority populations.

Another participant outlined the unique needs of people experiencing homelessness.

> They're experiencing challenges like: where do they bring their pets? So, some of the spaces do allow for pets, others don't and then sort of the same piece with their belongings. Some folks will have bags and bags of things. And it's like, that's not really the space [to bring them]. There's not enough space for that (Participant 13).

Due to differing policies across warming, cooling, and clean air spaces, people experiencing homelessness are averse to using the service at all. In turn, this may disallow a marginalized population to use a public service, further disenfranchising them. Interview data outlined that Waterloo Region is home to numerous populations with varying needs such as people experiencing homelessness, people with substance use and mental health concerns, newcomers, and older adults. As such, these needs must be reflected in warming, cooling, and clean air spaces to make them effective in being a space useful for the entire community. Targeted spaces that are specific to unique needs of all populations would be beneficial in improving the utility of warming, cooling, and clean air spaces.

3.6 System Level Reflections on the Operations of Community Supports in Waterloo Region Including Warming, Cooling, and Clean Air Spaces

3.6.1 Funding Constraints

Participants consistently referred to a lack of funding and money as a significant limitation in providing more support to the Waterloo Region community. These funding limitations were not just limited to warming, cooling, and clean air spaces, but also other community supports across Waterloo Region.

> We're not funded appropriately to offer free service [Free Transit] on extreme weather days, which is something that I think would be a great opportunity if we could ever source significant external funding (Participant 4).

> We also have a wide range of affordable and supportive housing units that we support. And of course, we have now two shelters, which is about to be reduced to one shelter from two with the King Street shelter closing at the end of this month due to funding cuts (Participant 11).

Participant insights emphasized that funding cuts have driven the closure of essential community supports in the Waterloo Region, including housing shelters. Furthermore, Participant 4's reflections highlighted that supplementary services, such as free transit, could significantly alleviate the impacts of extreme temperature and poor air quality events; however, these initiatives remain unfeasible due to ongoing financial constraints. Echoing these sentiments, another participant elaborated on the practical implications of expanding services at warming, cooling, and clean air spaces.

> Are we happy with the status quo, or do we try and look at expanding it [WCCA operations]? But, you know, with expansion comes costs of people's time, effort and money. And would that reduce the overall effectiveness of the program (Participant 6)?

This insight also amplified existing structural issues related to funding in community support organizations. Broadening the mandate of warming, cooling, and clean air spaces would require significant financial resources for staffing, security, and programming. Participant 6's reflections warned that in the absence of available, sustainable funding, forcing spaces to expand operations would potentially compromise the primary objectives of warming, cooling, and clean air spaces.

3.6.2 The Role of Different Levels of Government

When discussing financial constraints, participants also made connections to the roles of different levels of government in Canada when disseminating supports across the Region.

> And so, we're also the recipients of the new HART hub funding. I'm not sure if you're familiar with that but when the CTS sites were closed by the provincial government, the HART hub is the funding that's supposed to replace that service in the community (Participant 7).

> It's [Housing and Homelessness] not really a lower or upper tier municipality item. I think it's more at the provincial level and I'm not sure and I don't know enough about the funding. I think the struggles are real and that the municipalities, in general, lower or upper tier across the province are trying to tackle this on their own (Partcipant 5).

Participant insights revealed that community supports in the Waterloo Region operated within a complex funding landscape, where different services are managed by distinct tiers of government. For instance, the closure of Consumption and Treatment Services (CTS) sites was mandated by the provincial government, despite local municipal support for these programs. Similarly, housing shortages highlight a structural issue tied to federal and provincial funding policies, yet municipal governments are left managing the operational burden of addressing this issue. These insights mirror intersecting structural challenges across Canada, where provincial budget cuts shifting greater responsibility onto municipalities. Because these systemic issues often fall outside the traditional scope of local authorities, first responders, and community networks, they demonstrate a need for coordinated intervention across all levels of Government. In line with findings demonstrating structural issues, Participant 5 reflected on national level issues that Canada is facing:

> But federal level, we've got tariffs coming, we've got unemployment, we've got healthcare, we've got education so it is very strapped and so I understand those challenges (Participant 5).

Due to financial constraints and the broad scope of challenges, network members were unable to comment on concrete solutions to further support the function of warming, cooling, and clean air spaces. The roles of municipal, provincial, and federal governments are inherently tied to how and

where funding is allocated. Analyzing these connections provided a better understanding of how warming, cooling, and clean air spaces rely not only on all levels of Canadian government, but also on how they function alongside broader community supports.

3.6.3 The Role of the Housing Crisis in Increasing Demand for Community Supports

Participant perspectives on system level reflections on warming, cooling, and clean air spaces referenced the housing crisis many times. Interview data emphasized that structural issues such as the housing crisis will continue to have an impact on warming, cooling, and clean air spaces.

> Hot weather doesn't dissipate overnight during these [extreme heat] events. So, you're kicking people out into hot weather at night or to cold weather during the day. And I think the thought is that well the shelter system will absorb these people. But I think you're seeing the shelter system at significant strain and not everybody's going to get a space (Participant 6).

This finding emphasized that the housing crisis is a structural, interconnected issue that strains other community supports. Because unaffordable housing has increased homelessness, emergency shelter systems are overwhelmed. Compounding the issue, alternative supports, such as warming, cooling, and clean air spaces, have limited operating hours, leaving individuals with nowhere to go. As Participant 11 noted, this crisis expanding rapidly, becoming an issue for the broader public, not just those experiencing homelessness.

> This year we were seeing lots of people just losing their housing that had never had the experience of homelessness at all, and we were just having to give them tents and send them outside (Participant 11).

Participant 11's insights highlight a broader structural issue: the recurring economic crises across Canada. Participant 3 expanded on this point, noting that

> It's going to continue to get worse. We are under threat of higher economic upheaval, where people who may actually even be working full time and have a roof over their head, we see higher numbers of individuals accessing our financial assistance emergency lines because they can't figure out whether they should put food on their table or keep the electricity on (Participant 3).

Interview data highlighted that economic crises also function as structural stressors, impacting a wide range of demographics. As Participant 3 implied, rising costs for necessities like heating and electricity mean that previously affordable utilities are now out of reach for many, driving up the demand for public warming, cooling, and clean air spaces. Counterintuitively, these economic pressures restrict the operations of these spaces. As inflation drives up the cost of labor and supplies, public funding most likely decreases, leaving municipalities to face structural issues while capacity to provide optimal warming, cooling, and clean air spaces shrinks. These insights revealed a complex web of interconnected systems demonstrating climate adaptation strategies

such as warming, cooling, and clean air spaces do not operate in isolation; rather, they continuously interact with, and are shaped by, broader structural realities like the housing crisis and community infrastructure.

3.6.4 Stigma in Accessing Warming, Cooling, and Clean Air Spaces

Participants spoke of the stigma certain populations face, namely those experiencing homelessness and substance use concerns, when accessing warming, cooling, and clean air spaces.

> A large number of the homeless know...where they're going to be accepted. The challenge is, is it getting to the homeless that are not part of the general homeless population (Participant 1)

> I don't think it's unique. I don't think it's just the warming and cooling centres that are the one places that are hard to access for sure. I think, though, that there is space for the warming and cooling centres if they wanted to provide a warmer welcome to this [people experiencing homelessness] group. (Participant 11)

Importantly, stigma faced by these populations is not unique to warming, cooling, and clean air spaces. People that experience homelessness, people who have substance use concerns and those with mental health concerns, all face barriers to accessing resources in most public spaces that are open to the general population. Participant 11's insights reflect earlier themes on creating welcoming and tailored warming, cooling, and clean air spaces for individuals with unique needs. Additionally, this connected directly to previous reflections on stigma, specifically, how public perceptions of people who use drugs can acts as barrier to their utility of warming, cooling, and clean air paces.

> But I think the one of the things that we hear is the stigma of somebody who uses drugs who might look a little different from somebody else being in public spaces, and other folks might not feel comfortable. That kind of thing. So how that kind of clashes with wanting to be a safer space versus like a safe space for all (Participant 13)

The presence of stigma at warming, cooling, and clean air spaces amplified earlier reflections on the nature of warming, cooling, and clean air space availability- that these barriers do not exist in isolation, rather the stigma that specific populations face is a result of broader, systems levels challenges. Individual experiences during extreme temperature and poor air quality events do not occur in isolation; rather, they are a result of continuous interplay between a person, their localized community, and the broader social and structural contexts they occupy.

3.6.5 Warming, Cooling, and Clean Air Spaces as 'Release Valves'

Participant perspectives on warming, cooling, and clean air spaces were consistently positive, citing them as a great resource and valuable avenue to share resources and information with other network members. However, participants also pointed out that warming, cooling, and clean air spaces cannot be seen as a solution to tackle other local and national issues.

> We're in a very dire circumstance, I think in not just the Region of Waterloo, but Ontario and Canada across the board that we do need to make shifts, otherwise there is going to be higher reliance on programs like this (Participant 3).

> It plays a role, but right now it's being asked to play a much bigger role because anything that we can look for to fill these gaps that the system has. And so, I'm worried that we're going to end up drowning these other systems that are put in place for emergency type moments because everything feels like an emergency right now (Participant 11).

Within Waterloo Region, warming, cooling, and clean air spaces operate inside a broader ecosystem shaped by compounding societal challenges, including the housing, economic, and unregulated substance use crises. While these spaces play a critical role during extreme temperature and poor air quality events, they function as temporary interventions. Because they intersect with these larger crises, they are frequently overextended functioning as a safety net. This structural strain forces these spaces to absorb pressures far beyond their intended scope. Ultimately, these findings emphasized that while warming, cooling, and clean air spaces are impactful climate adaptation strategies, they cannot replace targeted, structural reforms needed to address Waterloo Region's intersecting issues.

Chapter 4: Discussion

4.1 Synthesis of Findings

4.1.1 Structural Factors Influencing Operations of Warming, Cooling, and Clean Air Spaces

4.1.1.1 Housing Crisis

The ongoing housing crisis in Canada and Waterloo Region functions as a critical structural challenge that influences the operations of warming, cooling, and clean air spaces. Specifically, participants identified several interconnected housing challenges, including severe strain on Waterloo Region's emergency shelter system, rising unaffordability across single-family dwellings, and an increase in people experiencing homelessness. Furthermore, participant reflections demonstrate how policy decisions, economic shifts and sociohistorical trends impacted the operations of warming, cooling, and clean air spaces. Notably, these factors represent macrosystem level components that all interact to drive chronosystem level impacts such as the housing crisis. In particular, the housing crisis has been shaped by policies that enabled a rapid 22% population increase in Waterloo Region from 2015 to 2022 as well as the mid-1990s shift toward financialization of housing, where corporate investors began to buy out affordable housing units to sell them at premium rates (Ayer, 2024; Carriere & Lesnikowski, 2024; Government of Canada, 2024; Morrissey, 2023). Scholars refer to this phenomenon as the commodification of housing wherein housing is merely treated as capital, and not a human right. Furthermore, rapid population growth along with the financialization of housing is a trend visible across Canada and has directly led to increased wealth inequality and income disparity (Carriere & Lesnikowski, 2024). As supported by study findings, these macro-level factors have consequently strained social infrastructure across several jurisdictions in Canada, including Waterloo Region.

Participant accounts on structural factors impacting the operations of warming, cooling, and clean air spaces reveal a potential policy disconnect: the housing crisis and the operation of warming, cooling, and clean air spaces are viewed as separate processes. Conversely, participants find them to be deeply interconnected. Waterloo Region will continue to struggle with increased rates of people experiencing homelessness while extreme temperature and poor air quality events persist. These findings are echoed by Carriere and Lesnikowski (2024) and Yue and Lesnikowski (2025) who argue that climate change adaptation and housing affordability are treated as isolated issues. Existing research also emphasizes that most climate change adaption frameworks focus on biophysical impacts of climate change and may be less attuned to social vulnerability caused by structural factors such as the housing crisis (Yue & Lesnikowski, 2025). This body of literature further confirms study findings on the deeply integrated nature of the housing crisis and its influence on the operations of warming, cooling, and clean air spaces in Waterloo Region (Balakrishnan et al., 2024; Bernhardt & Amiri, 2024c)

Treating extreme temperature and poor air quality events and the housing crisis as separate issues reveals a common pattern in organizational planning and, specifically, in climate adaptation

strategy literature, wherein focus remains heavily on the physical availability of a space rather than the social and structural factors that limit its optimal operations. Instead, effective planning must begin by understanding the deeply embedded social fabric of a region and treating these challenges as a web of interconnected systems rather than events happening in isolation. Furthermore, this policy disconnect leaves people experiencing homelessness who are impacted by the housing crisis heavily reliant on emergency shelters that are already under immense strain, leaving them with few viable options during extreme temperature and poor air quality events, thereby escalating the housing crisis. Warming, cooling, and clean air spaces should be designed with these broader structural issues as a backdrop. Future research should unpack the specific socio-political and institutional barriers that prevent municipal planners from co-designing integrated and climate-resilient housing and emergency shelter strategies.

4.1.1.2 Unregulated Substance Use and Macro-level Policies

Study findings indicated that the ongoing national and localized concerns surrounding unregulated substance use in Canada is a structural issue that influences the operations of warming, cooling, and clean air spaces in Waterloo Region. Unregulated substance use across Canada and Waterloo Region is another example of a chronosystem level structural factor that has changed over time due to shifting policies.

Specifically, study findings indicated that the increasing presence of people experiencing substance use concerns in concurrence with mental health concerns, coupled with the closure of supervised consumption sites in Ontario, deeply impacted the operations of warming, cooling, and clean air spaces in Waterloo Region. In line with Friedman et al.'s (2020) analysis, findings suggest that the unregulated substance use concerns are multifaceted, complex, and driven by decades of systemic disinvestment such as cutting funding for health and social services. To add, research on the closure of supervised consumption sites in Ontario highlights that these programs did not simply distribute regulated substances, they also acted as essential spaces connecting individuals who use substances to relevant health and social services (Ali, Sprakes, et al., 2025).

There is a diverse body of literature that situates unregulated substance use as an issue driven by macro level policy frameworks (Galea, 2004; Jalali et al., 2020; Latimore et al., 2023; Park et al., 2020). In Waterloo Region, these macro level policies directly influence the capacity of warming, cooling, and clean air spaces to deliver appropriate care for different populations during extreme temperature and poor air quality events. For instance, participants outlined that many individuals use drugs in the washrooms of warming, cooling, and clean air spaces because no other safe spaces are available to them. However, these reflections highlight that while warming, cooling, and clean air spaces must navigate overlapping crises, they should not be treated as a remedy for systemic issues like substance use, concurrent mental health crises, and toxic drug poisonings.

Participant reflections also emphasized that compounding risks related to unregulated substance use overdose are exacerbated by and increasing frequency of extreme temperature and poor air quality events. These reflections align with a growing body of evidence that demonstrates that people who use substances, including opioids, are at an increased risk for hospitalization and death during extreme heat events (H. H. Chang et al., 2023; Dennett et al., 2026; Lu et al., 2026). As a result, access to supportive cooling spaces amid extreme heat events is increasingly viewed as an important harm reduction strategy (H. H. Chang et al., 2023). Future research should explore community-based strategies to support people who use substances and those with mental health concerns amid increasing extreme temperature and poor air quality related events.

4.1.1.3 Demographic Shifts

Additionally, participants highlighted that demographic shifts in Waterloo Region directly influenced the operations of warming, cooling, and clean air spaces. Specifically, they referenced the unique position of older adults, newcomers, and immigrants who access these spaces. Participants reflected on the specific care older adults require during extreme temperature and poor air quality events. For instance, many older adults navigate these events on fixed incomes and lack residential heating or air conditioning. Similarly, newcomers and immigrants frequently encounter language barriers, social barriers, and a lack knowledge of various community supports in the region. Participants also outlined that information regarding warming, cooling, and clean air spaces is readily available online, however, it remains inaccessible to older adults that may face digital literacy limitations, as well as newcomers who are English language learners or lack reliable internet access.

Importantly, while demographic shifts represent structural factors that dictate macro-level policies (such as resource allocation for newcomers, housing availability, and community supports for older adults), integration of demographic changes into local climate change adaptation strategies remains limited (Ayer, 2024). At the same time, recent demographic shifts have contributed to an increased demand for social services due to shifting population needs. In the context of increasing extreme temperature and poor air quality events, there is a need to ensure that the provision of warming, cooling, and clean air spaces is responsive to shifting demographic trends and emergent needs. Future research should examine the role of major demographic shifts and corresponding policies on community supports such as warming, cooling, and clean air spaces, as well as opportunities to integrate projecting demographic changes within community-based climate change adaptation initiatives.

4.1.1.4 Political and Systemic Influences

Broadly, political governance plays a key role in structural factors that impact warming, cooling, and clean air spaces in Waterloo Region. Findings indicated that funding cuts and policy changes across several health and social services, including the closure of supervised consumption

sites, mental health supports, and emergency housing shelters in the region are all interconnected. These findings align with the socioecological model as a web of interconnected systems that interact with and impact one another. Coupled with the increasing frequency of extreme temperature and poor air quality events, regional community supports (such as warming, cooling, and clean air spaces) bear the burden of absorbing the needs experienced by populations that require specialized support. Findings suggest that structural factors in political governance across Canada's three-tier government structure deeply impact the function of community supports such as warming, cooling, and clean air spaces. In line with findings by Birchall et al. (2025) on strengthening the relationship between federal and territorial governments to decrease the adaptation gap in climate change policies, this study would also benefit from having more explicit roles defined for each level of government. Beyond this, understanding that structural factors related to policies and financial constraints exist across the board for multiple issues, not just climate change adaptation strategies is significant. Chronosystemic factors, such as extreme temperature and poor air quality events will persist and policy landscapes will continue to change. As such, it is essential that all levels of Canadian government strengthen and create policies that do not create larger adaptation gaps, a reflection that was present in study findings.

While the present study focuses on warming, cooling, and clean air spaces as a localized example of climate change adaptation, future research should focus on exploring coordinated action across all three levels of government to address climate-health needs. Specifically, investigating the vertical and horizontal dynamics in Waterloo Region will provide a deeper understanding of the institutional systems required for climate adaptation policies to succeed beyond a localized context. This line of inquiry directly aligns with research that highlights how institutional barriers limit local adaptive capacity and resilience (Birchall et al., 2025; Burch, 2010; Oberlack, 2017). When upper-level governing bodies offload responsibilities to municipalities and regions without appropriate financial support or authority, they are left to absorb structural crises with limited resources. Additionally, because this study was limited to the perceptions of participants working within Waterloo Region, gaining insights from provincial and federal governmental bodies could provide further information on these governance relationships. Ultimately, the findings suggest that structural factors related to policy planning and financial support across different levels of government are directly tied to implementing and maintaining warming, cooling, and clean air spaces in Waterloo Region.

4.1.2 Relationships between Warming, Cooling, and Clean Air Spaces and Other Community Supports

4.1.2.1 Barriers to Accessing Community Supports

Findings suggest that certain populations face social barriers when accessing warming, cooling, and clean air spaces in Waterloo Region. Specifically, participants outlined that people experiencing homelessness, those with substance use concerns, and individuals with mental health

concerns may face judgment and stigma in accessing these public spaces. Participants also recounted that during extreme temperature and poor air quality events, many individuals avoided regional community supports and instead sought out support in environments where they felt accepted and safe such as encampments and emergency shelters, highlighting stigma as a barrier to accessing extreme temperature and poor air quality event related supports. Critically, these experiences are not unique to warming, cooling, and clean air spaces; rather, they mirror broader challenges across a variety of regional and community supports in the Waterloo Region. While a breadth of literature exists on the stigma that people experiencing homelessness, people with substance use concerns, and people with mental health concerns face when accessing health, social, and community services (Birtel et al., 2017; Mejia-Lancheros et al., 2021; Mercado et al., 2024; Rea, 2023; Wogen & Restrepo, 2020), research focusing specifically on warming, cooling, and clean air spaces remains sparse. This literature gap may exist because these spaces are relatively novel climate adaptation strategies, or because they are implicitly assumed to be integrated into broader health and social support networks.

Theoretically, findings related to barriers in accessing community supports unpack mesosystem-level interactions, demonstrating how support seeking is dictated by individual level perceptions of safety. This finding closely aligns with literature that argues macrosystemic factors, such as structural stigma, which refers to systemic practices and cultural beliefs, directly influences one's ability in seeking social support (Easton et al., 2024). Furthermore, study findings underscore relationships between several supports across Waterloo Region, wherein supports such as warming, cooling, and clean air spaces are marketed as open to the public. However, populations experiencing homelessness, and those with mental health and substance use concerns (according to warming, cooling, and clean air representatives) are most impacted by extreme temperature and poor air quality events. Yet, those same individuals most likely do not use warming, cooling, and clean air spaces due to stigma and fear of discrimination (Canham et al., 2024).

Participants also reflected on the position of older adults, refugees, and newcomers, especially those arriving from conflict zones, noting that these groups may find behaviors associated with homelessness, mental health crises, or substance use unfamiliar or distressing. As a result, they may avoid warming, cooling, and clean air spaces altogether. This presents a core systemic tension: while warming, cooling, and clean air spaces must feel safe and welcoming for everyone, there is a concurrent need to ensure these environments do not exclude individuals experiencing homelessness, substance use, and mental health concerns due to societal stigma and fear. While some of these interactions with social supports are understood through the lens of social stigma faced by people experiencing homelessness and people with substance use and mental health concerns (Birtel et al., 2017; Rea, 2023), this study emphasizes the importance of further exploring interactions between different populations and shared public environments.

4.1.2.2 Integrating Warming, Cooling, and Clean Air Spaces with Other Community Supports

Study findings highlight the importance of tailoring warming, cooling, and clean air supports to different populations within Waterloo Region. As established in the study, individuals experiencing homelessness and those facing mental health and substance use concerns navigate needs and behaviors distinct from the general population. In addition, participant perceptions revealed that frontline workers at warming, cooling, and clean air spaces did not always possess the specialized training required to address these complex needs, suggesting a gap in current warming, cooling, and clean air space delivery. As such, developing tailored warming, cooling, and clean air spaces is a vital strategy. This aligns with findings by O'Toole et al. (2010) and Kertesz et al. (2013), who demonstrated that tailored primary care for people experiencing homelessness significantly enhanced service experiences and health outcomes for these populations. Similarly, participant accounts suggested that people with substance use concerns would be referred to a warming, cooling, and clean air space close to a supervised consumption site if they were still operational, as supervised consumption sites were also an avenue for individuals to access health and social services in line with their specific needs.

A broad scope of scholarship exists on integrating community and health care supports for people experiencing homelessness, and people with mental and substance use concerns, as these exposures often overlap (Grove et al., 2025; Kirst et al., 2020; O'Campo et al., 2009; Polcin, 2016). However, study findings suggest integration with climate adaptation strategies such as warming, cooling, and clean air spaces is limited. Importantly, some local initiatives exist, such as members of the WRHCAN who focus primarily on housing supports. Although, these spaces are not fundamentally designed with comprehensive extreme temperature and poor air quality related interventions in mind. While the integration of community supports within warming, cooling, and clean air spaces would be ideal, participants identified significant barriers to this approach, including high administrative coordination and funding constraints. Additionally, warming, cooling, and clean air spaces face operational limitations, including limited operating hours and differing organizational policies. Although integrated and targeted warming, cooling, and clean air spaces are highly desirable, implementation is hindered by operational, logistical, and fragmented policy frameworks across multiple levels of government. Currently, these spaces interact with other community resources in an isolated manner.

Despite many of these spaces being embedded within everyday community supports such as housing supports organizations, community centres, and municipal buildings that are open continuously rather than only during extreme temperature and poor air quality events, their design is not primarily built for continuous support for various populations. Although they must adhere to standard organizational policies, limitations such as fixed business operating hours and facility regulations further isolate warming, cooling, and clean air spaces as a comprehensive strategy to mitigate impacts of extreme temperature and poor air quality events. Applying the socioecological model reveals that even when analyzing constructive mesosystemic interactions (such as

collaborations between local organizations), macro-level policies ultimately dictate and restrict daily operations. As outlined by Ferreira et al (2025) macro, meso, and individual level factors must be strategically aligned in climate adaptation strategy planning, specifically for marginalized populations such as those experiencing homelessness, and those with substance use and mental health concerns. Factors such as provincial and federal funding structures, upper-level governance, and systemic policy gaps remain outside the direct control of municipal regions. While Waterloo Region offers several localized supports, extreme temperature and poor air quality events persist, and the fragmented nature of these intersecting systems continues to create barriers for people who use warming, cooling, and clean air spaces, especially among other issues the region faces. To bridge these gaps, future research should delve deeper into practical frameworks for designing integrated strategies that leverage existing regional infrastructure instead of solely relying on novel strategies such as warming, cooling, and clean air spaces. For instance, embedding climate adaptation initiatives, including warming, cooling, and clean air spaces, within community organizations serving people experiencing homelessness can reduce barriers related to stigma and capitalize on existing staff training. A notable limitation, however, involves determining how to market these supports without excluding the broader community, suggesting an avenue for future inquiry. The efforts of the WRHCAN demonstrate that diverse regional stakeholders can successfully unite to mitigate the impacts of extreme temperature and poor air quality events. Ultimately, achieving an integrated and tailored strategy will require enhanced coordination, a deeper understanding of population-specific needs, and a critical examination of upper-level governing policy frameworks.

4.2 Strengths and Limitations

A primary strength of this study lies in its semi-structured interview approach, which balanced thematic focus with the flexibility to adapt questions based on participant responses (Adeoye-Olatunde & Olenik, 2021; Klandermans, 2007). WRHCAN members offered a unique, and relevant perspective on the local context of the Waterloo Region. Utilizing open-ended questions facilitated a collaborative dialogue, enabling network members to elaborate on the nuanced social and structural issues impacting the operation of warming, cooling, and clean air spaces, insights that a structured design may have missed (Klandermans, 2007). Furthermore, this methodological choice fostered a high degree of reflexivity within the research process. The rich variety of conversations prompted a re-evaluation of the initial research objectives, shifting the focus more intentionally toward structural factors influencing the delivery and operation of these spaces. Consequently, two additional interviews were conducted, deepening the analysis and enabling the emergence of critical themes regarding vertical and horizontal supports, policy frameworks, and targeted warming, cooling, and clean air spaces for distinct populations.

However, the study is not without its limitations. A key constraint was the absence of perspectives from individuals who utilize warming, cooling, and clean air spaces. While study participants highlighted the utility of these spaces for specific groups, such as individuals experiencing homelessness, those navigating substance use and mental health concerns, older

adults, and newcomers, they also noted a lack of demographic data available on the individuals who access and use warming, cooling, and clean air spaces (Dodd et al., 2023; Veldmeijer et al., 2023; Wong et al., 2026). Gathering this information is challenging, as it can pose questions surrounding ethics when questioning individuals entering public facilities about their specific needs. For instance, many public libraries across the Waterloo Region double as designated warming, cooling, and clean air spaces within the WRHCAN. People are free to use them regardless of whether they seek standard library services or extreme temperature and poor air quality related relief. While the findings successfully met the research objectives regarding structural and relational factors, integrating the lived experiences of people who use these spaces would have provided valuable insight into individual engagement, operational barriers (such as business hours), and direct accounts and experiences of social barriers. A secondary limitation was the recruitment strategy, which relied exclusively on the WRHCAN network. While recruiting through a trusted source ensured relevant viewpoints, several of the participants who were interviewed worked for the Region of Waterloo. Expanding recruitment beyond regional government bodies may have provided more diverse accounts and mitigated potential institutional social desirability bias or hesitancy among participants (Jiwani & Krawchenko, 2014).

Despite these limitations, capturing the perspectives of those operating or interacting with warming, cooling, and clean air spaces offered a rich analysis of the structural and relational factors influencing their operations alongside broader health and social services. Given that warming, cooling, and clean air spaces remain underrepresented in academic literature, this research offers valuable insights to inform future iterations of climate adaptation strategies amid rising extreme temperature and poor air quality events.

4.3 Contributions

The study was conducted at a time where Ontario continues to reach record high temperatures and is experiencing extreme heat events and wildfires contributing to poor air quality days. (Donnini, 2026). As such, the need for appropriate climate adaptation strategies is relevant now more than ever. By positioning Waterloo Region as a complex, synergistic system where extreme temperature and poor air quality events overlap with structural challenges such as the housing crisis, demographic shifts, and unregulated substance use, this research provides insights into how these issues may interact to shape the operations of warming, cooling and clean air spaces. Importantly, this study outlines how systemic barriers such as political governance and structural stigma may influence how individuals interact with climate adaptation strategies such as warming, cooling, and clean air spaces. Consequently, these findings offer preliminary insights for policymakers to consider how to implement climate adaptation strategies and initiatives that reflect on and are responsive to the interconnected issues and systems that interact with these strategies.

This research also contributes to scholarly literature on macro level factors that influence the delivery of warming, cooling, and clean air spaces and expands on the importance of integrated and tailored community supports. Findings can inform improvements in the operations of

warming, cooling, and clean air spaces in Waterloo Region. Unpacking macro level impacts alongside the analysis of interactions between community supports in Waterloo Region may allow future research and policies to implement both vertical and horizontal support frameworks when establishing climate adaptation strategies. Further, this case study can provide insights for other jurisdictions in Ontario and more broadly in Canada to consider various structural factors that shape the delivery and operations of community supports aimed at addressing the impacts of extreme temperature and poor air quality events. (Birtel et al., 2017; Nayak et al., 2019; OECD, 2025; Rea, 2023).

4.4 Conclusion

This study explored the perceptions of Waterloo Region Heat, Cold, and Air Quality Network members on the strengths and limitations of warming, cooling, and clean air spaces operating in Waterloo Region. Results from the study amplify existing conversations on the importance of creating extreme temperature and poor air quality related adaptation strategies. This study also highlights the influence of structural challenges on the operations of specific community supports. Despite the reality that warming, cooling, and clean air spaces in Waterloo Region are open for the general public, there is recognition that specific populations, including people experiencing homelessness, people with substance use and mental health concerns, older adults, and newcomers may have a greater need for these spaces. Amid worsening extreme temperature and air quality events, this research underscores the need for integrated and tailored community supports that are responsive to both the climate-health and social needs of priority populations.

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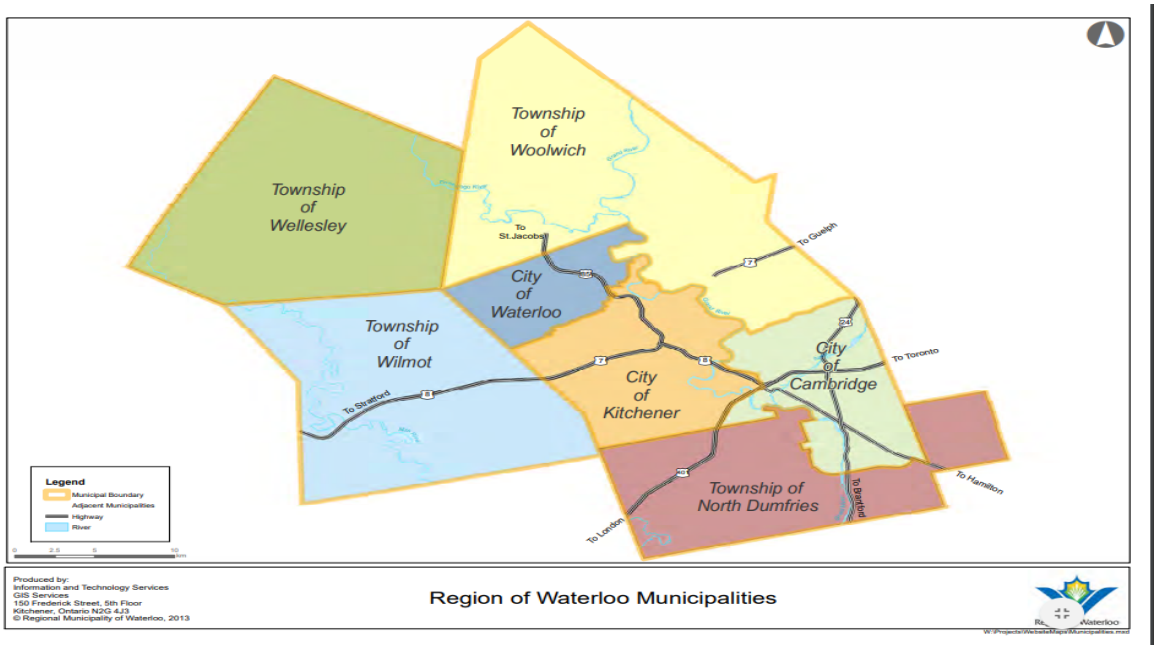
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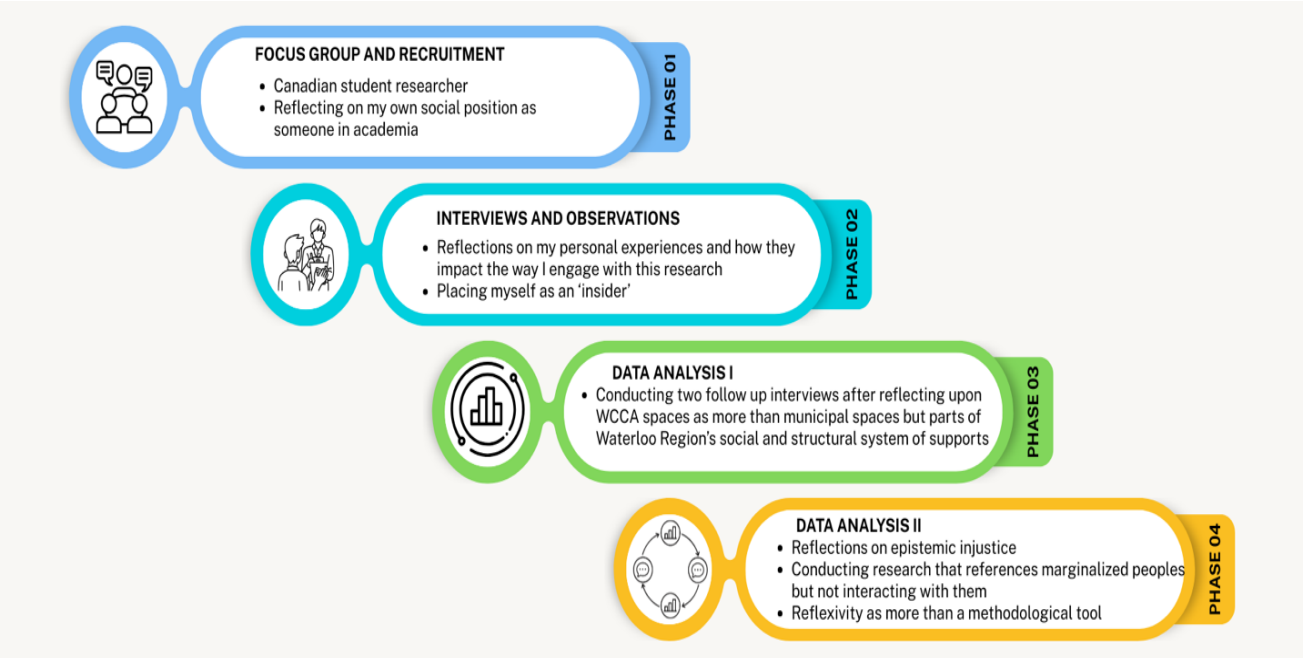
Appendices

Appendix A: Map of Region of Waterloo



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Appendix B: Positionality and Reflexivity Process



Appendix C: Original Interview Guide

INTERVIEW GUIDE: Waterloo Region Heat, Cold, and Air Quality Network (WRHCAN)

Notes:

- Target interview duration: approximately 45-60 minutes
- Format: virtual (Teams)
- Provide a high-level overview of the information letter (e.g., purpose of the study) shared via email
- Reminder of the consent process, right to withdraw, etc. (written informed consent will have been provided in advance of the interview)
- Reminder: ROWPH will not have access to the raw data of the evaluation

ADMINISTRATIVE
Date:
Two-Digit Participant Number:
Interview Location:
Interviewer Name:

PREAMBLE:
Thank you for taking the time to share your experiences of participating in the Waterloo Region Heat, Cold and Air Quality Network. During our conversation today, I'm interested in hearing about your experiences and perspectives as a member of the network and also your reflections on the capacity of the broader health and social service system in Waterloo Region to respond to the health risks posed by extreme heat, extreme cold, and poor air quality.

QUESTIONS AND PROMPTS:

Questions about your organization and context-setting

1. Can you tell me a little bit about your role in [ORGANIZATION] (i.e., your occupation, the organization/department you work for?)
   Probe: How long have you been working with the organization/in that role?

2. What populations does your organization serve?

Questions about your organization's experience with the WRHCAN

3. How did your organization become involved with the WRHCAN?

4. Does your organization offer a Warming, Cooling, and Clean Air Space(s) to the community?

   A) Probe: If *yes*, can you tell me about the space? When Environment and Climate Change Canada issues a Heat Warning, Extreme Cold Warning, or Special Air Quality Statement, what does your organization do to respond? Are there specific supports or services your organization offers?

   B) Probe: If *no*, can you tell me about how you or your organization connects with the work of the WRHCAN? When Environment and Climate Change Canada issues a Heat Warning, Extreme Cold Warning, or Special Air Quality Statement, what does your organization do to respond? Are there specific supports or services your organization offers?

5. How has your organization's participation in the network changed over time?
   Probe: How has the network changed over time? How have changes in the network affected how your organization has participated in the network?

Questions related to strengths and challenges of the WRHCAN

6. What are the benefits of participating in the WRHCAN for your organization?
   Probe: How does your organization's participation in the network contribute to your work? How does being part of this network enhance the ability of your organization to serve individuals?
   Probe: Collaboration with other organizations? Please tell me more about your experience of collaboration?
   Probe: Knowledge exchange? Learning about what other organizations are doing?
   Probe: What resources are needed for your organization to participate in the network?
   Probe: Have the benefits of participating with the WRHCAN changed over time?

7. Based on your experiences, how does the WRHCAN support your organization's work in the community and/or make it easier for individuals to access Warming, Cooling and Clean Air Spaces?
   Probe: Are there specific actions or processes implemented by ROWPH as part of their coordination role that supports your organization's work (e.g., information sharing, resource sharing, etc.)
   Probe: Are there specific resources associated with the WRHCAN that are helpful (e.g., Share information about the WCCA Spaces on a centralized webpage, provide an interactive map, share information via social media, respond to media inquiries (i.e., radio, TV, newspaper))

Probe: Has your experience of the network's coordination by ROWPH changed over time?

8. Based on your experiences, are there any challenges to being a part of the WRHCAN?
   Probe: What do you think contributes to these challenges?
   Probe: What recommendations do you have to address these challenges?

Questions related to impact and future directions for the WRHCAN

9. What impact does WRHCAN have in the community?
   Probe: What types of feedback do you receive from community members who use WCCA spaces? What types of feedback do you receive from community members who might not use the WCCA spaces?
   Probe: Why is the WRHCAN needed in the community? What would change if the WRHCAN did not exist?

10. How could WRHCAN improve their coordination efforts? What would you like to see changed about what the WRHCAN does or how it functions?

11. Are there any lessons about how the WRHCAN operates that you think might be beneficial for other communities or regions trying to implement similar initiatives?

Questions about systems-level response to extreme temperatures and poor air quality

12. How does WRHCAN fit in relation to other responses to climate change happening in Waterloo Region?
    Probe: How does WRHCAN contribute to climate adaptation efforts in Waterloo Region?

13. Do you see any trade-offs between addressing heating, cooling, and air quality within one network?
    Probe: resource efficiencies, different needs across heating, cooling, and air quality?
    Probe: What are the benefits of combining heating, cooling, and air quality?
    Probe: What are the drawbacks of combining heating, cooling, and air quality?

14. Are there any priority populations that you think are underserved by the current system-level response to extreme temperatures and poor air quality in our community?
    Probe: Why are these populations underserved?
    Probe: Any recommendations to better serve these populations?

15. Do you think the health and social service system in Waterloo Region is equipped to address current and anticipated challenges related to extreme temperatures and poor air quality?
    Probe: If yes, please explain the strengths of the current system?
    Probe: If no, what more needs to be done to strengthen the system?
    Probe: What is WRHCAN's role in supporting the broader health and social service system to respond to challenges related to extreme temperatures and poor air quality?
    Probe: What might an 'ideal' system's level response to extreme temperatures and poor air quality look like? What are the more important components of this response?

16. Is there anything else that you would like to add about your organization's experience supporting individuals in the community or your perspective on the WRHCAN?

CLOSING: Thank you for your time and for sharing your experiences and perspectives. Please feel free to email any questions or if you would like to share any additional thoughts on our conversation today. A reminder that you can withdraw any information or withdraw from the study altogether up to the point when synthesized/anonymized results are submitted for publication. We estimate that this will be about six months from now.

Appendix D: Follow-up Interview Guide

INTERVIEW GUIDE: Waterloo Region Heat, Cold, and Air Quality Network (WRHCAN)

Notes:

- Target interview duration: approximately 20-30 minutes
- Format: virtual (Teams)
- Reminder of the consent process, right to withdraw, etc. (written informed consent will have been provided in advance of the interview)

ADMINISTRATIVE

Date:
Two-Digit Participant Number: Interview Location: Interviewer Name:

1. Can you describe the role warming, cooling, and clean air spaces play in supporting people in Waterloo Region?

- *Probe:* How do these spaces connect to the services your organization already provides?
- *Probe:* What kinds of needs do people usually come with?

2. How do these spaces work alongside other community services in Waterloo Region? *Probe*: Do they help people connect to other supports?

- *Probe:* What works well about offering these supports together?
- *Probe:* Are there any gaps or limitations?

3. What factors shape the day-to-day operations of warming, cooling, and clean air spaces?

- *Probe:* Do issues like housing insecurity, substance use, or mental health affect how these spaces operate?
- *Probe:* Has this changed over time?

4. What challenges arise when people using these spaces have multiple needs, and how has your organization responded?

- *Probe:* How does your team adapt when someone needs more than just a place to stay warm, cool, or get clean air?
- *Probe:* Do you partner with other organizations?

5. Are there particular groups of people your organization focuses on supporting? *Probe:* Who tends to use these spaces most often?

- *Probe:* Are there groups whose needs are harder to meet?

Appendix E: Thematic Analysis-Themes and Sub-Themes

Theme 1: Cross-sectoral collaboration and information sharing in the WRHCAN	
Sub-Theme	**Example Quotations**
Information sharing across different network organizations	"It really demonstrates that this is our opportunity to engage, network, and share information and resources and it helps break down those silos. A lot of us are either interacting with or working towards programming to support the same groups."
Resources offered and shared across different network organizations	"And I think also to that effect, we can also be a point of distribution, not just information, but also for things. We still have the masks that were distributed when there was the air quality issues."
WRHCAN as a formal coordinating body	"I would say a tangible example is that it saves me time having to investigate or find out credible sources of information to relay to the rest of my team and my work colleagues. So, the minute I receive an update from any of the team at the Region, I automatically read it, vet it for what I really need my frontline workers to know, and then I disseminate that information agency wide."
Theme 2: Challenges that affect the operations of warming, cooling, and clean air spaces	
Sub-Theme	**Quotations**
Limited hours of operation	"I think the biggest thing for us honestly would be some help in figuring out how to provide resources to people who need to access us outside of our open hours, right?"
Availability of warming, cooling, and clean air spaces	"Do we have people who are sharing this information at encampments or those types of places? Or [is that] reaching folks who are on the streets to let them know of these spaces?"
Operational alignment across warming, cooling, and clean air spaces	"Who could we contact on a Saturday afternoon of a long weekend? Winter or summer? What resources are there that maybe they don't need to go to the hospital?"
Theme 3: Participant perspectives on community supports operating alongside warming, colling, and clean air spaces	
Sub-Theme	**Quotations**
Overlapping supports for different populations	"We embed this kind of work from the very beginning as a CHC [Community Health Centre], so you know when it was reaching temperatures that were considered a heat advisory, we always allowed people to sit in our lobbies. We offered water. And just respite from the weather."
Tailored supports for community members across different organizations	"Like the consumption and treatment services site not only offered supervised consumption, but it also offered a space for people who use drugs to go and be. For example, the Kitchener Public Library is super close to the CTS and so that was one of the spaces that we kind of said, you know, here's one space that people can access as a heating, cooling and clean air space."

Theme 4: System level reflections on the operations of community supports in the Waterloo Region including warming, cooling, and clean air spaces	
Sub-Theme	**Quotations**
Funding constraints	"Are we happy with the status quo, or do we try and look at expanding it [WCCA operations]? But, you know, with expansion comes costs of people's time, effort and money. And would that reduce the overall effectiveness of the program?"
The role of different levels of government	"And so, we're also the recipients of the new HART hub funding. I'm not sure if you're familiar with that but when the CTS sites were closed by the provincial government, the HART hub is the funding that's supposed to replace that service in the community."
Housing crisis as a factor for increasing demand of community supports	"This year we were seeing lots of people just losing their housing that had never had the experience of homelessness at all, and we were just having to give them tents and send them outside."
Stigma in accessing warming, cooling, and clean air spaces	"A large number of the homeless know where they're going to be accepted. The challenge is: is it getting to the homeless that are not part of the general homeless population."
WCCA spaces as release valves	"We're in a very dire circumstance, I think in not just the Region of Waterloo, but Ontario and Canada across the board that we do need to make shifts, otherwise there is going to be higher reliance on programs like this."