

Exploring intersectoral collaboration in a community-based climate adaptation initiative: A qualitative case study of the Waterloo Region Heat, Cold and Air Quality Network (WRHCAN)

by

Sabeen Abbas

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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, Sabeen Abbas, authored Chapters 1, 2, and 4 of this thesis under the supervision of Dr. Warren Dodd. These chapters were prepared for this thesis and not for publication. Chapter 3 was prepared as a manuscript with the intent of publication. Co-authors of the manuscript are indicated in Chapter 3, and their contributions to the work are described below.

Chapter 3

I, under the supervision of Dr. Warren Dodd, have been the primary researcher and contributor to the preparation of the manuscript to date, including data collection, analysis, and write-up. Contributions from co-authors have been primarily to the total research efforts as members of the research team.

Dr. Laura Jane Brubacher is a postdoctoral fellow at the University of Waterloo and a member of the research team. Dr. Brubacher co-facilitated the focus group with Region of Waterloo Public Health, provided guidance on participant recruitment and data collection as well as reviewing and revising the manuscript as a thesis committee member.

Minal Waqar is a PhD student at the University of Waterloo and a member of the research team. Minal assisted with participant recruitment and data analysis.

Hateem Noor is a MSc student at the University of Waterloo and a member of the research team. Hateem assisted with participant recruitment and data collection.

Dr. Samantha Meyer is a Professor at the University of Waterloo. Dr. Meyer contributed to reviewing and revising the manuscript as a thesis committee member.

Dr. Chris Perlman is an Associate Professor at the University of Waterloo. Dr. Perlman contributed to reviewing and revising the manuscript as a thesis committee member.

Dr. Warren Dodd is the supervisor of this thesis research and an Associate Professor at the University of Waterloo. Dr. Dodd provided support throughout all stages of the project, and contributed to research study design and implementation, as well as reviewing and revising the manuscript.

Abstract

Background: An increase in the frequency and severity of extreme weather and poor air quality events due to anthropogenic climate change has resulted in negative implications for human and planetary health. Understanding the role of local public health units in the development and implementation of community-based climate change adaptation initiatives can minimize the health impacts of climate change and enhance community resilience. This study aimed to explore the facilitators and barriers to intersectoral collaboration for Network partners of the Waterloo Region Heat, Cold and Air Quality Network (WRHCAN), a public health led climate adaptation initiative.

Methods: A community engaged research approach informed the study design and community-academic partnership between the University of Waterloo and Region of Waterloo Public Health (ROWPH). A case study methodology was applied to explore the processes of intersectoral collaboration in the context of the WRHCAN. Data sources included a focus group with ROWPH, 13 semi-structured interviews with Network partners, participant observation of two Network meetings, and a document review of selected WRHCAN internal documents. Recruitment was facilitated by ROWPH, and data collection and analysis were guided by the Bergen Model of Collaborative Functioning, a theoretical framework for intersectoral collaboration. All interviews were audio-recorded using Teams and transcribed verbatim. Interview data were thematically analyzed using a hybrid inductive-deductive approach.

Results: Network partners identified several facilitators and barriers, as well as contextual factors influencing intersectoral collaboration in the WRHCAN. For Network partners, facilitators included alignment with WRHCAN objectives, coordination by ROWPH, usefulness of communication products, and information and resource sharing with other Network partners. Barriers included accessibility of information and resources for vulnerable populations, and the need for more tailored training and response by frontline staff. Contextual factors included the housing and affordability crisis impacting Waterloo Region and the need to address the specific challenges of those experiencing substance use challenges, mental health concerns, and/or homelessness.

Conclusion: This study highlighted intersectoral collaboration as an approach that can be leveraged by local public health units in the design and implementation of community-based climate change adaptation initiatives. This study provides insights into the facilitators and barriers experienced by WRHCAN Network partners. The findings from this study can inform future climate change adaptation efforts that utilize intersectoral collaboration.

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List of Abbreviations

BMCF	Bergen Model of Collaborative Functioning
CBPR	Community Based Participatory Research
CCHVA	Climate Change Health and Vulnerability Assessment
CEnR	Community Engaged Research Approach
EHE	Extreme heat event
HAP	Heat action plan
HiAP	Health in All Policies
IPCC	Intergovernmental Panel on Climate Change
ROWPH	Region of Waterloo Public Health
WCCA Spaces	Warming, Cooling and Clean Air Spaces
WRHCAN	Waterloo Region Heat, Cold and Air Quality Network

Chapter 1: Introduction

For this thesis research project, I explored the facilitators and barriers to intersectoral collaboration in a public health led community-based climate adaptation initiative – the Waterloo Region Heat, Cold and Air Quality Network (WRHCAN). In this chapter, I will provide a synthesis of selected literature on health and climate change broadly, followed by the role of public health as it relates to climate change adaptation, and finally intersectoral collaboration in health promotion to situate and contextualize the research study within a body of academic literature.

1.1 Health and climate change

Anthropogenic climate change poses an existential threat to Earth's biodiversity and planetary systems and has significant negative impacts on human health (Calvin et al., 2023; Kareiva & Carranza, 2018; McMichael, 2013; Rockström et al., 2009; Romanello et al., 2022). Climate change has increased the frequency and severity of extreme temperature and poor air quality events, such as heat waves, wildfires, violent storms, floods, and drought (Calvin et al., 2023; Romanello et al., 2024). This has resulted in excess morbidity and mortality, and has had adverse health impacts on mental health and well-being (Calvin et al., 2023; Dodd et al., 2018; Romanello et al., 2024). Given the current trajectory of global fossil fuel emissions, the negative impacts of climate change on population health are unavoidable; however, building climate-resilient health systems through improved risk reduction, preparation, response, and recovery can reduce or prevent some of the health risks (Ebi et al., 2021b). It is relatively recent that climate change has begun to be considered a public health emergency (Solomon & LaRocque, 2019). A focus on the human health impacts of climate change resulting from extreme temperature and poor air quality events may be what is needed to spur greater climate action and policy change (Sheehan, 2022).

1.1.1 Health impacts of climate change

The health impacts of climate change are wide-ranging, in part due to the ways in which climate change interacts with other environmental, social, and political factors, such as population growth, urbanization, land use changes, and availability of freshwater resources, to name just a few (Haines et al., 2006; Liu et al., 2023; Ofremu et al., 2025). Health risks posed by climate change include mental illness, malnutrition, allergies, cardiovascular diseases, infectious diseases, injuries, respiratory diseases, and poisoning (Romanello et al., 2024; S. Tong & Ebi, 2019; Yenew et al., 2025). These health risks are influenced by a combination of direct (e.g., storms, drought, flood, heatwave) and indirect

effects (e.g., water quality, air pollution, land use change, ecological change), as well as the social dynamics (e.g., age, gender, health status, socioeconomic status) of the specific population in question (Negandhi et al., 2025; S. Tong & Ebi, 2019). The negative health impacts of climate change are not distributed equally in a population, but often reflect underlying inequitable social structures and existing social vulnerabilities (Li et al., 2023a). Specifically, the physical and mental health impacts of climate change disproportionately impact people with low socioeconomic status, children, older adults, pregnant women, communities of color, Indigenous peoples, vulnerable occupational groups, people with disabilities, and people with chronic or preexisting medical conditions (Crimmins et al., 2016; Li et al., 2023b; White et al., 2023a). Epidemiological studies have demonstrated the relationship between extreme heat and air pollution attributed to climate change with increased mortality and morbidity (Ebi et al., 2021a; Goldberg, 2008; Hamanaka & Mutlu, 2018). More recently, research has focused on exploring the connection between climate change and mental health impacts (Charlson et al., 2022; Hayes et al., 2018; White et al., 2023b). As a result of climate change, Canada is experiencing warming at twice the global average, with future heat-related mortality projected to increase by as much as 10.7% by 2090 (Health Canada, 2025; Hebborn et al., 2023). Understanding and being prepared for the health impacts of climate change is essential for maintaining population health at the local as well as the national and global levels.

1.2 Public health and climate change adaptation

A commonly cited definition of public health dating back a century defines public health as “the art and science of preventing disease, prolonging life and promoting health through the organized efforts of society (Winslow, 1920).” Having a shared understanding of public health is important for being able to respond to contemporary challenges, such as those posed by climate change, and can potentially lead to more timely climate action (Azari & Borisch, 2023). In Canada, public health is a shared responsibility between the provincial, territorial, and federal governments. Local public health units play an important role in being the institutions responsible for taking action at the local level (Plante et al., 2023). There are six essential public health functions that define the key activities of public health systems: health promotion, health surveillance, health protection, population health assessment, disease and injury prevention, and emergency prediction, preparedness, and response (Public Health Agency of Canada, 2022). Public health plays a critical role in responding to climate change through each of these six functions (Public Health Agency of Canada, 2022). For instance, examples related to health surveillance include collecting data on disease incidence for Lyme disease, West Nile virus or syndromic surveillance for heat-related illnesses in emergency departments (Public Health Agency of Canada, 2022). Local public health units are uniquely positioned to develop effective responses that take

into consideration the interaction between human and environmental health through their scope of work, which includes risk management, preparation, and public communication (Gough et al., 2016).

Action on climate change can be divided into two broad categories: mitigation and adaptation. While mitigation aims to reduce or eliminate greenhouse gas emissions to limit future climate change, climate adaptation seeks to respond to current and predicted future climatic scenarios, with the aim of reducing negative health impacts of climate change. Effective adaptation and adaptive strategies to respond to climate change health risks require collaboration between diverse stakeholders and community members (Joseph et al., 2023). The 2015 legally binding international treaty on climate change, also known as the Paris Agreement, included adaptation as a critical component in the global response to climate change. Climate adaptation can be described broadly as interventions that seek to minimize the health impacts of climate change and enhance resilience (Brink et al., 2024). In Canada, there is a lot of variability across jurisdictions both in terms of health adaptation type (e.g., capacity building, management planning and policy, practice and behaviour, information, warning or observing systems, vulnerability assessment) and whether an action is still in the planning stages or has been implemented and this has implications for population health (Austin et al., 2015; Biagini et al., 2014). While adaptation actions may be implemented at the local level through the actions of local public health units, these actions are often shaped by federal and provincial or territorial guidelines and funding (Austin et al., 2015). The role of local public health units in translating policy to action means that learning from different contexts can inform the development of future climate adaptation initiatives. For instance, lessons learned from the 2021 heat dome event in British Columbia informed public health planning and response activities in other communities across Canada (Henderson et al., 2022).

Research on the impact and effectiveness of climate change adaptation initiatives on health outcomes is limited (Berrang-Ford et al., 2021; Brink et al., 2024; Jabakhanji et al., 2022; Luyten et al., 2023). Understanding the effectiveness of various climate adaptation initiatives and their impact on health is important because it ensures that policies and programs are appropriate to the specific context and are supporting population health. Evaluations of climate adaptation initiatives can support evidence-based decision-making and contribute to bridging this research gap in the climate adaptation literature (Berrang-Ford et al., 2021). Evaluating climate change adaptation initiatives is challenging for several reasons (Alderwick et al., 2021; Joseph et al., 2023). One of the challenges is related to attribution of positive outcomes to a specific program because of the many up- and down-stream factors that impact climate change adaptation initiatives, such as the impact of climate change at a local level and the specific community context that has been

shaped by various policy decisions (Joseph et al., 2023). Additionally, organizational barriers to conducting evaluations, such as the perceived need and feasibility of an evaluation, availability of funding and expertise, and willingness to learn from an evaluation, may impact whether an evaluation of a climate adaptation initiative is conducted (Moser & Ekstrom, 2010). Examples from the adaptation literature provide some insights into how researchers are studying effectiveness of climate adaptation initiatives and this can inform evaluation efforts (Owen, 2020).

1.2.1 Vulnerability assessments

Climate change and health vulnerability assessments have been used by the public health sector as a tool to develop an understanding of climate-health risks for local/regional populations under projected future climate scenarios (Buse, 2018; Ebi et al., 2006). These assessments are used to support adaptation planning processes to reduce climate-health risks (Brown et al., 2011). Understanding vulnerability to climate change is a precursor to developing effective adaptation strategies to respond to extreme temperature and poor air quality events (Füssel & Klein, 2006; *Ontario CCHVAA Guidelines*, 2016; Wang et al., 2014). Climate change vulnerability and adaptation assessments help inform local programs and policies by considering current and future climate risks (*Ontario CCHVAA Guidelines*, 2016).

A climate change and health vulnerability assessment was recently completed for the area spanning Waterloo Region, Wellington County, Dufferin County, and the City of Guelph (Buse et al., 2022). The report included a description of the methodology used to identify health vulnerability to climate change in the focus regions; a review of public health evidence related to climate-health risks (e.g., extreme temperatures, ultraviolet radiation, extreme weather, food- and water-borne illnesses, air quality, vector-borne diseases, and mental health); and a rapid risk assessment related to each of the climate-health risk areas. The purpose of the report was to support the development of adaptation and mitigation initiatives to reduce vulnerability. The Climate Change and Health Vulnerability Assessment (CCHVA) for Waterloo Region, Wellington County, Dufferin County, and the City of Guelph identified extreme heat as the highest priority climate-health risk now and into the future (Buse et al., 2022). Extreme heat events pose a significant risk of morbidity and mortality, even with a short exposure period and are especially serious for vulnerable groups, such as older adults, people with chronic health conditions, and those living alone or socially isolated (Bassil & Cole, 2010; Hess et al., 2023; Mayrhuber et al., 2018). Hess and colleagues (2023) have pointed to extreme heat event (EHE) preparedness and heat action plan (HAP) development as fundamental activities in the development of climate-resilient health systems and a site for public health action. An understanding of the

current and projected climate-health risks gained through a vulnerability assessment can lead to the development of adaptation strategies that are contextually appropriate and support communities in being climate resilient.

1.2.2 Adaptation strategies

Communities are engaging in a wide range of activities to support mitigation and adaptation efforts (Gupta & Shukla, 2024; Zimmerman & Faris, 2011). Adaptation strategies are often developed to reflect local needs and priorities (Zimmerman & Faris, 2011). Examples of adaptation strategies include climate resilience plans to support emergency preparedness and response or heat action plans to support greater public awareness of heat waves through early warning systems (Gupta & Shukla, 2024). In the North American context, cooling centres are a common adaptation intervention in many cities and communities (Dearman et al., 2025). However, the first systemic review to assess the evidence-base for the public impact of cooling centres on heat-related health outcomes only found five published studies of low to moderate quality (Dearman et al., 2025). The study authors cautioned that this does not mean that there are no benefits to cooling centres, but that more research would need to be completed to conclusively determine public health benefits of cooling centres. Another study took a different approach by exploring the barriers and opportunities related to access and use of cooling centres from user and service provider perspectives in the metro Vancouver region of British Columbia (Yoon et al., 2025). The study found several barriers including residents' concerns related to access (e.g., safety concerns around public spaces and stigma around intended users of cooling centres), operational barriers (e.g., awareness about the centres), and infrastructural barriers (e.g., transit-related challenges). The study authors found that the voluntary use of cooling centres for cooling was low, possibly related to the tensions between individuals preferring to exercise their personal agency and the available cooling centres not being a good fit for their needs (Yoon et al., 2025). Given that cooling centres are a frequently implemented climate adaptation in North America, evaluation research can contribute to our understanding of the effectiveness of this climate adaptation strategy to reduce vulnerability to extreme heat.

1.3 Intersectoral collaboration and health promotion

Intersectoral collaboration, also referred to as multisectoral action or intersectoral action, is a strategy promoted by several institutions, including the World Health Organization, the Public Health Agency of Canada and the Canadian National Collaborating Centre for Healthy Public Policy (Chircop et al., 2015). Research on intersectoral collaboration exists in fields other than public health research, such as political science, public administration, and environmental sciences, and theories from these diverse fields has informed thinking

on intersectoral action in public health (Mondal et al., 2021). In a health promotion context, intersectoral collaboration is about building and strengthening networks within the health sector and also between health and other sectors, such as agriculture, education, and transportation, amongst others (Corbin et al., 2018; De Jong et al., 2023; Koelen et al., 2012). A definition that is useful in the context of this research project comes from the WHO, which defines intersectoral action as “the involvement of several sectors in developing and implementing public policies intended to improve health, equity, well-being and other policy outcomes” (*Working Together for Equity and Healthier Populations*, 2023, p.5). Various terms have been used to describe intersectoral partnerships, such as alliances, coalitions, consortiums, collaborations, partnerships and networks (Dubois et al., 2015; Parent & Harvey, 2009). Climate change is a complex, multi-causal problem that requires multiple sectors and organizations working in collaboration to address intersecting and overlapping challenges (Rutter et al., 2017). Due to the way climate change impacts multiple sectors, a systems-based approach is needed to address the adverse health risks posed by climate change (Bowen & Ebi, 2015). This thesis aims to contribute to the emerging body of literature on climate change adaptation (Hossain, 2025; Shakya & Khan, 2025) through a case study of a public health coordinated climate change adaptation initiative that leverages intersectoral collaboration.

Several reviews have been published to date that synthesize current understandings of intersectoral collaboration in health promotion partnerships (Alderwick et al., 2021; Corbin et al., 2018; Foster-Fishman et al., 2001; Ndumbe-Eyoh & Moffatt, 2013; Roussos & Fawcett, 2000; Seaton et al., 2018; Wiggins et al., 2021; Zakocs & Edwards, 2006). In a narrative synthesis review, Corbin et al. (2018) used the Bergen Model of Collaborative Functioning (BMCF) as the analytic anchor to examine the processes that support and inhibit partnership functioning in the health promotion literature. The synthesis of findings across different studies provides a more nuanced understanding of the processes that shape intersectoral collaboration and resulted in recommendations for best practices for practitioners (Corbin et al., 2018). A systematic review combined two different theoretical frameworks, the Parent and Harvey model (Parent & Harvey, 2009) with the BMCF (Corbin & Mittelmark, 2008) to identify the characteristics of successful intersectoral partnerships that lead to synergistic outputs (Wiggins et al., 2021). They found that the elements represented by the selected frameworks were reflected in the literature, but that some aspects were not captured, such as ongoing sustainability of partnerships (Wiggins et al., 2021). There is some consensus that successful partnerships result in synergy (Corbin et al., 2018; Corbin & Mittelmark, 2008; Lasker & Weiss, 2003) through the “pooling and exchange of diverse and complementary resources” to better achieve common goals (Holt & Aveling, 2023, p.1). Intersectoral collaboration is also an aspect of the Health in All

Policies approach, which is a strategy to improve population health and health equity by addressing the social determinants of health (Guglielmin et al., 2018; World Health Organization, 2013). An intersectoral approach contributes to improved health and well-being for communities by addressing the social determinants of health. This approach is particularly suited for complex public health challenges, such as those posed by climate change. While intersectoral collaboration has been studied extensively in different settings, there are few studies specifically focused on intersectoral collaboration to facilitate climate adaptation initiatives from a public health perspective.

1.3.1 Theoretical frameworks of intersectoral collaboration

In the field of health promotion, several different theoretical frameworks pertaining to intersectoral collaboration have been described in the literature. Some of these frameworks include the Community Coalition Action theory (Kegler et al., 2010), the Healthy Alliances Framework (Koelen et al., 2012), the Parent and Harvey model (Parent & Harvey, 2009) and the Bergen Model of Collaborative Functioning (BMCF) (Corbin & Mittelmark, 2008). The theoretical models seek to identify elements that lead to the success of a collaboration or partnership and those factors that hinder collaborations. Different theoretical frameworks conceptualize intersectoral collaboration in slightly different ways. For instance, the Healthy Alliances framework has identified institutional factors, (inter)personal factors, and the organization of the coalition as being the three areas that affect collaboration (Koelen et al., 2012). In contrast, the Parent and Harvey (2009) model includes three main components: the antecedents, the management, and the evaluation of a partnership, as well as several sub-components within each component. Researchers have also merged and adapted frameworks to better respond to specific research contexts or to better answer a research question. For example, Raftery et al. (2022) adapted the BMCF using elements from the literature not captured by this framework in order to understand and evaluate a global health partnership in the United Kingdom. This suggests that theoretical frameworks can provide a starting point to understand intersectoral collaboration but may benefit from refinements specific to a particular research context.

1.3.2 Bergen Model of Collaborative Functioning (BMCF)

The BMCF is a theoretical framework that conceptualizes intersectoral collaboration as a system that consists of inputs, throughputs, outputs, and feedback components (Corbin & Mittelmark, 2008). The BMCF defines partnership inputs as the mission, partner resources (skills, expertise and networks), and financial resources. The throughputs consist of four different elements that shape the collaboration: interaction between the inputs, leadership, roles and structures, and communication practices. Partnerships require both

maintenance activities that relate to administrative tasks that support the ongoing collaboration and production activities that are the tangible results of a collaboration and take place within and are shaped by the collaborative space. The outputs of a collaborative partnership can be evaluated as additive, antagonistic, or synergistic (Corbin & Mittelmark, 2008).

I selected the Bergen Model of Collaborative Functioning (BMCF) as the theoretical framework to inform my thinking around intersectoral collaboration in the context of the WRHCAN. The BMCF has been empirically tested in health promotion programs and may be the most widely used framework for analyzing partnership functioning (Raftery et al., 2022), which informed my decision to use the BMCF as an analytical tool during the data analysis process. The BMCF has also been used in partnership evaluations as a tool to understand and improve existing processes within partnerships (Corbin & Mittelmark, 2008). As this research included an evaluation of an intersectoral partnership, the BMCF was selected to support the study.

1.4 Study context and research objectives

1.4.1 Case description

The study takes place in Waterloo Region in Southwestern Ontario. Waterloo Region includes the cities of Cambridge, Kitchener, and Waterloo, and the rural townships of North Dumfries, Wellesley, Wilmot, and Woolwich. In recent years, the Region has seen significant population growth. Based on the past 15 years of population data, the Region's population has grown at an average of 1.5 percent per year (Region of Waterloo, n.d.). As of year-end 2024, the total population of Waterloo Region is estimated to be 678,170, which includes post-secondary students (Region of Waterloo, n.d.). Like much of the rest of Ontario and Canada, the housing crisis has also impacted Waterloo Region (Petric et al., 2024). The housing crisis is in part due to population growth but also a lack of housing supply and appropriate housing options (Petric et al., 2024). Waterloo Region has also experienced recent climate-change related extreme temperatures (Kuivenhoven, 2024) and poor air quality due to wildfire smoke (Pavia, 2025). The Region has begun to take steps to address climate change, including conducting a Climate Change Health and Vulnerability Assessment (Buse et al., 2022).

The Waterloo Region Heat, Cold and Air Quality Network (WRHCAN) is the focus of this study. Waterloo Region's Community Climate Adaptation (CCA) Plan describes the WRHCAN as one current action being taken to support the goal of helping vulnerable populations avoid or reduce experiencing health-related risks of extreme weather and temperatures (Regional Municipality of Waterloo, 2019). The Region of Waterloo is

implementing a wide range of practices that fall under adaptation, which are described in the CCA Plan. A few examples include having heat- and weather-related policies for workers, collaborating with community partners, such as the Emergency Management Office and Wellbeing WR to support mental health and wellbeing, and having emergency kit information available via the AlertWR.ca website.

The WRHCAN is coordinated by Region of Waterloo Public Health (ROWPH) and consists of approximately 36 Network partners who represent municipal and regional government departments and community-based organizations focused on providing health and social services within Waterloo Region. Some Network partners offer what are referred to as Warming, Cooling and Clean Air Spaces (WCCA Spaces). The terminology of “WCCA Spaces” is specific to the WRHCAN and was recently introduced by ROWPH. WCCA Spaces are generally public spaces, although private businesses can also offer WCCA spaces. These spaces are open during regular business hours. An interactive map is available online with information on the 53 available sites:

<https://experience.arcgis.com/experience/b85000514c104d1ea675f7b2f41b7008/> ([Map], n.d.). Sites are distributed throughout Waterloo Region. Locations include recreation centres, administrative buildings, libraries, and museums. The majority of WCCA spaces are libraries and recreation centres. Some sites are only available to the public when a heat or cold warning is issued by Environment and Climate Change Canada, while others are open to all members of the public regardless of any special weather statements.

The main objectives of the Network are to strengthen community resilience through effective community preparedness and response; facilitate knowledge exchange and resource sharing; increase community capacity through enhanced skills and knowledge to respond to climate change related weather events; and to address local needs and community-specific challenges (internal WRHCAN Terms of Reference document, 2025). Poor air quality due to wildfire smoke was identified as an emergent concern following the record-breaking wildfires in Ontario during the summer of 2023. The name of the Network was recently changed to reflect the inclusion of this climate health risk consideration. ROWPH coordinates the Network through bi-annual meetings and email bulletins (e-bulletins), maintains an interactive map of WCCA Spaces, maintains documentation and contact information related to the Network, and shares health information and resources with the public and with community partners. Network partners may offer WCCA Spaces although not all partners do. All Network partners may participate in knowledge exchange opportunities, share health-related information with staff and/or the public, and inform ROWPH if heat, cold, and/or air quality related illnesses/injuries are observed.

ROWPH expressed an interest in evaluating partnership functioning within the WRHCAN to the research team from the University of Waterloo School of Public Health led by Dr. Warren Dodd. To better understand the context of the WRHCAN's development, and build a conceptual foundation for the thesis research that follows, a focus group with ROWPH was held to understand key events that shaped the WRHCAN and to clarify evaluation objectives. A semi-structured interview guide and a timeline mapping activity were used to guide the conversation between the University of Waterloo research team and ROWPH partners to understand the context and decision-making process that shaped the WRHCAN. The WRHCAN originated in 2010 when it began as a network of "heat partners" made up of Community Emergency Management Coordinators, fire chiefs, and other emergency management leads. The original network continued to grow through word of mouth. The WRHCAN has evolved over time to reflect community needs and priorities. As climate change impacts become more severe, it becomes increasingly important to be able to respond to local climate-health risks through appropriate climate adaptation initiatives. The WRHCAN is an illustrative case to explore the processes that shape intersectoral collaboration in a climate adaptation initiative.

1.4.2 Research partnership

A previous research-evaluation project in 2023-2024 established a research relationship between the University of Waterloo research team that would go on to be involved in the WRHCAN project in partnership with ROWPH. That research relationship resulted in discussions around a possible future project supporting the ongoing climate-health work coordinated by ROWPH. The current research study that is the basis of this thesis evolved out of those conversations between the research team and ROWPH and the need to understand partnership functioning in the WRHCAN.

1.4.3 Rationale and research objectives

This study seeks to explore intersectoral collaboration in the context of the WRHCAN. The research question is: What are the facilitators and barriers to intersectoral collaboration in a community-based climate adaptation initiative in Waterloo Region? The objectives of this research were to: 1) explore Network partners' experiences of participating in the WRHCAN, and 2) explore the perceived facilitators and barriers to providing supports and services within the scope of adaptation activities provided by the WRHCAN.

This research makes two important contributions related to the role of intersectoral collaboration in offering heating, cooling, and clean air spaces in the North American context. Firstly, this study describes the processes of intersectoral collaboration that influence the WHRCAN through the perspective of Network partners. Network partners are

uniquely positioned to provide insights related to intersectoral collaboration in the context of this climate adaptation initiative. Understanding the processes that shape intersectoral collaboration through research and evaluation can support planning and decision-making. Secondly, this study contributes to the available evidence base to support the development of evidence-based policies and practices to respond to climate-health risks (Hess et al., 2014). This study represents the first evaluation of the WRHCAN. The results of this study can inform the future direction and development of the WRHCAN and more broadly, contribute to reducing barriers to implementation of action on climate change in other contexts (Fears et al., 2021).

Chapter 2: Methods

2.1 Research approach and methodology

2.1.1 Community-engaged research and community-academic partnerships

This research study leveraged an established community-academic partnership between Dr. Warren Dodd's research team at the University of Waterloo and the Region of Waterloo Public Health (ROWPH) to explore intersectoral collaboration in the context of a public health coordinated community-based climate adaptation. ROWPH was interested in having the research team evaluate partnership functioning in the Waterloo Region Heat, Cold and Air Quality Network (WRHCAN). Guided by a community-engaged research (CEnR) approach, the research team collaborated with ROWPH to conduct an evaluation of the WRHCAN and explore the processes of intersectoral collaboration in this context.

CEnR exists along a continuum involving different levels and forms of community involvement that may vary at different stages of the research process (Key et al., 2019). CEnR falls under the broader research umbrella of community-based participatory research (CBPR). The principles underlying CBPR – relationship building, trust, open communication, co-learning, shared power, resources, and decision-making between researchers and community partners – remain the same for different levels of CEnR (Irby et al., 2021; Israel et al., 1998; London et al., 2020; Rhodes et al., 2018; N. B. Wallerstein & Duran, 2006). The inclusion of community members and representatives from community organizations may improve the design and implementation of a research project (Rhodes et al., 2018). This approach can result in findings that are more contextually relevant and culturally appropriate, contributing to sustained improvements in community and population level health (Rhodes et al., 2018). A CEnR approach enables meaningful participation in the research process by community partners that aligns with community capacity to participate (Key et al., 2019; London et al., 2020). The goals of public health research conducted using a CEnR paradigm vary; however they often prioritize increasing health equity, reducing health disparities, and improving overall community and population-level health outcomes (Irby et al., 2021).

Working on a community-engaged research project can also help emerging scholars gain valuable skills as they navigate the strengths and challenges of a community-academic partnership (Nelson & Dodd, 2017). My experience of working on this research project was shaped by my role as a graduate student researcher within a broader research team. Having an experienced researcher guiding the partnership provided me with an opportunity to observe and learn from their experiences of navigating community-academic partnerships. I also experienced the challenge of conducting research that contributes to

the scholarly literature on intersectoral collaboration while providing useful results for community partners (i.e., ROWPH and the WRHCAN), all within the timeline of a Masters program. I appreciated the team approach that a community-academic partnership encouraged for the opportunities to collaborate with other graduate students on all aspects of the research process and the ways in which this supported the ability to be reflexive through ongoing discussions on methodological issues and during the data analysis process.

Conceptualizing CEnR on a continuum is particularly useful for understanding how researchers and community partners can engage in the research process when developing a community-academic partnership, as was the case for this research project (Key et al., 2019). This research project falls somewhere in the middle of the continuum described by Key et al. (2019) in that it involved community consultation with ROWPH, both in the identification of key objectives for the process evaluation and in the facilitation of participant recruitment for data collection. Ongoing efforts towards relationship-building during meetings further built trust and facilitated the research process (e.g., incorporating feedback from ROWPH on interview guides).

2.1.2 Qualitative case study and partnership evaluation

I used a qualitative case study methodology to explore intersectoral collaboration in the context of the WRHCAN. A case study methodology is an appropriate choice for exploratory research questions that ask “how”, “what”, and “why” questions in order to explore an issue or phenomena in-depth and in context (Baxter & Jack, 2015; Crowe et al., 2011; Sibbald et al., 2021). There are three main types of case studies: intrinsic, instrumental, and collective (Stake, 1995). An instrumental case study approach was used for this research project as the focus was on the phenomenon of interest rather than the uniqueness of the case. In this case, the phenomenon of interest is intersectoral collaboration and the unique case is the WRHCAN. Providing warming, cooling, and clean air spaces as an adaptation to climate change health risks is not a unique climate adaptation. However, the role of public health leadership in coordinating and communicating with diverse organizations may be of interest in furthering climate adaptation efforts in other communities. An instrumental case study also allows for research findings to be used to refine existing theoretical frameworks, which is another potential contribution of this research study (Stake, 1995).

Case study research involves defining the case and identifying the phenomenon of interest. Cases need to be bound by time and place (VanWynsberghe & Khan, 2007). The starting point for this research project was the ROWPH’s interest in an evaluation of the WRHCAN to understand the functioning of the Network from the perspective of Network

partners. The WHRCAN was selected as the case because of its function within Waterloo Region as one initiative to support climate change adaptation. An effective adaptation response enhances adaptive capacity, strengthens resilience, and reduces vulnerability to climate change (Owen, 2020; Singh et al., 2022). Evaluating the effectiveness of climate change adaptations and engaging in knowledge translation is essential for making evidence-based policy decisions in public health (Hess et al., 2014). A range of tools and methods are available to public health actors to support climate and health related policies and actions, such as health impact assessments, vulnerability and adaptation assessments, conceptual frameworks (e.g., the Driver, Pressure, State, Exposure, Effect, Action (DPSEEA) approach for modifying green spaces), and participatory approaches (*Tools and Methods for Integrating Health into Climate Change Adaptation and Mitigation Policies and Strategies. Report*, 2021). An evidence-based approach supported by case studies can help to prioritize implementation of climate change adaptation efforts, contributing to better population health outcomes (Neta et al., 2022).

2.2 Data Collection

The research team was comprised of Dr. Warren Dodd (supervisor), Dr. Laura Jane Brubacher (post-doctoral scholar), Minal Waqar (PhD student), Hateem Noor (MSc student), and me. Data collection was designed with the goals of collecting data to support an evaluation of partnership functioning in the WRHCAN and to explore intersectoral collaboration in a public health led climate change adaptation initiative. Data sources for this research study included: a focus group with ROWPH, 13 semi-structured interviews with participants, a document review, and participant observations made during the Spring 2025 bi-annual Network meeting. The 13 semi-structured interviews were the primary data source analyzed for this thesis. The focus group, document review, and participant observations served as important data sources to support broader contextual understanding of the WRHCAN and to allow for a richer analysis process.

2.2.1 Research ethics

Research ethics approval was obtained from the Research Ethics Board (REB) of the University of Waterloo (REB #47029). Ethics requirements shaped the participant recruitment strategy and subsequent data collection.

2.2.2 Focus Group

Prior to beginning the recruitment process for the semi-structured interviews with Network partners, the research team conducted a focus group with the staff team at ROWPH responsible for coordinating the WRHCAN. The focus group was conducted in person at the Region of Waterloo Public Health regional building at 99 Region Street in Waterloo. The

focus group consisted of three ROWPH staff, which included two Health Promotion and Research Analysts and a Manager. One of the Health Promotion and Research Analysts had the longest and most direct experience with the WRHCAN and provided the majority of context related to the history of the WRHCAN. Prior to holding the focus group, the research team developed a focus group interview guide to better understand the past, current, and future trajectory of the WRHCAN (see **Appendix A**). The objective of the focus group was to use a timeline-building activity to map out key events in the history of the WRHCAN to date. An open discussion followed the timeline building activity to better understand WRHCAN activities and functioning. The focus group discussion provided historical and institutional contextual information.

2.2.3 Semi-structured interviews

Interviews were conducted virtually using Microsoft Teams with WRHCAN Network partners identified as Main Contacts. An internal Terms of Reference document describes a three-tiered structure where Network partners are classified as Main Contacts, Knowledge Exchange Partners, or Inform Only, based on their engagement level in relation to Network activities. The Inform Only group receives e-bulletins sent out to all WRHCAN members. Knowledge Exchange Partners are invited to meetings and receive program updates, in addition to receiving e-bulletins. Individuals identified as Main Contacts, in addition to the activities described above, are also involved in program consultation and can influence decisions related to the WRHCAN. ROWPH maintains a contact list of Network partners. The list shows 36 different organizations participating in the WRHCAN with 70 individuals listed as Main Contacts. Of note, the Region of Waterloo was represented by eight different regional departments and 27 individuals.

2.2.3.1 Participant recruitment

The research team developed a participant recruitment strategy with the goal of interviewing a representative from each of the Network partner organizations to ensure the depth and breadth of experiences were captured. Pragmatically, a target sample size of 20 was selected to achieve data saturation (Blaikie, 2018). An initial meeting was scheduled with ROWPH partners to review the planned recruitment strategy. The Research Ethics Board stipulated that the research team avoid directly contacting Network partners using ROWPH's contact list to avoid potential privacy violations. Participant recruitment was coordinated with ROWPH to ensure ethics requirements were followed. ROWPH, on behalf of the research team, sent out initial and follow-up recruitment emails to Network contacts. Once a potential participant indicated interest through an online form, a member of the research team connected with them via email. An information letter was sent as part of the recruitment emails and to all those indicating interest in participating. The principles

of informed consent were followed. Written consent was collected prior to the interviews. Ongoing consent to participate in the study was reviewed prior to beginning the semi-structured interviews with participants.

The data collection phase was projected to begin in February 2025 and end in March 2025; however, due to a slow uptake by Network partners to the interview request, a follow-up email was sent on February 28th, and data collection was extended until May 2025. Myself and Hateem Noor conducted the interviews separately using the semi-structured guide (see **Appendix B**). I conducted seven interviews and Hateem conducted five interviews. The first two interviews were conducted by Dr. Dodd with Hateem in attendance. Over a period of several weeks, three separate requests were sent by ROWPH on behalf of the research team to encourage participation. Additionally, Dr. Dodd invited study participation during evaluation updates provided during the Fall virtual and Spring in-person Network meetings.

2.2.3.2 Interview guide development

The interview guide questions were developed with the research and evaluation objectives in mind. ROWPH provided feedback on the interview guide which was taken into consideration during revisions. Participants were asked questions related to the WRHCAN's strengths, challenges, and areas for improvement. Participants were also asked for their insights into the broader system-level capacity of the Region of Waterloo to respond to health and social impacts related to extreme temperature and poor air quality events. Interviews were anticipated to be between 45 minutes to one hour in duration and were scheduled in one hour time slots. Interview duration varied, ranging from 17 to 57 minutes in duration (average=41 minutes). All interviews were audio recorded and transcribed using the built in feature in Microsoft Teams. Transcripts were further checked for accuracy and cleaned to produce verbatim transcripts by either myself, Hateem, or Minal.

2.2.4 Document review

Several ROWPH internal documents were shared with the research team to assist with understanding the structure and functioning of the WRHCAN. The ROWPH recently developed a Terms of Reference document for Network members outlining objectives, roles, and responsibilities; levels of engagement; and other key information to support Network partners. Other key internal documentation included a document describing the minimum requirements for Warming, Cooling, and Clean Air Spaces (WCCA Spaces).

2.2.5 Participant observation of Network meetings

Research team members were invited to attend the online Fall and in-person Spring 2025 WRHCAN meetings. Observations made during the Spring 2025 meeting provided additional context to better understand the scope of activities of the WRHCAN as well as the priorities of Network members. These

2.3 Data Analysis

2.3.1 Thematic analysis

Data from the focus group, document review, and participant observation were used to support a more thorough understanding of the contextual factors shaping the WRHCAN. Analytic memos related to these data sources supported the subsequent analysis of the semi-structured interview data. I used a hybrid inductive-deductive thematic analysis approach to analyze the interview data (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006). Thematic analysis is a flexible method used to identify patterns or themes in a qualitative data set and interpret findings in relation to a research question (Braun & Clarke, 2006). Themes capture something important in relation to the phenomenon being researched (Braun & Clarke, 2006). In a hybrid inductive-deductive approach to thematic analysis as described by Fereday and Muir (2006), the researcher analyzes the data set with a coding manual informed by a relevant existing theoretical framework. A hybrid inductive-deductive approach allows for inductive codes to be developed during the coding process.

Phase 1: Familiarization with data and initial analysis

Prior to beginning the coding process, I familiarized myself with the data set. This took the form of converting audio interview data to text during the transcription process. As I cleaned transcripts, I lightly edited for clarity to produce verbatim transcripts (Corden & Sainsbury, 2006). I wrote brief memos identifying moments in the interview transcripts that appeared salient to the research question. Part of the familiarization process involved reflecting on whether the interviews captured responses relevant to the research question in order to course-correct, if needed, through a revised interview guide. After transcription was complete, I read and re-read the interview transcripts several times to become more familiar with the content of the interviews, both in terms of breadth and depth, and wrote memos and summary notes for each interview. This also helped with assessing overall data quality and in determining whether data saturation had been achieved during the data collection process and the need to extend participant recruitment (Francis et al., 2010). I completed a first round of coding in Microsoft Word by highlighting text and jotting down codes using an inductive approach.

Phase 2: Generating initial codes

Braun and Clarke (2008) offer several pieces of advice related to this phase that I followed: coding for as many potential themes as possible, coding extracts in a way that context was still present, and being open to having codes fit in more than one theme. They also caution researchers to remain aware of data that departs from the dominant story or pattern and to capture those moments in the coding process.

I used the Bergen Model of Collaborative Functioning (BMCF) conceptual framework to develop *a priori* codes for the coding manual to support a deductive approach to coding. The three overarching code categories were based on the three categories within the BMCF: inputs, throughputs, and outputs. Within these categories, several sub-categories were also included to reflect the constructs that define this conceptual framework. Definitions for the codes came from scholarly articles that initially conceptualized the BMCF or used the BMCF as part of the analysis (see **Appendix C** for the development of themes from codes). The deductive parent codes derived from the BMCF were broad enough to capture different aspects of intersectoral collaboration. There was alignment between the BMCF model and the interview data which made it easier to develop inductive child codes that were specific to the context of the WRHCAN. I tested the reliability of the codes as defined in the codebook through closely collaborating with another research team member (Fereday and Muir, 2006). A research team member (Minal Waqar) and I coded two transcripts separately and then met to discuss our application of the codes and to further define the codes. This process was repeated for every transcript (n=13). We found that discussing the codes to define what would fit in one code category over another helped clarify the code definitions beyond those provided in the literature. Through these discussions and during each subsequent review of the data, inductive child codes were developed and refined to reflect the data set. We discussed divergent coding decisions and resolved them orally and documented the decision-making process in the transcript documents.

Phase 3: Searching for themes

At this point, I began to think about the relationship between codes, between themes, and between different levels of themes (Braun & Clarke, 2006). I used NVivo qualitative analysis software to keep track of codes more systematically. I further refined the codebook using definitions from the literature. This provided an opportunity to review the transcripts once again and to adjust previous coding decisions if needed.

Phase 4: Reviewing themes

I reviewed the initial candidate themes to determine if any changes needed to be made and considered ways to refine the thematic relationships in the data set. Themes that did not

have enough data to be supported or that had data that varied greatly were removed and other themes were combined to better reflect thematic categories. The concept of internal homogeneity and external heterogeneity (Patton, 1990 in Braun and Clarke, 2008) was considered – in other words, data within the themes should be similar and there should be clear differences between data in different themes. In this phase, I reviewed the coded data extracts to ensure they fit within the identified theme. In those instances where coded extracts within a theme lacked a clear pattern, I reconsidered the codes, removed the coded data extract, or modified the theme itself.

Phase 5: Defining and naming themes

The process of defining and naming themes was an iterative process that involved thinking about how the coded extracts related to the research question. In this phase, my goal was to ensure that each theme was distinctive and accurately reflected a specific aspect of the data set (Ahmed et al., 2025; Braun & Clarke, 2006).

Phase 6: Manuscript preparation

Once the themes had been clearly defined, I began to prepare a written report of the findings (Braun & Clarke, 2006). I aimed to present the themes in a coherent and clear narrative using data extracts and analytic commentary to demonstrate how I interpreted the data (Ahmed et al., 2025). The BMCF model served as an organizing analytic framework to understand the facilitators, barriers, and contextual factors that shaped intersectoral collaboration in the WRHCAN at different stages (i.e., inputs, throughputs, outputs). The relationship between the codes and the development of themes and subthemes was explored during the writing process (see **Appendix C** for a table showing the process of moving from codes to themes).

2.3.2 Rigour, reflexivity and trustworthiness

Rigour, or as Guba and Lincoln termed, trustworthiness (1989 in Morse, 2015), in qualitative research is an indicator of quality (Fereday & Muir-Cochrane, 2006; Johnson et al., 2020; Patterson et al., 2023). There are established strategies for enhancing rigour in qualitative research that I drew upon throughout the research cycle for this thesis (Barusch et al., 2011; Hays et al., 2016; Patterson et al., 2023). I also considered the appropriateness of the strategies I was using and their impact on the research process itself (Morse, 2015).

An important component of demonstrating rigour is clearly documenting all aspects of the research process and communicating this information to readers so that there is transparency between the methods used and the findings of a research project (Fereday & Muir-Cochrane, 2006). Decisions related to study design were carefully thought through

and recorded in process documents (e.g., participant recruitment process). I also kept an audit trail of memos and notes as I worked on transcribing, coding and analyzing the data.

Additionally, Roberts et al. (2019) suggested that the quality of the coding process contributes to the rigour, validity, and reliability of the interpretations and analysis and overall trustworthiness. I developed a preliminary codebook based on the BMCF to be used by myself and a second coder from the research team and refined definitions for the codes through an iterative process of reviewing the transcripts and the literature (DeCuir-Gunby et al., 2011). Minal Waqar, the second coder, and I met regularly to review our coded transcripts and this directly enhanced the coding quality as our discussions led to a deeper understanding of the nuanced distinctions between codes (Zairul, 2025). Peer debriefing also encouraged reflexivity as it created a space that allowed for questioning, discussion, and reflection on our own biases and assumptions in relation to the research process (Van Draanen, 2017). The writing process supported the development of the final themes as presented in this thesis manuscript as initial themes were revised through further coding, joint code reviews, and reflexive peer debriefing.

2.3.3 Positionality statement

In order to demonstrate my engagement with an ethical research approach, I have reflected on the six dimensions that are impacted by one's social identities and positionality (Secules et al., 2021). According to Secules et al. (2021), these six dimensions include: research topic, epistemology, ontology, methodology, researcher-as-instrument, and communication (see **Appendix D for reflection prompts provided by** Secules et al. (2021) that informed this positionality statement).

This research study is about how individuals and communities are responding to the negative health impacts of climate change. I returned to graduate school after a career in public education to work in the climate health space because of the personal stakes I felt towards taking climate action. This is informed greatly by my identity as a mother to two young children whose futures feel imperiled because of climate change. I recognize the privilege of being worried for a future when so many are facing the impacts of climate change now and do not have the luxury of feeling anxiety over the future.

My epistemological worldview is that knowledge is socially constructed (Phillips, 2023). I know what I know by reading about what others have written about this topic and by what I have learned through asking questions. This particular understanding of knowledge means that qualitative research and semi-structured interviews are an appropriate way of understanding the world – by asking questions of people with experience of the context that I am interested in exploring. My epistemological view on how knowledge is

constructed means that talking with the research team and with the participants during the interview process, I am making meaning and analyzing the responses (Phillips, 2023).

My ontological worldview means that a case study methodology is an appropriate way to better understand a theoretical construct, in this case, how intersectoral collaboration functions within a health promotion partnership. I can only observe what I can directly participate in – that may be through the meetings with the partners or what the interviewees themselves choose to share.

As a graduate student, I am aware that my methodological choices will be guided through collaboration with my supervisor and my own current understanding of the research process. Choosing to be reflexive throughout the research process is an intentional choice that I demonstrated by writing analytic memos, and maintaining a robust audit trail in order to be able to trace coding decisions that were made in collaboration with other team members. As a graduate student engaged in academic work, I have tried to demonstrate academic practices that are understood to indicate rigour and validity.

I felt that it was important to build rapport with the participants during the interview process (Knox & Burkard, 2009; Schmid et al., 2024). I relied on listening deeply and asking follow-up questions where appropriate. I was very much an outsider to the work that the participants were doing for their respective organizations and I believe conveying a curious attitude helped build trust during our relatively brief encounter over Microsoft Teams. The conventions of beginning the interview with a review of informed consent and closing the interview with the next steps for the research project encouraged transparency and invited the participants into the research process.

Thinking about positionality along these different dimensions has helped me be more reflective about the implications my different social identities have for doing research. In the writing of this thesis, I considered my usage of the word “vulnerable” and “unhoused” to describe individuals and communities who previously might have been described as “marginalized” or “homeless” and am cognizant of how language use may change even as the social and structural factors remain the same.

Chapter 3: Facilitators and barriers to intersectoral collaboration in a community-based climate adaptation initiative: A case study of the Waterloo Region Heat, Cold and Air Quality Network (WRHCAN)

3.1 Introduction

Anthropogenic climate change has significant negative impacts on human health (Calvin et al., 2023; Romanello et al., 2022). Increased frequency and severity of extreme temperature and poor air quality events, such as heat waves, wildfires, violent storms, floods, and drought, has resulted in increased morbidity and mortality (Calvin et al., 2023; Romanello et al., 2024). Much of the evidence supporting the connection between climate change related extreme heat and air pollution and increased morbidity and mortality comes from epidemiological studies (Ebi et al., 2021a; Goldberg, 2008; Hamanaka & Mutlu, 2018). Climate change impacts health through direct (e.g., storms, drought, flood, heatwave) and indirect pathways (e.g., water quality, air pollution, land use change, ecological change), increasing health risks for mental illness, malnutrition, allergies, cardiovascular diseases, infectious diseases, injuries, respiratory diseases, and poisoning (Dodd et al., 2018; S. Tong & Ebi, 2019). Existing societal inequities exacerbate the health risks posed by climate change for vulnerable populations (Li et al., 2023a). For example, people with low socioeconomic status, children, older adults, pregnant women, certain communities of color, Indigenous peoples, vulnerable occupational groups, people with disabilities and people with chronic or preexisting medical conditions are disproportionately impacted by climate change impacts (Crimmins et al., 2016). Canada is currently experiencing warming at twice the global average, making this an urgent concern (Health Canada, 2025). The framing of climate change impacts on human health as a public health emergency is relatively recent, and is intended to inspire more action on climate change (Solomon & LaRocque, 2019). Developing appropriate responses to the health impacts of climate change falls under the domain of climate change adaptation and is an essential component of maintaining population health locally, nationally, and globally.

Climate adaptation initiatives can be understood as interventions that seek to minimize the health impacts of climate change and enhance resilience (Brink et al., 2024). Local public health units have an important role to play in the development and implementation of community-based climate adaptations given the scope of their work, which includes risk management, preparation, and public communication (Gough et al., 2016; Plante et al., 2023). Local public health actions are often guided and shaped by federal and provincial or territorial guidelines and available funding (Austin et al., 2015). In Canada,

there are several policy documents related to supporting adaptation (*Canada's National Adaptation Strategy*, 2023; Cooke et al., 2024). There are corresponding actions for each of the six essential public health functions in developing a comprehensive response to climate change (Public Health Agency of Canada, 2022). For instance, health surveillance for a climate change related condition may involve focusing on data collection for Lyme disease or West Nile virus, both of which have seen increases in incidence as mosquito and tick vectors have expanded their territories North (Public Health Agency of Canada, 2022). Climate change and health vulnerability assessments are often a precursor to developing context specific adaptation strategies based on current and future climate risks (Füssel & Klein, 2006; *Ontario CCHVAA*, 2016). The public health sector has used these types of assessments as a tool to support adaptation planning processes with the goal of reducing climate-health risks (Buse, 2018; Ebi et al., 2006; Brown et al., 2011). A Climate Change and Health Vulnerability Assessment for Waterloo Region, Wellington County, Dufferin County, and the City of Guelph was recently conducted and one of the main findings was that extreme heat was the highest-priority climate health risk now and into the future (Buse et al., 2022).

Addressing the various intersecting and overlapping challenges posed by climate change requires an intersectoral approach (Rutter et al., 2017). Intersectoral collaboration (ISC) refers to contexts where different sectors or organizations work together on developing and implementing policies or programs to improve health and equity-related outcomes (*Working Together for Equity and Healthier Populations*, 2023). Intersectoral collaboration in health promotion contexts has been the focus of several reviews (Alderwick et al., 2021; Corbin et al., 2018; Foster-Fishman et al., 2001; Seaton et al., 2018; Wiggins et al., 2021). The goal of successful partnerships is to result in 'synergy' or the ability to produce an outcome greater than what an individual organization could have achieved, often through the pooling and sharing of resources (Corbin et al., 2018; Holt & Aveling, 2023; Lasker & Weiss, 2003). A number of theoretical frameworks have been developed to better understand intersectoral collaboration (Corbin & Mittelmark, 2008; Kegler et al., 2010; Koelen et al., 2012; Parent & Harvey, 2009). For this study, I selected the Bergen Model of Collaborative Functioning (BMCF) to explore intersectoral collaboration in a public health coordinated community-based climate adaptation.

This study aims to contribute to the emerging body of literature on climate change adaptation through a public health lens (Hossain, 2025; Huang et al., 2011; Shakya & Khan, 2025). The research question guiding this study was: What are the facilitators and barriers to intersectoral collaboration in a public health coordinated community-based climate adaptation?

3.2 Methods

3.2.1 Case description

The Waterloo Region Heat, Cold and Air Quality Network (WRHCAN) is one among several community climate adaptations in Waterloo Region (Regional Municipality of Waterloo, 2019). Coordinated by Region of Waterloo Public Health (ROWPH), the WRHCAN is a Network made up of representatives from municipal and regional government departments and community-based organizations. The Network's overall objectives are to strengthen community resilience through effective community preparedness and response, with a focus on reducing the health-related risks of extreme temperature and poor air quality events for vulnerable populations. Roles and responsibilities for ROWPH and Network partners have recently been defined in a Terms of Reference document. ROWPH actions include coordinating bi-annual meetings, sending weather advisories related to extreme weather (email bulletins), maintaining an interactive map of Warming, Cooling and Clean Air Spaces (WCCA Spaces), maintaining documentation and contact information related to the Network, and sharing health information and resources with the public and with community partners. Network partners may offer WCCA Spaces, although not all partners do. A recently drafted document by ROWPH specifies the minimum requirements for a WCCA space. These include: public access (i.e., no key card/fob access and not limited to specific clients), space for people to stand and sit, access to washrooms, air conditioning in the summer, and heat in the winter. While there is no requirement to provide additional supports and services, ROWPH has a list of suggestions for extra services or amenities to consider, such as ways to support access for people with disabilities and access to drinking water. WCCA Spaces are generally public spaces, such as recreation centres or libraries, although private organizations can also offer WCCA spaces. 53 available WCCA Spaces are distributed across Cambridge, Kitchener, and the rural townships of North Dumfries, Waterloo, Wellesley, Wilmot, and Woolwich. Network partners also participate in knowledge exchange opportunities, share health-related information with staff and/or the public, and inform ROWPH if heat, cold and/or air quality related illnesses/injuries are observed at a WCCA Space. Organizations providing WCCA Spaces do not routinely collect data related to use of those spaces during extreme temperature and poor air quality events.

3.2.2 Study design and conceptual framework

A community-engaged research approach guided the study design. An existing research relationship between the University of Waterloo research team and ROWPH facilitated the ability to do this research. Case study methodology was used to explore intersectoral collaboration in the context of the WRHCAN. Research studies that take an exploratory

approach are well-suited for a case study methodology (Baxter & Jack, 2015; Crowe et al., 2011; Sibbald et al., 2021). An instrumental case study approach was used to explore the processes of intersectoral collaboration.

The Bergen Model of Collaborative Functioning served as a theoretical framework to analyze data. The BMCF conceptualizes intersectoral collaboration as a system consisting of inputs, throughputs, and outputs (see **Table 1**). The BMCF defines partnership inputs as the mission, partner resources (skills, expertise and networks) and financial resources. The throughputs consist of four different elements that shape the collaboration: interaction between the inputs, leadership, roles and structures, and communication practices. Partnerships require both maintenance activities that relate to administrative tasks that support the ongoing collaboration and production activities that are the tangible results of a collaboration and take place within and are shaped by the collaborative space. The outputs of a collaborative partnership can be evaluated as additive, antagonistic or synergistic (Corbin & Mittelmark, 2008). The BMCF has been described as the most widely used framework for analyzing partnership functioning (Raftery et al., 2022) and has been used as an evaluation tool to support improvements to partnership functioning (Corbin & Mittelmark, 2008).

Table 1. The components of the inputs, throughputs, and outputs of the Bergen Model of Collaborative Functioning

Inputs	Throughputs	Outputs
-mission -partnership resources (skills, expertise and networks) -financial resources	-input interactions -leadership -roles and structures -communication -maintenance activities -production activities	-additive -antagonistic -synergistic

3.2.3 Participant recruitment and data collection

The research team comprised Dr. Warren Dodd (supervisor), Dr. Laura Jane Brubacher (post-doctoral scholar), Minal Waqar (PhD student), Hateem Noor (MSc student), and me (MSc student). Research ethics approval was obtained from the Research Ethics Board of the University of Waterloo (REB #47029) (see **Appendix E**). Participant recruitment of Network members was facilitated by ROWPH to adhere to ethics requirements. ROWPH sent recruitment and follow-up emails to the WRHCAN contact list on behalf of the research team. An information letter describing the purpose of the study was included in the recruitment emails. Participants self-selected to participate in the study and the research team followed up with interested individuals.

An interview guide was developed by the research team that incorporated feedback from ROWPH. Participants were also verbally briefed on the purpose of the study prior to the start of an interview. Between February 2025 and May 2025, Hateem and I virtually conducted semi-structured interviews with Network partners (n=13). Interviews took place virtually over Microsoft Teams. The duration of interviews ranged from 17 to 57 minutes (average 41 minutes). All interviews were audio recorded and transcribed verbatim.

Dr. Dodd and Dr. Brubacher conducted an in-person focus group with ROWPH to learn more about evolution of the WRHCAN and to gain contextual insights related to the WRHCAN structure. Hateem and I provided note-taking support at this focus group. Additional. Other data sources that provided additional contextual information about the WRHCAN included: a document review of WRHCAN reference documents, and participant observations made during the Spring 2025 bi-annual Network meeting.

3.2.4 Data analysis

Data collected through the focus group, document review, and participant observation was used to support my overall understanding of the WRHCAN and was not coded. Interview data were coded and analyzed using a hybrid inductive-deductive approach (Fereday & Muir-Cochrane, 2006). Prior to coding, interview transcripts were reviewed as part of the data familiarization process and in order to prepare verbatim transcripts for coding. The interview guide was not developed to align with the Bergen Model of Collaborative Functioning (BMCF), rather the interview questions sought to capture facilitators and barriers experienced by participants as part of their involvement with the WRHCAN. The BMCF model was used to create deductive codes to structure the analysis. Inductive codes were developed iteratively during the coding process and fit within the broad deductive categories of inputs, throughputs, outputs, and context. NVivo qualitative analysis software was used to organize codes and facilitate data analysis.

I used several strategies to enhance rigour for this research study. I documented the research process through the writing of analytic memos following transcript reviews, as well as during the coding and analysis process (Fereday & Muir-Cochrane, 2006). Additionally, I refined the codebook through an iterative process of coding, checking with a second coder (Minal W.), and reviewing the literature to improve the quality of coding (DeCuir-Gunby et al., 2011; Roberts et al., 2019). I also used peer debriefing with Minal W. and Hateem N. to support the analysis process, as this facilitated discussion and reflection on the data and engagement with the research process (Van Draanen, 2017; Zairul, 2025).

3.3 Results

Thirteen Network partners (i.e., participants) participated in one-to-one semi-structured interviews. Participants belonged to one of two broadly defined groups: municipal or regional government departments (n=8) and community-based organizations focused on social services, health, or advocacy (n=5). Another distinction between participants was whether they provided a Warming, Cooling, and Clean Air Space (WCCA Space) (n=7) or not (n=6) (see **Table 2** for participant categorization). Organizations that did not provide a WCCA Space supported or interacted with vulnerable populations as part of their work responsibilities. Municipal or regional government departments represented multiple WCCA spaces distributed across the region. Participants representing community-based organizations that offered a WCCA provided a single space. WCCA spaces are distributed across the Region and locations are publicly listed on an interactive map maintained by ROWPH (<https://experience.arcgis.com/experience/b85000514c104d1ea675f7b2f41b7008/>). Libraries and community centres make up the majority of listed WCCA Spaces.

Table 2. Categorization of participants by type of organization and by provision of Warming, Cooling and Clean Air Spaces

Type of Organization	Participants	WCCA spaces
Municipal or regional government departments	8	4 ¹
Community-based organizations	5	3
TOTAL	13	7

¹Municipal or regional government departments often represent the availability of multiple WCCA Spaces. For example, 23 libraries serve as WCCA Spaces in Waterloo Region.

3.3.1 Facilitators of intersectoral collaboration within the WRHCAN

3.3.1.1 Alignment between WRHCAN objectives and Network partner goals

‘Mission’ and ‘partnership resources’ were inputs, as theorized in the BMCF, that facilitated intersectoral collaboration in the WRHCAN. Many participants expressed that joining the WRHCAN was seen as an extension of their organization’s work, specifically their focus on supporting vulnerable populations (P1, P3, P4, P5, P7, P12). One participant described how joining the WRHCAN supported current organizational efforts:

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; however, what [joining WRHCAN] did for us was not only formalize

[these efforts], but then it gave us access to other resources in the community. (P7, community organization)

Some participants identified the facilities available through their organization as public spaces that were intended to be for everyone and saw alignment with WRHCAN objectives and the use of organizational resources through this lens (P8, P9). While some participants recently joined the Network (P10, community organization), others were mandated to be involved by management (P3, regional department), or were continuing with their involvement based on a previously established relationship between their organization and the WRHCAN (P2, municipal department). Participants generally found that participation in the WRHCAN supported their day-to-day work without adding unnecessary work or requiring a significant additional time commitment or additional resources. As discussed in the focus group with ROWPH, participating in the WRHCAN does not result in any additional funding to Network partners, however, ROWPH does provide coordination of specific requests for resources by Network partners. For example, a Network partner requested water bottles and this request was shared with other WRHCAN Network partners. Additionally, during the wildfires of 2023, ROWPH was able to share excess N65 masks with Network partners to support the response to poor air quality. Participants reflected on how their ability to provide supports and services to individuals accessing their spaces was largely dependent on the existing resources of their organization (e.g., staff, open hours) (P2, P7, P11).

3.3.1.2 ROWPH's leadership role in WRHCAN coordination

Leadership is one of the throughputs identified in the BMCF. ROWPH's leadership role in the coordination of the WRHCAN was seen as beneficial by participants. Participants generally perceived ROWPH as being trustworthy and a source of credible information (P7, P9). One participant described the perceived value of information shared by ROWPH related to climate health risks:

We're receptive to and looking for their [Region of Waterloo Public Health] guidance on what we can do and what we can plan for. Whether we can achieve everything is kind of subject to our resource limitations, but at least we know how we can align and keep this top of mind when we are prioritizing the work that we're mandated to do. And it empowers us to know that we're supported by public health. (P4, Regional department)

Another component that supported ROWPH's leadership role in WRHCAN coordination are the maintenance activities or actions that supported partnership functioning. Some participants spoke of how the Network's purpose and function had become clearer over time and had improved through streamlining of information sharing (P2, P7), which reflects

efforts by ROWPH to ensure relevance to Network partners. Another participant found that the Network had remained fairly consistent over time in terms of key objectives and messaging, while keeping in line with the scope of the WRHCAN (P6, regional department).

Coordination by ROWPH supported opportunities for knowledge exchange and networking between municipal and regional government departments and community-based organizations, as shared by participants (P5, P7, P8). For instance, ROWPH's coordinates bi-annual Network meetings that support these functions. During the COVID-19 pandemic, these meetings were held virtually. More recently, a return to in-person meetings were highlighted among some participants as a potential source of additional networking opportunities for members. Several participants identified Network meetings as being useful to their understanding of supports and services available in the Region of Waterloo. ROWPH's role in the creation of an online interactive map of WCCA spaces and the distribution of resources, such as N65 masks, were also mentioned by a few participants as benefits of ROWPH's coordinating role of the WRHCAN.

3.3.1.3 Communication pathways support WRHCAN objectives

Communication is one of the core components of the throughputs identified by the BMCF. Most participants expressed that they found the communication products and processes of the WRHCAN to be useful. The direction of communication mostly flows from ROWPH to Network partners, with the most frequent form of communication being the e-bulletin sent out during extreme temperature and poor air quality events. Participants mentioned this form of communication as being especially useful for their work because they were able to share that information with frontline staff and at times, this affected how staff prepared for their day (P5, P7, P11). Several participants mentioned how the information provided by ROWPH saved them time (P7, P10). Another participant described the value of being connected to broader conversations related to emergency preparedness through the WRHCAN and being able to share frontline observations to support overall community health:

And for us, being a part of discussions and a part of surveys, a part of this opportunity [WRHCAN partnership evaluation] to provide some feedback. And supporting their [Region of Waterloo Public Health] initiatives that we can... [ROWPH] coming to us and saying what challenges do you face? And what are you seeing out in the frontline community and then taking that, embracing it and helping their department [ROWPH] serve the community better. (P5, Regional department)

Participants also discussed how they shared information received by ROWPH (i.e., e-bulletins) with other networks, and/or with the general public (e.g., via social media posts, community bulletin boards) (P9, P10, P12).

3.3.1.4 Connecting with community partners to share information and resources

Being a part of the WRHCAN has facilitated synergistic outputs by connecting Network partners to existing community resources offered by other Network partners. In the case of the WRHCAN, the desired output is the ability to reduce the negative health impacts of extreme temperature and poor air quality events. A participant described the impact this has on their organization's ability to support vulnerable populations:

So for example, we're closed from 12 till 1:00 for lunch and for staff self-care. And with being part of this agency [WRHCAN], then we had the resource list to be able to say to somebody, 'I do have to close the doors at noon today.' We recognize it's really, really hot out. The humidex factor is off the chart. Here is somewhere that is open right now that you'll be able to receive the same support and services. So that was really important for us, for our clients, as well as for access to weekend support, after hours, respite from the weather. So that's what really motivated us, that continuity of care. (P7, community organization).

Another participant echoed a similar sentiment in that knowledge of additional WCCA spaces in the Region reduces the pressure on individual organizations (P9, municipal department). The coordination of the WRHCAN by ROWPH supports Network partners in their communications with individuals accessing supports and services for extreme temperature and poor air quality events and results in tangible options available to Network partners that might not previously have been considered.

Network partners that do not operate WCCA spaces or work exclusively with vulnerable populations also saw a benefit to being a part of the WRHCAN. For instance, one participant felt that coordination by ROWPH amplified efforts in a collective manner, while allowing for flexible engagement (P4, Regional department). Another participant valued the knowledge exchange aspect of participating in the WRHCAN and the ways that this information contributed to being able to support all community members, and especially vulnerable populations (P9, municipal department). For instance, the WRHCAN has facilitated conversations between Network partners to better support vulnerable populations and to identify gaps in services.

3.3.2 Barriers to intersectoral collaboration in the WRHCAN

3.3.2.1 Challenges related to communication pathways

Some participants identified challenges related to communication pathways. While ROWPH maintains an interactive map with a list of WCCA spaces, participants noted that the website may not be accessible to everyone and especially those who might need

shelter during extreme temperature and poor air quality events (P1, P3, P9, P12). Language barriers for newcomers may also pose a challenge (P2, P7).

The majority of communications from ROWPH to Network partners are e-bulletins containing weather advisory information. Participants described sharing this information with frontline staff (P5, P7, P11) or to the public via social media (P6, Regional department). One participant described how frontline staff use the information in the weather advisories to plan for their work with vulnerable populations and how sending e-bulletins directly to frontline staff may be helpful:

My team packs up each morning for what they anticipate they might need that day. Well, if it's going to be that much colder, they're going to bring more hot paws [mittens], they're going to bring more socks, if somebody's socks are wet. So, you know, prevention is half the battle, right, and being prepared. So some way to get that information to those [team members], because in all honesty it comes to me. I'm the manager. I'm not out on the streets. I get it to them. However, there are times when probably, skipping me and getting to the people that are really out there [with vulnerable populations], would be super helpful. (P7, community organization)

Internal and external communication pathways can be strengthened by identifying ways to support Network partner needs through ongoing consultations. As described by the participant above, direct communications with frontline staff can improve the ability of Network partners to support vulnerable populations. Improving accessibility of information related to health risks posed by extreme temperature and poor air quality events, such as poor air quality from wildfire smoke, for the general public (P9) and for vulnerable populations, is an opportunity to improve external communications and awareness of the health risks posed by climate change.

3.3.2.2 Training opportunities

Participants identified the need for additional supports and/or training related to supporting individuals experiencing multiple intersecting challenges (e.g., mental health, addictions, substance abuse, homelessness). One participant described the need to be prepared through appropriate policies and resources:

We need to have community partners on site who are equipped to manage the issues that are going to also come with that [working with vulnerable populations]. So security issues, you are going to manage mental health crises in those moments [when issues arise], you are going to manage addictions crisis in those moments, that's just the nature of this. The work that we do, we have to be prepared. We have

policies in place for substances that may be left or paraphernalia that may be left for a reason. It's not just because it's never happened. (P3, Regional department)

Organizations are trying to be proactive about responding to the needs of vulnerable populations (e.g., taking a trauma-informed approach, challenging stigma around mental health and/or homelessness). There is also a need to ensure that frontline staff are adequately supported and feel prepared to respond to the potential challenges of being a designated WCCA Space. One participant described how frontline staff are often not trained specifically for the potential scenarios they might encounter as a result of being a designated WCCA space:

I think making sure that the staff at these warming, cooling spaces also feel safe or supported. So, recognizing we are in an overdose crisis that folks who use drugs might be in bathrooms or public spaces or, warming and cooling spaces and might have just used a certain drug, whether they're supposed to or not, is a whole other conversation. But it happens. I think it's part of our reality. And recognizing that staff are almost like having to take on a responsibility they might not be ready for, may not be trained for in responding to an overdose or medical emergency kind of situation. And yes, I think that's one of the big challenges is it [WCCA Space] needs to be both a safe space for the clients, but also for the staff not to feel like “every day I might be going in experiencing, you know stress and trauma”. (P13, Regional department)

Specific trainings, such as naloxone training and de-escalation training might be useful tools for ROWPH and Network partners to consider (P13). Additionally, discussions between Network partners around reducing stigma and creating inclusive spaces for vulnerable populations can support the WRHCAN's objectives of supporting community resilience.

3.3.3 Contextual factors impacting intersectoral collaboration

3.3.3.1 Housing and affordability crisis in Waterloo Region

Contextual factors have influenced intersectoral collaboration in the WRHCAN in several ways. In particular, the housing and affordability crisis facing Waterloo Region was referenced by more than half of the participants (P1, P3, P5, P7, P8, P9, P11). Awareness of the housing crisis by participants may have been heightened by a recently completed official plan to address and end chronic homelessness in Waterloo Region (Waterloo Region, 2024). Participants spoke positively about the Region's efforts to address homelessness, while identifying needs to be greater than current system level capacity. The ability of organizations to meet the needs of vulnerable populations is often hampered

by a lack of financial or other resources. One participant felt that broader political and financial support was needed to make an impact (P5). Another participant described how certain organizations within the Region have been proactive in trying to destigmatize homelessness by shifting the narrative through greater public awareness (P7, community organization).

3.3.3.2 Supporting vulnerable populations experiencing multiple intersecting challenges

Participants also raised concerns about individuals who are experiencing homelessness, substance use concerns, and/or mental health challenges simultaneously. Of note, many participants perceived that these vulnerable populations were the most likely to use the WCCA spaces. The scope of the Network is limited to providing respite from extreme temperature and poor air quality events during operating hours of WCCA spaces. Some participants expressed frustration with not being able to meet the needs of the most vulnerable, while acknowledging that there would be more issues if this Network did not exist (P3, regional department) and also that the objective of the WRHCAN is not to replace social services (P6, Regional department).

Participants who work closely with vulnerable populations brought up the need for extended hours and overnight hours to meet community needs. One participant expressed the following:

And how many overnights [available overnight locations] do we actually have? Where places are 24/7 or opening their doors with the exception of, it's almost like pop ups that they would have to do in certain circumstances or like even being open on the weekends, like the regular Monday to Friday, 9 to 5 does not serve the most vulnerable of populations in the worst of times. (P3, Regional department)

The supports and services covered by WRHCAN partners likely do not meet the needs of the most vulnerable who, in addition to needing shelter beyond business hours, may also be experiencing additional challenges related to mental health or substance use. The supports and services offered by Network partners may be most appropriate to meet the needs of people who are experiencing a temporary challenge, such as a malfunctioning air conditioner or furnace (P6). This implies that having WCCA spaces is useful for both the general public and vulnerable population. Using public spaces as part of a climate adaptation strategy is an effective use of existing resources, but participants wondered about how to support individuals beyond “open hours” and whether to tailor services for different types of extreme temperature and poor air quality events (P2, P9). Additionally, one participant wondered whether staff at WCCA spaces were prepared to identify and respond to individuals experiencing health challenges from extreme heat, extreme cold and/or poor air quality (P10). Participants are still willing to participate in the WRHCAN,

despite the limitations of the scope of WRHCAN activities, because they see value in being part of the Network. The provision of WCCA spaces by partners is the most visible aspect of the Network and has the most direct effects on reducing the negative health impacts of extreme temperature and poor air quality events. Other aspects of belonging to the Network, such as the ability to advocate for vulnerable populations, may also support intersectoral collaboration between diverse organizations (see **Table 3** for a synthesis of the results).

Table 3. Synthesis of themes and subthemes

Component of BMCF¹	Theme	Subtheme	Key considerations
Inputs – mission Inputs – partnership resources	Facilitators	Alignment between WHRCAN objectives and Network partner goals	Participation complements or supports ongoing work by an organization Participation allows for pooling of some community resources
Throughputs – leadership – trust Throughputs – maintenance activities – Network meetings		ROWPH’s leadership role in WRHCAN coordination	ROWPH perceived as trustworthy and source of credible information Network meetings create opportunities for knowledge exchange and networking ROWPH access to additional resources can support Network partners
Throughputs - communication		Communication pathways support WRHCAN objectives	Communication from ROWPH supports Network partners’ work related to extreme weather
Outputs - synergistic		Connecting with community partners to	WRHCAN connects diverse organizations to

		share information and resources	shared community resources
Throughputs – communication	Barriers	Strengthening communication pathways	Participants identified the need for more accessible communication tailored for vulnerable populations
Throughputs – roles and structures – frontline staff preparedness Throughputs – production activities - training		Training opportunities	Participants identified need for additional training to support frontline staff
Context - housing	Contextual factors	Affordability and housing issues in the Region	Many participants aware of housing crisis in Waterloo Region and seeing impacts on their organizations
Context – vulnerable populations		Vulnerable populations	Intersecting challenges facing individuals may fall beyond scope of WRHCAN supports and services

¹ Bolded terms are deductive codes informed by the Bergen Model of Collaborative Functioning, followed by non-bolded inductive codes.

3.4 Discussion

This study explored the experiences of WRHCAN Network partners to understand the facilitators, barriers, and contextual factors influencing intersectoral collaboration in the context of a public health coordinated community-based climate adaptation initiative (see **Figure 1**). Findings from this study highlight intersectoral collaboration as an effective strategy that can be used by local public health units to support climate adaptation initiatives.

The findings from this study show that engaging in intersectoral collaboration can result in synergistic outputs. Network partners identified the value of being able to refer individuals to available community resources as a key benefit of participating in the WRHCAN (e.g., WCCA Spaces, pocket guide). Achieving synergy in intersectoral partnerships depends on the contributions partners are able to make and on partnership dynamics (Corbin et al., 2018; Holt & Aveling, 2023). Certain factors are known to strengthen intersectoral partnerships, such as clear goals and purpose, accountable and efficient use of resources, and trust and communication between partners (Holt & Aveling, 2023). The facilitators for participants in this study of the WRHCAN largely reflect the key factors identified in the literature.

Intersectoral collaboration between different sectors is needed to address the health risks posed by climate change (Bowen & Ebi, 2015) and as a means to address the social determinants of health (Asirvatham et al., 2024). Intersectoral collaboration can break down silos between sectors and contribute to a better understanding of climate-health risks, which are foundational to developing effective adaptation plans (Rose & Birchall, 2025). Examples of intersectoral collaboration frameworks outside of the climate change space, include One Health, Health in All Policies, Commission on the Social Determinants of Health, and Disaster Risk Management (Bowen & Ebi, 2015). Learning from these varied examples can strengthen intersectoral collaboration for climate adaptation and contribute to closing the health adaptation gap, which refers to the difference between current actions and needed actions to protect human and planetary health (Sheehan et al., 2021a; United Nations Environment Programme, 2025). Evaluating intersectoral collaboration often poses a methodological challenge due to the inherent complexity of intersectoral partnerships (Asirvatham et al., 2024; Joseph et al., 2023). However, evaluation is needed in order to assess partnership effectiveness in achieving project outcomes and goals, despite the challenge of attributing specific outcomes to intersectoral initiatives (Asirvatham et al., 2024; Joseph et al., 2023).

Participants in this study highlighted the importance of the role that ROWPH played in coordinating the WRHCAN. ROWPH was perceived to be trustworthy and a source of credible information on climate-health risks. Leadership by ROWPH was a key factor in the development and growth of the WRHCAN and the ongoing learning and networking opportunities it provided to Network partners. Community-based climate adaptation initiatives led by local public health units can play a key role in supporting vulnerable populations to reduce the health risks posed by extreme temperatures and poor air quality (Hossain, 2025). Some examples of public health strategies to reduce climate-health risks include: public awareness programs, heat alerts and heat action plans, cooling centres, and health checks (Bell et al., 2024). Additionally, public health practitioners can

contribute to health-focused adaptation planning to reduce the climate-health risks posed by climate change (Araos et al., 2016; Sheehan et al., 2021b; Wheeler & Watts, 2018).

The need to understand and address the underlying contextual factors impacting the WRHCAN was an important finding of this research study. The housing and affordability crisis in Waterloo Region is characterized by a mismatch between the rapid population growth in the Region and the lack of appropriate and adequate housing to meet demand (Petric et al., 2024). Individuals experiencing homelessness are also more likely to experience challenges with substance use and mental illness (Polcin, 2016). A study on cooling centre usage in Metro Vancouver found that a number of factors impact access and usage of cooling centres, including concerns around safety and stigma (Yoon et al., 2025). For frontline staff, a lack of adequate training can impact their stress level and feelings of preparedness. Research has shown that frontline staff that interact with vulnerable populations feel more equipped to respond after receiving naloxone training (Febres-Cordero et al., 2023). Incorporating the perspectives of people with lived experience in future evaluations of the WRHCAN can lead to insights to support the development of equitable climate adaptation initiatives (Beames et al., 2021; Jenkins et al., 2024; Sunkel & Sartor, 2022).

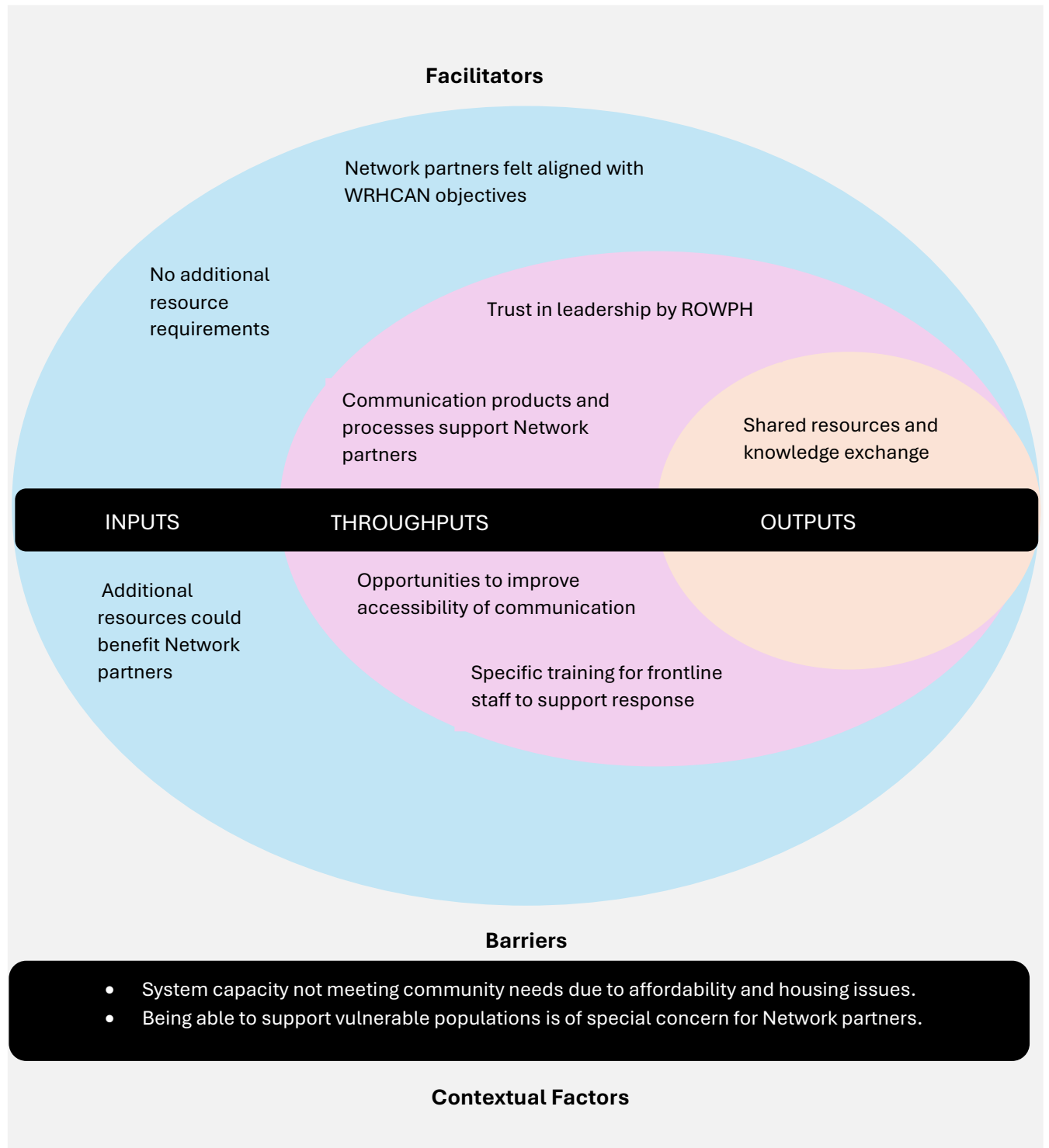


Figure 1. Facilitators, barriers, and contextual factors impacting intersectoral collaboration in the Waterloo Region Heat, Cold and Air Quality Network

Additionally, this research applied the Bergen Model of Collaborative Functioning to a climate adaptation research and evaluation context. Theoretical frameworks, such as the BMCF, can be used to structure evaluations seeking to understand the impact and effectiveness of intersectoral collaboration in climate adaptation initiatives. As the impacts of climate change continue to intensify, the need to understand, explore, and apply intersectoral collaborative processes to a range of adaptation scenarios and initiatives can be supported through the use of validated theoretical frameworks.

3.4.1 Limitations

This study focused on Network partners' experiences of intersectoral collaboration in the WRHCAN. With the support of ROWPH, multiple recruitment attempts resulted in 13 participants who agreed to engage in a semi-structured interview. While there was representation from municipal or regional government (n=8) and community-based organizations (n=5), additional representation from a greater diversity of Network partners may have provided alternative or additional insights into the facilitators, barriers, and contextual factors shaping intersectoral collaboration in the WRHCAN.

3.5 Conclusion

This study examined intersectoral collaboration in the WRHCAN and identified the facilitators, barriers, and contextual factors shaping participation for Network partners. By exploring partnership functioning through the lens of intersectoral collaboration, the study highlighted the role local public health units can play in initiating and supporting community-based climate adaptation initiatives. The findings of the study suggest the need for increased attention to equity and inclusivity when designing supports and services to reduce climate-health risks for vulnerable populations and for the general public. Overall, this study used an evaluative approach to understand the processes shaping intersectoral collaboration. Future research can explore the effectiveness of this particular climate adaptation initiative from the perspective of users. Additionally, research to better understand the role of local public health units in contributing to broader adaptation and mitigation initiatives can contribute to improving population health in the face of increasing climate-health risks.

Chapter 4: Conclusion

This thesis explored the facilitators and barriers to intersectoral collaboration for Network partners of the Waterloo Region Heat, Cold and Air Quality Network (WRHCAN), which is a community-based climate adaptation initiative coordinated by Region of Waterloo Public Health (ROWPH). A community-engaged research approach and a community-academic partnership between ROWPH and the University of Waterloo guided the study design, participant recruitment strategy, and data collection tools for this case study. Semi-structured interviews with Network partners provided insights related to facilitators and barriers to intersectoral collaboration in the WRHCAN. Additional sources of data included a focus group with ROWPH, participant observation of two Network meetings, and a document review of several internal WRHCAN reference documents. The Bergen Model of Collaborative Functioning (BMCF) informed the hybrid inductive-deductive thematic analysis of qualitative interview data.

4.1 Summary of findings

The findings of this study were presented as a single co-authored manuscript (see Statement of Contributions for co-authorship information) that detailed key facilitators and barriers of intersectoral collaboration as experienced by WRHCAN partners participating in this research study (Chapter 3). Semi-structured interviews with participants resulted in the identification of several facilitators and barriers, as well as contextual factors, that influenced intersectoral collaboration in the WRHCAN.

Firstly, Network partners saw alignment between their work and the objectives of the WRHCAN, specifically in relation to supporting vulnerable populations. Secondly, ROWPH's coordination role greatly encouraged participation due to perceived credibility and trust in ROWPH as an institution, which increased opportunities among Network partners to engage in knowledge exchange and networking opportunities. Thirdly, communication products (e.g., interactive map, e-bulletins) shared by ROWPH supported the ability of Network partners to support vulnerable populations and the general public during extreme temperature and poor air quality events. Finally, Network partners identified that participating in the WRHCAN aided them in learning about and accessing other community resources, which enhanced their ability to support vulnerable populations and the general public.

Participants also identified several barriers to intersectoral collaboration. The need for more accessible forms of communication tailored to vulnerable populations in the community was identified by several participants. Additionally, participants felt that frontline staff may not have been prepared to respond to individuals experiencing

substance use concerns or mental health challenges in the Warming, Cooling and Clean Air Spaces (WCCA Spaces).

Contextual factors shaping the WRHCAN include the homelessness crisis facing Waterloo Region. Many of the participants identified the need to support this priority population and the associated challenges with adequately meeting their needs when system capacity seems to have been surpassed. It was also pointed out by participants that the scope of WRHCAN activities is not necessarily designed specifically to meet the needs of vulnerable populations. For instance, public spaces, such as libraries, recreation centres, and municipal buildings may differ greatly in their suitability for individuals experiencing substance use concerns, mental health challenges, and/or homelessness. The results of this research study demonstrate how research and evaluation can be used to better understand intersectoral collaboration as a public health strategy to support climate change adaptation initiatives.

4.2 Study strengths and limitations

There are several strengths and limitations of this research study. The community-academic partnership between ROWPH and the University of Waterloo allowed for a collaboration between community stakeholders and academics to engage in an evaluation-based research study that resulted in timely, relevant, and useful findings for community partners. The extensive literature on community-engaged research (Ortiz et al., 2020; Wallerstein et al., 2020) and community-academic partnerships reflects continued interest in involving community stakeholders in the research process and speaks to the value of this approach, especially for work that is based in a community setting (Drahota et al., 2016; Khatib et al., 2025; Pellicano et al., 2025). A community-engaged approach meant that ROWPH was a valued research partner and actively involved during different stages of the research process. A previously established research partnership meant that ROWPH research partners had confidence and trust in the research team and this facilitated the research process, particularly during the participant recruitment stage (Frerichs et al., 2017). Sharing the findings of the evaluation and WRHCAN Network partners through an evaluation report was also an important part of knowledge dissemination to ensure that ROWPH and participants benefitted from the time and effort they gave to the research project.

Methodologically, an instrumental case study approach was an appropriate choice for the research question (Baxter & Jack, 2015; Crowe et al., 2011; Sibbald et al., 2021; Stake, 1995). The WRHCAN is coordinated by ROWPH and currently consists of approximately 36 organizations, representing different local municipal and regional government departments, and community-based organizations. The WRHCAN was selected as the

case because it is an example of a community adaptation initiative that utilizes intersectoral collaboration to achieve its objectives. By defining the WRHCAN as the case for this research study, the nuances of the phenomenon of interest – the facilitators and barriers to intersectoral collaboration in a public health coordinated climate adaptation initiative – could be explored. Case study methodology enhanced the credibility of findings by taking different viewpoints into account through the inclusion of multiple data sources (e.g., focus group with ROWPH, semi-structured interviews with Network partners, participant observation of Network meetings) (Sibbald et al., 2021; Stake, 1995). Multiple data sources facilitated a more thorough analysis of intersectoral collaboration in this context through triangulation (Baxter & Jack, 2015).

In addition to the specific qualities of case study methodology that result in rigour (e.g., multiple data sources, triangulation), general strategies that apply to qualitative research were also considered during the research process (Patterson et al., 2023). I used strategies such as maintaining an audit trail, writing research memos, and engaging in peer debriefing to enhance rigour (Patterson et al., 2023). Maintaining an audit trail and writing research memos enhances the dependability of research because it allows for others to examine the documentation process that led to the final analysis and results (Tobin & Begley, 2004). Peer debriefing allows for discussions with peers and supervisors about the research methodology, data analysis, and interpretation to ensure that the emergent themes are sound (Hadi & José Closs, 2015). The use of different strategies to enhance rigour results in research findings that can be used by researchers and public health practitioners.

Additionally, the COnsolidated criteria for Reporting Qualitative research checklist (COREQ checklist) was applied to the Chapter 3 manuscript and is included in an appendix (see **Appendix F**) (Tong et al., 2007). The purpose of using formal reporting guidelines is to support decision-making and to guide future research (Tong et al., 2007). Readers of research (e.g., academics, researchers, policy-makers) will be better equipped to critically appraise the quality, validity, and applicability of research findings when information related to research design, data collection, and analysis are included in published research (Tong et al., 2007). By including a COREQ checklist, I can demonstrate that I have reported on important aspects related to qualitative research in the manuscript, which supports transparency in research methods (Tong et al., 2007).

Participant recruitment proved to be challenging, despite multiple attempts to recruit participants with support from ROWPH. These challenges may have limited the diversity of insights shared in the study. For instance, participants who engage with vulnerable populations may have been more motivated to participate for personal and professional reasons. The desired sample size was not reached; however, within the sample of 13

participants, there is representation from different types of Network partner organizations, including municipal and regional government departments, and community-based organizations. In addition, perspectives and experiences were shared by Network partner organizations that operate WCCA Spaces and those that do not operate WCCA Spaces.

The semi-structured interview guide was the primary method of data collection used to explore Network partner's experiences of participating in the WRHCAN. A well developed interview guide can enhance data collection and improve trustworthiness of a study (Kallio et al., 2016). The BMCF was used to guide data analysis, however, the interview guide was not explicitly designed with the BMCF in mind. Rigour in the data collection process could have been enhanced by aligning interview guide questions with the BMCF to ensure that the components of the BMCF were being directly addressed by participants. Despite this limitation, the BMCF proved to be a flexible conceptual framework, that supported a hybrid inductive-deductive analytic approach. The study objectives were primarily exploratory and descriptive and a more open-ended semi-structured interview guide aligned with these goals.

4.3 Research contributions

This research contributed to a greater understanding of the processes of intersectoral collaboration that supported a public health-coordinated climate adaptation initiative. The findings can be used to guide implementation of similar strategies as part of a climate adaptation plan or heat response plan (Bedi et al., 2022; *Heat Alert and Response Systems to Protect Health*, 2012; Widerynski et al., 2017). Intersectoral collaboration is an approach that is suited to address complex problems, such as climate change (Bowen & Ebi, 2015). Additionally, understanding the processes that support intersectoral collaboration may contribute to closing the “health adaptation gap” (Sheehan et al., 2021b; United Nations Environment Programme, 2025). The health adaptation gap refers to the difference between the necessary actions to address climate-health risks and those that are actually taken. Overcoming the barriers and leveraging facilitators to intersectoral action for climate-health can lead to synergistic outcomes that support individual and planetary health (Buse et al., 2022).

Secondly, this research is a case study of intersectoral collaboration in a public health coordinated community-based climate initiative, the WRHCAN, in a Canadian mid-sized region. This case can be used to support the development of evidence-based policies and practices to support climate adaptation initiatives (Hess et al., 2014). While climate-health research in the North American context has increased in recent years, several research gaps exist, including research on the feasibility and effectiveness of adaptation actions (Harper et al., 2021; Huang et al., 2011). Climate adaptation

requires understanding current and projected climate impacts, identifying and implementing adaptation actions, and monitoring and evaluating the effectiveness of the selected actions (*Canada's National Adaptation Strategy*, 2023). Research on climate adaptation initiatives in Western Canadian cities found that health-focused climate adaptations faced several challenges due to limited climate-health knowledge, a focus on addressing heat to the exclusion of other health concerns (e.g., infectious disease, poor air quality), and difficulties with implementation (Rose & Birchall, 2025).

This research highlights the role that local public health units can play in supporting climate adaptation initiatives due to their broad scope and focus on overall population health and wellbeing. Local public health units are situated to take on leadership roles in intersectoral efforts that seek to reduce health inequities and support building community capacity to respond to local needs (South et al., 2019). Further, local public health units may be able to leverage existing partnerships with organizations across sectors and thematic areas to address intersecting challenges that consider climate-health risks holistically (e.g., intersections between housing insecurity and extreme temperature events). The case of the WRHCAN presents an opportunity to address existing institutional and organizational siloes between local government departments and community organizations seeking to support vulnerable populations. By connecting Network partners with diverse insights and perspectives on contextually specific community needs together, the WRHCAN provides a space to engage in information and knowledge exchange and begin conversations that can support collaboration across silos.

Finally, this research highlights the interconnectedness of contextual factors, such as housing, substance use, and mental health, and the need to consider intersectionality during the design and implementation of adaptation initiatives to reduce climate-health risks for vulnerable populations. Research on municipality-led heat-abatement strategies (e.g., green roofs, tree planting, climate shelters) in North American and European cities has shown that not all residents benefit equally from these initiatives because equity considerations are often not part of the planning process (Anguelovski et al., 2024). An example of a municipal-led initiative in Europe is the Climate Shelter Program in Barcelona, which includes over 200 indoor and outdoor public spaces. Research found that there were differences between higher income individuals and those who were working class or migrants in terms of accessing and using these spaces (Amorim-Maia et al., 2023). These different experiences and outcomes point to the need for a deeper understanding of social vulnerabilities when designing climate adaptation initiatives in order to protect population health (Li et al., 2023a).

4.4 Implications, future research, and concluding remarks

The results of this research study have several implications. The findings can be used to strengthen partnership functioning within the WRHCAN. Many of the frontline staff involved in the WRHCAN or operating a WCCA Space are not trained as health and social care workers. While many participants felt that providing a WCCA Space fell within the broad mandate of their organizations to provide a public space, they also expressed some concern about their capacity to adequately support vulnerable populations. Providing Network partners with resources and training can support frontline staff and enhance the quality and experience of individuals seeking the supports and services available through accessing a WCCA Space (Perez et al., 2025). For instance, Network partners and ROWPH can develop specific trainings related to naloxone use to support frontline staff who may be interacting with vulnerable populations (e.g., people who use substances) (Febres-Cordero et al., 2023).

The role of local public health units in addressing the health effects of climate change and promoting climate resilience falls into two broad areas – to promote adaptation, and to support climate change mitigation (Joseph et al., 2025). While the focus of this research study was on understanding intersectoral collaboration in the context of a community adaptation initiative, a few participants spoke about sustainability and mitigation efforts by their organizations. Increasingly, there have been calls to consider adaptation initiatives alongside mitigation efforts in different sectors, including the health sector (Raihan, 2023). Additionally, the health sector has a large carbon footprint that can be reduced through more sustainable practices (Karliner et al., 2020; Rodríguez-Jiménez et al., 2023). Future iterations of public health coordinated climate initiatives can consider ways to integrate adaptation and mitigation strategies that lead to improvements in health, equity, and the environment (Bell et al., 2019; McKay et al., 2025).

The availability of WCCA spaces is a key feature of the WRHCAN. A challenge facing ROWPH and Network Partners is ensuring that WCCA spaces are inclusive and suitable for people with different intersecting needs (e.g., vulnerable populations, general public). A future evaluation of the WRHCAN could consider the perspectives of the intended users of WCCA sites, in order to identify the most appropriate way of supporting people who rely on WCCA spaces during extreme temperature and poor air quality events (Beames et al., 2021; Jenkins et al., 2024; Sunkel & Sartor, 2022). The findings of this research also underscore the need for a broader transdisciplinary urban adaptation response, with WCCA spaces being one component among other adaptation initiatives, with the ultimate goal of creating more sustainable and livable cities for all (Lawrence, 2022; Sádaba et al., 2025).

In addition, future research could focus on understanding and evaluating the effectiveness of this climate adaptation on specific health outcomes in order to support evidence-based public health decision making (Hess et al., 2014). For instance, a consideration of specific health outcomes (e.g., decrease in heat-related morbidity or mortality) or program outcomes (e.g., increase in WCCA space usage) as they relate to WRHCAN activities could be formalized. While this study showed that participants valued the synergies facilitated by the WRHCAN, a lack of information related to outcomes left participants wondering about the broader impact of the WRHCAN. Participants did not necessarily support a quantitative approach to data collection (e.g., utilization rates), given the stigma many vulnerable populations already experience. Instead, a more community-driven participatory approach that is based on the lived experiences of those seeking supports and services may be more appropriate (Brubacher et al., 2025; Duea et al., 2022). The use of evaluation to support intersectoral collaboration in public health interventions has been explored in the European context (Kriegner et al., 2021). For instance, involving non-health sector partners early in the evaluation process can result in improved motivation to participate in an intersectoral collaboration as a result of feeling included (Kriegner et al., 2021). Health impact assessments have also been used as a tool to support intersectoral collaboration by supporting the decision making process as it relates to policies, programs, and initiatives through a more nuanced understanding of health risks and benefits (Kang et al., 2011; Osofsky & Pongsiri, 2018; Properzi et al., 2025). The findings of this thesis research support the idea that intersectoral collaboration can encourage synergistic outputs. The use of evaluation and tools such as health impact assessments can contribute to more impactful climate adaptation initiatives through a more comprehensive planning process that also includes equity considerations.

In conclusion, this thesis research sought to understand the facilitators and barriers to intersectoral collaboration in the case of the WRHCAN, a public health coordinated community-based climate adaptation initiative. The BMCF informed the analysis of participants' experiences of intersectoral collaboration. Interviews with participants highlighted that contextual factors, such as homelessness in Waterloo Region, and the specific challenges associated with supporting vulnerable populations, shaped Network partner responses. Participants identified several facilitators and barriers to their participation in the Network that fit within the BMCF categories of inputs, throughputs, and outputs. The findings of this research provide additional evidence to support the use of the BMCF as a conceptual framework and evaluation tool to understand intersectoral collaboration. Additionally, this study demonstrated that public health units have an important role to play in coordinating and advancing climate change adaptation. Specifically, local public health units can leverage their expertise in supporting

intersectoral collaboration to improve population health now and in the future while advocating for climate justice and health equity.

References

- Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., M. Ameen, B. M., & Khahir, R. M. (2025). Using thematic analysis in qualitative research. *Journal of Medicine, Surgery, and Public Health*, 6, 100198.
<https://doi.org/10.1016/j.glmedi.2025.100198>
- Alderwick, H., Hutchings, A., Briggs, A., & Mays, N. (2021). The impacts of collaboration between local health care and non-health care organizations and factors shaping how they work: A systematic review of reviews. *BMC Public Health*, 21(1), 753.
<https://doi.org/10.1186/s12889-021-10630-1>
- Araos, M., Austin, S. E., Berrang-Ford, L., & Ford, J. D. (2016). Public Health Adaptation to Climate Change in Large Cities: A Global Baseline. *International Journal of Health Services*, 46(1), 53–78. <https://doi.org/10.1177/0020731415621458>
- Asirvatham, R., Nelson, A., Northam, J., & Lucyk, K. (2024). Methods for evaluating intersectoral action partnerships to address the social determinants of health: A scoping review. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice*, 44(10), 440–449.
<https://doi.org/10.24095/hpcdp.44.9.04>
- Austin, S., Ford, J., Berrang-Ford, L., Araos, M., Parker, S., & Fleury, M. (2015). Public Health Adaptation to Climate Change in Canadian Jurisdictions. *International Journal of Environmental Research and Public Health*, 12(1), 623–651.
<https://doi.org/10.3390/ijerph120100623>

- Azari, R., & Borisch, B. (2023). What is public health? A scoping review. *Archives of Public Health*, 81(1), 86. <https://doi.org/10.1186/s13690-023-01091-6>
- Barusch, A., Gringeri, C., & George, M. (2011). Rigor in Qualitative Social Work Research: A Review of Strategies Used in Published Articles. *Social Work Research*, 35(1), 11–19. <https://doi.org/10.1093/swr/35.1.11>
- Bassil, K. L., & Cole, D. C. (2010). Effectiveness of Public Health Interventions in Reducing Morbidity and Mortality during Heat Episodes: A Structured Review. *International Journal of Environmental Research and Public Health*, 7(3), 991–1001. <https://doi.org/10.3390/ijerph7030991>
- Baxter, P., & Jack, S. (2015). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*. <https://doi.org/10.46743/2160-3715/2008.1573>
- Beames, J. R., Kikas, K., O’Grady-Lee, M., Gale, N., Werner-Seidler, A., Boydell, K. M., & Hudson, J. L. (2021). A New Normal: Integrating Lived Experience Into Scientific Data Syntheses. *Frontiers in Psychiatry*, 12, 763005. <https://doi.org/10.3389/fpsyt.2021.763005>
- Bedi, N. S., Adams, Q. H., Hess, J. J., & Wellenius, G. A. (2022). The Role of Cooling Centers in Protecting Vulnerable Individuals from Extreme Heat. *Epidemiology*, 33(5), 611–615. <https://doi.org/10.1097/EDE.0000000000001503>
- Bell, M. L., Gasparrini, A., & Benjamin, G. C. (2024). Climate Change, Extreme Heat, and Health. *New England Journal of Medicine*, 390(19), 1793–1801. <https://doi.org/10.1056/NEJMra2210769>

- Bell, R., Khan, M., Romeo-Velilla, M., Stegeman, I., Godfrey, A., Taylor, T., Morris, G., Staatsen, B., Van Der Vliet, N., Kruize, H., Anthun, K. S., Lillefjell, M., Espnes, G. A., Chiabai, A., García De Jalón, S., Quiroga, S., Martinez-Juarez, P., Máca, V., Zvěřinová, I., ... Costongs, C. (2019). Ten Lessons for Good Practice for the INHERIT Triple Win: Health, Equity, and Environmental Sustainability. *International Journal of Environmental Research and Public Health*, 16(22), 4546.
<https://doi.org/10.3390/ijerph16224546>
- Berrang-Ford, L., Siders, A. R., Lesnikowski, A., Fischer, A. P., Callaghan, M. W., Haddaway, N. R., Mach, K. J., Araos, M., Shah, M. A. R., Wannewitz, M., Doshi, D., Leiter, T., Matavel, C., Musah-Surugu, J. I., Wong-Parodi, G., Antwi-Agyei, P., Ajibade, I., Chauhan, N., Kakenmaster, W., ... Abu, T. Z. (2021). A systematic global stocktake of evidence on human adaptation to climate change. *Nature Climate Change*, 11(11), 989–1000. <https://doi.org/10.1038/s41558-021-01170-y>
- Biagini, B., Bierbaum, R., Stults, M., Dobardzic, S., & McNeeley, S. M. (2014). A typology of adaptation actions: A global look at climate adaptation actions financed through the Global Environment Facility. *Global Environmental Change*, 25, 97–108.
<https://doi.org/10.1016/j.gloenvcha.2014.01.003>
- Blaikie, N. (2018). Confounding issues related to determining sample size in qualitative research. *International Journal of Social Research Methodology*, 21(5), 635–641.
<https://doi.org/10.1080/13645579.2018.1454644>

- Bowen, K. J., & Ebi, K. L. (2015). Governing the health risks of climate change: Towards multi-sector responses. *Current Opinion in Environmental Sustainability*, 12, 80–85. <https://doi.org/10.1016/j.cosust.2014.12.001>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Brink, N., Mansoor, K., Swiers, J., Lakhoo, D. P., Parker, C., Nakstad, B., Sawry, S., Aunan, K., Otto, I. M., & Chersich, M. F. (2024). Scoping Review of Climate Change Adaptation Interventions for Health: Implications for Policy and Practice. *International Journal of Environmental Research and Public Health*, 21(12), 1565. <https://doi.org/10.3390/ijerph21121565>
- Brubacher, L. J., Rajeswaran, K., McDonald, K., Keczem, S., & Dodd, W. (2025). Engaging People With Lived Experience in Mental Health Service Co-design in Ontario, Canada. *Journal of Prevention and Health Promotion*, 26320770251359606. <https://doi.org/10.1177/26320770251359606>
- Buse, C. G. (2018). Why should public health agencies across Canada conduct climate change and health vulnerability assessments? *Canadian Journal of Public Health*, 109(5–6), 782–785. <https://doi.org/10.17269/s41997-018-0118-6>
- Buse, C. G., Brubacher, J., Lapp, H., Jackson, E., Wilson, R., Bevis, B., Komorowski, C., Zentner, S., Folkema, A., & Trotz-Williams, L. (2022). *Climate Change and Health—Vulnerability Assessment*. <https://www.regionofwaterloo.ca/en/health-and-wellness/resources/Documents/Climate-Change-and-Health-Vulnerability-Assessment.pdf>

Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., ... Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. (First). Intergovernmental Panel on Climate Change (IPCC). <https://doi.org/10.59327/IPCC/AR6-9789291691647>*

Canada's national adaptation strategy: Building resilient communities and a strong economy. (2023). Government of Canada = Gouvernement du Canada.

Charlson, F., Ali, S., Augustinavicius, J., Benmarhnia, T., Birch, S., Clayton, S., Fielding, K., Jones, L., Juma, D., Snider, L., Ugo, V., Zeitz, L., Jayawardana, D., La Nauze, A., & Massazza, A. (2022). Global priorities for climate change and mental health research. *Environment International*, 158, 106984. <https://doi.org/10.1016/j.envint.2021.106984>

Chircop, A., Bassett, R., & Taylor, E. (2015). Evidence on how to practice intersectoral collaboration for health equity: A scoping review. *Critical Public Health*, 25(2), 178–191. <https://doi.org/10.1080/09581596.2014.887831>

Cooke, S. J., Vermey, J., Taylor, J. J., Rytwinski, T., Twardek, W. M., Auld, G., Van Bogaert, R., & MacDonald, A. L. (2024). A policy scan related to assisted migration as a climate change adaptation tactic in Canada reveals major policy gaps. *FACETS*, 9, 1–7. <https://doi.org/10.1139/facets-2023-0012>

- Corbin, J. H., Jones, J., & Barry, M. M. (2018). What makes intersectoral partnerships for health promotion work? A review of the international literature. *Health Promotion International*, daw061. <https://doi.org/10.1093/heapro/daw061>
- Corbin, J. H., & Mittelmark, M. B. (2008). Partnership lessons from the Global Programme for Health Promotion Effectiveness: A case study. *Health Promotion International*, 23(4), 365–371. <https://doi.org/10.1093/heapro/dan029>
- Corden, A., & Sainsbury, R. (2006). *Using verbatim quotations in reporting qualitative social research: Researchers' views*. University of York.
- Crimmins, A., Balbus, J., Gamble, J. L., Beard, C. B., Bell, J. E., Dodgen, D., Eisen, R. J., Fann, N., Hawkins, M. D., Herring, S. C., Jantarasami, L., Mills, D. M., Saha, S., Sarofim, M. C., Trtanj, J., & Ziska, L. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. U.S. Global Change Research Program. <https://doi.org/10.7930/J0R49NQX>
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, 11(1), 100. <https://doi.org/10.1186/1471-2288-11-100>
- De Jong, M., Tjhuis, Y., Koelen, M., & Wagemakers, A. (2023). Intersectoral collaboration in a Dutch community health promotion programme: Building a coalition and networks. *Health Promotion International*, 38(4), daab207. <https://doi.org/10.1093/heapro/daab207>
- Dearman, C., Adams, N., Brooks, K., Sousa, A., Pearce-Smith, N., & Petrokofsky, C. (2025). Public health effectiveness of cooling centres during periods of adverse hot

- weather: A systematic literature review. *Oxford Open Climate Change*, 5(1), kgaf020. <https://doi.org/10.1093/oxfclm/kgaf020>
- DeCuir-Gunby, J. T., Marshall, P. L., & McCulloch, A. W. (2011). Developing and Using a Codebook for the Analysis of Interview Data: An Example from a Professional Development Research Project. *Field Methods*, 23(2), 136–155. <https://doi.org/10.1177/1525822X10388468>
- Dodd, W., Scott, P., Howard, C., Scott, C., Rose, C., Cunsolo, A., & Orbinski, J. (2018). Lived experience of a record wildfire season in the Northwest Territories, Canada. *Canadian Journal of Public Health*, 109(3), 327–337. <https://doi.org/10.17269/s41997-018-0070-5>
- Drahota, A., Meza, R. D., Brikho, B., Naaf, M., Estabillo, J. A., Gomez, E. D., Vejnaska, S. F., Dufek, S., Stahmer, A. C., & Aarons, G. A. (2016). Community-Academic Partnerships: A Systematic Review of the State of the Literature and Recommendations for Future Research: Systematic Review of Community-Academic Partnerships. *The Milbank Quarterly*, 94(1), 163–214. <https://doi.org/10.1111/1468-0009.12184>
- Dubois, A., St-Pierre, L., & Veras, M. (2015). A scoping review of definitions and frameworks of intersectoral action. *Ciência & Saúde Coletiva*, 20(10), 2933–2942. <https://doi.org/10.1590/1413-812320152010.01222014>
- Duea, S. R., Zimmerman, E. B., Vaughn, L. M., Dias, S., & Harris, J. (2022). A Guide to Selecting Participatory Research Methods Based on Project and Partnership Goals.

- Journal of Participatory Research Methods*, 3(1).
<https://doi.org/10.35844/001c.32605>
- Ebi, K. L., Capon, A., Berry, P., Broderick, C., Dear, R. de, Havenith, G., Honda, Y., Kovats, R. S., Ma, W., Malik, A., Morris, N. B., Nybo, L., Seneviratne, S. I., Vanos, J., & Jay, O. (2021). Hot weather and heat extremes: Health risks. *The Lancet*, 398(10301), 698–708. [https://doi.org/10.1016/S0140-6736\(21\)01208-3](https://doi.org/10.1016/S0140-6736(21)01208-3)
- Ebi, K. L., Kovats, R. S., & Menne, B. (2006). An Approach for Assessing Human Health Vulnerability and Public Health Interventions to Adapt to Climate Change. *Environmental Health Perspectives*, 114(12), 1930–1934.
<https://doi.org/10.1289/ehp.8430>
- Ebi, K. L., Vanos, J., Baldwin, J. W., Bell, J. E., Hondula, D. M., Errett, N. A., Hayes, K., Reid, C. E., Saha, S., Spector, J., & Berry, P. (2021). Extreme Weather and Climate Change: Population Health and Health System Implications. *Annual Review of Public Health*, 42(1), 293–315. <https://doi.org/10.1146/annurev-publhealth-012420-105026>
- Fears, R., Abdullah, K. A. B., Canales-Holzeis, C., Caussy, D., Haines, A., Harper, S. L., McNeil, J. N., Mogwitz, J., & Ter Meulen, V. (2021). Evidence-informed policy for tackling adverse climate change effects on health: Linking regional and global assessments of science to catalyse action. *PLoS Medicine*, 18(7), e1003719.
<https://doi.org/10.1371/journal.pmed.1003719>
- Febres-Cordero, S., Smith, D. J., Wulkan, A. Z., Béliveau, A. J., Gish, A., Zine, S., Fugitt, L., & Giordano, N. A. (2023). It’s what the community demands: Results of community-

based emergency opioid overdose trainings. *Public Health Nursing*, 40(1), 44–53.

<https://doi.org/10.1111/phn.13151>

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, 5(1), 80–92.

<https://doi.org/10.1177/160940690600500107>

Foster-Fishman, P. G., Berkowitz, S. L., Lounsbury, D. W., Jacobson, S., & Allen, N. A. (2001). Building Collaborative Capacity in Community Coalitions: A Review and Integrative Framework. *American Journal of Community Psychology*, 29(2), 241–261. <https://doi.org/10.1023/a:1010378613583>

Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M. P., & Grimshaw, J. M. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology & Health*, 25(10), 1229–1245. <https://doi.org/10.1080/08870440903194015>

Frerichs, L., Kim, M., Dave, G., Cheney, A., Hassmiller Lich, K., Jones, J., Young, T. L., Cene, C. W., Varma, D. S., Schaal, J., Black, A., Striley, C. W., Vassar, S., Sullivan, G., Cottler, L. B., Brown, A., Burke, J. G., & Corbie-Smith, G. (2017). Stakeholder Perspectives on Creating and Maintaining Trust in Community–Academic Research Partnerships. *Health Education & Behavior*, 44(1), 182–191.

<https://doi.org/10.1177/1090198116648291>

- Füssel, H.-M., & Klein, R. J. T. (2006). Climate Change Vulnerability Assessments: An Evolution of Conceptual Thinking. *Climatic Change*, 75(3), 301–329.
<https://doi.org/10.1007/s10584-006-0329-3>
- Goldberg, M. (2008). A Systematic Review of the Relation Between Long-term Exposure to Ambient Air Pollution and Chronic Diseases. *Reviews on Environmental Health*, 23(4). <https://doi.org/10.1515/reveh.2008.23.4.243>
- Gough, W., Anderson, V., & Herod, K. (2016). *Ontario Climate Change and Health Modelling Study*. Ministry of Health and Long-Term Care.
- Guglielmin, M., Muntaner, C., O'Campo, P., & Shankardass, K. (2018). A scoping review of the implementation of health in all policies at the local level. *Health Policy*, 122(3), 284–292. <https://doi.org/10.1016/j.healthpol.2017.12.005>
- Gupta, A., & Shukla, A. K. (2024). Optimal approaches in global warming mitigation and adaptation strategies at city scale. *Discover Sustainability*, 5(1), 272.
<https://doi.org/10.1007/s43621-024-00497-8>
- Hadi, M. A., & José Closs, S. (2015). Ensuring rigour and trustworthiness of qualitative research in clinical pharmacy. *International Journal of Clinical Pharmacy*.
<https://doi.org/10.1007/s11096-015-0237-6>
- Haines, A., Kovats, R. S., Campbell-Lendrum, D., & Corvalan, C. (2006). Climate change and human health: Impacts, vulnerability and public health. *Public Health*, 120(7), 585–596. <https://doi.org/10.1016/j.puhe.2006.01.002>

- Hamanaka, R. B., & Mutlu, G. M. (2018). Particulate Matter Air Pollution: Effects on the Cardiovascular System. *Frontiers in Endocrinology*, 9.
<https://doi.org/10.3389/fendo.2018.00680>
- Harper, S. L., Cunsolo, A., Babujee, A., Coggins, S., De Jongh, E., Rusnak, T., Wright, C. J., & Domínguez Aguilar, M. (2021). Trends and gaps in climate change and health research in North America. *Environmental Research*, 199, 111205.
<https://doi.org/10.1016/j.envres.2021.111205>
- Hayes, K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018). Climate change and mental health: Risks, impacts and priority actions. *International Journal of Mental Health Systems*, 12(1), 28. <https://doi.org/10.1186/s13033-018-0210-6>
- Hays, D. G., Wood, C., Dahl, H., & Kirk-Jenkins, A. (2016). Methodological Rigor in *Journal of Counseling & Development* Qualitative Research Articles: A 15-Year Review. *Journal of Counseling & Development*, 94(2), 172–183.
<https://doi.org/10.1002/jcad.12074>
- Health Canada. (2025). *Heat-related morbidity and mortality in Canada*. Government of Canada. <https://www.canada.ca/en/health-canada/services/publications/healthy-living/heat-related-morbidity-mortality.html>
- Heat alert and response systems to protect health: Best practices guidebook*. (2012). Health Canada.
- Hebbern, C., Gosselin, P., Chen, K., Chen, H., Cakmak, S., MacDonald, M., Chagnon, J., Dion, P., Martel, L., & Lavigne, E. (2023). Future temperature-related excess mortality under climate change and population aging scenarios in Canada.

Canadian Journal of Public Health, 114(5), 726–736.

<https://doi.org/10.17269/s41997-023-00782-5>

Henderson, S. B., McLean, K. E., Lee, M. J., & Kosatsky, T. (2022). Analysis of community deaths during the catastrophic 2021 heat dome: Early evidence to inform the public health response during subsequent events in greater Vancouver, Canada.

Environmental Epidemiology, 6(1), e189.

<https://doi.org/10.1097/EE9.0000000000000189>

Hess, J. J., Eidson, M., Tlumak, J. E., Raab, K. K., & Lubet, G. (2014). An Evidence-Based Public Health Approach to Climate Change Adaptation. *Environmental Health Perspectives*, 122(11), 1177–1186. <https://doi.org/10.1289/ehp.1307396>

Hess, J. J., Errett, N. A., McGregor, G., Busch Isaksen, T., Wettstein, Z. S., Wheat, S. K., & Ebi, K. L. (2023). Public Health Preparedness for Extreme Heat Events. *Annual Review of Public Health*, 44(1), 301–321. <https://doi.org/10.1146/annurev-publhealth-071421-025508>

Holt, D. H., & Aveling, E.-L. (2023). Achieving partnership synergy: Resource inputs, shared mission and interdependencies in Danish health promotion partnerships. *Health Promotion International*, 38(1), daac203. <https://doi.org/10.1093/heapro/daac203>

Hossain, B. (2025). A systematic review of adaptation practices to promote health resilience in response to climate change. *Environmental Development*, 54, 101166. <https://doi.org/10.1016/j.envdev.2025.101166>

- Huang, C., Vaneckova, P., Wang, X., FitzGerald, G., Guo, Y., & Tong, S. (2011). Constraints and Barriers to Public Health Adaptation to Climate Change. *American Journal of Preventive Medicine*, 40(2), 183–190. <https://doi.org/10.1016/j.amepre.2010.10.025>
- Irby, M. B., Moore, K. R., Mann-Jackson, L., Hamlin, D., Randall, I., Summers, P., Skelton, J. A., Daniel, S. S., & Rhodes, S. D. (2021). Community-Engaged Research: Common Themes and Needs Identified by Investigators and Research Teams at an Emerging Academic Learning Health System. *International Journal of Environmental Research and Public Health*, 18(8), 3893. <https://doi.org/10.3390/ijerph18083893>
- Israel, B. A., Schulz, A. J., Parker, E. A., & Becker, A. B. (1998). REVIEW OF COMMUNITY-BASED RESEARCH: Assessing Partnership Approaches to Improve Public Health. *Annual Review of Public Health*, 19(1), 173–202. <https://doi.org/10.1146/annurev.publhealth.19.1.173>
- Jabakhanji, S. B., Arnold, S. R., Aunan, K., Chersich, M. F., Jakobsson, K., McGushin, A., Kelly, I., Roche, N., Stauffer, A., & Stanistreet, D. (2022). Public Health Measures to Address the Impact of Climate Change on Population Health—Proceedings from a Stakeholder Workshop. *International Journal of Environmental Research and Public Health*, 19(20), 13665. <https://doi.org/10.3390/ijerph192013665>
- Jenkins, C. L., Mills, T., Grimes, J., Bland, C., Reavey, P., Wills, J., & Sykes, S. (2024). Involving lived experience in regional efforts to address gambling-related harms: Going beyond ‘window dressing’ and ‘tick box exercises.’ *BMC Public Health*, 24(1), 384. <https://doi.org/10.1186/s12889-024-17939-7>

- Johnson, J. L., Adkins, D., & Chauvin, S. (2020). A Review of the Quality Indicators of Rigor in Qualitative Research. *American Journal of Pharmaceutical Education*, 84(1), 7120. <https://doi.org/10.5688/ajpe7120>
- Joseph, H. A., Lemon, S. C., Goins, K. V., Aytur, S. A., Zimmerman, S., Alexander, E., Brown, C., Saha, S., & Schramm, P. J. (2025). A Flexible Framework for Urgent Public Health Climate Action. *American Journal of Public Health*, 115(7), 1062–1073. <https://doi.org/10.2105/AJPH.2025.308061>
- Joseph, H. A., Mallen, E., McLaughlin, M., Grossman, E., Holmes, T. J., Locklear, A., Powell, E., Thie, L., Uejio, C. K., Vacca, K., Williams, C., Bishop, T., Jeffers, C., Siegel, H., & Austin, C. (2023). Evaluating public health strategies for climate adaptation: Challenges and opportunities from the climate ready states and cities initiative. *PLOS Climate*, 2(3), e0000102. <https://doi.org/10.1371/journal.pclm.0000102>
- Kallio, H., Pietilä, A., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, 72(12), 2954–2965. <https://doi.org/10.1111/jan.13031>
- Kang, E., Park, H. J., & Kim, J. E. (2011). Health impact assessment as a strategy for intersectoral collaboration. *Journal of Preventive Medicine and Public Health = Yebang Uihakhoe Chi*, 44(5), 201–209. <https://doi.org/10.3961/jpmp.2011.44.5.201>
- Kareiva, P., & Carranza, V. (2018). Existential risk due to ecosystem collapse: Nature strikes back. *Futures*, 102, 39–50. <https://doi.org/10.1016/j.futures.2018.01.001>

- Karliner, J., Slotterback, S., Boyd, R., Ashby, B., Steele, K., & Wang, J. (2020). Health care's climate footprint: The health sector contribution and opportunities for action. *European Journal of Public Health*, 30(Supplement_5), ckaa165.843.
<https://doi.org/10.1093/eurpub/ckaa165.843>
- Kegler, M. C., Rigler, J., & Honeycutt, S. (2010). How does community context influence coalitions in the formation stage? A multiple case study based on the Community Coalition Action Theory. *BMC Public Health*, 10(1), 90.
<https://doi.org/10.1186/1471-2458-10-90>
- Key, K. D., Furr-Holden, D., Lewis, E. Y., Cunningham, R., Zimmerman, M. A., Johnson-Lawrence, V., & Selig, S. (2019). The Continuum of Community Engagement in Research: A Roadmap for Understanding and Assessing Progress. *Progress in Community Health Partnerships: Research, Education, and Action*, 13(4), 427–434.
<https://doi.org/10.1353/cpr.2019.0064>
- Khatib, M., Shah, R., Mendhe, S., Whisner, C., & Buman, M. (2025). Bridging the divide: Barriers and facilitators to equitable community-academic partnerships in health research. *Frontiers in Public Health*, 13, 1617908.
<https://doi.org/10.3389/fpubh.2025.1617908>
- Knox, S., & Burkard, A. W. (2009). Qualitative research interviews. *Psychotherapy Research*, 19(4–5), 566–575. <https://doi.org/10.1080/10503300802702105>
- Koelen, M. A., Vaandrager, L., & Wagemakers, A. (2012). The healthy alliances (HALL) framework: Prerequisites for success. *Family Practice*, 29(suppl 1), i132–i138.
<https://doi.org/10.1093/fampra/cm088>

- Kriegner, S., Ottersen, T., Røttingen, J.-A., & Gopinathan, U. (2021). Promoting Intersectoral Collaboration Through the Evaluations of Public Health Interventions: Insights From Key Informants in 6 European Countries. *International Journal of Health Policy and Management*, 10(2), 67–76. <https://doi.org/10.34172/ijhpm.2020.19>
- Kuivenhoven, L. (2024, August 10). Seniors and low income earners are most vulnerable when it comes to extreme heat: UW study. *CBC News*.
<https://www.cbc.ca/news/canada/kitchener-waterloo/university-of-waterloo-extreme-heatwave-study-1.7284301>
- L Brown, H., Proust, K., Spickett, J., & Capon, A. (2011). The potential role of Health Impact Assessment in tackling the complexity of climate change adaptation for health. *Health Promotion Journal of Australia*, 22(4), 48–53.
<https://doi.org/10.1071/HE11448>
- Lasker, R. D., & Weiss, E. S. (2003). Creating partnership synergy: The critical role of community stakeholders. *Journal of Health and Human Services Administration*, 26(1), 119–139.
- Lawrence, R. J. (2022). Co-Benefits of Transdisciplinary Planning for Healthy Cities. *Urban Planning*, 7(4). <https://doi.org/10.17645/up.v7i4.5674>
- Li, A., Toll, M., & Bentley, R. (2023a). Mapping social vulnerability indicators to understand the health impacts of climate change: A scoping review. *The Lancet Planetary Health*, 7(11), e925–e937. [https://doi.org/10.1016/S2542-5196\(23\)00216-4](https://doi.org/10.1016/S2542-5196(23)00216-4)

- Li, A., Toll, M., & Bentley, R. (2023b). Mapping social vulnerability indicators to understand the health impacts of climate change: A scoping review. *The Lancet Planetary Health*, 7(11), e925–e937. [https://doi.org/10.1016/S2542-5196\(23\)00216-4](https://doi.org/10.1016/S2542-5196(23)00216-4)
- Liu, F., Chang-Richards, A., Wang, K. I., & Dirks, K. N. (2023). Effects of climate change on health and wellbeing: A systematic review. *Sustainable Development*, 31(4), 2067–2090. <https://doi.org/10.1002/sd.2513>
- London, J. K., Haapanen, K. A., Backus, A., Mack, S. M., Lindsey, M., & Andrade, K. (2020). Aligning Community-Engaged Research to Context. *International Journal of Environmental Research and Public Health*, 17(4), 1187. <https://doi.org/10.3390/ijerph17041187>
- Luyten, A., Winkler, M. S., Ammann, P., & Dietler, D. (2023). Health impact studies of climate change adaptation and mitigation measures – A scoping review. *The Journal of Climate Change and Health*, 9, 100186. <https://doi.org/10.1016/j.joclim.2022.100186>
- [Map]. (n.d.). [Map]. <https://experience.arcgis.com/experience/b85000514c104d1ea675f7b2f41b7008/>
- Mayrhuber, E. A.-S., Dückers, M. L. A., Wallner, P., Arnberger, A., Alex, B., Wiesböck, L., Wanka, A., Kolland, F., Eder, R., Hutter, H.-P., & Kutalek, R. (2018). Vulnerability to heatwaves and implications for public health interventions – A scoping review. *Environmental Research*, 166, 42–54. <https://doi.org/10.1016/j.envres.2018.05.021>
- Mckay, V., Tetteh, E., Wong, N., Kramer, C. B., & Burnham, J. (2025). Environmental sustainability, an essential outcome for implementation scientists to improve

- health. *Frontiers in Health Services*, 5, 1664446.
<https://doi.org/10.3389/frhs.2025.1664446>
- McMichael, A. J. (2013). Globalization, Climate Change, and Human Health. *New England Journal of Medicine*, 368(14), 1335–1343. <https://doi.org/10.1056/NEJMra1109341>
- Mondal, S., Van Belle, S., & Maioni, A. (2021). Learning from intersectoral action beyond health: A meta-narrative review. *Health Policy and Planning*, 36(4), 552–571.
<https://doi.org/10.1093/heapol/czaa163>
- Morse, J. M. (2015). Critical Analysis of Strategies for Determining Rigor in Qualitative Inquiry. *Qualitative Health Research*, 25(9), 1212–1222.
<https://doi.org/10.1177/1049732315588501>
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the National Academy of Sciences*, 107(51), 22026–22031. <https://doi.org/10.1073/pnas.1007887107>
- Ndumbe-Eyoh, S., & Moffatt, H. (2013). Intersectoral action for health equity: A rapid systematic review. *BMC Public Health*, 13(1), 1056. <https://doi.org/10.1186/1471-2458-13-1056>
- Negandhi, P., Acharya, S., Khan, F., & Kumar, S. (2025). Climate change and human health: A medical perspective on emerging challenges and mitigation: A comprehensive review. *Multidisciplinary Reviews*, 9(4), 2026169.
<https://doi.org/10.31893/multirev.2026169>

- Nelson, E., & Dodd, W. (2017). Collaborating for community food security: Emerging scholar participation in a community–university partnership. *Action Research*, 15(4), 402–423. <https://doi.org/10.1177/1476750316656041>
- Neta, G., Pan, W., Ebi, K., Buss, D. F., Castranio, T., Lowe, R., Ryan, S. J., Stewart-Ibarra, A. M., Hapairai, L. K., Sehgal, M., Wimberly, M. C., Rollock, L., Lichtveld, M., & Balbus, J. (2022). Advancing climate change health adaptation through implementation science. *The Lancet Planetary Health*, 6(11), e909–e918. [https://doi.org/10.1016/S2542-5196\(22\)00199-1](https://doi.org/10.1016/S2542-5196(22)00199-1)
- Ofremu, G. O., Raimi, B. Y., Yusuf, S. O., Dziwornu, B. A., Nnabuike, S. G., Eze, A. M., & Nnajifor, C. A. (2025). Exploring the relationship between climate change, air pollutants and human health: Impacts, adaptation, and mitigation strategies. *Green Energy and Resources*, 3(2), 100074. <https://doi.org/10.1016/j.gerr.2024.100074>
- Ontario Climate Change and Health Vulnerability and Adaptation Assessment Guidelines: Technical Document. (2016). Ministry of Health and Long-Term Care.
- Ortiz, K., Nash, J., Shea, L., Oetzel, J., Garoutte, J., Sanchez-Youngman, S., & Wallerstein, N. (2020). Partnerships, Processes, and Outcomes: A Health Equity–Focused Scoping Meta-Review of Community-Engaged Scholarship. *Annual Review of Public Health*, 41(1), 177–199. <https://doi.org/10.1146/annurev-publhealth-040119-094220>
- Osofsky, S. A., & Pongsiri, M. J. (2018). Operationalising planetary health as a game-changing paradigm: Health impact assessments are key. *The Lancet Planetary Health*, 2(2), e54–e55. [https://doi.org/10.1016/S2542-5196\(17\)30183-3](https://doi.org/10.1016/S2542-5196(17)30183-3)

- Owen, G. (2020). What makes climate change adaptation effective? A systematic review of the literature. *Global Environmental Change*, 62, 102071.
<https://doi.org/10.1016/j.gloenvcha.2020.102071>
- Parent, M. M., & Harvey, J. (2009). Towards a Management Model for Sport and Physical Activity Community-based Partnerships. *European Sport Management Quarterly*, 9(1), 23–45. <https://doi.org/10.1080/16184740802461694>
- Patterson, E. W., Ball, K., Corkish, J., & Whittick, I. M. (2023). Do you see what I see? Enhancement of rigour in qualitative approaches to inquiry: a systematic review of evidence. *Qualitative Research Journal*, 23(2), 164–180.
<https://doi.org/10.1108/QRJ-06-2022-0086>
- Pavia, J. (2025, July 31). Poor air quality expected for Waterloo region and area due to wildfire smoke. *CBC News*. <https://www.cbc.ca/news/canada/kitchener-waterloo/air-quality-waterloo-region-guelph-1.7598478>
- Pellicano, E., Bent, C. A., Iacono, T., Capes, K., Upson, S., & Hudry, K. (2025). ‘You feel part of something bigger’: Stakeholders’ experiences of a long-term community–academic participatory research partnership. *Autism*, 29(11), 2818–2831.
<https://doi.org/10.1177/13623613251348485>
- Perez, S., Kerman, N., Dej, E., Forchuk, C., George, C., Easton, C., & Marshall, C. A. (2025). When I can’t help, I suffer: A scoping review of moral distress in service providers working with persons experiencing homelessness. *Journal of Mental Health*, 34(5), 596–611. <https://doi.org/10.1080/09638237.2024.2426986>

- Petric, A., Parker, D. C., Geobey, S., & Wright, K. (2024). Making room for everyone: Assessing housing needs and suitability in Waterloo Region, Ontario via time, space, and equity lenses. *Canadian Planning and Policy / Aménagement et Politique Au Canada*, 2024(2), 43–80. <https://doi.org/10.24908/cpp-apc.v2024i2.17254>
- Phillips, M. J. (2023). Towards a social constructionist, criticalist, Foucauldian-informed qualitative research approach: Opportunities and challenges. *SN Social Sciences*, 3(10), 175. <https://doi.org/10.1007/s43545-023-00774-9>
- Plante, C., Sandhu, N., Bandara, T., Fuller, D., & Neudorf, C. (2023). Defining the “local public health unit” for public health systems and services research in Canada. *Canadian Journal of Public Health = Revue Canadienne De Sante Publique*, 114(1), 5–9. <https://doi.org/10.17269/s41997-022-00714-9>
- Polcin, D. L. (2016). Co-occurring substance abuse and mental health problems among homeless persons: Suggestions for research and practice. *Journal of Social Distress and the Homeless*, 25(1), 1–10. <https://doi.org/10.1179/1573658X15Y.0000000004>
- Properzi, S., Coa, A. A., Fiorilla, C., & Pasetto, R. (2025). Exploring methods to assess environmental health inequalities in health impact assessments of local interventions: A systematic review within the JA PreventNCD project. *Frontiers in Public Health*, 13, 1546394. <https://doi.org/10.3389/fpubh.2025.1546394>
- Public Health Agency of Canada. (2022). *Mobilizing Public Health Action on Climate Change in Canada: The Chief Public Health Officer of Canada’s Report on the State of Public Health in Canada 2022*. <https://www.canada.ca/content/dam/phac->

aspc/documents/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/state-public-health-canada-2022/report-rapport/report.pdf

Raftery, P., Hossain, M., & Palmer, J. (2022). A conceptual framework for analysing partnership and synergy in a global health alliance: Case of the UK Public Health Rapid Support Team. *Health Policy and Planning*, 37(3), 322–336.

<https://doi.org/10.1093/heapol/czab150>

Raihan, A. (2023). A review of the global climate change impacts, adaptation strategies, and mitigation options in the socio-economic and environmental sectors. *Journal of Environmental Science and Economics*, 2(3), 36–58.

<https://doi.org/10.56556/jescae.v2i3.587>

Region of Waterloo. (n.d.). *Population* [<https://www.regionofwaterloo.ca/en/regional-government/population.aspx>].

Regional Municipality of Waterloo. (2019). *Community Climate Adaptation Plan for Waterloo Region*. <https://www.regionofwaterloo.ca/en/living-here/resources/Environment/Community-Climate-Adaptation-Plan---Full-ACCESS.pdf>

Rhodes, S. D., Tanner, A. E., Mann-Jackson, L., Alonzo, J., Simán, F. M., Song, E. Y., Bell, J., Irby, M. B., Vissman, A. T., & Aronson, R. E. (2018). Promoting Community and Population Health in Public Health and Medicine: A Stepwise Guide to Initiating and Conducting Community-engaged Research. *Journal of Health Disparities Research and Practice*, 11(3), 16–31.

- Roberts, K., Dowell, A., & Nie, J.-B. (2019). Attempting rigour and replicability in thematic analysis of qualitative research data; a case study of codebook development. *BMC Medical Research Methodology*, 19(1), 66. <https://doi.org/10.1186/s12874-019-0707-y>
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., De Wit, C. A., Hughes, T., Van Der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... Foley, J. A. (2009). A safe operating space for humanity. *Nature*, 461(7263), 472–475. <https://doi.org/10.1038/461472a>
- Rodríguez-Jiménez, L., Romero-Martín, M., Spruell, T., Steley, Z., & Gómez-Salgado, J. (2023). The carbon footprint of healthcare settings: A systematic review. *Journal of Advanced Nursing*, 79(8), 2830–2844. <https://doi.org/10.1111/jan.15671>
- Romanello, M., Napoli, C. D., Drummond, P., Green, C., Kennard, H., Lampard, P., Scamman, D., Arnell, N., Ayeb-Karlsson, S., Ford, L. B., Belesova, K., Bowen, K., Cai, W., Callaghan, M., Campbell-Lendrum, D., Chambers, J., Daalen, K. R. van, Dalin, C., Dasandi, N., ... Costello, A. (2022). The 2022 report of the Lancet Countdown on health and climate change: Health at the mercy of fossil fuels. *The Lancet*, 400(10363), 1619–1654. [https://doi.org/10.1016/S0140-6736\(22\)01540-9](https://doi.org/10.1016/S0140-6736(22)01540-9)
- Romanello, M., Walawender, M., Hsu, S.-C., Moskeland, A., Palmeiro-Silva, Y., Scamman, D., Ali, Z., Ameli, N., Angelova, D., Ayeb-Karlsson, S., Basart, S., Beagley, J., Beggs, P. J., Blanco-Villafuerte, L., Cai, W., Callaghan, M., Campbell-Lendrum, D., Chambers, J. D., Chicmana-Zapata, V., ... Costello, A. (2024). The 2024 report of the

- Lancet Countdown on health and climate change: Facing record-breaking threats from delayed action. *The Lancet*, 404(10465), 1847–1896.
[https://doi.org/10.1016/S0140-6736\(24\)01822-1](https://doi.org/10.1016/S0140-6736(24)01822-1)
- Rose, D., & Birchall, S. J. (2025). Investigating the extent and quality of health-focused climate adaptation planning: Insights from Western Canadian cities. *Environmental Science & Policy*, 172, 104192. <https://doi.org/10.1016/j.envsci.2025.104192>
- Roussos, S. T., & Fawcett, S. B. (2000). A Review of Collaborative Partnerships as a Strategy for Improving Community Health. *Annual Review of Public Health*, 21(1), 369–402. <https://doi.org/10.1146/annurev.publhealth.21.1.369>
- Rutter, H., Savona, N., Glonti, K., Bibby, J., Cummins, S., Finegood, D. T., Greaves, F., Harper, L., Hawe, P., Moore, L., Petticrew, M., Rehfuss, E., Shiell, A., Thomas, J., & White, M. (2017). The need for a complex systems model of evidence for public health. *The Lancet*, 390(10112), 2602–2604. [https://doi.org/10.1016/S0140-6736\(17\)31267-9](https://doi.org/10.1016/S0140-6736(17)31267-9)
- Sádaba, J., Luzarraga, A., & Lenzi, S. (2025). Designing for Climate Adaptation: A Case Study Integrating Nature-Based Solutions with Urban Infrastructure. *Urban Science*, 9(3), 74. <https://doi.org/10.3390/urbansci9030074>
- Schmid, E., Garrels, V., & Skåland, B. (2024). The continuum of rapport: Ethical tensions in qualitative interviews with vulnerable participants. *Qualitative Research*, 24(5), 1253–1271. <https://doi.org/10.1177/14687941231224600>
- Seaton, C. L., Holm, N., Bottorff, J. L., Jones-Bricker, M., Errey, S., Caperchione, C. M., Lamont, S., Johnson, S. T., & Healy, T. (2018). Factors That Impact the Success of

- Interorganizational Health Promotion Collaborations: A Scoping Review. *American Journal of Health Promotion*, 32(4), 1095–1109.
<https://doi.org/10.1177/0890117117710875>
- Secules, S., McCall, C., Mejia, J. A., Beebe, C., Masters, A. S., L. Sánchez-Peña, M., & Svyantek, M. (2021). Positionality practices and dimensions of impact on equity research: A collaborative inquiry and call to the community. *Journal of Engineering Education*, 110(1), 19–43. <https://doi.org/10.1002/jee.20377>
- Shakya, R., & Khan, S. (2025). Climate Change and Livability: A Systematic Review of Adaptation Strategies and Policy Challenges. *Sustainable Development*, sd.70242. <https://doi.org/10.1002/sd.70242>
- Sheehan, M. C. (2022). 2021 Climate and Health Review – Uncharted Territory: Extreme Weather Events and Morbidity. *International Journal of Health Services*, 52(2), 189–200. <https://doi.org/10.1177/00207314221082452>
- Sheehan, M. C., Freire, M., & Martinez, G. S. (2021a). Piloting a city health adaptation typology with data from climate-engaged cities: Toward identification of an urban health adaptation gap. *Environmental Research*, 196, 110435. <https://doi.org/10.1016/j.envres.2020.110435>
- Sheehan, M. C., Freire, M., & Martinez, G. S. (2021b). Piloting a city health adaptation typology with data from climate-engaged cities: Toward identification of an urban health adaptation gap. *Environmental Research*, 196, 110435. <https://doi.org/10.1016/j.envres.2020.110435>

- Sibbald, S. L., Paciocco, S., Fournie, M., Van Asseldonk, R., & Scurr, T. (2021). Continuing to enhance the quality of case study methodology in health services research. *Healthcare Management Forum*, 34(5), 291–296.
<https://doi.org/10.1177/08404704211028857>
- Singh, C., Iyer, S., New, M. G., Few, R., Kuchimanchi, B., Segnon, A. C., & Morchain, D. (2022). Interrogating ‘effectiveness’ in climate change adaptation: 11 guiding principles for adaptation research and practice. *Climate and Development*, 14(7), 650–664. <https://doi.org/10.1080/17565529.2021.1964937>
- Solomon, C. G., & LaRocque, R. C. (2019). Climate Change—A Health Emergency. *New England Journal of Medicine*, 380(3), 209–211.
<https://doi.org/10.1056/NEJMp1817067>
- South, J., Connolly, A. M., Stansfield, J. A., Johnstone, P., Henderson, G., & Fenton, K. A. (2019). Putting the public (back) into public health: Leadership, evidence and action. *Journal of Public Health*, 41(1), 10–17.
<https://doi.org/10.1093/pubmed/fdy041>
- Stake, R. E. (1995). *The art of case study research* (Nachdr.). Sage Publ.
- Sunkel, C., & Sartor, C. (2022). Perspectives: Involving persons with lived experience of mental health conditions in service delivery, development and leadership. *BJPsych Bulletin*, 46(3), 160–164. <https://doi.org/10.1192/bjb.2021.51>
- Tobin, G. A., & Begley, C. M. (2004). Methodological rigour within a qualitative framework. *Journal of Advanced Nursing*, 48(4), 388–396. <https://doi.org/10.1111/j.1365-2648.2004.03207.x>

- Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, 19(6), 349–357.
<https://doi.org/10.1093/intqhc/mzm042>
- Tong, S., & Ebi, K. (2019). Preventing and mitigating health risks of climate change. *Environmental Research*, 174, 9–13. <https://doi.org/10.1016/j.envres.2019.04.012>
- Tools and methods for integrating health into climate change adaptation and mitigation policies and strategies. Report* (with Diallo, T.). (2021). Centre de collaboration nationale sur les politiques publiques et la santé = National collaborating centre for healthy public policy, Institut national de santé publique Québec.
- United Nations Environment Programme. (2025). *Adaptation Gap Report 2025: Running on Empty - The World is Gearing up for Climate Resilience — without the Money to get there*. United Nations Environment Programme.
<https://doi.org/10.59117/20.500.11822/48798>
- Van Draanen, J. (2017). Introducing Reflexivity to Evaluation Practice: An In-Depth Case Study. *American Journal of Evaluation*, 38(3), 360–375.
<https://doi.org/10.1177/1098214016668401>
- VanWynsberghe, R., & Khan, S. (2007). Redefining Case Study. *International Journal of Qualitative Methods*, 6(2), 80–94. <https://doi.org/10.1177/160940690700600208>
- Wallerstein, N. B., & Duran, B. (2006). Using Community-Based Participatory Research to Address Health Disparities. *Health Promotion Practice*, 7(3), 312–323.
<https://doi.org/10.1177/1524839906289376>

- Wallerstein, N., Oetzel, J. G., Sanchez-Youngman, S., Boursaw, B., Dickson, E., Kastelic, S., Koegel, P., Lucero, J. E., Magarati, M., Ortiz, K., Parker, M., Peña, J., Richmond, A., & Duran, B. (2020). Engage for Equity: A Long-Term Study of Community-Based Participatory Research and Community-Engaged Research Practices and Outcomes. *Health Education & Behavior*, 47(3), 380–390.
<https://doi.org/10.1177/1090198119897075>
- Wang, B., Pan, S.-Y., Ke, R.-Y., Wang, K., & Wei, Y.-M. (2014). An overview of climate change vulnerability: A bibliometric analysis based on Web of Science database. *Natural Hazards*, 74(3), 1649–1666. <https://doi.org/10.1007/s11069-014-1260-y>
- Waterloo Region. (2024). *Navigating complexity together: A roadmap to functional zero by 2030*. <https://pub-regionofwaterloo.escribemeetings.com/filestream.ashx?DocumentId=7355>
- Wheeler, N., & Watts, N. (2018). Climate Change: From Science to Practice. *Current Environmental Health Reports*, 5(1), 170–178. <https://doi.org/10.1007/s40572-018-0187-y>
- White, B. P., Breakey, S., Brown, M. J., Smith, J. R., Tarbet, A., Nicholas, P. K., & Ros, A. M. V. (2023a). Mental Health Impacts of Climate Change Among Vulnerable Populations Globally: An Integrative Review. *Annals of Global Health*, 89(1), 66.
<https://doi.org/10.5334/aogh.4105>
- White, B. P., Breakey, S., Brown, M. J., Smith, J. R., Tarbet, A., Nicholas, P. K., & Ros, A. M. V. (2023b). Mental Health Impacts of Climate Change Among Vulnerable

- Populations Globally: An Integrative Review. *Annals of Global Health*, 89(1), 66.
<https://doi.org/10.5334/aogh.4105>
- Widerynski, S., Schramm, P., Conlon, K., Noe, R., & Grossman, E. (2017). *The use of cooling centres to prevent heat-related illness: Summary of evidence and strategies for implementation*. <https://stacks.cdc.gov/view/cdc/47657>
- Wiggins, B., Anastasiou, K., & Cox, D. N. (2021). A Systematic Review of Key Factors in the Effectiveness of Multisector Alliances in the Public Health Domain. *American Journal of Health Promotion: AJHP*, 35(1), 93–105.
<https://doi.org/10.1177/0890117120928789>
- Winslow, C.-E. A. (1920). The Untilled Fields of Public Health. *Science*, 51(1306), 23–33.
<https://doi.org/10.1126/science.51.1306.23>
- Working Together for Equity and Healthier Populations: Sustainable Multisectoral Collaboration Based on Health in All Policies Approaches* (1st ed). (2023). World Health Organization.
- World Health Organization. (2013). *The Helsinki statement on health in all policies*.
http://www.who.int/healthpromotion/conferences/8gchp/8gchp_helsinki_statement.pdf
- Yenew, C., Bayeh, G. M., Gebeyehu, A. A., Enawgaw, A. S., Asmare, Z. A., Ejigu, A. G., Tsega, T. D., Temesgen, A., Anteneh, R. M., Yigzaw, Z. A., Yirdaw, G., Tsega, S. S., Ahmed, A. F., & Yeshiwas, A. G. (2025). Scoping review on assessing climate-sensitive health risks. *BMC Public Health*, 25(1), 914.
<https://doi.org/10.1186/s12889-025-22148-x>

- Yoon, L., Belotti, G., Stern, R., White, K., Mohajeri, A., Zhou, A., Rosales Miranda, E., Siao, E., Le, T., Masuda, J., Lee, E., & Buse, C. (2025). To cool or not to cool: Understanding and improving cooling centre use in metro vancouver through community-based participatory action research. *Environmental Research: Health*, 3(1), 015011. <https://doi.org/10.1088/2752-5309/ada6f4>
- Zairul, M. (2025). Mastering Thematic Analysis: A Step-by-step Guide for Beginners With Tips for Systematic Analysis Using ATLAS.ti 25. *International Journal of Qualitative Methods*, 24, 16094069251384401. <https://doi.org/10.1177/16094069251384401>
- Zakocs, R. C., & Edwards, E. M. (2006). What Explains Community Coalition Effectiveness? *American Journal of Preventive Medicine*, 30(4), 351–361. <https://doi.org/10.1016/j.amepre.2005.12.004>
- Zimmerman, R., & Faris, C. (2011). Climate change mitigation and adaptation in North American cities. *Current Opinion in Environmental Sustainability*, 3(3), 181–187. <https://doi.org/10.1016/j.cosust.2010.12.004>

Appendices

Appendix A: Focus group discussion guide with ROWPH

FOCUS GROUP DISCUSSION GUIDE:

Region of Waterloo Public Health and Paramedic Services (ROWPHP) Staff

NOTES:

- Target focus group duration: approximately 90 minutes
- Format: in-person (Regional building)
- Light snacks/refreshments will be provided

FACILITATORS/NOTE-TAKERS: Warren Dodd (PI), Hateem Noor, Sabeen Abbas; one will facilitate discussion and the other will take notes on the conversation and process, to be integrated with the transcript/audio recording data.

FOCUS GROUP GUIDE: ROWPHP STAFF	
1. Introduction 10 minutes	• Provide a high-level overview of the information letter (e.g., purpose of the focus group discussion) shared via email • Reminder of the consent process, right to withdraw, etc. (written informed consent will have been provided in advance of the focus group discussion) • Housekeeping (e.g., washrooms, refreshments) • Round of introductions: participants, facilitator, notetaker(s): ○ Briefly introduce yourself: your name, your position at ROWPHP, your role in connection to the WRHCAN • Agenda/arc for the meeting – a focus on process: ○ Why was the WRHCAN initiated/needed?

	○ What has happened over the trajectory of the WRHCAN's history? ○ Where do you foresee this going?
2. Timeline Building 45 minutes	Help us build a timeline of key events or decision points that have been important in the work of the WRHCAN to date: (a) <u>what has happened</u> chronologically, and then (b) the <u>relative importance of these events</u> in shaping where things are at now, and how the network has functioned overall. (a) So first: <u>Let's figure out the sequence of events.</u> • Work done before WRHCAN establishment • Establishment/bringing together of the WRHCAN • Decisions around composition • Preliminary WRHCAN meetings • Figuring out leadership model of WRHCAN • Where's this all headed? (b) <u>Relative importance of these events</u>: * = did not radically alter the trajectory of things; *** = if this did not happen, the WRHCAN would be very different now. • What events catapulted network activities forward? Delayed or caused distraction/interruption? • What events were transformational – or more significant – in terms of shifting the way people worked together? • Overall perspectives; barriers/facilitators associated with these events?

POTENTIAL SHORT BREAK – 5 minutes	
3. Perspectives on WRHCAN Activities and Functioning 25 minutes	• Roundtable, open discussion: ○ What has gone well? ○ Where have there been challenges? ○ What do you see as the purpose of the WRHCAN now and moving forward? • Anything else to add from your experience of supporting the WRHCAN to date? Additional Questions • How would you describe the network or define the network? Has this changed over time? • What impact do WRHCAN activities have in Waterloo Region? Is the impact distributed equally across the Region? • How does WRHCAN fit in relation to other responses to climate change happening in Waterloo Region? • How could WRHCAN improve their activities? What would you like to see changed about what the WRHCAN does or how activities are carried out? • Do you see any trade-offs between addressing heating, cooling, and air quality within one network? Positive or negative • 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?

	• 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?
4. Wrap-up: Synthesis of Discussion and Closing Remarks 5 minutes	• Recap/synthesis of discussion from the facilitators/note-takers (e.g., These are the themes I am hearing from our discussions today: [theme 1], [theme 2], [theme 3]). ○ Does this resonate with you? ○ Anything else you would like to change or add? • Thank you for your time and for the contributions you shared. • If you have any questions, comments, or concerns – or anything you’d like to add to our conversation today, please feel free to email or call me to follow up. • 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 (approximately 3 months from now).

Appendix B: Interview guide for semi-structured interviews with research participants

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 C: Development of themes from codes

Example Quotations (Key words are bolded)	Codes (Deductive parent codes – inductive child codes)	Subtheme	Theme
“We do a lot of advocacy around homelessness as well as housing.” P1 “... because we're responding to community health and well-being, which is a shared objective of almost everyone participating in the network and beyond.” P4 “So in light of the warming, cooling air quality, we were very motivated to be part of that group because our population experiences weather and it impacts their health and their life dramatically.” P7	Inputs - mission	Alignment between ROWPH and Network partners	Facilitators
“We’re one of the few spaces - public spaces, government spaces in the townships, and so I don't think there was any question that we would participate.” P2 “We have public facing free phones. We also have access to free public computers that folks can also utilize during those periods of time. We do have, like we can offer water fountain, those types of things. So we do have access to water for the general public too.” P3 “We’ll take steps to get cold water, ice, maybe popsicles.” P5 “...all the public hallways and lobby areas are always open for the public.” P8	Inputs-partnership resources		
“... having a centralized trusted agent like Public Health leading this helps.” P4	Throughputs – leadership - trust	Leadership by Public Health	

“... I think it falling under their purview is a really good thing so it was beneficial to us.” P5 “I would say a really tangible example is 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.” P7 “We've had infographics before from the Region, that in itself, seeing that it's from the Region and that it's obviously researched and the numbers are correct, that's something that we can lean into when people do have questions, for example.” P9			
“... from a learning perspective, I find this all really helpful and it's good to have the support.” P2 “... brought in speakers to speak on different social elements for those within the network, and so that brings value to the network and something again that I would otherwise not have been able to access or have the pleasure of like hearing or learning about.” P8	Throughputs – maintenance activities – Network meetings		
“I think they're getting much better at their communications. And it's much more timely. There's a lot of confusion with our warming, they're not actually warming and they're now calling them spaces cause they're trying to differentiate. They're trying to provide a clarity of their mandate.” P1 “I have never reached out to them and not been able to have somebody answer my question and answer it in a timely manner. That's very helpful for me and I appreciate the resources they give to us.” P2	Throughputs - communication	Communication pathways	

“Like what public health is providing us with when they provide this information, it's in relatively real time because it's when they're anticipating a significant temperature or air quality event and we're given this information and a general understanding of what the network's response will likely be. And that can help us prepare our own pieces.” P4 “And also to some extent, when information can be communicated, then and it's something that say coming from the Region about what are the risks, for example, then we can post that, say on our community boards or have it available to staff when people ask, and then also, when the masks were available, we can be the place where we can distribute it to those people who are more vulnerable to smoke inhalation.” P9 “We post on our social media and e-mail out to our e-mail list that we have to let them know that we're here and they can let people know that we're open.” P12 One of the things that's pretty cool too, that this network did was create that interactive map that you can see where all the warming cooling spaces are. P13			
“It's part of a bigger thing where we become connected to the people who are in community services at the Welcome Centre. They've helped train our staff. They've helped provide support for language interpretation.” P2 “I feel like whatever it takes to have people get the information is great. So I think that again it is a very positive program. I think that it is a very valuable program. I think it is a	Outputs - synergistic	Connecting with community partners to share information and resources	

life saving program in certain instances for individuals. And it would be nice if more people were part of the network. .” P3 “And so that's something that we never would have ever thought to purchase N95 masks to distribute to the public if they so desired. And so that was something I thought that was a really added value because of the relationship that we have with public health.” P8 “It kind of shares, I don't want to say burden, but it shares the responsibility, right.” P9 “If people want to know where there are other locations, we can help them find that. I think it's just the more people that are on board and part of the network it you know makes it a better, more. I don't know the word I'm looking for. It just makes it stronger for the community.” P12			
“But we also have to appreciate that a lot of individuals, not just the homeless, don't have access to the website.” P1 “And in terms of people moving in, there can be language issues. In some towns, right now, we've gone very quickly from German being our second language on the census to Punjabi or Hindi. And these aren't necessarily languages staff learn in school, right? So yeah, language can be a barrier.” P2 “Talk to people who are homeless or unhoused and don't have a computer or a cell phone with data on it. And how are they getting that information? It's a big gap, right? Like vulnerable populations are the ones who are not getting the information that is accessible via the Internet, whereas people who have access to the Internet and have	Throughputs - communications	Accessibility of communications	

access readily to these things don't need those services." P3			
"And so they have identified to me that they have seen an increase utilization of un-homed individuals seeking shelter within our recreation spaces. And that come the cold weather, it does even increase further. So it's there no matter what now and then the cold weather will heighten it and that sometimes they feel ill equipped to respond and or communicate with some of the un-homed individuals. So some of the un-homed individuals likely have some mental health issues and so either experiences that our frontline staff have seen are either complete withdrawn and not responding, not communicating, not responding when being asked to leave. At the end of the night, just complete ignoring of them and then they're like then what do we do?" P8 "But I think kind of like reverse that is also making sure that the staff at these warming, cooling spaces also feel safe or like supported. So, recognizing you know we are in an overdose crisis. An opioid crisis that folks who use drugs might be in bathrooms or public spaces or, you know, warming and cooling spaces and might have just used a certain drug, whether they're supposed to or not, is a whole other conversation. But It happens. I think it's part of our reality. And then you know, recognizing that staff are almost like having to take on a responsibility they might not be ready for may not be trained for in responding to an overdose on medical emergency kind of situation." P13	Throughputs – roles and structures – frontline staff preparedness	Additional trainings for frontline staff	
"We need to be willing to not shy away from the reality that folks who, a lot of people do not want to	Throughputs – production		

acknowledge, are actually dealing with and deal with it in an accepting manner, dealing with it in a compassionate manner and dealing with it in an effective way and having access to those resources." P3	activities - training		
"We have a large population of folks who are in shelter who maybe are only in the shelters at night and during the day they're out in the open spaces." P3 "Well, and I may get on my political bandwagon here and I don't mean it disrespectfully, but I think this region has really embraced housing and homelessness." P5 "There was a day where it was really wet, a lot of rain and there was more people coming in from outside, so there wasn't a weather event, but definitely the weather affected individuals in our community who don't have a secure home and they come in to get dry, right?" P9	Context - housing	Homelessness crisis in Waterloo Region	Contextual Factors
"I think also, just you know, we look at the elderly population in in the summer and in the winter, because you know, very fixed incomes." P5 "And I think in general what we've been talking about people that don't have a place to live, like the unhoused, the homeless population." P6 "So it's a very progressive model of healthcare and CHCs really work towards reaching marginalized populations." P7 "I know that, not necessarily our challenges, but in previous meetings I think people have struggled especially with those people who are vulnerable and living on the streets or living in variable housing situations, where when you have people entering your	Context – vulnerable populations	Supporting vulnerable populations experiencing multiple intersecting challenges	

spaces and they're bringing, for example, their items, how do you manage that?" P9			
"That being said, we have our priority populations and those priority populations are older adults, medically complex and mental health and addictions." P10			

Appendix D: Six dimensions of positionality and orienting questions

Research questions:

How does your positionality impact what research you choose to do?

Epistemology:

How does your positionality impact how you know what you know?

Ontology:

How does your positionality impact what you can observe as researchers?

Methodology:

How does your positionality impact how you make methodological choices?

Researcher-as-instrument:

How does your positionality impact how you relate to your participants?

Communication:

How does your positionality impact how you represent yourself in writing and other communication?

(Secules et al., 2021)

Appendix E: Research ethics approval, University of Waterloo

UNIVERSITY OF WATERLOO

Notification of Ethics Clearance to Conduct Research with Human Participants

Principal Investigator: Warren Dodd (School of Public Health Sciences)

Co-Investigator: Laura Brubacher (School of Public Health Sciences)

Student investigator: Sabeen Abbas (School of Public Health Sciences)

Student investigator: Hateem Noor (School of Public Health Sciences)

Student investigator: Minal Waqar (School of Public Health Sciences)

Collaborator: Adele Parkinson (Region of Waterloo Public Health)

Collaborator: Brandie Bevis (Region of Waterloo Public Health)

Collaborator: Laura Aguiar (Region of Waterloo Public Health)

File #: 47029

Title: Partnership Evaluation of Waterloo Region Heat, Cold and Air Quality Network

The Human Research Ethics Board is pleased to inform you this study has been reviewed and given ethics clearance.

Initial Approval Date: 12/09/24 (m/d/y)

University of Waterloo Research Ethics Boards are composed in accordance with, and carry out their functions and operate in a manner consistent with, the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS2 2022), the Ontario Personal Health Information Protection Act (PHIPA), and all laws and regulations of the province of Ontario (as applicable). Additionally, CREB operates in a manner consistent with the International Conference for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) Guidance E6(R2): Good Clinical Practice, the International Organization for Standardization of Good Clinical Practices (GCP) as set out by ISO 14155 - Clinical investigation of medical devices for human subjects, Part C, Division 5 of the Food and Drug Regulations, Part 4 of the Natural Health Products Regulations, Part 3 of the Medical Devices Regulations. Both Boards are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (HREB) and IRB00007409 (CREB).

Expiry Date: 12/10/25 (m/d/y)

Multi-year research must be renewed at least once every 12 months unless a more frequent review has otherwise been specified. Studies will only be renewed if the renewal report is received and approved before the expiry date. Failure to submit renewal reports will result in the investigators being notified

ethics clearance has been suspended and Research Finance being notified the ethics clearance is no longer valid.

Level of review: Delegated Review

Signed on behalf of the Human Research Ethics Board

A handwritten signature in blue ink, reading "Joanna Eidse".

Joanna Eidse, Research Ethics Officer, jeidse@uwaterloo.ca

This above-named study is to be conducted in accordance with the submitted application and the most recently approved versions of all supporting materials.

Documents reviewed and received ethics clearance for use in the study and/or received for information:

file: DOCS_ADMIN-#4750633-v3-Project_Data_Sharing_Agreement_-_Partnership_Evaluation_of_WRHCAN_-_UW_&_ROWPH_FE 16-Sep-24.pdf

file: Interview Guide_WRHCAN Partnership Evaluation.pdf

file: Email Script_Interviews_version 1_20240711.pdf

file: Written Consent Form_Interviews_version 2_20240312.pdf

file: Letter of Information_version 3_20240512.pdf

file: Appreciation Letter_version 1_20240711.pdf

Approved Protocol Version 3 in Research Ethics System

This is an official document. Retain for your files.

You are responsible for obtaining any additional institutional approvals that might be required to complete this study.

Appendix F: COREQ checklist

No. Item	Guide questions/description	Reported on Page # (section)
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	3.2.3
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	3.2.3
3. Occupation	What was their occupation at the time of the study?	3.2.3
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	3.2.3
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	3.2.3
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	3.2.3
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A

Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	3.2.2
<i>Participant selection</i>		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	3.2.3
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	3.2.3
12. Sample size	How many participants were in the study?	3.2.3
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	3.2.3
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	N/A
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	3.2.3

18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	3.2.3
20. Field notes	Were field notes made during and/or after the interview or focus group?	N/A
21. Duration	What was the duration of the interviews or focus group?	3.2.3
22. Data saturation	Was data saturation discussed?	
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	3.2.4
25. Description of the coding tree	Did authors provide a description of the coding tree?	3.2.4
26. Derivation of themes	Were themes identified in advance or derived from the data?	3.2.4
27. Software	What software, if applicable, was used to manage the data?	3.2.4
28. Participant checking	Did participants provide feedback on the findings?	N/A
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	3.3.1 3.3.2 3.3.3

30. Data and findings consistent	Was there consistency between the data presented and the findings?	3.3.1 3.3.2 3.3.3 3.4
31. Clarity of major themes	Were major themes clearly presented in the findings?	3.3.1 3.3.2 3.3.3
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	N/A