COMMUNITY RESILIENCE POST-OUTBREAK IN WALKERTON, ON

EXAMINING COMMUNITY CAPACITY AND RESILIENCE POST-OUTBREAK IN
WALKERTON, ONTARIO

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A Thesis Submitted to the School of Graduate Studies in Partial Fulfillment of the
Requirements for the Degree Master of Public Health

MASTER OF PUBLIC HEALTH (2017)   McMaster University

(Health Research Methods, Evidence, and Impact)   Hamilton, Ontario

TITLE: Examining Community Capacity and Resilience Post-Outbreak in Walkerton,

Ontario

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NUMBER OF PAGES: xi, 154

Abstract

Most disaster management studies only assess community resilience immediately following the event with no further follow-up. Accordingly, there is a lack of research being conducted to determine whether communities truly recover over time after a disaster strikes. Thus, the purpose of this research was to examine the different factors and dimensions that facilitate or hinder community resilience more than a decade post-disaster using present day Walkerton, Ontario (16 years after the effects of the 2000 water contamination outbreak).

This exploratory study utilized an interpretive description qualitative methodology. Semi-structured interviews and focus groups were conducted with a purposeful sample of 29 Walkerton community members. The data were transcribed verbatim and coded using conventional content analysis to identify themes inductively. Several barriers and enabling factors were identified in maintaining community resilience under non-crisis conditions in the community. A conceptual model was developed based on the study's findings to demonstrate the application of the life course approach within an existing community resilience framework. This model contributes to the field of disaster management in demonstrating the various ways that a disaster affects the subsequent life course of individuals post-disaster. It highlights the need to integrate a community-centred approach in disaster management to yield more effective and efficient mitigation, preparation, response, and recovery strategies.

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List of Abbreviations

CDC: Centers for Disease Control and Prevention

CEMC: Community Emergency Management Coordinator

CIHR: Canadian Institutes of Health Research

CRED: Centre for Research on the Epidemiology of Disasters

CWA: Clean Water Act

CWC: Concerned Walkerton Citizens

E. coli: *Escherichia coli*

HUS: Hemolytic uremic syndrome

HiREB: Hamilton Integrated Research Ethics Board

IFRCRCS: International Federation of Red Cross and Red Crescent Societies

IBS: Irritable bowel syndrome

JIBC: Justice Institute of British Columbia

KT: Knowledge translation

MOE: Ministry of the Environment

MOECC: Ministry of the Environment and Climate Change

PUC: Public Utilities Commission

PTSD: Post-traumatic stress disorder

RDRP: Rural Disaster Resilience Planning

RRC: Rural, remote, and coastal

RRI: Rural Resiliency Index

SDWA: Safe Drinking Water Act

WCWC: Walkerton Clean Water Centre

Dedication

I would like to dedicate this study to the individuals whose lives were tragically lost due to the events of the *E. coli* outbreak in Walkerton, Ontario in May 2000.

Chapter One: Introduction

1.1 – Background

1.1.1 – Disaster Management

Disaster management refers to the strategies and actions taken to manage the adverse effects of extreme events (Drabek and Hoetmer, 1991). It includes four critical components: mitigation, preparedness, response, and recovery (Etkin et al., 2004). The discipline is becoming increasingly interdisciplinary and holistic in nature. It was traditionally examined using a geophysical or biophysical lens (Burton and Kates, 1964; Haque and Etkin, 2007; Perry, 2007); however, its area of study has now expanded to incorporate a coupled human-environment system. It integrates various social, cultural, physical, environmental, economic, and political components together to yield a more effective and efficient disaster management plan (Amaratunga et al., 2013; Cork, 2010; Haque and Etkin, 2007; Perrow, 1984).

1.1.2 – Community Resilience

In the context of disaster management, community resilience looks at a community's capacity to collectively mitigate, prepare for, respond to, and recover from the implications of a disaster (Kafle, 2012; Mayunga, 2007; Pasteur, 2011). Community resilience frameworks are commonly embedded in the discipline to measure and determine how a community recovers from a disaster using its inherent strengths, assets, and resources (Cox, 2015; Frankenberger et al., 2013; Ostadtaghizadeh et al., 2015). However, most studies only assess community resilience immediately following the event with no longer term follow-up examinations. There is a lack of research that has been conducted to determine whether communities truly recover over time post-disaster.

1.1.3 – Life Course Approach

The implications of a disaster may be devastating and long-term depending on the severity of the disaster, as well as the capacity of individuals and communities to respond to and recover from its implications. A unique way to examine the long-term impacts of a disaster on the lives of individuals and communities is using the life course approach. This multidisciplinary paradigm analyzes the interaction of how individual and group lives are

affected from gestation to death and across generations, in terms of broad social, economic, structural, and environmental contexts (Elder Jr, 1994; Fink and Galea, 2015; Kuh et al., 2003). It provides a framework for exploring developmental processes and outcomes across one's life trajectory to understand how early life events, such as a disaster, shape later life events (Elder Jr., 1994). There are four principles embedded in this theory: the interplay of human lives and historical time and place, the timing in lives, linked lives, and human agency in making choices (Elder Jr., 1994). This approach is often excluded from disaster management research, despite its ability to demonstrate how a disaster affects the later lives of individuals or communities in determining whether or not they were able to achieve and maintain resilience.

1.1.4 – Water Contamination Outbreak in Walkerton, Ontario

A prime example of the previously identified gaps in literature is exhibited in the rural community of Walkerton, Ontario. In May 2000, there was a water contamination outbreak after *Escherichia coli* (*E. coli*) O157:H7 and *Campylobacter jejuni* were discovered in the community's drinking water (Clark et al., 2008; Hrudey et al., 2002; O'Connor, 2002a). Heavy rainfall contributed to the excess runoff of livestock faecal contaminants from agricultural fields into a shallow municipal well, Well #5, that inadequately chlorinated drinking water (Hrudey et al., 2002). This event resulted in 2,321 cases of acute gastrointestinal illness, over 750 emergency room visits, 65 hospital admissions, 27 confirmed cases of haemolytic uremic syndrome, and 7 deaths (Clark et al., 2008; Garg et al., 2005). Following the events of this tragedy, research was conducted to: examine the individual political (Prudham, 2004; Snider, 2004), institutional (Breen et al., 2015), environmental (Arya et al., 2009), and socio-ecological (Ali, 2012) factors leading up to the outbreak; examine social capital during the tragedy (Murphy, 2007); and, assess the health implications for ill residents (Clark et al., 2008). There were also some studies investigating how the event could have been prevented altogether (Hewitt, 2013; Tang et al., 2013), while others looked at the lessons learned following the tragedy (Hrudey et al., 2002; Hrudey and Hrudey, 2002). However, there have not been any interdisciplinary long-term studies conducted in this community to determine the state to which the community

returned to, and whether the residents were collectively able to achieve or maintain resilience over time.

1.2 – Research Objectives and Questions

The purpose of this study was to:

1. Identify the various human, physical, social, cultural, economic, political, natural, and preparedness factors that facilitated or hindered community resilience in Walkerton at the time of the outbreak under crisis conditions;

2. Identify the various human, physical, social, cultural, economic, political, natural, and preparedness factors that facilitate or hinder community resilience in Walkerton in the present day under non-crisis conditions;

3. Utilize the life course approach to examine if the 2000 *E. coli* contamination outbreak has any impact on the present day lives of Walkerton residents; and

4. Contribute to an existing framework of community resiliency to better understand how a rural community can prepare for the effects of a disaster under non-crisis conditions.

These objectives address the limitations in the literature through the following two research questions:

1. What factors impact community resilience following a disaster under non-crisis conditions? Do they differ from the factors that affect community resilience under crisis conditions? If so, how? and

2. How can the life course approach be used to examine the water contamination outbreak on the present day lives of Walkerton residents?

1.3 – Thesis Organization

This thesis is organized into five chapters. The first chapter provides an overview of the research topic and states the goal, objectives, and scope of the study. The second chapter provides a detailed review of the literature related to disaster management, community resilience, the life course approach, and the 2000 Walkerton water contamination outbreak. Chapter three describes the qualitative research methodology employed in this work. It provides information about the study design, setting, sampling

and participant recruitment strategy, data collection, data analysis, strategies to ensure rigour, and to address ethical considerations. Chapter four presents the observations from this research, and provides an analysis, founded in the literature, of these observations. It introduces a conceptual model that integrates the life course approach into an existing community resilience framework. It then identifies the implications and limitations of this research. This chapter is concluded by presenting strategies to enhance the dissemination of this study. Lastly, chapter five presents the overall conclusions for this research.

Chapter Two: Literature Review

This chapter presents the previous theoretical, conceptual, and empirical research conducted in the areas of disaster management, community resilience, the life course approach, and the 2000 Walkerton water contamination outbreak to inform the present study.

2.1 – Disasters

A disaster is defined as a risk event, that is observable in time and space, which severely disrupts the routine functioning of society (Centers for Disease Control and Prevention [CDC], 2016; Kreps, 1984). For an event to be classified as a disaster, the Centre for Research on the Epidemiology of Disasters (CRED) indicates that it must fulfill one or more of the following criteria: 10 or more individuals reported killed; 100 or more individuals negatively affected[1]; a declaration of a state of emergency; or a call for international assistance (Guha-Sapir et al., 2015; Witham, 2005). There are two common categories of disasters that exist: natural and technological (Abbott, 1996; CRED, 2016). Natural disasters encompass adverse events resulting from the Earth's natural processes, which can be further characterized by their relative subgroup: geophysical, meteorological, hydrological, climatological, biological, and extraterrestrial (Abbott, 1996). In contrast, technological disasters are events caused by humans, which include factors such as displaced populations, famine, war, and industrial, transport and miscellaneous accidents (Abbott, 1996; International Federation of Red Cross and Red Crescent Societies [IFRCRCS], 2016).

Kirschenbaum (2004) states that disasters typically occur in specific geographic areas, where populations that are in close proximity to the region are most affected. Norris (2002) approximates 500 disasters occur worldwide annually, affecting 80 million, displacing 5 million, injuring 74,000, and killing 50,000 individuals. Likewise, the United Nations Office for Disaster Risk Reduction (2013) estimates that 1.2 million people were

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[1] Individuals negatively affected refers to the "number of people requiring immediate assistance during a period of emergency; this may include displaced or evacuated people" (Guha-Sapir et al., 2015).

killed and 2.9 billion individuals were impacted by a disaster between 2000 and 2012. Accordingly, such events cause extensive human, environmental, economic, and material losses that often exceed the local capacity of a society to respond using its own resources, which in turn requires external support (CDC, 2016).

2.1.1 – Disaster Management

Disaster management refers to the strategies and actions taken to manage the adverse effects of extreme events (Drabek and Hoetmer, 1991). It includes four critical components: mitigation, preparedness, response, and recovery (Etkin et al., 2004). Mitigation encompasses the measures taken to avoid, reduce or eliminate the long-term risks and consequences of disasters before they occur (Etkin et al., 2004; Hays, 1991). It is essentially the phase committed to ending the cycle of damage, reconstruction, and repeated damage due to disasters (Federal Emergency Management Agency, 2000). Preparedness ensures that plans, procedures, and resources are in place to facilitate recovery in the event of a disaster (Cox, 2015; Etkin et al., 2004). Response involves the actions taken after a disaster strikes in order to minimize its implications, as well as to protect the overall population (Cox and Hamlen, 2015; Etkin et al., 2004). Recovery entails the long-term activities required to rehabilitate the impacted area to its pre-disaster state (Etkin et al., 2004). Collectively, these four processes compose the foundation of effective disaster management.

The discipline of disaster management is becoming increasingly interdisciplinary and holistic in nature. Traditionally, it has been examined using a geophysical or biophysical lens, implying that the Earth's natural processes were the sole source of disasters (Burton and Kates, 1964; Haque and Etkin, 2007; Perry, 2007). This resulted in an incomplete and distorted understanding of how to successfully manage disasters, which in turn yielded ineffective or counter-productive solutions (Ali, 2004; Haque and Etkin, 2007). Accordingly, in the last two decades, this field has expanded to incorporate a coupled human-environment system, which integrates various social, cultural, physical, environmental, economic, and political aspects (Haque and Etkin, 2007; Miller et al., 2010). By considering all intersecting system factors at multiple scales, a complete picture

including required elements of an effective disaster management plan is captured (Amaratunga et al., 2013; Cork, 2010; Perrow, 1984). This results in a cross-sectoral and cross-institutional understanding of disaster management, which is a form of capacity building that successfully promotes optimal strategies to deal and cope with various risks and hazards (Haque and Etkin, 2007; Kafle, 2012).

2.1.2 – Community-Centred Approach to Disaster Management

In conventional disaster management research, a community typically refers to a group of individuals in spatial terms who share defined geographic or administrative boundaries, and who are exposed to the same physical risks or exposures (IFRCRCS, 2014; Twigg, 2009). Although this definition is practical for programming, measurement, and response purposes (Cox, 2015; Longstaff et al., 2010; Oxley, 2013; Twigg, 2009), it ignores the significant social system interactions that people share within spatial parameters (Murphy, 2007; Twigg, 2009; Ungar and Liebenberg, 2011). Modern definitions of community incorporate the common values, interests, beliefs, norms, identities, collective actions, behaviours, commitments, and psychological ties amongst a group of individuals, in addition to their geographically defined space (Christensen and Robertson, 1980; Jewkes and Murcott, 1996; Maguire and Cartwright, 2008; Murphy, 2007; Twigg, 2009).

Despite sharing several similar characteristics, it is imperative to recognize that communities are not homogeneous, but instead are complex and dynamic (Harrington et al., 2008; Maguire and Cartwright, 2008; Twigg, 2009). A community is typically composed of diverse people who differ by wealth, occupation, social status, health status, gender, sexual orientation, race, ethnicity, religion, and other power inequities (Bridger and Luloff, 1999; Frankenberger et al., 2007; Twigg, 2009; Zellner et al., 2012). It is also important to mention that an individual can belong to more than one community simultaneously (IFRCRCS, 2014; Twigg, 2009). Communities are fluid where individuals may come together to fulfill a common goal, need, or desire, but separate once it has been achieved (Maguire and Cartwright, 2008; Twigg, 2009).

A community-centred approach to disaster management is an optimal way of capacity building, as discussed in Section 2.2 (Cox, 2015; Shaw, 2012). Most disaster implications impact communities at the local level, where their collective needs, resources, and experiences will play the most critical role in responding to and recovering from any internal or external shocks or stresses (Frankenberger et al., 2013). According to the IFRCRCS (2014), "local knowledge, skills, determination, livelihoods, cooperation, access to resources, and representation" (p. 8-9) are all critical factors that enable individuals to recover from the consequences of a disaster. Local communities become empowered when they are actively involved in the process of disaster management (Murphy, 2007; Walker and Salt, 2012). This is evident as collaborative local participation taps into the unique experiences and strengths of diverse members who are most familiar with the causes, conditions, and consequences of the disaster (Cox, 2015; O'Brien, 2008; Zellner et al., 2012). In turn, such participation permits building on core strengths and skills, promoting agency, enhancing social cohesion, empowering the community, and ultimately strengthening community capacity (Berkes and Ross, 2013; Krewski et al., 2007).

2.2 – Community Capacity

Community capacity refers to the collective ability of individuals who make up a community to respond to any internal or external stresses, such as a disaster, to establish and participate in any given opportunities, and to meet the needs of the people who make up the community (Kusel, 1996). This is typically achieved by combining and mobilizing various forms of tangible and intangible resources, which are known as capitals or community assets, when needed within their existing institutional and relational contexts in responding to the disaster (Akamani, 2012; Beckley et al., 2008; Frankenberger, 2013). There are several types of capitals or assets that are central to the field of disaster management, including human capital, physical capital, social capital, cultural capital, political capital, economic capital, natural capital, and preparedness capital (Amaratunga et al., 2013; Cox and Hamlen, 2015; Frankenberger et al., 2013; Mayunga, 2007). It is important to consider these community assets through a holistic lens where they exist interdependently by influencing one another (Beckley et al., 2008; IFRCRCS, 2014).

Frankenberger et al. (2013) argue that the greater the diversity of these capitals, the higher the likelihood of a community is to become resilient in overcoming the implications of a disaster.

2.2.1 – Human Capital

At the community level, human capital comprises the collective skills, knowledge, educational attainment, labour, training, competency, physical and mental health status, functional ability, and leadership of community members that are translatable to disaster mitigation, preparedness, response, and recovery (Akamani, 2012; Cox, 2015; Cox and Hamlen, 2015; Frankenberger et al., 2013; Mayunga, 2007; Twigg, 2009). Many of these dimensions can be determined quantitatively by examining the socio-demographics, population distribution and stability, and access and quality of services within a community (Frankenberger et al., 2013). This form of capital is critical for communities to effectively mitigate, prepare for, respond to, and recover from the consequences of a disaster and to adapt to any changes in their social, economic or environmental conditions (Bahadur et al., 2010; Buckle, 1999; Frankenberger et al., 2013). Sen (1997) argues that human capital is a measure of community agency, as it looks at the ability of a community to self-organize (Lebel et al., 2006). This involves being innovative in utilizing their assets to establish and coordinate priorities, proactively manage and respond to any disaster implications, adapt to any changes in their social, economic or environmental conditions, and recover in a way that reduces vulnerability to future disasters (Bahadur et al., 2010; Buckle, 1999; Frankenberger et al., 2013; Twigg, 2009).

2.2.2 – Physical Capital

Physical capital encompasses the utilities, infrastructure, shelter, equipment and materials, technology, telecommunications, transportation, and services that support communities (Cox, 2015; Cox and Hamlen, 2015; Cutter et al., 2010; Frankenberger et al., 2013; Mayunga, 2007). This includes dimensions of the built environment such as the access, availability, and reliability of: water, sanitation, and energy systems; television, radio, and media; landlines and cellular phones; public transportation and roads; housing; and key community buildings (hospitals, schools, and social and municipal service

buildings) (Akamani, 2012; Cox, 2015; Cox and Hamlen, 2015). It is vital that communities have the capability to access, maintain, repair, and renovate their physical assets in the event of a disaster in order to aid in their response and recovery (Longstaff et al., 2010; Pasteur, 2011; IFRCRCS, 2012).

2.2.3 – Social Capital

Social capital is a concept that examines the components of social organization, such as networks of civic engagement, the norms or reciprocity that arise from them, local civic identity, and the trustworthiness and values shared among individuals that promote collective action and cooperation for mutual benefit (Akamani, 2012; Beckley et al., 2008; Chamlee-Wright and Storr, 2011; Chaskin, 2008; Frankenberger et al., 2013; Holland et al., 2007; Putnam, 2000; Putnam et al., 1993). It is embedded in the participation and membership of various formal and informal, stable and ad hoc relationships among community members, in the form of families, friendships, neighbourhood ties, religious institutions, community service organizations, and voluntary associations (Godschalk, 2003; Kirmayer et al., 2009; Mayunga, 2007; Paxton, 1999; Twigg, 2009). Additionally, communities have access to external networks or relationships which can supply tangible and intangible resources (IFRCRCS, 2014).

Strong social capital is associated with a positive impact on the other types of community assets. This includes improving economic growth and development, increased civic engagement, strengthening government performance, enhanced education, and skills (Chamlee-Wright and Storr, 2011; Putnam et al., 1993). At the community level, there is evidence demonstrating that social capital results in higher levels of physical and mental health status, and decreased levels of crime (Chamlee-Wright and Storr, 2011; Coleman, 1988; Griffiths et al., 2007; Putnam et al., 1993). Dynes (2005) argues that disaster management should primarily focus on this type of capital, as it has a strong influence in achieving community resilience (Aldrich, 2012; Cutter et al., 2008; Frankenberger et al., 2013). It facilitates the mitigation and planning of structures, processes, and practices before a disaster strikes (Chamlee-Wright and Storr, 2011; Frankenberger et al., 2013). In the event of a disaster, social capital encourages and mobilizes community members

together to respond and return to their pre-disaster state (Chamlee-Wright and Storr, 2011; Frankenberger et al., 2013).

Aldrich (2012) established a useful framework for assessing three forms of social capital that aid communities in the event of a disaster, including bonding social capital, bridging social capital, and linking social capital. Bonding social capital looks at the "intra-community" connections within a community, such as the relationships among immediate family members, close friends, and neighbourhood ties (Aldrich, 2012; Beckley et al., 2008). It is conceived as the horizontal ties among people who are similar and who live in close proximity to one another (Putnam, 2000). In the context of disaster management, it examines the trust, cooperation, and reciprocity among community members to help one another in responding and recovering from the implications of disasters (Aldrich, 2012; Solnit, 2009). Bridging social capital looks at the "inter-community" connections that connect members outside of their immediate communities (Aldrich, 2012). It is built on the respect and mutuality among individuals that often crosses ethnic, racial, geographic, and language boundaries (Aldrich, 2012; Poortinga, 2012; Szreter and Woolcock, 2004). This type of social capital can facilitate connections and access to external assets when local community resources are insufficient or unavailable during a disaster (Aldrich, 2012; Wetterberg, 2004). Lastly, linking social capital looks at relationships with individuals who are in positions of power beyond the community (Aldrich, 2012; Beckley et al., 2008; Woolcock and Narayan, 2000). It is conceived as the vertical ties between a community and an authoritative figure in the social sphere (Aldrich, 2012). This form of capital is essential at the time of a disaster, as it provides economic development, resources, and information that are outside of the capacity of the other forms of social capital (Aldrich, 2012). Aldrich (2012) argues that communities are more likely to become resilient and overcome the effects of a disaster when each form of social capital exists, as it strengthens collective action (Elliott et al., 2010; Woolcock and Narayan, 2000).

2.2.4 – Cultural Capital

Cultural capital looks at the values, traditions, customs, beliefs, origins, languages, and knowledge that exist in a community (Cox, 2015; IFRCRCS, 2014). It includes the

ways that creative processes, capacity, and vitality are both practiced and shared among community members both formally and informally (Cox, 2015; IFRCRCS, 2014). It is typically experienced through the participation in community events, festivals, and activities (Cox, 2015). Cultural capital is an essential, yet often excluded, aspect to consider in the management of disasters as it provides local context that will help communities mitigate, prepare for, respond to, and recover from the implications.

2.2.5 – Economic Capital

Economic capital denotes the public and private cash and liquid resources within a community that can be used to achieve any financial or social objectives (Beckley et al., 2008; Frankenberger et al., 2013). It includes municipal budgets, business cash flow and operating funds, credit institutions, individual and household savings, property value, and the availability of income and employment vitality and diversity (Akamani, 2012; Beckley et al., 2008; Cox and Hamlen, 2015; Frankenberger et al., 2013; IFRCRCS, 2014; Rose and Krausmann, 2013). It is important that communities have economic opportunities that allow them to remain flexible, resourceful, and functional in the event of a disaster at both the micro and macro levels in order to facilitate the response to disaster implications, as well as to expedite the recovery process (Frankenberger et al., 2013; Gahin et al., 2003; IFRCRCS, 2012; Pasteur, 2011; Rose and Krausmann, 2013; Twigg, 2009). Furthermore, Frankenberger et al. (2013) express the significance of investing in economic capital post-disaster to provide essential resources in facilitating the response or recovery of a community.

2.2.6 – Political Capital

Political capital looks at the "nature and quality of formal and informal governance structures, systems, and processes" (Cox, 2015, p. 16) within a community. In particular, it examines the power relationships that exist, as well as an individual's inclusion in, access to, and influence on political and governmental processes within a community, such as policy formulation and implementation (Cox, 2015; Frankenberger et al., 2013; TANGO International, 2003). Some of the key characteristics that this type of capital considers include: the trust, transparency, accountability, and reliability of government

communication; governmental support and funding in addressing any community needs or priorities; local political engagement and leadership; and the inclusion and participation of vulnerable groups (Cox, 2015; Cox and Hamlen, 2015; Twigg, 2009). If optimal support is to be provided post-disaster, it is crucial that governance and institutional structures are effective, flexible, and representative of the community's needs and priorities when the disaster strikes (Bahadur et al., 2010; Cutter et al., 2010; Pasteur, 2011; Twigg, 2009).

2.2.7 – Natural Capital

Natural capital refers to the stock of, access to, and maintenance of the natural resources found in the biophysical system to support livelihoods (Akamani, 2012; Frankenberger et al., 2013; Pasteur, 2011; Twigg, 2009). It considers the environmental status (e.g., air, water, and soil quality, pollution, acidification), ecological exposure (soil, fisheries, wetlands, forests, and coastal areas), utilization of local water and food sources, energy production and supply, and geographic attributes (weather, climate, and topography) (Cox, 2015; Cox and Hamlen, 2015; Mayunga, 2007). Communities have the responsibility to manage, protect, maintain, and enhance their natural capital in the event of a disaster (Frankenberger et al., 2013; IFRCRCS, 2014; Twigg, 2009).

2.2.8 – Preparedness Capital

Preparedness capital encompasses the processes, resources, and investments that a community considers in the mitigation of, preparedness for, response to, and recovery from disasters (Cox, 2015). It includes preparing, managing, and maintaining a hazard risk assessment and emergency plan, identifying and securing resources (shelter, fuel, food, water, and energy generators), and ensuring that the community has adequate first response and medical response capacity in the event of a disaster (Cox, 2015; Cox and Hamlen, 2015). This is vital in the discipline of disaster management, as it ensures the community has the internal capacity to effectively mitigate, prepare for, respond to, and recover from any implications.

2.3 – Resilience

The concept of resilience is rooted in the Latin word "resilio," which means to adapt or recover from a disruptive event (Klein et al., 2003). The concept of resilience was first

introduced in ecology, where Holling (1973) used it to explain an ecosystem's ability to absorb and adapt to stressors, while simultaneously maintaining its existing state of functioning (Maguire and Cartwright, 2008; Mayunga, 2007). It has since been adopted and applied in several disciplines, such as engineering, psychology, economics, and sociology (Bonanno, 2005; Janssen and Ostrom, 2006; Maguire and Cartwright, 2008; Mayunga, 2007; Pimm, 1984). It has also been identified as the foundation across all phases of effective disaster management (Amaratunga et al., 2013; Murphy, 2007). Resilience is a complex phenomenon that examines the capacity of a system in anticipating, mitigating, preparing, responding, adapting, resisting, restoring, and recovering from any implications of an unexpected stressor in a prompt and effective manner (Cox, 2015; Frankenberger et al., 2013; Klein et al., 2003; Twigg, 2009). Integral to this concept is the ability and willingness of a system to be flexible, agile, and innovative to sustain its basic function, structure, and identity (Cox, 2015; Klein et al., 2003; Walker and Salt, 2012). It is manifested at various levels, including at the individual, household, community, societal, national, and ecosystem level (Béné et al., 2012; Frankenberger et al., 2013).

2.3.1 – Community Resilience

In the context of disaster management, community resilience is defined as a community's capacity to collectively mitigate, prepare for, respond to, and recover from the impacts of a disaster (Kafle, 2012; Mayunga, 2007; Pasteur, 2011). Magis (2010) further refers to it as the "existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (p. 402). It focuses on a community's ability to collectively optimize and mobilize its inherent strengths, capitals, assets, resources, and characteristics to resist, absorb, cope with, and recover from the impacts of a disaster using a negotiated coordinated response (Amaratunga et al., 2013; Cox, 2015; Frankenberger et al., 2013; Harris et al., 1998; Klein et al., 2003; Richardson, 2002; Walker et al., 2010).

Several key factors are essential to contributing to community resilience. The most prominent one is ensuring there is collective access to food, water, health, sanitation, and shelter at all stages of the disaster management process (IFRCRCS, 2012; Pasteur, 2011).

It is also important that community members have ownership and control over various capitals, such as human capital, physical capital, social capital, cultural capital, economic capital, political capital, natural capital, and preparedness capital to enhance their collective capacity to respond and recover from a disaster (IFRCRCS, 2012). Having access to external resources from either outside communities or individuals of authority, which is embedded in the principles of bridging and linking social capital, are important in the event that local community resources are insufficient or unavailable during a disaster to assist in the response and recovery process (Aldrich, 2012; IFRCRCS, 2012). Collectively, these composite factors of resilience influence the strength of a community's capacity in becoming resilient before, during, and after a disaster.

There are three forms of capacities that are essential to achieving resilience: absorptive capacity, adaptive capacity, and transformative capacity (Frankenberger et al., 2013; Maguire and Cartwright, 2008). Primarily, absorptive capacity looks at the ability of a community to use preventative and coping mechanisms to reduce the sensitivity or exposure to any stressors in the short-term to avoid any long-term, adverse implications (Béné et al., 2012; Frankenberger et al., 2013). This type of capacity looks at stability and persistence, which is integral to resilience as its presence will result in a community having adaptive capacity, but its absence will reduce the community to a state of vulnerability (Adger, 2000; Frankenberger et al., 2013). Adaptive capacity examines the ability of a community to modify or change its existing structure, function or identity in a positive way to adjust to the stresses of a disaster (Brooks, 2003; Frankenberger et al., 2013). It is vital that a community is flexible and resourceful to enhance its capability to become resilient in coping with future stressors (Béné et al., 2012; Frankenberger et al., 2013). Kahan et al. (2009) simplify this type of capacity by explaining that a community experiences damage where it bends, but does not break. Finally, transformative capacity refers to the ability of a community to reorganize and change into an entirely new, enhanced system after the physical, social, economic, or environmental implications of a disaster make the existing one unsustainable (Akamani, 2012; Folke, 2006; Walker et al., 2004). It looks specifically at the physical and economic infrastructure, social networks, and governance mechanisms

that enable systemic change within a community (Béné et al., 2012; Frankenberger et al., 2013).

2.3.2 – Perspectives of Community Resilience

It is important to understand that achieving community resilience is not a static state, but rather it a process that occurs over time and a developmental trajectory within changing physical, social, economic, and environmental circumstances (Frankenberger et al., 2013; IFRCRCS, 2012; Kirmayer et al., 2009). Accordingly, Maguire and Cartwright (2008) have conceptualized three perspectives of disaster resilience: resilience as stability, resilience as recovery, and resilience as transformation.

The stability perspective of resilience originates from the discipline of ecology, where it refers to the ability of an ecosystem or community to return to its pre-disturbed state (Adger, 2000; Folke, 2006; Maguire and Cartwright, 2008). It is commonly referred to as the buffer capacity, and is measured as the amount of disturbance an ecosystem or community can tolerate before it reaches its threshold resulting in a permanently changed state (Folke, 2006; Holling, 1973; Maguire and Cartwright, 2008). Folke (2006) argues that once a system has hit its threshold, it is unable to return to its functional state. However, a resilient community typically has a high threshold, where it can absorb a significant amount of stress before it reaches its threshold (Maguire and Cartwright, 2008). In the context of disaster management, the stability view of resilience encompasses the amount of collective capital that a community has in responding to a disaster in order to return its pre-disaster state. If a community is unable to alleviate the impacts of a disaster, it will reach its threshold resulting in a changed structure, function or identity.

The recovery perspective of resilience looks at a community's ability to bounce back from a stressor to its pre-disturbed state (Maguire and Cartwright, 2008). This view measures resilience as the amount of time that it takes for a community to recover from a stressor, such as the implications of a disaster (Maguire and Cartwright, 2008; Maguire and Hagan, 2007; Pimm, 1984). A resilient community has the capacity to return to its original state quickly, "whereas a less resilient community may take longer or not be able to recover at all" (Maguire and Cartwright, 2008, p. 4).

The transformation perspective of resilience recognizes the complexity of communities in which they are unlikely to return to their pre-disaster stage but instead will transform in an adaptive manner to reach a higher state of function, structure, or identity (Maguire and Cartwright, 2008). This view accepts that change is inevitable by demonstrating the dynamic nature of a community to respond and adapt positively to change (Folke, 2006; Maguire and Cartwright, 2008). Herreria et al. (2006) argue that this perspective of resilience recognizes that individuals can shape the trajectory of change by playing a significant role in both the number and type of impacts that the change causes.

2.3.3 – Vulnerability

Vulnerability is a concept that refers to the characteristics, components, and circumstances of a community that weakens its ability to respond to the negative implications of a disaster (Brooks, 2003; Maguire and Cartwright, 2008). Vulnerability is often framed in opposition to resilience; however, it is imperative to recognize that it is not the inverse of resilience (Cox, 2015; Frankenberger et al., 2013). Therefore, a community can experience both vulnerability and resilience simultaneously, in which neither concept is absolute (Cox, 2015). Similar to the discipline of disaster management, vulnerability was initially examined in relation to natural hazards, but has since been adopted and applied in several other domains (Maguire and Cartwright, 2008). Fenton et al. (2007) have categorized three approaches to examining vulnerability: vulnerability to natural hazards and disasters, social vulnerability, and an integrated vulnerability perspective.

From a natural hazards and disaster perspective, vulnerability is defined by "the frequency, duration, probability, intensity, severity, and magnitude" (p. 747) of a community being susceptible to the physical impacts of a disaster (Fenton et al., 2007). This view is interested in the broad-scale impacts that a community experiences as a result of a disaster in terms of fiscal expenses, production costs, mortality, and ecosystem damage (Fenton et al., 2007; Maguire and Cartwright, 2008). This approach is not concerned with the capacity of a community to respond or adapt following a disaster (Maguire and Cartwright, 2008; Yamin et al., 2005).

Social vulnerability looks at the internal structural, economic, and political factors of a community that weaken its ability to cope and respond to an external event, such as a disaster, while increasing its overall exposure (Allen, 2003; Brooks, 2003; Fenton et al., 2007). Factors such as poverty, poor housing quality, limited access to health and social services, food insecurity, racism, and social exclusion exacerbate the social vulnerability of a community (Public Health Agency of Canada, 2011). Additionally, communities with limited pre-disaster resources, mobility, and control are more susceptible to disaster-related morbidity and mortality (Johnson and Galea, 2009).

An integrated approach to vulnerability incorporates the limited resources and poor adaptive capacity of a community to a risk event, such as a disaster (Fenton et al., 2007). This perspective conceptualizes vulnerability as a function of a community's sensitivity and its inability to respond, as well as the "frequency, duration, probability, intensity, severity, and magnitude" (Fenton et al., 2007, p. 747) of the disaster that the community is exposed to (Yamin et al., 2005). Therefore, community vulnerability is increased when there is a combined high exposure to a risk event and low level of internal capacity.

2.3.4 – Community Resilience Frameworks

A framework is essentially a theoretical construct of the best available knowledge and evidence that is developed and intended to guide future research and practice (Cox, 2015). Frameworks integrate conceptual distinctions of a phenomenon to provide a comprehensive understanding of the factors and processes that influence it (Frankenberger et al., 2013), and encompass indicators for evaluating and benchmarking the baseline conditions that result in desired outcomes of a phenomenon (Cox, 2015; Cutter et al., 2010). An indicator is a mechanism that reduces, simplifies, and provides a quantitative or qualitative measure of complex processes and outcomes (e.g. as a Likert-style measure) to inform the assessment of a construct that itself is unmeasurable (Cox and Hamlen, 2015; Cutter et al., 2010; Freudenberg, 2003; Marlor et al., 1999). A set of related indicators is conceptualized as an index, which organizes and combines individual variables or thematic sets of variables that represent fundamental categories or domains of a phenomenon that cannot be captured by any indicator alone (Cox, 2015; Cutter et al., 2010; Nardo et al.,

2008; Ostadtaghizadeh et al., 2015; Uy and Shaw, 2013). Saisana and Cartwright (2007) argue that indices are powerful tools for policy making and public communication, as they provide data that can be used as performance measures. For a framework to be useful and relevant, the blend of indicators needs to be flexible, adaptable, and responsive to different conditions and outcomes (Cox, 2015). This is ultimately because the intent of a framework is to be adopted and adapted to meet the contextual needs, considerations, and capacities of the phenomenon being investigated (Cox, 2015).

Community resilience frameworks are commonly embedded in disaster management research to measure and determine how a community recovers from a disaster. These conceptual frameworks look at the factors or processes in time and place that contribute to enhancing the capacity of a community by using its own inherent strengths, assets, and resources to mitigate, prepare for, respond to, and recover from the effects of a disaster (Cox, 2015; Frankenberger et al., 2013; Ostadtaghizadeh et al., 2015). Rolfe (2006) argues that community resilience itself is difficult to measure, and it is instead inferred from a set of indicators. This is predominantly due to the lack of agreement regarding how resilience is defined and conceptualized in various disciplines (Ostadtaghizadeh et al., 2015).

One approach to measuring resilience is by aggregating individual level data to generate an average, which may be indicative of resilience at the community level (Kirmayer et al., 2009). Here, community resilience is the result of averaging all of the community members' resilience (Kirmayer et al., 2009). Although this method is cost-efficient, it is at risk of atomistic fallacy, which is a concept that incorrectly assumes and misattributes that individual level characteristics can solely be used to identify group level processes (Diez-Roux, 1998; Kirmayer et al., 2009). Kirmayer et al. (2009) therefore argue that community-level concepts must be measured using community-level indicators.

Accordingly, community resilience frameworks should incorporate and measure community-level indices and indicators in each of the various forms of capital to develop a comprehensive understanding of the phenomenon (Cox, 2015). Table 2.1 provides a list

of indicators that have been previously used to measure each of the aforementioned types of capitals.

Table 2.1: Indexes and Indicators of Community Resilience

Domain	Index	Potential Indicators at the Community Level
Human Capital	Socio-demographics	• Age structure • Gender • Education • Number of cultures represented • Religion • Household composition
	Knowledge and Skills	• Literacy rates • Knowledge and skills inventories (science, technology, engineering, arts, mathematics, trades sector, and emergency and security services sector) • Traditional knowledge and skills
	Population Density, Distribution, and Stability	• Community maps • Migration • Tourists
	Health Status	• Prevalence of morbidity and mortality • Self-rated health, well-being, and level of physical activity • Alcohol, smoking, drug use, gambling, and suicide rates • Life expectancy • Food security • Functional disabilities
	Health and Social Services	• Access to primary, acute, and mental health care • Numbers, types, and staffing of workers • Rates, use, and accessibility of services and programs • Culturally sensitive options • Domestic violence and child abuse
Physical Capital	Access, Availability, and Reliability to Critical Infrastructure	• Water, power, electricity, and sanitation • Transportation (private vehicles, driver's licenses, public transit, alternative routes, school buses, special need transportation services, and status of roads and bridges)

		• Telecommunications (landlines, cellular phones, radio, and newspaper)
		• Internet
		• Shelter (private home ownership, housing affordability, rental, community housing, hotels, motels, nursing homes)
		• Hospitals, schools, child care facilities, senior residences, and fire and police stations
Social Capital	Relationships	• Trust in others from same group (bonding social capital), from other groups (bridging social capital), and from those in power (linking social capital)
		• Sense of belonging and safety
		• Self-reliance and mutual aid
		• Social equity and inclusivity
	Social Networks and Support	• Availability, access, and proximity
		• Formal and informal
		• Membership or participation in social, recreational, religious, cultural or advocacy groups
		• Civic engagement
Cultural Capital	Creative Capacity and Vitality	• Events, festivals, and activities
		• Number of artists (visual, music, theatre, and media)
		• Traditional knowledge and skills
		• Intergenerational transmission of culture, traditions, and language
Economic Capital	Economic Health and Vitality	• Employment (including female employment)
		• Income and savings (per capita or household)
		• Economic development and diversity
		• Local businesses and services
		• Real estate value
Political Capital	Political Engagement	• Voter rates
		• Generalized trust
		• Citizen involvement and empowerment in decision-making process
	Leadership	• Trust, transparency, communication, and accountability

Natural Capital	Natural Resources and Resource Management	• Fish and wildlife stocks • Forest and energy resources • Coastal areas and wetlands • Ecosystem services
	Environmental Status	• Air, water, and soil quality • Pollution • Acidification • Frequency of natural hazards
	Geographic Attributes	• Weather and climate • Topography
Preparedness Capital	Risk Management	• Hazards, capacity, and vulnerability mapping and assessments • Risk mitigation activities and strategies • Education and training • Resources to support the planning, updating, and execution of procedures in various scenarios • Community awareness
	Response Capacity	• First response capacity (fire, police, ambulance, and emergency services) • Medical response capital (physicians, nurses, paramedics, hospitals, ambulance) • Community response capacity (community shelters, first aid, volunteers, organizations, mental health providers) • Search and rescue
	Household Resources	• Shelter, food, water, and energy

(Adapted from Cox, 2015; Mulligan, 2012; Ostadtaghizadeh et al., 2015).

2.3.5 – Rural Disaster Resilience Planning Guide

Rural, remote, and coastal (RRC) communities are less likely than urban centres to have effective disaster management plans and strategies (Amaratunga et al., 2013). Such communities have less financial and human resources, have fewer emergency measures infrastructure and training, and often have physical challenges due to complex geography, demographics, and isolation (Amaratunga et al., 2013). In response to this, the Justice Institute of British Columbia (JIBC) team created the Rural Disaster Resilience Planning (RDRP) Guide, which consisted of three main tools: the Rural Resiliency Index (RRI), the

Hazard Resilience Index, and the Hazard Risk Assessment (Cox et al., 2012). The purpose of this project was to develop a community-centred participatory approach for engaging RRC communities in disaster resilience assessment and planning at the local scale, when technical experts are unavailable (Cox et al., 2012). In creating the RRI, the JIBC team used community capitals to organize various dimensions of resilience (Cox, 2015; Cox et al., 2012). Accordingly, the RRI integrated various composite indicators of community resilience to address the human, social, cultural, economic, political, and preparedness capitals (Cox et al., 2012). In turn, this allows RRC communities to produce a situational assessment of their current resilience status, as well as to monitor and strengthen their resilience in the future (Cox et al., 2012; Cox and Hamlen, 2015). However, the RDRP project, along with a majority of other studies that have been conducted on this topic, assess the resilience of a community immediately following a disaster with no long-term follow-up under non-crisis conditions. Long-term assessment is important in determining the state to which the community ultimately returned, and the ability to respond to a future disaster, which are key elements of resilience. Additionally, the RDRP project did not implement its framework in any post-disaster communities (it was implemented in three random non-post-disaster communities), and therefore it is still unclear how well this framework is able to assess community resilience in disaster situations.

2.4 – Life Course Approach

The implications of a disaster may be devastating and long-term depending on the severity of the disaster, as well as the capacity of individuals and communities to respond to and recover from its implications. A unique and effective way to examine the long-term implications of a disaster on the lives of individuals and communities is using the life course approach. This is a multidisciplinary paradigm that analyzes the accumulation and interaction of how individual and group lives are affected from gestation to death within and across generations, in terms of broad social, economic, structural, and environmental contexts (Elder Jr, 1994; Fink and Galea, 2015; Kuh et al., 2003). The life-course approach provides a framework for exploring developmental processes and outcomes across one's life trajectory to understand how early life events, such as a disaster, shape subsequent life

events (Elder Jr., 1994). The following paragraphs explain the four principles embedded in this paradigm: time and place, timing, linked lives, and human agency in making choices (Elder Jr., 1994).

The first principle of time and place explains how the life course of individuals and groups is both embedded in and shaped by the historical events and factors in the geographical location where they reside (Elder Jr., 1994). Historical time is indexed by being a member of a birth cohort effect (Kuh et al., 2003), where "differences in birth year expose individuals to different historical worlds, with their constraints and options" (Elder Jr., 1994, p. 5).

Next, timing examines the developmental impacts of an event depend on when it occurs during an individual's life (Elder Jr., 1994). This encompasses the chronological age of an individual, where individuals who are near the beginning and end of their lives are more sensitive to the exposures of an event, such as a disaster (DeWaard, 2016). This principle also examines the social timing in people's lives, where chronological age dictates specific expectations, responsibilities, roles, and events (Elder Jr., 1994).

Linked lives looks at how the individuals' lives are interdependent, in which people engage in social relationships with one another throughout their life course (Elder Jr., 1994). Broadly speaking, this includes formal and informal networks, such as interacting with family members, friends, co-workers, and team members (Elder Jr., 1994). According to this principle, Elder Jr. (1998) argues that "social and historical influences are expressed through this network of shared relationships" (p. 4).

The principle of human agency in constrained situations examines how the autonomy of individuals is controlled by society (Elder Jr., 1994). In particular, people construct their own life course through their choices and actions, which are limited by historical and social conditions (Elder Jr, 1994; Elder Jr, 1998). This allows individuals to exert a measure of control over their life course (Elder Jr., 1998).

Collectively, the principles of the life course approach integrate various factors and forces that affect both individuals and communities over a life course. However, it is often excluded from disaster management research, despite its capacity to examine how a

disaster affects the later lives of individuals or communities to see if they are able to achieve resiliency over time.

2.5 – Example: Walkerton, Ontario

A prime example of the previously identified gaps in literature is exhibited in the rural community of Walkerton, Ontario. It is located in the municipality of Brockton in central-southern Ontario, and has a population of 4,517 residents (Statistics Canada, 2017). In May 2000, there was a water contamination outbreak after *Escherichia coli* (*E. coli*) O157:H7 and *Campylobacter jejuni* were discovered in the community's drinking water (Clark et al., 2008; Hrudey et al., 2002; O'Connor, 2002a). Heavy rainfall contributed to the excess runoff of livestock faecal contaminants from agricultural fields into a shallow municipal well, Well #5, that inadequately chlorinated drinking water (Hrudey et al., 2002). This event resulted in 2,321 cases of acute gastrointestinal illness, over 750 emergency room visits, 65 hospital admissions, 27 confirmed cases of haemolytic uremic syndrome, and seven deaths (Clark et al., 2008; Garg et al., 2005). Accordingly, the Walkerton tragedy fulfills the criteria established by the CRED to be classified as both an environmental and technological disaster.

2.5.1 – Previous Studies on Walkerton

In response to this tragedy, the Government of Canada called a public inquiry to be led by the Honourable Dennis O'Connor to identify the causes of this disaster (Part 1), as well as to examine the broader issues that pertain to drinking water safety in Ontario (Part 2) (Hrudey et al., 2002; O'Connor, 2002a; O'Connor, 2002b). In addition to the physical causes of the event, O'Connor (2002a) determined that various actors were collectively responsible for this tragedy, including the Walkerton Public Utilities Commission (PUC) operators, the former Ontario Ministry of Environment (MOE), and the provincial government of Canada. Primarily, the PUC operators were held accountable for their improper practices and systemic fraudulence with respect to the community's drinking water (O'Connor, 2002a). This included: "falsifying water monitoring entries in the daily operating records, inaccurately reporting the locations where microbiological samples were

taken, failing to monitor chlorine residuals on a [regular] basis, and failing to add adequate doses of chlorine disinfectant to the water supply" (Ali, 2004, p. 2606).

Moreover, O'Connor (2002a) states that the provincial government introduced budget cuts to various MOE policies and programs that, in turn, resulted in the deficient monitoring, regulation, and oversight of municipal drinking water systems. The most prominent changes included privatizing municipal water testing, removing criteria that governed the quality of water testing, eliminating legislation that made it mandatory for a municipality to report adverse results to the MOE and their local Medical Officer of Health, and making it voluntary for operators to follow procedures related to the chlorination and monitoring drinking water (Clark et al., 2008; O'Connor, 2002a). Lastly, the MOE was at fault for not providing any source protection measures for Well 5 when it was approved in 1979, as well as the failure to install continuous chlorine residual and turbidity monitors at the site (O'Connor, 2002a). This was despite various warnings that the shallow aquifer was subject to being contaminated by surface activities, namely nearby agriculture (O'Connor, 2002a).

In Part 2 of the Walkerton Inquiry, O'Connor (2002b) discussed the changes needed to be made to existing water planning and management procedures in Ontario. In particular, O'Connor (2002b) advocated for a multi-barrier approach to protecting drinking water supplies. This included five key elements: source protection, treatment, distribution system, monitoring programs, and response to adverse conditions (Hrudey et al., 2002; O'Connor, 2002b). Source protection stresses the importance of maintaining and protecting the best possible raw water quality to decrease the risk of contaminants being able to be transmitted through the treatment system (Hrudey et al., 2002; O'Connor, 2002b). Treatment involves designing, operating, and maintaining strategies that remove or inactivate contaminants (Hrudey et al., 2002; O'Connor, 2002b). The distribution system of treated water should be secure against intruding contaminants, and an appropriate chlorine, chloramine, and combined chlorine residual should be ensured to deliver safe water (Hrudey et al., 2002; O'Connor, 2002b). Moreover, O'Connor (2002b) stresses the importance of monitoring programs in returning water systems to normal operation when

contaminations beyond acceptable limits are detected. Appropriate and effective monitoring programs are often continuous online systems with warning or automatic control devices (O'Connor, 2002b). Lastly, it is critical to provide effective responses in the event of adverse conditions (Hrudey et al., 2002; O'Connor, 2002b).

Post-disaster research was conducted in Walkerton to examine the individual political (Prudham, 2004; Snider, 2004), institutional (Breen et al., 2015), environmental (Arya et al., 2009), and socio-ecological (Ali, 2004) factors leading up to the catastrophe, examine social capital during the outbreak (Murphy, 2007), and assess the health implications for ill residents (Clark et al., 2008). As well, some studies investigated how the event could have been prevented altogether (Hewitt, 2013; Tang et al., 2013), while others looked at the lessons learned following the tragedy (Hrudey et al., 2002; Hrudey and Hrudey, 2002). However, there have not been any long-term studies conducted in this community to determine the state to which the community returned, and whether the residents were collectively able to achieve resilience over time.

2.6 – Literature Gaps and Rationale for Current Research

Most disaster management studies only assess community resilience immediately following the incident with no longer term follow-up examinations. There is a lack of research that has been conducted to determine if communities truly recover over time post-disaster. There is also little research incorporating the life course approach into the field of disaster management to examine how a disaster affects the later lives of individuals and communities.

The purpose of this interdisciplinary study was to address these gaps to determine what factors facilitate or impede community resilience following a disaster under non-crisis conditions. In addition, it sought to integrate the life course approach to examine the long-term effects of a disaster on the subsequent lives of community members.

Chapter Three: Methodology

This chapter presents a detailed account of the qualitative research methodology used to conduct this project, including: the study design, setting, sampling and participant recruitment strategy, data collection, data management and analysis, strategies to ensure rigour, and ethics approval.

3.1 – Study Design

An interpretive description qualitative approach was used to guide all data collection and analysis components of this research project. This methodology permits a detailed description of the phenomenon being investigated by providing responses to who, what, and where questions. It then moves beyond mere description by seeking an in-depth analysis to discover and interpret any themes or patterns that may exist in the phenomenon (Thorne, 2008). In turn, this yields responses to why and how questions with the goal of applying these findings in practice (Thorne, 2008).

This design is applicable in the present study, as the researcher is interested in describing and interpreting the various enablers and barriers to achieving community resilience at the time of the water contamination outbreak in Walkerton, as well as describing the various factors involved to maintaining community resilience in the present day. The researcher then sought to utilize the findings in contributing to an existing operational framework of community resiliency that could be adopted in practice in the discipline of disaster management.

3.2 – Study Setting

Walkerton is a rural community located within and governed by the Municipality of Brockton in central-southern Ontario on the banks of the Saugeen River. According to the 2016 Canadian Census, the total population has decreased by 6.9 percent from 2000 to 4,517 residents in 2016 (Statistics Canada, 2001; Statistics Canada, 2017). It was previously a predominantly agricultural-based community, whose industrial base has now expanded to more diversified manufacturing businesses and government administration (Municipality of Brockton, 2015a). According to the Walkerton Herald Times (2015), the average household income is $79,868. Walkerton continues to be notoriously recognized

worldwide after *E. coli* O157:H7 and *Campylobacter jejuni* were discovered in the community's drinking water in May 2000. This event resulted in over 2300 confirmed cases of acute gastrointestinal illness and 7 deaths (Clark et al., 2008; Garg et al., 2005).

3.3 – Sampling and Participant Recruitment Strategy

This interpretive description study utilized purposeful sampling to gather participants, as it is the preferred design strategy in this type of research (Neergaard et al., 2009; Thorne, 2008). Patton (2002) argues that this non-random sampling strategy is appropriate when qualitative researchers are interested in identifying information-rich participants who can successfully contribute to an in-depth description of the phenomenon being investigated. This is supported by Creswell et al. (2007) who states that this sampling approach purposefully informs a thorough understanding of the central phenomenon of interest. In particular, a maximum variation purposive sampling strategy was employed to attain a comprehensive understanding of the phenomenon being described (Neergaard et al., 2009). This approach allows researchers to explore "the convergence and divergence of factors in a disparate group of people experiencing the same event" (Sandelowski, 1998, p. 381).

Additionally, criterion sampling was used to identify participants who met the predetermined criterion of importance (Patton, 2002). Only English speaking persons who either resided or worked in the community at the time of the outbreak were invited to participate in the study. Age was another exclusion criterion that limited the age of participants to be above 16 years old to ensure that individuals were affected by the *E. coli* outbreak in some capacity, as the event occurred 16 years ago. There were no exclusion criteria posed in regards to gender, socioeconomic status, health status, ethnicity, culture, religion, race, mental or physical disability, or educational level, as all of these factors would collectively contribute to a full understanding of the research problem or event.

Since the focus of this study was on the entire Walkerton community, various individuals, organizations and interest groups that serve all domains of the town were invited via e-mail to participate in this study, upon approval from the Hamilton Integrated Research Ethics Board (HiREB) (Certificate Number 2016-1934) (Appendix A), as

discussed further in Section 3.8. The e-mail provided a letter of information (Appendix B) about the study by outlining the purpose, methods involved, duration, and included a consent form (Appendix C). Interested individuals were asked to contact either the local principal investigator (SD) or student investigator (KL) via e-mail or to telephone the investigators for further information about the project. In appreciation of their time, participants were given a $20.00 honorarium. Due to a poor response rate, snowball or chain sampling was used as a subsequent purposeful strategy to gather participants. In particular, two Walkerton residents played a vital role in assisting the student researcher in identifying and recruiting participants who they suggested may be knowledgeable about the study topic (Patton, 2002).

Qualitative research differs from quantitative research in regards to sample size. Quantitative research aims to gather a large number of context-stripped subjects in order to seek statistical significance (Miles and Huberman, 1994). In contrast, the goal of qualitative studies is to identify small samples of individuals in their context to be studied in great detail (Miles and Huberman, 1994). Qualitative scholars argue that there is no set criteria or formula to calculate sample size (Patton, 2002). However, in standard practice for small group analysis, as found in the relevant literature where small group statistical methods are applied, many qualitative researchers typically seek a sample of 20+ individuals to reach the theoretical saturation of data (Miller and Salkind, 2002; Morse, 1995; Patton, 2002; Strauss, 1987). This concept essentially states that there is a point in the analysis of data where sampling more individuals will not result in any additional information related to the research question being investigated (Green and Thorogood, 2004).

3.4 – Data Collection

In qualitative research, interviews are recognized as an ideal mode of data collection when depth of meaning is important, as the researcher is able to gain insight and understanding of the phenomenon being investigated (Sandelowski, 2000). The objective of this method is to gather and understand a detailed description of a research topic through the interviewee's perspective (Neuman and Robson, 2012). This is relevant in this study,

as the researcher was interested in understanding the various dimensions that either promoted or prevented community resiliency among the residents of Walkerton both at the time of the *E. coli* outbreak and in the present day.

Semi-structured interviews are especially useful in qualitative research, as they provide the researcher with the flexibility to attain rich descriptions from participants (Creswell et al., 2013). This type of interview covers a predetermined set of open-ended questions or overarching topics, while allowing the interviewer to ask questions and to probe themes relevant to the interview guide in order to gather a more comprehensive understanding the research topic (Patton, 2002). In turn, this permits the production of a micro type of knowledge, where the interviewer can gain greater depth and detail about the personal perceptions and experiences of participants, such as their feelings and emotions, which cannot be captured using other methods. It is important to recognize that data collection and analysis are often interlinked in a cyclical process in qualitative studies, where it occurs simultaneously (David and Sutton, 2011). This allows the researcher to alter data collection strategies in order to gather further perceptions and improve the data (Miles and Huberman, 1994).

Focus groups are a type of interview that involves a group of individuals at the same time, and often in the same place (David and Sutton, 2011). The purpose of this method is to use the interaction between participants to generate discussion surrounding a research area, as it enables ideas to bounce off one another (David and Sutton, 2011). Focus groups are especially useful when researchers are interested in assessing group dynamics of individuals with common characteristics (e.g. age, gender, ethnicity, class) surrounding a topic (David and Sutton, 2011). David and Sutton (2011) argue that there is no set number of participants in a focus group, and that they may consist of strangers or of individuals who already know one another.

Face-to-face, semi-structured interviews were employed as the mode of data collection for this study, and were conducted either one-on-one or in a focus group. In total, 29 individuals participated in this study (Table 3.1 outlines the gender, age category at the time of the outbreak, current age category, and current occupation of study participants;

this information was collected from participants using Appendix H). Twenty-three individuals opted to participate in a one-on-one interview, while three groups of two individuals (six participants in total) requested to participate in a focus group due to time restrictions. The focus group participants were known to each other; in two cases they were spouses, and co-workers in the third. All interviews/focus groups were conducted in a mutually agreed upon location between the participants and student researcher between November 14th and December 7th, 2016 in Walkerton, ON, and ranged between 35 to 75 minutes in length.

Table 3.1: Study Participants' Demographics

Variable	Category	*N* = 29 (%)
Gender	Male	17 (59)
	Female	12 (41)
Age Category at the Time of the Outbreak (years)	0-19	1 (3)
	20-39	9 (31)
	40-59	17 (59)
	60-79	2 (7)
	> 80	0 (0)
Current Age Category (years)	0-19	0 (0)
	20-39	1 (3)
	40-59	12 (41)
	60-79	16 (55)
	> 80	0 (0)
Current Occupation[2]	Management Occupations	10 (34)
	Business, Finance and Administration Occupations	1 (3)
	Natural and Applied Sciences and Related Occupations	1 (3)
	Health Occupations	4 (14)
	Occupations in Education, Law and Social, Community and Government Services	11 (38)
	Occupations in Art, Culture, Recreation and Sport	1 (3)
	Sales and Service Occupations	1 (3)
	Trades, Transport and Equipment Operators and Related Occupations	0 (0)
	Natural Resources, Agriculture and Related Production Occupations	0 (0)
	Occupations in Manufacturing and Utilities	0 (0)

[2] Occupations are categorized by the National Occupation Classification, which is Canada's "accepted taxonomy and organizational framework of occupations in the Canadian labour market" (Government of Canada, 2017).

The objectives of this project were used to inform both the interview and focus group guide (Appendices F and G, respectively). In particular, the following categories were explored:

1. Perceptions of community, resilience, and community resilience;

2. Identifying the facilitators and barriers to achieving community resilience at the time of the outbreak under crisis conditions; and

3. Using the life course approach to examine the effects of the 2000 E. coli outbreak in maintaining community resilience in the present day under non-crisis conditions.

Prior to the interview/focus group, the student researcher provided a brief background of their experience and project to assist with rapport building, to ensure the participant was aware they had the right to refuse to answer any questions that they found uncomfortable or end the interview at any time, and to form a non-judgmental relationship (Partington, 2001). All interviews/focus groups were audio-recorded and field notes were taken with permission of the participants to ensure the data were accurately collected. All audio recordings and notes taken were password-protected and saved under an alias on the student researcher's computer, which will be passed on to the local principal investigator following the completion of this project to be stored under locked cabinet in a locked institutional office. The student researcher also received permission from each participant to be contacted after the interview/focus group for clarification if required. Data saturation was achieved, as no new concepts or themes were emerging upon completion of the 23 interviews and three focus groups.

3.5 – Data Management and Analysis

Once all interviews/focus groups were complete, the audio files were encrypted and transcribed verbatim by a paid transcriptionist. To ensure the accuracy of every transcript, the student researcher reviewed each transcript word for word while listening to the original audio recording and made any necessary changes. The transcripts were then reviewed again to remove any identifying information from the participants to protect the confidentiality and anonymity of all study participants. The transcripts were then sent via e-mail or post

to their respective participant to ensure all conversations were captured accurately. This technique enhances the credibility of the data analysis, as discussed in Section 3.7.

Conventional content analysis was the strategy used to inductively code the interview/focus group transcripts, create categories based on similar codes, identify overarching themes and patterns, and ultimately develop a conceptual model in this study. This type of analysis is most appropriate when researchers are interested in investigating a multi-faceted phenomenon, such as community resilience (Hsieh and Shannon, 2005). The analysis commenced by closely reviewing all interview/focus group transcripts repeatedly to enhance the understanding of the data collected (Miles and Huberman, 1994). Following this, open coding was used to condense the data into preliminary analytical codes. This is a form of data reduction where the researcher identifies and focuses on the raw information that is both relevant and meaningful to the objectives the study. These initial codes identified common themes, words, phrases, causes and explanations, and emerging constructs in the data (Creswell et al., 2007; Miles and Huberman, 1994; Neuman and Robson, 2012). The researcher used memos as they assigned codes to document their initial thoughts during the analysis (Fielding and Lee, 1998). Axial coding then organized similar codes into a codebook, which sought to develop links among them to discover categories (David and Sutton, 2011). Selective coding was the final step, which examined the previously established categories of codes to identify core themes or patterns among participants' responses (Neuman and Robson, 2012). It is important to note that a constant comparative approach was used throughout the entire data analysis process where each transcript was constantly revisited after its initial coding to ensure that no new themes emerged (Creswell et al., 2007; David and Sutton, 2011).

In particular, a computer-assisted qualitative data analysis software called NVivo for Mac (Version 11) QSR International was used to code, manage, and organize the data collected in a clear format. It facilitated the researcher in exploring connections among codes to identify themes more easily (David and Sutton, 2011). The use of this software helped ensure a quotation from each participant was included to support an emerging theme.

3.6 – Strategies to Ensure Rigour

Qualitative research employs several evaluative criteria to ensure the data were collected and analyzed in a rigorous way to enhance the trustworthiness of the findings reported in a study. Strategies include credibility, transferability, dependability, and confirmability (Baxter and Eyles, 1997; Lincoln and Guba, 1985).

Credibility According to Baxter and Eyles (1997), credibility is the most important principle for assessing rigour. It refers to the ability of a researcher to describe a phenomenon in a clear and authentic way that allows individuals who experienced it to recognize it as their own, while those who have not experienced the phenomenon would still be able to understand it (Lincoln and Guba, 1985). It also encompasses the probability that the methods of a study will yield plausible results (Russell and Gregory, 2008). There were several strategies used to satisfy this criterion in this study, including purposeful sampling, prolonged engagement, triangulation, member checking, and researcher reflexivity.

Purposeful sampling was employed to identify information-rich cases (Walkerton residents) who would be able to identify the factors that facilitated or hindered resilience at the time of the outbreak in their community, as well as in the present day.

Prolonged engagement with the participants further strengthened this criterion, as it allowed the researcher to build trust and rapport with the Walkerton residents being interviewed. The researcher learned the culture and dynamics of the Walkerton community, and developed the ability to identify either misinformation or the distortion of information provided by participants or the researcher themselves (Baxter and Eyles, 1997).

Triangulation is arguably the most powerful strategy for strengthening credibility (Baxter and Eyles, 1997). It involves corroborating similar findings across several sources of information. In this study, the student researcher used quotations from multiple participants to support the construction of emerging themes. As well, peer debriefing was utilized which involved the student investigator sharing the initial coding structure and results with their supervisor to ensure information was not being misinterpreted.

As previously discussed, member checking was utilized in the present study. It is critical to strengthen credibility, as participants "have privileged access to their own opinions and meanings," (Baxter and Eyles, 1997, p. 515) which is essentially the goal of qualitative research. Each participant was provided with a transcript of their respective interview/focus group, either via e-mail or post, and was asked to validate the accuracy, clarity, and completeness of the data and to mark any passages that they did not want to be quoted directly.

Furthermore, reflexivity acknowledges the subjective nature of qualitative researcher's own experiences that may influence any stage of the research process (Baxter and Eyles, 1997). To enhance the credibility of a study's findings, it is important for researchers to disclose how their identity affect any interpretations of the data collected and analyzed. With respect to the details of the student researcher's life, the individual is a Caucasian, heterosexual, physically and mentally healthy male who does not reside in the Walkerton community. The student researcher comes from a Roman Catholic, middle-class background, and is seeking post-secondary education in the discipline of public health. Accordingly, the researcher's identity may have held some unintentional assumptions or biases that may have some influence on the findings of the study.

Transferability refers to the degree to which the results of a study have meaning to other studies in similar situations (Baxter and Eyles, 1997; Lincoln and Guba, 1985). As mentioned, a maximum variation purposive sampling strategy was initially used to recruit participants in the study. This allowed the researcher to explore community resilience in Walkerton through several perspectives; many of which could exist in other similar communities. Another strategy to strengthen transferability between studies is to provide dense descriptions of the methodology employed and the results obtained (Baxter and Eyles, 1997). This study provided specific information regarding its design, setting, sampling, data collection, and data analysis strategy. In addition, the student researcher captured detailed accounts of the experiences of Walkerton residents. Collectively, this could allow readers to decide whether the methodology and/or findings would be applicable in their own context.

Dependability accounts for the consistency between the data collected and analyzed with the results being reported (Baxter and Eyles, 1997). It ensures that the research is logical and clearly documented, particularly in regards to methods employed and decisions made by the researchers (Russell and Gregory, 2008). Primarily, low-inference descriptors were utilized in which field notes and audio recordings were kept to capture verbatim accounts of the interviews/focus groups conducted. This helped ensure that the information gathered accurately captured the true accounts that the Walkerton residents shared.

Additionally, to strengthen the dependability of the project, all data were collected and analyzed by the student researcher to ensure consistency across the semi-structured interview/focus group (Baxter and Eyles, 1997). After initially coding the first few transcripts, the student researcher used a constant comparison approach by returning to the files to recode additional codes that were added to subsequent transcripts. This technique ensured that the data were coded consistently.

The student researcher also maintained an extensive audit trail to document the various steps taken throughout the study in order to provide transparency to the decisions made. This included keeping detailed files on each step form the initial codes all the way through to the decisions made on how the data were reduced for analysis purposes. Peer debriefing with the student researcher's thesis supervisor also strengthened the dependability of the project, by having access to the coded transcripts.

Confirmability is the criterion that focuses on the neutrality of the researcher. It looks at the extent to which the results are determined by participants, and not subject to any biases, motivations, interests or perspectives that the researcher may hold (Lincoln and Guba, 1985). Strategies to strengthen the confirmability of the study's findings included maintaining a detailed audit trail to document all decisions made throughout the duration of the study. This includes recording information on "raw data, data reduction and analysis products, data reconstruction and synthesis products, process notes, and instrument development information" (Baxter and Eyles, 1997, p. 517).

3.7 – Ethics Approval

Ethics approval was obtained from the HiREB in September 2016 prior to commencing this study (Certificate Number 2016-1934). The application and certificate are both included in Appendix A. As per the ethics approval, several measures were taken to safeguard the confidentiality of participants. A letter of information (Appendices B and D, respectively) and a consent form (Appendices C and E, respectively) were provided to each participant outlining the purpose of the study, the procedures involved, the type of questions that would be asked, and any potential risks and benefits to participants.

Individuals were also made aware that their participation was entirely voluntary, that they had the right to refuse to answer any questions they did not want to, that they could withdraw from the interview at any time without any repercussions, and that they could request that the data they provided could be excluded from the study up to the end of the calendar year (December 31, 2016) following the interview/focus group. Since Walkerton is a small community, participants were also informed that others might be able to identify them by the references they made and to consider this in deciding what they wanted to share.

Permission was also received to use an audio recorder and to take handwritten field notes to ensure the information was accurately captured. All audio recordings and notes taken were password-protected and saved under an alias on the researcher's computer, which will be given to the local principal investigator following the completion of this project to be stored in a locked cabinet in a locked institutional office. In addition, the participants were made aware that identifying information would be removed and replaced using a generalized pseudonym to ensure anonymity. Finally, prior to the commencement of the interview/focus group, each participant was asked to provide written consent outlining that they understood all aspects of the study.

Chapter Four: Results and Discussion

This chapter presents the observations from this research, and provides an analysis, founded in the literature, of these observations.

This chapter begins by identifying, describing, and interpreting participants' perceptions of community resilience, the barriers and facilitators to community resilience under crisis conditions, and the barriers and facilitators to community resilience in the present day. It then introduces a conceptual model that incorporates the life course approach into an existing community resilience framework. It then presents the implications and limitations of the current study. This chapter is concluded by presenting strategies to enhance the dissemination of this study.

4.1 – Perceptions of Community Resilience

This category of questions sought to capture the participants' perceptions of community, resilience, and community resilience in a general sense. Insight on how the participants conceptualize these terminologies provides context to the subsequent areas of exploration in the study. Four key themes that emerged from this category, including: a collective understanding of community; Walkerton is a community; resiliency is a positive phenomenon; and, resiliency is inherent in Walkerton. The paragraphs elaborate on each of these themes.

Collective Understanding of Community Participants were asked to define the term "community" in their own words, as well as to provide the common characteristics that are embedded in a community to inform the context of their respective interview/focus group. All individuals independently conceptualized a similar description of the concept in varying capacities. They collectively agreed that community involves a diverse group of individuals residing in a defined geographical setting who share similar interests, values, and goals. It extends beyond the immediate family to include other formal and informal relationships in their daily lives, such as friends, neighbours, coworkers, and colleagues. The following excerpts from participants support this statement:

> [A] community is composed of the people that I see the most often. My family, my friends, my coworkers. They're the people that I see whether I like them or don't like them. They're the people in my world. (Participant 27)

It's a group of people who, um, live in a given defined area. [They] share some common values and common interests. (Participant 6)

Community refers to a group of people who are able to reside within a particular environment. It provides them a sharedness, support, resources, and, um, a way of life. (Participant 22)

Community is, is your home, is your life, is your family. It's where you reside, where you contribute, and the people you associate with. (Participant 17)

Community is an extended family… It's that [familiarity] that you have with the people, you all speak the same language, and [that's] a shared experience (Participant 11)

It's a group of people that come together. (Participant 19)

It's a just, uh, broad grouping of people, uh, that have some common interests. And can work together towards common goals and there, there may be a lot of diversity within that or a lot of contrary opinions but, uh, you know, I would call that some common goal and some common bond. (Participant 25)

A community has the same kind of principles, ideas, ideals, and thoughts, and are prepared to share these with each other and also to support each other in their beliefs and what they think… and the way they do things. (Participant 23)

There's every age, [every] race. Everything… There's everything. (Participant 18)

These passages reflect the description of community presented in the literature. Existing definitions of the concept of community encompass shared values, interests, beliefs, norms, identities, collective actions, behaviours, commitments, and psychological ties among a unified group of individuals with one another, as well as to their geographically defined space (Christensen and Robertson, 1980; Jewkes and Murcott, 1996; Maguire and Cartwright, 2008; Murphy, 2007; Twigg, 2009). As well, the findings from the interviews and focus groups identified communities as heterogeneous, complex, and dynamic owing to the fact that the individuals who collectively make up a community are diverse. This finding was also supported by the literature (e.g. Harrington et al., 2008; Maguire and Cartwright, 2008; Twigg, 2009). These findings enabled the researchers to confirm that the participants have a mutual understanding of community, which is aligned with the definition of community in the literature. This was critical to setting the foundation for the rest of the discussion.

Walkerton is a Community Participants emphasized that their understanding of community was informed through their living experience in Walkerton, as they consider Walkerton to be a community. This was described by several participants:

> When I think of, like, our community in terms of community, I think of like Brockton, Walkerton, all of us living in the same area, working together towards a common cause. (Participant 9)

> Community can be, um, a very distinct area and a very broad area and then even broader after that. So, it's like, you know, it's spheres and levels, I guess you'd say, right? Because if you wanna talk about our community, then I basically think of Walkerton, Brockton, and so on. Then your next kind of community involves those ones that revolve around Walkerton and area… The broader community that we live in here is referred to as Grey Bruce. And then we go to Midwestern Ontario. And then we're part of Canada basically, right? So, you get those different levels of community, but they're all, I guess, I guess it tends to stem from being geographical because it's people in one area… But I guess if you're thinking of community as in town, I would consider it Walkerton. (Participant 20)

> Walkerton is part of a small, rural community where you have, uh, a, a definite, uh, I'd say, uh, uh, people have an affiliation with each other, and that, that is one of the reasons why I stayed here… It [has] a family-type of atmosphere that you're, you're involved in. To give you an example, when I take my granddaughter [to] the post office to pick up the mail, she says to me always, "[Don't] take so long to get the mail." … You always meet in there. You, you talk to people. You, you read the announcements on the board with regard to who's passed away over the course of the last couple weeks and what other individuals are related to them and when the visitation is and all that sort of stuff. It's all just part of the community that, that everybody does. (Participant 14)

These excerpts highlight that the participants understand Walkerton itself to be a community, as defined in the literature, as the individuals who make up the community physically live in a geographically defined area, share common goals and interests, and have psychological and mutual ties to each other. The participants recognize that their conceptualization of Walkerton as a community extends beyond a spatial parameter to include the social system interactions that residents share with one another.

Incorporating a community-centred approach is critical to the domain of disaster management (Cox, 2015; Shaw, 2012). It empowers communities to strengthen local capacity building by using its own inherent skills and knowledge to collectively mitigate, prepare for, respond to, and recover from the effects of a disaster. By recognizing that the

individuals who reside in Walkerton make up a community at the time of the *E. coli* outbreak, it demonstrates that residents share a common goal of working together in responding to, and recovering from, the effects of the event.

Resilience is a Positive Phenomenon Participants were also asked to define and conceptualize the term resilience in their own words in a general sense, as well as with respect to the context of community. The intent of asking such questions was to build on the previous section of community, as the researchers were interested in the personal accounts and first-hand experiences of how residents perceived the phenomenon, as they were the unit of analysis. In turn, this would provide clarity to the following questions asked regarding what factors the participants believed hindered or facilitated resilience in their community at the outbreak, as well as in the present day.

All participants acknowledged that resilience is a positive term, which involves the ability of individuals to overcome the adverse effects of an incident or event. The following definitions were provided by participants:

> My definition of resilience would be, like, your ability to rebound. Um, you know, get back to the, what your, your thought of normal is after, after a difficult time. (Participant 18)

> I think if, if you're resilient, that means you've overcome something, or you're trying to overcome something. (Participant 16)

> If I'm a resilient individual, to me, it means I have the capacity whether the situation that I'm involved in is good, bad or ugly, I have the capacity to survive. (Participant 23)

> The word has to be, uh, something positive. I don't think you want to move on in life being a, you know, going from bad to bad to bad and never getting better. You want to see, like, the light at the end of the tunnel [in] a positive [way]. (Participant 15)

> It's the ability to overcome problems. It's the ability to, uh, forge ahead as a, as a unified, coherent group. (Participant 14)

> Well to me, resilience, uh it means kind of an ability to bounce back. A community [that] isn't resilient, you know, once they go through change, um you know, perhaps that alteration always exists and they never get back to a a positive state. And to me, it is kinda that bouncing back as opposed to a just a permanent change in direction… the ability to uh to respond in a positive way. (Participant 24)

These quotes reveal that participants conceptualize the phenomenon in a way that reflects what is found in the literature. Their definitions describe absorptive and adaptive capacity, which are both critical to achieving resilience. As described in Chapter 2, absorptive capacity involves utilizing preventative and coping strategies to reduce long-term, negative implications, while adaptive capacity entails modifying the existing structures and functions of a community in a positive manner to adapt to the impacts of an event (Adger, 2000; Brooks, 2003; Frankenberger et al., 2013). Here, the participants indicate a general understanding that resilience involves a positive outlook to enhance an individual's or group's ability to adapt to or recover from a disruptive or adverse event, and to prevent any long-term repercussions. These capacities are integral to the disaster management process.

Resilience is Inherent in Walkerton In discussing community resilience, individuals focused on their own community, Walkerton, to shape and strengthen their understanding of the phenomenon. This was illustrated by several participants:

> I would say that this community is, like, it's bred-to-the-bone resilient… That's one of the prime, kind of, um, like, any time you think of any other kind of main characters in town, resilience is something you would definitely call them. (Participant 11)

> One thing that the crisis brought was this community back together. That we had a common goal that we were going to work through [it]. (Participant 3)

> We are a human race that are to survive, and we, we do survive. Some of us do it better than others, and, uh, but then that whole community, part of that, comes back into that resilience, and [Walkerton residents] came through it, and they did it well, and they worked as, as a family, a community family within Brockton. (Participant 17)

> What [resilience] means to me is really rising about the adversity and recognizing it for what it is, that it [the *E. coli* outbreak] should've never happened, but the fact is, it did. So, you can either let that eat you up and destroy you, and you're the only one that that's gonna hurt, or you figure out a way that, you know, go deal with it, put it in some type of a [compartment] and move on. (Participant 28)

The participants' own experiences of being community members in Walkerton at the time of the *E. coli* outbreak facilitated their ability to conceptualize resilience in a positive way. The participants discussed that the entire community needed to, and was able

to, come together by bringing their inherent skills, strengths, knowledge, and resources in order to absorb, cope with, and recover from the impacts of the outbreak. This is vital to the process of disaster management, as it empowers the community with a degree of control over what is happening. This ultimately strengthens their community capacity (Berkes and Ross, 2013; Krewski et al., 2007).

The participants' definition and conceptualization of community, resilience, and community resilience greatly overlapped those in the literature. Additionally, providing them with the opportunity to explore these concepts at the beginning of the interview/discussion enabled them to set their respective subsequent discussions within the context of these concepts.

4.2 – Barriers and Facilitators to Community Resilience Under Crisis Conditions

The next category of questions aimed to identify the specific facilitators and barriers to the community's collective response to, and recovery from, the *E. coli* outbreak at the time of the outbreak. The purpose of this line of inquiry was to determine if these previous factors continue to affect resiliency in the Walkerton community in the present day.

Since this is an interdisciplinary study, each interview and focus group was guided by a group of probing questions pertaining to each of the capitals central to the field of disaster management, including social capital, cultural capital, human capital, political capital, economic capital, natural capital, built capital, and preparedness capital. The following paragraphs discuss the themes that emerged in the interviews within the categories of barriers and facilitators at the time of the outbreak.

4.2.1 – Barriers to Community Resilience Under Crisis Conditions

Three major themes, each with a number of sub-themes, arose as barriers and challenges to achieving community resilience at the time of the water contamination outbreak in Walkerton (Table 4.1).

Table 4.1: Themes and Subthemes Acting as Barriers to Community Resilience Under Crisis Conditions

Major Theme	Subtheme
Disruption of Services and Status Quo	• Economy suffered • Daily life disruptions • Direct and indirect implications

	• Health care sector overwhelmed
Lack of Communication and Transparency	• Information being withheld
	• Lack of mental health counseling available
Fear of the Unknown	• Lack of knowledge surrounding *E. coli* O157:H7
	• Sound of helicopters
	• Individuals avoiding Walkerton

Disruption of Services and Status Quo A number of aspects contributed to the disruption of services and status quo while Walkerton was experiencing crisis conditions, including economic downturn, interruptions to daily life, adverse health outcomes, and an overwhelmed medical sector. Participants mentioned that many areas in the local economy were adversely affected at the time of the outbreak. An overwhelming number of individuals reported that restaurants were especially affected, as they relied on potable water to run their businesses. Participants noted that:

> Restaurants suffered drastically [for] quite a period of time. (Participant 14)

> I would have to say, uh, the food and restaurant business … definitely, the food, and, and restaurant business [were] impacted. (Participant 16)

> The restaurant industry… You know, that was definitely a scary time for them. (Participant 18)

> Well, obviously, all the food industries were deeply affected, particularly the restaurants. I mean the business[es] went [down]. (Participant 23)

> Nobody would go in and buy a hamburger at a restaurant because they couldn't use the water, so all the restaurants immediately were shut down. (Participant 4)

> The restaurants were, you know, massively devastated, like people just stopped going to restaurants. (Participant 7)

> We were closed for three, I think three and a half weeks. … It was very stressful. (Participant 1)

Additionally, several individuals stated that real estate and property value were severely impacted at the time of the water contamination outbreak. The following quotes support this assertion:

I'm in real estate. We did not have a sale or a showing for 30 some days. … [Property value] went down at least 20 percent. (Participant 3)

[Property value] went down at the time, for sure. (Participant 7)

There was no building [homes] going on for, I'm gonna say, three to five years. (Participant 15)

Finally, tourism in the community was negatively affected by the *E. coli* outbreak. This was made evident by the following individuals:

The tourism shutdown… [We] had a very poor year that year because tourism was down because Americans weren't coming here. (Participant 3)

I think the tourism dollars were probably hit the hardest because I know they like to promote us as a tourist fishing area (Participant 20)

The other thing is, nobody came to town. It was so bad. (Participant 5)

The water contamination outbreak had a detrimental impact on the local economy in Walkerton, as restaurants, real estate, and tourism spending came to a collective halt. This reduced the economic capital of the community, as these industries were unable to achieve their financial or social objectives at the time of the crisis (Beckley et al., 2008; Frankenberger et al., 2013). The outbreak made it difficult for community members who relied on these sectors to recover from its implications, instead increasing their social vulnerability by weakening their ability to cope with, and respond to, the event (Allen, 2003).

The *E. coli* outbreak resulted in various daily life disruptions, which also contributed to the disruption of services and the status quo. In particular, school closures were mentioned by the following participants:

You had the schools closed. (Participant 13)

My children were not allowed to go to school. (Participant 27)

The schools had closed, you know, sort of the kids were all pulled out of school. (Participant 8)

Our children were younger… We had to send them away because their school was closed, and making sure, of course, that they didn't use tap water when they were home. (Participant 20)

I think schools were actually closed, maybe the Thursday, Friday, Monday, Tuesday… We had [a] staff meeting, but it was still closed. And it was really, "Okay, what do we do?" (Participant 16)

The fact that education leaders were no longer teaching at schools impacted human capital as their labour, functional abilities, and leadership roles were interrupted (Cox and Hamlen, 2015). Human capital was also impacted by the fact that students were not attending school, as it diminished their ability to receive educational knowledge and training was restricted (Cox and Hamlen, 2015). The daily lives of many families in the community were also affected, as they needed to make alternate arrangements for child supervision during what should have been school hours, particularly those with young children.

Daily life was also disrupted by the additional steps and precautions that were required to prevent contact with the contaminated water. The following quotes by participants describe how their home lives were changed to prevent additional *E. coli* contamination:

You couldn't, uh, confidently go have a shower and brush your teeth from the, uh, the water in your taps (Participant 2)

We lived with bags over the taps for [who knows] how long. (Focus Group 3)

You couldn't wash things like lettuce and what have you that had to be washed, so you really had to think about it so that you wouldn't wash it with the tap water because that's the normal thing, you turn on the tap. (Participant 19)

When it was happening, because of the fear, mothers saying to their kids, "Stay away from the water." They would, um, they would cover the taps, tape them shut, nobody was getting a bath. … Especially those people who had children, it was very difficult for them, uh, especially with little ones when they wanted to have a little tub bath. They weren't allowed to do that because they were afraid the child would pick up the washcloth and suck on it. … The other issue was that your water was shut off for three days, as it was chlorinated [but], um, water heaters all broke down after because of the high [chlorine concentrations]. (Participant 5)

You lose your whole balance of this is what, you know, sort of a day ago this was what our safe was… Our norm was sort of turn on the tap and have, you know, wash our dishes and, you know, sort of have a glass of water. … It went right on to, you know, sort of as they were super chlorinating the water and trying to clean out the lines and things like that, um, you know, if you did your wash, I had dark

green towels, for example, they came out white. There was so much chlorine in the water. (Participant 8)

We [couldn't] use the water to wash dishes. … [Instead, we had to] be very careful, um, people's hands, we had to use bleach, a lot. (Participant 16)

The participants described that many of their typical routines at home were affected by the outbreak, especially in regards to their physical capital. They could no longer use tap water to complete simple tasks, such as washing dishes or maintaining their personal hygiene. The participants instead noted that bleach and chlorine were commonly used to disinfect surfaces that may have come into direct contact with the *E. coli*. Such actions, although necessary to take, had an impact on the daily functioning of Walkerton residents with respect to the equipment and materials they required to support their households. In turn, this presented challenges in achieving community resilience at the time of the water contamination outbreak in Walkerton.

E. coli O157:H7, the primary pathogen present in Walkerton's drinking water, is a subgroup of *E. coli* that It is associated with numerous adverse health outcomes, as it produces verotoxins resulting in hemorrhagic colitis (O'Connor 2002a). Symptoms of infected individuals include intestinal disease marked by diarrhea and abdominal pain lasting for approximately four days (O'Connor 2002a). In extreme cases, it can cause hemolytic uremic syndrome (HUS), which can lead to acute kidney failure, anemia, low platelet counts, and death (O'Connor 2002a). Children under the age of five years and seniors are especially vulnerable to HUS. The participants interviewed indicate that because Walkerton is a small community, all individuals were affected directly or indirectly by adverse health effects from the *E. coli* outbreak. This was supported by numerous participants, as described below:

It hit everybody… It affected a lot of people. (Participant 24)

Everybody knew someone who was sick. … So, everyone [was] directly or indirectly affected. (Participant 13)

I know there's a lot of people who were like us too, you know, they got so sick. … My four kids did, plus my son's girlfriend at the time [did]. (Participant 16)

Some were quite minor, but some had been really affected, and some died. Now when you think of other tragedies in the country, it's not a high amount of people compared to other, other tragedies. But it's still a tragedy, you know? I guess the biggest tragedy is the children that were sick and they, all their life, their life has been changed forever. (Participant 19)

There [were] seven that died. … We're all human, and I think, uh, you know, you can't not be affected by [such] difficult things. (Participant 2)

Of course, you had seven families that were immediately affected by the deaths in their families, and they will never get over that. (Participant 14)

When people die, there's an immediacy to that, that, you know, families are involved, neighbours are involved, communities are involved, and when you say it, when you see it on, on a scale of a small community of 5,000 people, you get seven people dying, I mean, you say, "Well, seven people isn't a lot." Yeah, but in a population of 5,000, that's, that's a high percentage. (Participant 23)

A lot of our parishioners were ill. Four of our parishioners died. (Participant 10)

We certainly had staff members that had children who were sick. (Participant 29)

The participants revealed that many of them personally experienced the symptoms associated with the pathogen. It was also found that the seven deaths in the community had a large impact on the lives of Walkerton residents, as this is a large proportion of their relatively small community. Accordingly, these adverse health outcomes affected the human capital of the community in regards to their physical health status, which hindered the individuals' ability to respond to and recover from the impacts of the outbreak.

The large number of community members who were directly impacted by the *E. coli* outbreak required services from the health care sector, placing overwhelming demands on the sector resulting in disruption to services. The high influx of patients experiencing symptoms resulted in overwhelmed medical staff and long wait times at the hospital. The following excerpts support this assertion:

As a physician, uh, there [was] quite a direct effect of, uh, added stress and, uh, added, uh, difficulties. … [There was a] burden of working too hard maybe, you know, and [added] stress and of what's happening. (Participant 2)

I think it was a huge stress on [hospitals], just the numbers. (Participant 6)

> At the time, [hospitals] would have called in extra staff or people had to double shift or something. (Participant 20)

> It was a mess at the hospital. And I don't mean a mess from what the doctors and staff was doing. I don't mean that at all, but when you go in there and go through and see people so sick in the waiting room and, you know, or different areas. And, oh my goodness, what the staff [was] having to [do] ... especially during the first, you know, three weeks or something like that when it was such a crisis situation, when staff was just, you know overwhelmed and needed so much help from other people. (Participant 10)

The participants expressed that medical staff at hospitals were stressed and overwhelmed due to the large number of cases affected by *E. coli* O157:H7 at the time of the outbreak. It resulted in physicians, nurses, and hospital administration having to work around the clock to respond to the outbreak, affecting both human capital with respect heath care workers' functional ability to treat patients, and preparedness capital in terms of medical response capacity. This contributed to the burnout of staff which reduced their ability to respond to the large number of patients seeking treatment at the hospitals.

Lack of Communication and Transparency Two factors contributed to the lack of communication and transparency in the Walkerton community under crisis conditions: withholding of information by Public Utilities Commission (PUC) operators and the Mayor at the time; and, a lack of mental health counselling services available. The Walkerton PUC operators were responsible for managing the community's water facility. O'Connor (2002a) states that the PUC operators "lacked the training and expertise either to identify the vulnerability of Well 5 to surface contamination or to understand the resulting need for continuous chlorine residual and turbidity monitors" (p. 216). In turn, this resulted in the failure to monitor and take daily chlorine residual measurements. Additionally, O'Connor (2002a) argues that the PUC operators misled the local health unit who was investigating the outbreak in Walkerton by assuring them that the water was safe. This contributed to the lack of communication in the community, as the PUC operators failed to disclose the adverse results of the community's water quality status. This is described by several participants below:

> [We] had been completely lied to by [our] water workers. … There was reassurance from the, uh, Public Utilities Commissioners … that the water was fine. And, of

course, what made it even worse is if you even look at the samples, he had mislabeled the samples. (Participant 13)

I think that's one thing we couldn't understand: why it took so long, and I think that's why people were really hurt. … We should've been told. That whole cover-up. People were getting sick, like we found out Monday, [but] people were getting sick the week before, like the Monday or Tuesday after Mother's Day. … I think a lot could've been [prevented]. (Participant 16)

Things can go bad. When they do, own up to it and make it right. Make it not get worse. Then at the end, people are dying, dying, dying. "Okay, you caught me. Okay." It's like, "Ahh, you had your chance." … The biggest thing was when they had [the new chlorinator], soon as they had it, if they would've said, "You know what, we never installed the chlorinator. We got the bad results. Guys don't drink the water." That would've saved so much, but to go, "No, the water's fine. It's good." And that's what they did, ... that's what made everyone mad 'cause the other stuff can happen, you know, "We should've did it." You didn't you dummies. You should've done it, but, you know, it wouldn't have been near as bad, but that made it awful. (Participant 28)

The participants describe being hurt when the PUC workers failed to admit their errors, as numerous resulting illnesses and several deaths may have been prevented. Instead, the operators reassured them that the water was safe. This severely diminished the political capital in the community by reducing the trust, transparency, accountability, and reliability of the PUC operators (Cox and Hamlen, 2015). The lack of communication and transparency also impacted the community's human capital, as their overall health status was diminished due to the overwhelming number of preventable illnesses and deaths that occurred.

Information was also withheld from the community by the Mayor at the time, and was expressed by multiple participants as follows:

Who knows what happened in the closed-door meeting between the Premier and the Mayor. (Participant 13)

I don't think [the Mayor] did a great job with that. In terms of, getting the word out, getting the facts out. That was, I think, one of the single biggest problems that we had. … I really do believe human beings; most human beings can handle almost anything if they're given the truth. You may not like it but at least you know what's going on. The communication was not clear, and the left hand did not know what the right hand was doing. The, the powers to be should have stepped in and recognized that this was completely out of control and the people that were in

control of the water really weren't in control of it and they've got to do something (Participant 29)

Like the initial, the initial four, five, six days before the public announcement that this was *E. coli* and it can kill you, ... the Municipal Council should have come out at least three to five days earlier or two days, whatever, before and said, "Folks, don't drink the water out of your tap." And that did not happen in enough time. It was, it was slowly done. (Participant 23)

The Mayor certainly didn't, but should have, absolutely should have responded immediately. … I mean, this [was] a crisis that [was] happening. ... Don't sit back and wonder "Is this really a crisis, or isn't it? What's happening? Should I…" You know, and your job [was] to be here for this community and, you know, some of his councillors were calling for this and trying to respond and here the Mayor [wasn't]. So, um, you know, so that he was, you know, certainly criticized for that. … [His response] should have been immediate and be available for people and, you know, and what's going on and what's happening. (Participant 10)

I can't even remember who was the Mayor at the time … But I can't remember him taking on a role where he actually do [anything]. (Participant 16)

Like, behind those closed doors, who knows? You know, did they know weeks before like some people say? (Participant 18)

There was a poor chain of um, you know sort of communication … There [were] no notices on our door [from the Municipality], there [was] nothing to tell us that "don't drink the water, throw out everything in your fridge, you know, ice cubes." All that sort of stuff. (Participant 8)

The participants felt that the Mayor at the time of the outbreak did not fulfill his due diligence in openly communicating what was happening. Several individuals note that he was neither transparent nor effective in leading the community, which significantly reduced the political capital in Walkerton. Instead, community members found it difficult to trust their Mayor, as many of his meetings were held behind closed-doors.

During a disaster, it is vital for leadership to emerge to help facilitate the recovery process in the community; oftentimes this involves pre-existing people in power to step up, so the community does not need to wait for new leadership to emerge. However, in the context of the *E. coli* outbreak in Walkerton, the Mayor and local Council did not lead the community successfully, as they failed to be transparent, accountable, and trustworthy.

Collectively, this challenged the resilience of the community to respond to, and recover from, the effects of the outbreak.

Also contributing to the lack of communication and transparency was the fact that many individuals were unable to access the mental health services they required. This is supported by the following excerpts:

> Yeah, like I don't remember, I don't remember when my daughter was in the hospital, anyone coming to me and saying, you know, "Are you gonna crack?" Kind of thing, right? (laughs) (Participant 18)

> Oh, I wouldn't think so. I wouldn't have heard or seen anything about that. … The idea of mental health counseling was almost non-existent. (Participant 20)

> I phoned the Ministry of something or other, and I said, "My concern is, summer's coming on. With what's going on in town, there's gonna be great heat, great ammonia, great alcohol, and I think there should be counselling up for the area." I never heard back from them. [A] huge concern of mine [was] that there was gonna be abuse in the families, because there were people that were laid off. People weren't working. They're stinking. They had frustrations of going through everything. They're really frustrated, and throw alcohol in. Isn't a good, isn't a good mixture. (Participant 3)

> Yeah, there was obviously people that were requiring counselling, but I can't remember if there was a public notice saying that … counselling is available. Whether or not there was anything at that time, I don't know. (Participant 5)

Some participants felt that counselling would have facilitated the recovery process from the implications of the outbreak by providing a space for people to communicate and express their thoughts. However, participants do not recall the presence of such services being made available to them at that time. This inaction failed to acknowledge the mental health status of community members, which is a vital component of strengthening their human capital. This may have hindered the community's collective capacity in adapting to any changes in their social, economic, or environmental conditions (Bahadur et al., 2010; Frankenberger et al., 2013).

Fear of the Unknown Several factors caused members of the Walkerton community to feel fearful at the time of the outbreak, including a lack of information surrounding *E. coli* O157:H7, the sound of helicopters, and the negative stigma that existed. Residents did not understand what was happening in the early days of the crisis due to the lack of information

made available to them. This is evidenced by the descriptions provided by the study participants:

> People didn't know why they were getting sick. … There was something, but nobody really knew [whether] it was a stomach flu going through town [or what]. (Participant 3)

> Nobody really knew what was all going on. … Even when you went to [the drug store], they were wearing masks. And everybody was wearing gloves and that kind of thing when this had happened. 'Cause see, they didn't know how this was really spreading and they didn't really know what was all going on. (Participant 1)

> It scared everybody because, um, you know, it was sort of "who was next?" So, you know, sort of, [like] fear of the unknown. So, you know, "How long is it going to take for me to come down with this?" Or, you know, "Will this ever go away?" (Participant 8)

These statements demonstrate that community members knew a pathogen was being transmitted around the community, but they were not certain exactly what it was. The withholding of information by PUC operators and the Mayor resulted in warranted fears that they or their family members may become infected; they did not know what actions to take to prevent infection or what the consequences of becoming infected might be. Due to their lack of understanding surrounding *E. coli* O157:H7, the community's collective human capital was reduced. Residents initially felt ill-equipped to respond when the fact that the community's drinking water was contaminated by *E. coli* O157:H7 finally did become public information. Many participants expressed a lack of knowledge surrounding *E. coli*, as demonstrated by the following quotes:

> It was not general knowledge like today [regarding] *E. coli*. Like back then that was a foreign word, and we didn't know what it was. … Are we gonna get it just by talking to somebody? Is it contagious like the flu? In the air? Or if you touch them? You shake their hand? … It was more just the not knowing, what is this? Is this a contagious, you know, disease? … From what I was getting, it was get the hell away from here if you could. Especially young people and old people should get out of here. (Participant 7)

> [*E. coli*] was something no one knew what it was about. (Participant 19)

Due to the lack of knowledge about *E. coli*, individuals were also fearful of the future implications for those infected. For example, participants commented:

[There was a lot of] fear and anxiety [about] "What's gonna happen in the future?" (Participant 2)

As far as anybody who, um, who actually had ingested the water at the time, it was an issue of greater concern about the children, and even though they didn't become sort of seriously ill, they were very concerned about the, um, the future with their children. (Participant 5)

It is evident that, at the onset of the outbreak, many residents were fearful of the pathogen as they lacked an understanding of how *E. coli* is transmitted, how long symptoms last, and future implications. This resulted in community members initially not having the human capital to respond to the outbreak making them more feel fearful and vulnerable to the event.

The sound of helicopters also caused community members to feel fearful, as individuals who were taken by air ambulance to external hospitals were in critical condition. This issue was shared by multiple participants:

It's because you just heard them going off to the hospital, and I heard that ambulance leaving, like, multiple times a day. And you knew anybody who was going by air ambulance could not be in good shape. (Participant 20)

[There was] a terrifying noise because the helicopter coming and going to the hospital was an indication of who's dying next. … That was probably one of the most, um, devastating, uh, components of it: is the roar of the helicopter. … It was just something that set you on edge because you could hear it coming at quite a distance. … It was the fear, it was the irritation, and, uh, unknown because you knew of a number that were dying because of it, and, uh, you were wondering who [was] next going to be taken out. (Participant 22)

Ten days in, my [spouse] and I were talking about it, saying "Well, they're kind of saying it should be okay now. If you haven't gotten sick, you're not going to." So, we, uh, talked to the neighbours across the street, my [child]'s best friend, it was their child, and said, "Um, can [they] come over and play for an afternoon to give [them] that little, I call it "an island of normalcy in a sea of disease" sort of thing?" And the kids had a great time. Next afternoon, I'm standing in the backyard and my [child] is crying [their] heart out, because [they're] looking up and watching the air ambulance lift off with the same little [child] that was playing in our backyard. And [they said], "Is he going to die?" Well, what do you say to [your children]? You can't say "No, [they're] going to be just fine. [They're] just going for a helicopter ride." I, I, you know, I, I was just brought to my knees. (Participant 13)

These quotes capture the intense fear that individuals felt at the time of the outbreak in regards to the sound of the helicopter. Participants expressed that only people in need of immediate assistance (e.g. those in critical condition) were taken by air ambulance. Accordingly, the roaring sound of the helicopter intensified the vulnerability and fear felt by community members during that time, hindering their capacity to respond to, and recover from, the implications of the outbreak.

People external to the community were also fearful of the *E. coli* outbreak as they did not want to become affected by it, which resulted in the negative stigmatization of Walkerton. Multiple participants shared this perspective:

> The perception of outsiders of the people of Walkerton, … we were almost a pariah type of thing. … [People] from outside the community were afraid of Walkerton people. They were afraid to touch us. … They had this fear that we were contagious, that, that, that the *E. coli* would spread just from breathing the same air or touching us. … People avoided us like the plague, you know, they would drive around Walkerton instead of driving through Walkerton even. … They didn't even have any intentions of getting out of the car. (Participant 14)

> There were people afraid to come. … As a whole community, we're being, you know, known around the world in a negative way. Um, how do we respond to that? How do we improve our image around the world? Um, we don't want to be known only as the community in Ontario that had people die and get sick because of *E. coli*. (Participant 10)

> There were hockey teams that would not come to town to play. Because they were, we're talking minor, minor hockey kids. … Parents were afraid that the kids would fall on the ice and some of the frost ice would get in to their mouths. They refused to come and play here. They shut down tournaments because of that. … [It] had a huge negative response as far as people accessing the community. Our hotels, um, motels, um, where people would, instead of staying in Walkerton motel, they would stay as far away as maybe Durham, Hanover, you know stay on the outside in the periphery. (Participant 5)

The fact that people external to the Walkerton community avoided Walkerton altogether reduced the community's ability to seek external resources from surrounding communities, which could have facilitated a faster response and recovery from the implications of the outbreak. This ultimately diminished the bridging social capital of the Walkerton community (Aldrich, 2012).

4.2.2 – Facilitators to Community Resilience Under Crisis Conditions

Over the course of the interviews and focus groups, three major themes emerged as facilitators and enablers to achieving community resilience at the time of the water contamination outbreak in Walkerton, each with several subthemes (Table 4.2).

Table 4.2: Themes and Subthemes Facilitating Community Resilience Under Crisis Conditions

Major Theme	Subtheme
Community Support and Spirit	• Shared identity • Members helping one another • Internal champions • Participation in events
Improved Accountability, Regulations, and Infrastructure	• The Walkerton Inquiry • Third-party operator hired • Walkerton Clean Water Centre constructed • Infrastructure upgraded
Adaptability	• Remaining optimistic • Successfully modifying behaviours • Time

Community Support and Spirit A number of elements enhanced community support and spirit in Walkerton under crisis conditions, including a shared identity among residents, members helping one another, internal champions emerging as leaders, and participation in events. A shared identity allows individuals from different backgrounds to have a sense of belonging to a group. There are various cultural, ethnic, and religious backgrounds prevalent in Walkerton; however, these differences were ignored at the time of the outbreak, during which all residents were collectively recognized as victims of the tragedy. This perspective was supported by several interviewees:

> We [were] all in the same boat. Like, we were all experiencing the same things. (Participant 16)

> One thing that the crisis brought was this community back together that we had a common goal that we were going to work through. … It wasn't that they were a stranger anymore. We all had something in common. (Participant 3)

> We all suffered together. We didn't know what was going on, but we protected each other. … We all became one big family. … It was just the Walkerton community. (Participant 4)

> We [were] all sharing this because we [were] all going through this together and, you know, everybody knows somebody that has somebody that's been affected by it. … We shared an identity. (Participant 8)

> I feel like since everybody had the same experiences, we all kind of went through it together, so that was definitely, it helped to be living like amongst the network of everyone who's experienced the same thing. … I feel like everybody kind of went through it and dealt with it the same way. (Participant 9)

These passages exemplify that all community members were experiencing the crisis together by looking beyond their explicit differences and recognizing themselves as a collective unit: the Walkerton community. This ultimately strengthened their social capital, as residents shared a local civic identity that promoted collective action and cooperation for mutual benefit (Akamani, 2012; Frankenberger et al., 2013).

This shared identity motivated the community members to help one another in responding to and recovering from the implications of the outbreak, thereby strengthening community support and spirit. This was described by many participants:

> People you didn't know cared about you, and they cared about the situation, and they cared about your families. There was certainly a lot of community and social support. Not only from your family and friends, but people that you didn't know. (Participant 18)

> There was a lot of that going on at that time; people helping people out. They knew where to call that they could get some help. … That [was] where the community really came together in a short time. (Participant 19)

> I think people were quite willing to do whatever they had to do to help everybody because we just had so many people who were sick, like, not even the ones who just went to the hospital. … I think what happens is, in a crisis situation, everybody steps up. … They definitely go over and above. (Participant 20)

> There was a commonality of, of event and cause for the community. So, I may have known my next-door neighbour or the two down the doors or right across the street or the one on the next block, and I mean I've known them to say "hi," you know. Once we experienced the water situation, we no longer just called each other by name, we said, "How you doing? Can we help you?" (Participant 23)

[There was a lot of] looking after one another, you know, kind of "I got your back" type of thing. So that definitely [was] alive and well here for sure, and, uh, you know, it just, you know, even people that may have otherwise been in conflict, you know, in crisis, they kind of set the things aside. (Participant 27)

These responses indicate that community support was extremely evident at the time of the outbreak. This support was provided by various formal and informal, stable and ad hoc relationships among community members. This included families, friends, neighbours, religious groups, community service organizations, and voluntary associations. Enhancing their social capital facilitated community members' ability to collectively respond to and recover from the water contamination crisis, as people could rely on others for assistance when needed.

As mentioned, several participants expressed that all service clubs took on a proactive role to ensure the needs of community members were met. Participants noted that:

All of the [service club] groups were strong during the crisis. (Participant 24)

Service clubs [were] instrumental in the distribution of water, um, fundraising, that sort of thing, um, assisting families that, um, had been, you know, in economically displaced, in some places delivering meals, in some cases, uh, assisting with transportation to, um, medical treatments outside the community, that sort of thing. (Participant 13)

The service clubs worked very hard. … [They] were part of the community that did what they could do at the time of the [outbreak]. (Participant 19)

I don't think there was a service group that didn't help out at the time. I think they were all involved. … I would say they all pitched in. (Participant 22)

Another group that was very instrumental in helping this community was the kinsmen. They set up a fund. … and did a hell of a job. I mean they were a force. … [They] were a huge, huge moral booster to give the comfort to people. (Participant 3)

These perceptions acknowledge the significant role that service clubs played in helping the community recover. They supported Walkerton residents by fundraising money, driving them to the hospital, and delivering resources to those who required it. Their presence played a vital role in mobilizing community members to respond and return to their pre-disaster state (Chamlee-Wright and Sorr, 2011; Frankenberger et al., 2013).

Religious organizations were another group that facilitated the Walkerton community to achieve resiliency at the time of the outbreak through their contributions to community spirit. A number of participants stated that Walkerton had a strong faith community, in which all faith-based organizations came together despite their different belief systems. The following quotes support this:

> [At] the start of the Inquiry, [there was] sort of an ecumenical, uh, prayer service, and, um, the Pentecostal Minister said, "Let's use the Catholic Church, because it's bigger." And you, you know, that's, that's crossing a whole lot of lines for those people [to support] a common cause, and, and really at that point, no one was going to argue about your specific faith, journey, and, and belief system. (Participant 13)

> Very soon after the crisis broke out, so this must have come together fast, just in prayer for people ... [It brought] people together of different denominations and, and no denomination if they, you know, they didn't have to be a member of any denomination to come and be a part of those prayer services that recognizes people that were hurting and so on. (Participant 10)

> It really didn't matter what church you went to, y'all just helped each other. I know at the time, we had a very, very strong ministerial, which was basically a gathering by all of the churches, and they all worked together all the time. … The faith community in Walkerton was very strong in helping people cope. (Participant 20)

> The clergy, I would think helped, especially through when they were, having their church services. (Participant 5)

Interviewees indicate that all faith-based organizations, regardless of the denomination, provided spiritual support to assist individuals in facilitating their disaster management response. They helped seek closure to people who may have lost a loved one, gave courage to those who needed to move on, and offered a helping hand to those seeking aid. Religious groups strengthened the networks of civic engagement that existed in the community, which in turn enabled community members to recover from the repercussions of the *E. coli* outbreak.

Multiple internal champions, or local leaders, emerged at the time of the outbreak. Their work to facilitate community recovery made a significant contribution to community spirit and therefore played a key role in facilitating community resilience. Many of these individuals held pre-existing leadership positions (e.g. school principal, service club members) and therefore had strong connections both within the community and externally.

These internal champions were instrumental in gathering resources, organizing events, and ultimately ensuring their voices were heard by those in power. This was echoed by many individuals:

> We had a few people who did come forward. (Participant 16)

> Some people like to be involved more than others in the community, doing things, and, you know, making the community a better place to live. (Participant 15)

> There [was] a bunch of people working in behind trying to make things happen and get things cleaned up and uh, a lot of people didn't realize how hard some people work to keep things going. (Participant 26)

> I think there were people in the community who have always been used to leadership roles, [whether] they are teachers, political people, chair people of organizations, clubs, [that] kind of stuff. (Participant 23)

> I aligned myself with some pretty strong people to do things, uh, that instead, there's a lot of times you sit there and say, "Well, we should do this, we should have this." We were then at a position, "We should do this." And then we could do it, like even if it cost us a bit of money ourselves. (Participant 3)

In one capacity, local leaders enhanced the preparedness capital of the community, as they actively sought to prepare, manage, and maintain a response and recovery plan. They indicated specific actions that were to be taken to facilitate the community's ability to recover. As well, the internal champions who emerged were positively perceived by residents, as they were transparent, reliable, and resourceful. This ultimately helped rebuild the previously fractured trust in the local Council, as these internal champions held Council accountable at the time of the outbreak.

Various community events were organized that contributed to community spirit thereby facilitating the recovery process. The two largest events were Watershed and a Blue Jays bus trip to Toronto. Each of these events collectively strengthened the cultural capital in the community as they drew numerous community members together.

Watershed was a music festival that drew over 14,000 people to raise money for the community, and to uplift community spirit to facilitate the recovery process. Several famous artists performed at the event, including the Barenaked Ladies, Jann Arden, and

Keith Urban. Study participants recognized the benefits of this event through the following statements:

> It [took] people's mind off the fear and [got] people [from] the community, [got] them into a more normal life situation. … I think something more, something like that Watershed had more impact as far as individually, um, like, if you, if you [were] there, and you [would] say, "Wow. This is what's going on." It [hit] you. It [hit] the individual. … That [was] the question culturally, you know, and these cultural things tend to hit, uh, emotions. (Participants 24 and 25)

> [It] kind of give them something rather than the gloom and doom. … That, to me, that helped, you know? And the reason for doing it is to lift people's spirits. It's a fun day, you know, come and enjoy it. (Participant 15)

> I thought it was great 'cause everyone was getting together. We had concerts. And, uh, I thought that it, it definitely helps the local culture. I think at that point of time, everybody just kind of wanted to move on and forget about what they could (laughs) but, um, yeah. I thought that it was a positive effect on the community. (Participant 9)

The Blue Jays trip to Toronto was organized by an internal champion who played a key role in rebuilding the community's resilience post-outbreak. This individual organized numerous buses to transport residents from Walkerton to Georgetown where they took the regional public transit system into Toronto to watch a Blue Jay's game at the Rogers Centre (known as SkyDome at the time). All were welcome, and attendees received free tickets to the game. Approximately 2500 community members participated in this event. Many study participants attended the event and spoke positively about it:

> The Blue Jays bus trip really brought people together. (Participant 19)

> There was thousands and thousands of people there [at] the Blue Jays game. … I think absolutely [that event was] great for the community. (Participant 18)

> I think the day going to the Blue Jays was good for everyone that went, because it kind, they kind of were away from Walkerton and they got to see something, they [were] outside, you know, everything that makes it great. (Participant 26)

> This was, was a huge emotional uplift, cause and spin, on a tragedy that, uh, and it's not to forget the negative stuff or absolve the blame or anything like that, but for the community itself, … but people that wouldn't normally see each other on a bus, you know, they all got on school buses and they all got on the GO Train together and you had all kinds of, you know, young families and older families and people together that were all part of this big group. …That was real example to me

of, uh, how we can build each other up. … It was sort of a great kind of, uh, a positive spin on things in a community feel and, um, showing, uh, everybody that we can still enjoy ourselves. We can still carry on. (Participant 2)

I think it was just to have a break and be away from, from all of this stuff that was going on here. And then, and doing it as a community event road trip kind of thing, as opposed to, you know, people just trying to get away on their own. I think the fact that it was done for everybody that they could go if they chose to or not, I think probably made you feel good as a community as a whole because it's like here I am with all of these people from my own town and we're all going together. … It [gave] people a purpose to get their mind off stuff for a while. (Participant 20)

Culturally, yeah, it was, it was a big plus. (Participant 4)

Improved Accountability, Regulations, and Infrastructure Various external responses to the outbreak improved accountability, regulations, and infrastructure in Walkerton, and indeed throughout Ontario. These responses include: the Walkerton Inquiry; hiring of a third-party operator; formation of the Walkerton Clean Water Centre (WCWC); and, upgrades to physical infrastructure in the community.

In response to the *E. coli* outbreak in Walkerton, the Ontario government conducted a public inquiry, led by the Honourable Dennis O'Connor, to identify the causes of the event (Part 1), and to propose recommendations pertaining to drinking water safety in the province (Part 2). Many participants recalled the significance of the Inquiry in helping their community find answers to the outbreak with respect to who was at fault and what changes needed to be made. In particular, interviewees shared the following perspectives highlighting Justice O'Connor's excellent work:

I think the single biggest thing in my mind, in terms of the external force, was the Inquiry, uh, where we got those answers and we had someone who restored the confidence. (Participant 13)

Dennis O'Connor [was] wonderful, for sure. And I think he did some good work. … [The Walkerton Inquiry] probably helped the community more in a symbolic way. … People were forced to have to explain themselves and I think that was, I think that was helpful. (Participant 29)

I think the, the Inquiry helped a lot of people. It helped them because I think that was a, what am I gonna say, an outlet to vent or share. … And O'Connor was super. (Participant 15)

I think [the Inquiry was] positive because people like answers. … So, to have [Justice Dennis O'Connor] physically be in the community and talk to people, I do think that's important. … He made the trek here, and he made himself visible to the community. I think that's important. And takes a bit of ownership, right, you know and, like, "I'm on it, let's make this right, let's figure out what happened." (Participant 18)

Part 1 of the Walkerton Inquiry facilitated the community in achieving resiliency on many levels. First, it enhanced human capital, as Justice O'Connor provided knowledge regarding the factors that collectively contributed to the outbreak. Second, Justice O'Connor's presence in the community enabled the linking of social capital, as it provided residents with the opportunity to form a relationship with an outside person in a position of authority (Aldrich, 2012). This contributed to community resilience as it enabled the Walkerton community to receive external resources and information that they would have otherwise been unable to attain.

As previously mentioned, Part 2 of the Inquiry produced recommendations for improving drinking water safety in the Province of Ontario. Participants supported the strict regulations proposed by Justice O'Connor to prevent future water contamination events both in Walkerton and throughout the rest of Ontario. For instance, interviewees noted that:

Source water protection and nutrient management plans were all really intensified by the province. (Participant 6)

Since all this has happened all over the province, like source water protection is a way bigger deal now. … Like, it's better to protect your water before it's contaminated than try to treat all of that out of it later. (Participant 9)

The town understood that [the Inquiry] had to be done. … They recognized that it was an excellent choice the province had, the, the, the gentleman who came in and did the job. He was, as I said, very well respected. His report was very well received. There was no criticism of the things that he said in there. We, we accepted them. We recognized that there were, there were these problems, and, uh, and hopefully the province recognized their weaknesses because that's where a lot of the onus was. … The changes had to be made more so on that level than on the local level. And, of course, the, the local level changes were changes that had to be made in every small community across the province, not just in Walkerton. (Participant 14)

I think that through that [the Walkerton Inquiry], um, rules and regulations across province changed. Provincial regulations of water systems changed substantially so

a lot of the things that existed that allowed this to happen, um, are much more difficult. … The province is, uh, better equipped now. (Participant 24)

There's no grandfathering as there was with the Koebel boys. Now everybody has to come to Walkerton to be trained to be able to handle water. (Participant 4)

Thus, the Inquiry's third contribution to community resilience was through enhancing the preparedness capital. The new rules and regulations proposed by Justice O'Connor encompass a five step multi-barrier approach to protecting drinking water supplies: source protection, treatment, distribution system, monitoring programs, and response to adverse conditions (Hrudey et al., 2002; O'Connor, 2002b). This provides a strategy for managing and maintaining safe drinking water. The regulations also ensure that PUC operators have the necessary training to effectively manage drinking water systems, which also enhances the human capital of operators. Additionally, water testing labs must now be accredited, and there is a designated reporting structure for negative results.

Finally, the mandatory source water protection plans proposed by Justice O'Connor require the development of strategies to manage, protect, and maintain source water quality for the community, which promotes natural capital.

The hiring of a third-party PUC operator to manage Walkerton's water contributed to community resilience at the time of crisis by helping the community to regain trust and confidence in their drinking water system. The fact that the PUC workers, who failed to treat the water adequately and notify proper authorities of the contamination, were members of their own community caused the community to lose trust in the municipal government's ability to manage the local water system. Accordingly, the community's municipal government decided to hire an external company to take over during the crisis to re-establish confidence in the public drinking water system, community leaders, and the municipal government. Participants support this by indicating that:

After the crisis, … we immediately went to a third-party to operate the water system. Um, so we didn't get back to having our own water system operator. … There [was] a little bit of redundancy there, but we thought that the community certainly, um, wasn't ready to accept its own water system operator. So, we wanted to have a little bit of arms-length to give everybody a little bit of extra comfort

factor. … A little bit of redundancy but, uh, it was a transition that the community was going through. (Participant 24)

New people were hired. A, uh, professional company was brought in to administer our, our system. It was taken out of the hands of local people. (Participant 14)

By hiring a third party to operate the community's drinking water system, Walkerton residents were empowered to strengthen political capital by improving their confidence, trust, and reliance in the municipal government.

The WCWC was established in 2004 as an operational service agency of the provincial government in response to the Justice O'Connor's recommendation. This centre "is responsible for delivering education, information and advice on water treatment, equipment, technology and operational requirements and environmental issues related to drinking water" (WCWC, 2011). Participants shared that the construction of the WCWC promoted a positive perspective on an otherwise negative event. It helped to change the general public perception of Walkerton from one of incompetence with respect to water management, to that of an emerging water leader. This is evidenced by the following participant comments:

> The good part that has come out of [the outbreak], and thanks to those people who quickly saw the, um, opportunity there for having water training, proper, proper water training, you know, has resulted in the water, the water, the Clean Water Centre being here, which is good for our community. … Because people come from many areas to train here … or the training centres go out, you know, they send people out to other areas to train people on water quality and, and water management. … I think that's the big, big positive that has come out of this is the Walkerton Clean Water Centre and what it can do for other communities, not just our own. (Participant 10)

> We have the Water Centre here in town now, which is, uh, a training facility for the entire province even beyond the, the limitations of the province of Ontario. I know that there are people who come in there to take courses to bring essential water services in smaller communities up to the standards that they, they should be at so that there isn't another water disaster. (Participant 14)

> I think them putting [the centre] here was definitely a good decision because this is, this is ground zero, this is where it happened. And a lot of our trainees will be like, "Oh, Walkerton is so far away. We can never get there." But, like, there is a purpose and there is a reason we're here. And I'm really glad they decided to build, build it here. (Participant 9)

The construction of the WCWC strengthened the human capital of the community. It increased the collective skills, knowledge, educational attainment, labour, training, competency, functional ability, and leadership of community members to successfully secure safe drinking water in their community (Akamani, 2012; Cox and Hamlen, 2015; Frankenberger et al., 2013).

E. coli contaminated a lot of the physical infrastructure in the community at the time of the outbreak, such as public and private water and sewer lines (i.e. inside and outside of homes). Accordingly, such infrastructure was replaced to prevent future contamination. This strengthened the physical capital, and therefore resiliency, of the Walkerton community as there were many infrastructural upgrades made to protect the community from similar events occurring in the future. This was acknowledged by various participants:

> There were a lot of positive things going at that time, a couple years afterwards, the fixing of the water lines, and the sewers, and the streets were torn up. (Participant 24)

> [There were] repairs or renovations that needed to be made to our water system, for example. Like a lot of the older pipes had to be dug up and replaced because they were contaminated. … A lot of money that came from the province, which, in retrospect, helped this community rebuild its infrastructure that, on our own, would have taken us decades to, to, to bring along these systems up to date, so we got a bit of a head start there, unfortunately because of the disaster. (Participant 14)

> They dug up every, like, everybody got a new shower head, a new line into the house, … and put, you know, new sewers [in]. (Participant 4)

> One of the good things that came out of this, as far as I'm concerned, is that, um, the infrastructure had to be because of the crisis. The infrastructure as far as replacing the water lines and water, um, and the cleaning of all the water pipes. All that was done because of the crisis in order to carry on properly to get the water back up and running and down. (Participant 5)

> They definitely made a lot of updates, um, to the water system, the underground infrastructure. Obviously, the distribution system, most of it was ripped out and re-put in because everything was contaminated. (Participant 9)

Adaptability Several factors helped Walkerton residents to adapt to, and recover from, the *E. coli* outbreak to achieve resilience shortly following the event. These factors include:

remaining optimistic; ability to rebound from any major implications; and, time. Adaptability contributes to community resiliency through adaptive capacity, which is the ability to modify or change an existing structure, function, or identity in a positive way (Brooks, 2003; Frankenberger et al., 2013). In particular, the community collectively remained flexible and resourceful in responding to and recovering from the *E. coli* crisis.

Many participants recognized that they had to accept, adapt, and make changes to facilitate their respective recovery processes. This is evident as participants said:

> I think [we learned] to move on from [the outbreak implications], accept and move on. … [We accepted] the things [we couldn't] do anything about. (Participant 27)

> We [adapted] because we had to. We had no choice. You, you have to roll with the punches. Whatever cards you're dealt with, you have to learn to, to cope with it. (Participant 14)

> I think it made it, I think it made it stronger. [We] had, [we] had to rebound, you know, it wasn't an option. (Participant 18)

A vital factor that strengthened the community's collective ability to accept, adapt and make changes was to remain optimistic. This encouraged individuals to be positive and maintain a constructive mindset that facilitated recovery from the repercussions of the outbreak. Over time, several individuals recognized that positivity promoted the capacity to respond to and recover from the *E. coli* outbreak:

> Pretty soon, we went, "Well wait a minute, we're not all gonna die here." And then we started really kicking in and we started pushing back. (Participant 4)

> From my perspective, the "we can rise above this" feeling very much, sort of, dominated. (Participant 2)

As previously discussed, a number of services and sectors in the community were disrupted at the time of the outbreak. Accordingly, many changes made to these areas to facilitate their progression. One participant noted that schools were initially closed to prevent the transmission of the outbreak. However, once it was established that *E. coli* O157:H7 was the primary pathogen (i.e. transmission was waterborne), schools began running again at an alternate location (with safe water):

> Schools were still closed. We had a staff meeting, but it was still closed. And it was really "Okay, what do we do?" … Well, we carried on. … So, what we did was we

> had classes in, um, the Knights of Columbus Hall, which is between Hanover and Walkerton. … I don't think the kids came every day … We couldn't fit them all in. … And I remember having exams, but what happens is, a lot of kids, uh, kind of rely on that exam to get the credit, you know? … But, uh, so, for the school, that's what we did. We tried, I think we just tried to go with the flow. (Participant 8)

This comment expressed the idea that students needed access to their education to facilitate recovery. As it was not safe to hold classes in the school with contaminated water lines, school officials agreed to hold classes at the Knights of Columbus Hall, which was not connected to the contaminated pipelines. This is one example of how the community was able to modify its existing structure to maintain function and routine at the time of the outbreak.

Another participant shared that the local health unit ordered restaurant owners to remove anything that had, or may have, come into direct contact with *E. coli* in order to continue running their businesses. Restaurant owners acknowledged that additional steps were needed to keep their businesses operational, and willingly modified any actions that would have normally used tap water. For example, restaurants used plastic cutlery as they were unable to use water to wash dishes. The ability to modify their behaviours enabled restaurant owners to strengthen their adaptive capacity and keep their businesses operating.

> Everything in [the restaurant] had to be washed down with bleach. [Public health] wanted, um, everything, um, and anything, um, that was gonna have any kind of contact with water had to be covered up, even with a box or something like that. … [We] couldn't even use the dishwasher so, you know, [we] had to have bottled water for that. So, we used plastic plates and plastic forks and stuff like that. (Participant 1)

The health care sector also needed to adapt in their response to the *E. coli* outbreak. In particular, the incident resulted in a large increase in the typical number of patients seeking medical attention, and medical staff became overwhelmed and unable to keep up with the large influx of patients. This was managed by both obtaining additional assistance from external medical staff and sending patients to external hospitals, namely in London and Owen Sound, for treatment. Further, the lack of availability of safe water in the Walkerton hospital affected the ability of medical staff to provide some services in Walkerton:

There was things that, that [we] had to adjust to … within our own community, uh, we had dedicated and flexible, um, physicians that were willing to sort of do extra work or be called in at, uh, more often, um, and to deal individually with the extra burden they had within all of their own practices at the same time. … We [also] had to shut down the water in the hospital and so, we had to do our [birth] deliveries in Hanover. … You [had] to be flexible and be able to adjust. (Participant 2)

Individual households made many changes to adapt to the implications of the *E. coli* crisis. Since the tap water was contaminated, residents either boiled their water or used an alternate source(s) of water were necessary to complete household routines safely:

[We] didn't use the [tap] water to wash [our] vegetables or to make [our] coffee or anything like that for, for quite a while. (Participant 14)

Making [food] was a pain. It really was. It was all boiled water, and you had to boil it for so long. (Participant 3)

Most people depended on bottled water for [cooking] through that time period. (Participant 10)

I think everyone in town received [a] water cooler. (Participant 18)

We found out, like, how we could use the water, um, that we really couldn't use it to wash dishes or whatever, um, and then what we, we could actually have showers. Um, we just had to be very, you know, be very careful. Um, people's hands, we had to use bleach a lot. … After you had your shower, you had to, uh, wash your hands using this jug of water or whatever. (Participant 8)

Time also contributed to adaptability thereby facilitating the Walkerton community to adapt and recover from the outbreak, ultimately increasing community resiliency. The passage of time enabled individuals to progressively change the existing structure, function, and/or identity as required. This perspective was supported by multiple participants:

How do people recover? ... I think it, it's just time. That's my perception, you know, and I've done it myself. I mean [I've] lived through some of the goods and the bads and, you know, maybe the next day or the next couple days, you know, if it's a disaster, it really sucks [but], you know, but time heals and you move on. And I think that's life. … It [just] takes time, and some families will move on quicker, and others take a few years, you know? (Participant 15)

As time passes, you know, it kinda heals those wounds. (Participant 18)

I think you get where time passes ... I think eventually people just went back to their normal lives, however that normal was. Whether it was absolutely nothing changed or whether they made, you know, the different changes in order to accommodate whatever they personally experienced. (Participant 20)

4.2.3 – Factors both Facilitating and Hindering Community Resilience Under Crisis Conditions

Cox (2015) argues that a community can experience both resilience and vulnerability simultaneously, in which neither concept is absolute. Accordingly, there are multiple factors that acted as both facilitator and barrier to achieving community resilience at the time of the *E. coli* outbreak in Walkerton. Table 4.3 outlines the major themes and subthemes that emerged from the interviews and focus groups in this work.

Table 4.3: Facilitator and Barrier Themes Contributing to Community Resilience Under Crisis Conditions

Major Theme	Positive Subtheme	Negative Subtheme
Government Assistance	• Financial assistance • Façade program • Publicly funded health care system	• Irrational ideas by government consultants • Negative perceptions of the Walkerton Compensation Plan
External Communities	• Resources provided	• Backlash experienced
External Media	• Brought attention	• Interrupted daily lives • Misrepresented
Anger	• Concerned Walkerton Citizens	• Negative perceptions
Rural Community Characteristics	• Close relationships	• Scarce resources

Government Assistance The Walkerton community relied on government assistance from both the provincial and federal levels. On the one hand, financial assistance, the creation of a façade program, and a publicly funded health care system enhanced the ability of residents to collectively recover at the time of the outbreak. In contrast, the irrational ideas presented by some government consultants together with negative perceptions of the compensation plan limited the ability of the Walkerton community to achieve resiliency.

Justice O'Connor identified the actions of the Ministry of the Environment (MOE)

as one of the contributing factors to the *E. coli* contamination outbreak. In 1979, the MOE approved the installation of a shallow well located near a farm with livestock without any source water protection measures despite being aware of the significant risk of contamination from surface activities. As a response to their guilt and unethical actions, the provincial government provided financial assistance to the Walkerton community to assist their recovery. Several participants expressed this form of aid:

> The province was there to help. … They did step in and provide funding to, um, to do some things in the community which we normally wouldn't have been able to do. … They brought some stability to the, uh, to the community. (Participant 24)

> We were very dependent upon the, the provincial government who, who came in and assisted. (Participant 14)

> Government put a ton of money in here. … It lubricated everything. (Participant 6)

> The government spent a bucket of money. It was over $90 million dollars from what I understand. (Participant 4)

> It was kind of amazing, uh, how [the provincial government] would work on certain things, trying to figure out how to fix it themselves … so that this community would not die. (Participant 26)

> The government, um, you know, provincially, um, and federal stepped in, and, um, that, that's a positive that came out of that, right? They came in, you know, the water, the research, the funds that, that were put into that, not only to benefit Walkerton, but for every, you know, worldwide. (Participant 17)

> I think the government handled it really well. … The agencies here were top-notch, … they were in here quick, getting facts, and doing, doing good work. … They had all their agencies here, wasn't just the Ministry of Environment but I mean, they had all these agencies here, they had the inquiry here in Walkerton, they built the Water Centre here, in Walkerton. (Participant 7)

Participants revealed that the government played a vital role in taking ownership over their previous actions by providing monetary assistance to the community. This boosted the economic capital at the time of the outbreak, as it expedited the recovery process allowing the community to remain flexible, resourceful, and functional. It also strengthened the linking social capital in the community by forming a vertical tie with individuals of power. This is evident as the Canadian government ultimately provided economic development and financial resources to the community.

One economic strategy supported financially by the provincial government was a façade program in the community. This involved improving the exterior appearance of businesses throughout Walkerton. This is clarified by the following participants:

> The government came through like with façade money. … So, there were funds that were here that were made available. (Participant 17)

> The, uh, province provided funding for an economic development officer planner, who worked with the community to … put together a façade improvement program for all of the businesses and, prior to that, I don't believe a façade improvement program existed across the province. But it was extremely successful to get the business owners to update the frontage of their buildings and it, it looked like a new community, so some of those buildings that had been looking a little bit dilapidated, um, you know, it just sparked everything up and nobody really knew what the positive impact would be, but it was a very positive impact. (Participant 25)

In turn, this investment enhanced the physical capital of the Walkerton community, as it made aesthetic improvements to the town and provided business owners with the opportunity to update their infrastructure. This is vital to the domain of disaster management, as it aids in the response and recovery of communities in the ability communities that have the being able to repair and renovate their physical assets (IFRCRCS, 2012; Longstaff et al., 2010; Pasteur, 2011). The façade program had additional benefits in helping both establish internal community pride and draw in tourists.

Ontario's publicly funded health care system was a critical facilitator in enabling community members to recover from the implications of the outbreak. Many individuals who were hospitalized at the time of the outbreak might not have been able to afford their health care costs if the health care system was privatized. This is evident as participants stated:

> We're fortunate we have the health system we do. Because a lot of people wouldn't have been able to access it otherwise because of financial implications. (Participant 19)

> I totally think we're so lucky to live here and [have free health care]. [We] take it for granted but we're really lucky. … Because not everyone can afford that and, I mean, that could've been scary. Because then you would have people with these illnesses spreading them, you know? (Participant 18)

The publicly funded health care system enabled those affected to focus on

recovering and responding to the outbreak implications as opposed to being overwhelmed by the health care costs incurred. This strengthened the community's economic capital, and thus contributed to its ability to achieve resiliency.

Another provincial government initiative was to hire an economic development officer to work with the community to rebuild the local economy in Walkerton. However, participants indicated that, in general, the community felt the ideas presented by the consultant were irrational:

> One of [them] said, "Oh, we'll, um, provide, uh, we, we should sell t-shirts saying "I survived the Walkerton water tragedy."" Not really funny when people [were] still dying. (Participant 13)

> We had, uh, Ontario economic development officers for the province come up. They came up with two [initial] plans for Walkerton's business recovery: a tractor pull and a ball tournament. That was it. That's how we were gonna recover our economy. … That was almost "let's leave the room." (Participant 3)

The strategies proposed by the government consultants were not well configured and did not form a comprehensive plan; as a result, the community would not endorse them.

The provincial government also established the Walkerton Compensation Plan to provide financial support and compensation to individuals and businesses affected by the *E. coli* outbreak in the community. Crawford Adjusters Canada was appointed by the court to administrate the funds, and ensure that persons affected by the outbreak received "full and complete compensation [promptly] in accordance with the laws of Ontario" (Walkerton Compensation Plan, 2011). As of 2011, over $72 million dollars was distributed in compensation to Walkerton residents, as well as other individuals who suffered from the outbreak implications (Bennett, 2011). However, participants argued that the Walkerton Compensation Plan had more of a negative impact than a positive one on the community:

> I know there [was] a huge focus on insurance and how insurance for victims was handled, and, um, I've heard lots of the negative side of that (Participant 25)

> There was stage one, everybody got, I don't know, a thousand dollars or whatever, it wasn't a lot. Stage two was another 2,000. That was a different qualifying level. If you lived here, I mean, you just, you got it, you just automatically qualified for it. And then there's people from outside the area coming in, trying to say, "Well I

was here." … So, everyone was trying to take advantage of it. … Which is, you know, people died here, that's pretty, that's pretty tragic, and yet, people like, tried to get free money out of that. … And we hear the lawyers got more money out of this than was ever paid out in compensation actually. (Participant 7)

The compensation was dick for us. … They [didn't] pay for pain and suffering. (Participant 28)

Businesses took a long time to access that [compensation, which] caused some problems. (Participant 6)

All the money in the world can't bring back those people that passed away. … It doesn't bring back your mom, your grandma, your child, you know? (Participant 18)

Yeah, you're almost like, "I'd rather not have this money and just live a normal life." … [The compensation] doesn't really matter. It's not going to replace, you know, sort of the people that were lost. (Participant 8)

The participants stressed that many outsiders tried to capitalize on their misfortune to be eligible to receive the payment, and that ultimately the money meant nothing in the grand scheme of things, as it cannot replace their loved ones who passed away. Although initially intended to enhance the economic capital in the community, the Walkerton Compensation Plan ended up increasing its social vulnerability.

External Communities External communities played a vital role in providing resources to help the Walkerton community recover at the time of the outbreak. However, some communities perceived Walkerton in a negative manner, which hindered their ability to achieve resilience during the water contamination crisis.

The community relied on the assistance of neighbouring communities, and those across the country, in receiving resources to facilitate in their recovery process. Participants noted that several external communities were responsive to providing financial assistance, water, and household products to Walkerton residents, as evidenced through their excerpts:

I think local people felt support from other external communities, and I'm sure that helped a lot, in terms of resilience, knowing that they weren't here isolated on their own. There were Municipalities all over Ontario that, uh, that supported financially, … and just calling and asking how [we were] doing … so that was kind of inspiring for all of us. (Participants 24 and 25)

it was Canada-wide, and that was very thoughtful. I think the community was given more water, bottled water, toothbrushes, stuff like that than you could [need], but it was all out of kindness. (Participant 27)

Even Molson's in Toronto briefly stopped bottling beer or, or started bottling water. They sent it up us in beer cases, in beer bottles. We just thought it was American beer. (Participant 13)

We were fortunate and blessed that there were a number of … businesses, there were a number of industries, there were a number communities, there were a number of individuals, groups, clubs across Canada, mostly in Ontario of course, but also across Canada, who gave us truckloads of water. (Participant 23)

Water was coming to us from out west in Alberta [and] down east from Michigan. (Participant 5)

Mildmay was a big help to this community during the, during the *E. coli* [outbreak] (Participant 17)

[Another] example of this [was] the Salvation Army, who [were] based in Hanover. They came over here with, with their, their trailer and provided, uh, lunches and whatever else they could do to help people, you know, especially various sites where volunteers were distributing things. They would set up there and, and feed the volunteers and, and feed any local people that, for any reason whatsoever, felt uncomfortable cooking in their own homes because it, for a while, they didn't wanna use the, the water at all (Participant 14)

It is apparent that the Walkerton community received extensive resources from outside areas. This was a form of bridging social capital, as it promoted access to external assets when local community resources were either insufficient or unavailable at the time of the outbreak (Aldrich, 2012; Wetterberg, 2004). Therefore, "inter-community" relationships were developed, as Walkerton received assistance from Mildmay, Hanover, Toronto, Alberta, and Michigan, among others. In turn, this assisted the community in achieving resilience. Additionally, the community of Stratford built a memorial garden in Walkerton to commemorate the lives of those individuals who were lost at the time of the outbreak.

The community of Stratford handled the, um, memorial garden in our, in our community. (Participant 21)

The Heritage Water Garden [was] initiated by the gardener from the Stratford, a head gardener, and brought that together to build that garden as a tribute to the people of Walkerton, especially those who had died. … It was so wonderful to feel,

hear somebody, you know, from outside the community coming like that, and no specific connection to the community, wanting to do that for us. … There's plaques there for the history of Walkerton, not just for the water crisis, but that as well. The fountain memorial is still there. (Participant 10)

On the other hand, a degree of backlash from external communities was experienced, in that Walkerton was perceived, by some, in a negative way. Participants shared the following insights:

We [were] kind of looked upon as some, I don't know, people who didn't care for themselves who, um, who didn't have sort of a sense of excellence as far as maintaining the services of water and whatever. (Participant 5)

I think that after the tragedy, we, as a community, experienced things like, "We're not sending our girls to your town to play baseball." … It's stigma, but it's almost like a, it's almost like an "otherness." Others [hated] us for, like, no real reason. (Participant 11)

There's people that wouldn't come to Walkerton. They would drive around. … We were moving our store from this side of the street to that side of the street, and uh, [name of company] sent workers out to move their, their product or their fixtures, and half their crew wouldn't come because it was Walkerton. (Participant 7)

The negative perceptions of external community members reduced the ability of Walkerton residents to form "inter-community" relationships with them.

External Media At the time of the outbreak, there were several news outlets present in the community who were reporting up-to-date facts on the happenings surrounding the outbreak. A positive perspective of this was they were able to bring attention to the community, which in turn brought in additional resources contributing to community resilience. However, the external media also acted as an obstacle by reducing the community's ability to respond to and recover from the outbreak in multiple ways thereby reducing resilience.

The Walkerton water contamination outbreak was one of the most reported news stories in the province in 2000. There were multiple reporters within the community who were providing ongoing updates to the general public. This raised attention worldwide, which resulted in the influx of resources into the community as noted by various participants:

CBC was around for a bit which was good. They, they provided us with support. … [They] went out on [saying] like, "Walkerton's running down on their water, can anybody, you know…?" Bing, bang, boom, we ended up with a situation, almost immediately, where some organization, group, whatever would phone and say we got a truck coming. (Participant 23)

The resilience of just other, um, uh, vendors that we utilize through our hospital [were] donating boxes of toothbrushes and water. … Part of that would probably [be linked] back to the media. (Participant 17)

These passages demonstrate that the presence of external media in Walkerton assisted in bridging social capital with outside communities and organizations, as they raised awareness to the ongoing struggles in the community. In turn, this brought in resources to facilitate in their response and recovery.

Numerous participants also shared that external media reporters impeded their ability to continue with their daily lives in responding to and recovering from the implications of the *E. coli* outbreak. External reporters sought coverage of the crisis by constantly intruding on community members. The following quotes by participants provide insight into the negative perceptions of external media at the time of the outbreak:

I think there were, probably as in all cases; there were certain individuals in the media that were a pain and were nothing more than disruptive. (Participant 23)

[The media] would park in front of [the] pharmacy and I'd go out and say, "Get outta here, go away." You're not gonna, like, nobody would come in. … [On another occasion], I had a shopping cart full of food and [the media] came in the front door of the grocery store and, um, I said, "I'm not doing this," and [the cashiers] said, "Yeah, at least you can leave." (Participant 4)

They were trying to come into the hospital; they were trying to interview people that were coming to [the] emergency room. (Participant 8)

It was maybe a bit intimidating to people because all of a sudden, you've got these news trucks all over and ... all of a sudden, you're walking in to get your mail, and they've got some guy shoving a microphone in your mouth. (Participant 18)

There were pictures on the, on the media of, of, of huge crowds at the Catholic church, uh, and people carrying the casket out and all the people pouring out afterwards and lined up on the sidewalk to say goodbye to these individuals. And, of course, they, they, at the same time, were not too thrilled with the presence of the media there with all these big trucks with the cameras and, or the satellites on top and the cameras taking pictures of funerals, which [were] really a much more

personal type of thing. Because they didn't need the whole world to, to see this part of our, our suffering. (Participant 14)

I think, after all the publicity left, I think that's when we [were able to finally respond]. (Participant 15)

We were glad when the news people moved out and everybody could kind of take a deep breath. (Participant 19)

Over time community members became overwhelmed by the constant presence of external media in Walkerton. Many individuals expressed that reporters misrepresented what they said in a way that made the community appear incompetent. Eventually, most people avoided the media altogether, except those who were representing Walkerton in an official capacity. This is supported by the following participants' perceptions:

[The media] just didn't understand the town and how it works. … They almost needed a translator, because it just really is different, you know, how people operate here, and the things people say can so easily be misinterpreted on a national stage, right? … I do remember watching this one guy, who [was] a character in town, everybody knows who he [was]. … He [said] what he [thought] and it [was] off the cuff and … [he was] very ignorant about the world. … And [the media] would run the stuff like he was like an expert on what [was] going on in the town. (Participant 11)

What bothered me the most was all the invasion of media and people saying really bad things about my town and portraying us in the worst ways like we're idiots ... 'cause that was not helping at all. … They would portray us as a person walking down the street pulling a wagon with a couple of cases of beer in it, wearing flood sweat pants with his belly hanging out and, uh, a t-shirt that didn't fit 'em and, and haven't shaved and looked really awful and they interviewed that guy who never even [worked] or [did] very little in the community. And he'd [be] the representative of Walkerton. … But it made good news, you know, and everyone here thought we were idiots. (Participant 27)

You'll always have wildcard people, you know, who will voice their opinion no matter what but they're representing the minority, not the majority, you know. (Participant 26)

I don't think the news media did a very good job. … Definitely a drawback. … They were definitely in the way, you know, … and they [were] twisting everything. (Participant 7)

These quotes demonstrate how the invasion of external media hindered their ability to respond to and recover from the water contamination repercussions. It was only after the

media left that community members finally had the capacity to manage the implications of the disaster on their own terms.

Anger Anger is another factor that acted as both a facilitator and barrier to achieving community resilience at the time of the outbreak. On the positive side, it established the Concerned Walkerton Citizens interest group, which played an active role in holding various parties accountable for their actions leading up the *E. coli* outbreak, contributing to recovery and resilience. However, anger also promoted negative perceptions of various components in the community, which challenged its ability to achieve resilience.

The Concerned Walkerton Citizens (CWC) are an interest group that was created at the time of the outbreak in response to the poor response that was initially provided by those in power. Anger motivated this group to hold individuals accountable for their actions and inactions that resulted in the crisis. In particular, this group sought to identify the factors that contributed to the water contamination outbreak by requesting a public inquiry, and ultimately advocated for justice for the people of Walkerton as demonstrated by the following excerpts:

> If you, you look at the sort of origins of the, the Concerned Walkerton Citizens, they came out of the, the concern after the tragedy, where the Mayor said, "Oh, it was just the heavy rains that caused it." And my visceral reaction was "lots of communities have heavy rains. People don't die from the drinking water." … And I thought "okay, we don't know what happened here at this point [but] if someone came into your town, knocked out half the businesses, made half the people sick, killed seven people, you would be investigating." … So then with the Concerned Walkerton Citizens, our, our thing was "No, we've got to have an inquiry. We've got to find out, we, we can't just assume that this isn't going to happen again." (Participant 13)

> The [Concerned Walkerton Citizens interest group] was a group of people that were "We want justice." … [They took] it upon [themselves] to start acting. [They] had to. If [they] wanted the government to do something, and [they] said there's no really follow up from Walkerton, … [they] felt that [they] had to put the plan together, put the policy in place, do the work and coordination, and hand it in so they could critique it, change it, uh, politicalize it, and go from there. (Participant 3)

However, not everybody in the Walkerton community was supportive of the CWC.

Many individuals felt they were not qualified to represent the community on a large platform, while others questioned the true intentions of the interest group as demonstrated by these excerpts:

> There was an attempt to frame us as a, uh, special interest group at one point by the government. And I responded to that saying, "Yes, we are. We are that group of people who like to drink water and live. There's a lot of us." (Participant 13)

> [The group was] self-appointed, uh, and they loved the limelight. … [They] stood up at some of these local town hall meetings and, the more they spoke, the more human nature let them speak. And so, they got some power, then they set up their organization, then all of a sudden, they're negotiating for Walkerton with the Ontario government. We're going, "Oh my God," but I'm not gonna go out and take them on, you know, and say, "you know, really you're not qualified." [The people] that talked the most got the recognition and they loved it. (Participant 4)

> Advocacy groups in my mind, um, are, tend to be sort of single focused, um, because they're advocating for, you know, sort of one thing, a specific cause, um, as opposed to a general cause. (Participant 8)

Anger also limited the ability of community members to move forward in responding to and recovering from the effects of the crisis. Many individuals felt extremely hurt due to the lack of accountability for, communication from, and transparency of PUC operators and the Municipal government.

> There was a lot of anger in those early days, and, uh, you know, who do you direct it at? Just who to blame, and yeah, and, you know, it, it was really a question of not action, so much as inaction, and it's like how, how did that happen, you know? I'd be lying if I said we weren't angry, cause we sure were. (Participant 29)

> There was a lot of anger. ... I just remember a lot of turmoil, and, you know, finger pointing. … There [was] so much anger and there [was] so much hurt. (Participant 17)

> I think that's one thing we couldn't understand: why it took so long, and I think that's why people were really hurt… We should've been told. That whole cover-up. People were getting sick, like we found out Monday, [but] people were getting sick the week before, like the Monday or Tuesday after Mother's Day… I think a lot could've been [prevented]. (Participant 16)

> We're Christian; we're supposed to be forgiving, but how can I forgive because my mother died, or my, you know, sister died, or whatever it was. (Participant 10)

> There was also a lot of anger, which, um, which did not help any of that resilience. … Anger just kind of breaks all that away. (Participant 11)

People who held anger towards those in power in the community were prevented from coming to terms with the disaster in their community. Acceptance of the events was difficult, which in turn diminished their trust in community leaders.

Rural Community Characteristics Many individuals indicate that there is higher social capital in rural areas compared to their urban counterparts; however, due to their sometimes-relative remoteness, they often also lack resources that would be expected in an urban area.

Walkerton is a rural community located within and governed by the Municipality of Brockton in central-southern Ontario. According to the 2016 Canadian census, there are currently 4,517 residents in the community (Statistics Canada, 2017). The participants expressed the strong social ties that exist in Walkerton among families, friends, neighbours, service clubs, religious organizations, sports teams, and businesses. Since it is a relatively small community, individuals rely on one another for assistance, contributing to social capital. This is demonstrated by the following statements:

> We're a small town, and you see that not only here, you see it all over in small towns. … Everybody knows everybody. (Participant 24)

> In the smaller communities, … there [are] very strong social bonds between, between people. (Participant 12)

> Because that's more the nature of people in a small town, you help your neighbour. (Participant 14)

> A small community like this is naturally closer in terms of being supportive if there is an issue. (Participant 22)

> There's a very strong sense of community, as there is in most small towns. (Participant 4)

> Well I think a small community pulls together more, because people know each other. … I think any small community is gonna rally real quick. (Participant 7)

> Um, there's such a strong sense of community at any point in time in a small town. (Participant 8)

> In rural communities, I find it's just ... it's a lot more a sense of belonging. And everybody really just works together a lot more than [in urban areas] (Participant 9)

The close relationships, both formal and informal, shared amongst individuals in Walkerton contributed to strengthening their bonding capital at the time of the outbreak, thereby facilitating recovery and contributing to resilience.

The community acknowledged that they required external aid to help respond to the implications of the outbreak, mainly through additional resources such as water and money. This is evident from the following statements:

We had external assistance, obviously. (Participant 23)

We require all sorts of external assistance to get us through this. … There [were] all sorts of various things that were provided from external sources, because we don't have those sources within the community. (Participant 14)

Dependence on outside assistance demonstrates the lack of Walkerton's preparedness capital, as they did not have sufficient resources to prepare for, mitigate, respond to, and recover from the disaster on their own.

4.3 – Barriers and Facilitators to Community Resilience Under Non-Crisis Conditions

The next category of questions aimed to identify the specific factors that prevent or enable the Walkerton community to maintain resilience in the present day. The purpose of investigating these barriers and facilitators is to utilize the life course approach to determine if the effects of the 2000 *E. coli* outbreak continues to shape the present day lives of the community under non-crisis conditions.

Since this is an interdisciplinary study, there were various probing questions pertaining to each form of capital central to the arena of disaster management that guided each interview and focus group discussion (Appendices F and G, respectively). This included social capital, cultural capital, human capital, political capital, economic capital, natural capital, built capital, and preparedness capital. Several themes emerged relevant to this category.

4.3.1 – Barriers to Community Resilience Under Non-Crisis Conditions

There are a few barriers and challenges identified in maintaining community resilience in the present day in Walkerton. Table 4.4 outlines the major themes and subthemes that emerged from the data.

Table 4.4: Barriers to Community Resilience Under Non-Crisis Conditions

Major Theme	Subtheme
Lingering Effects	• Adverse physical health outcomes
	• Adverse psychological health outcomes

Lingering Effects The effects of the 2000 *E. coli* outbreak continue to linger in the present day lives of many Walkerton residents. This is evident as individuals continue to experience many adverse physical and psychological health outcomes as a result of the event.

Several participants indicated that some of the individuals who suffered from *E. coli* O157:H7 symptoms at the time of the outbreak continue to experience negative physical health implications today. The following passages support this:

> There are a number of patients that are still receiving care … with respect to E. coli. … I guess the biggest tragedy is the children that were sick and they, all their life, their life has been changed forever. … The young people and the babies and the children that were really ill, their life has been affected for all their life. … A lot of people suffered from diabetes afterwards that didn't have diabetes before. So, those are some of the negative things, the illness that affected people were the, really the negative things that happened at the time. … The negative part is people got sick. (Participant 17)

> The other thing that stands out is that there's a lot of people who are still sick from it, and rubbing shoulders with them is, uh, a constant reminder, and also a constant reminder of some of the really sick ones who, uh, really haven't gotten much, um, support or financial gain from it with all their medical bills and so on. … Some of the people that I know are still, who are still suffering from IBS, and some of the children who will never be away from that. (Participant 22)

> As far as anybody who, um, who actually had ingested the water at the time, it's an issue there was greater concern about the children and even though they didn't become sort of seriously ill. They were very concerned about the um the future with their children and rightly so because there are some children still today that are now 16 years older that are still struggling with hypertension and kidney disease. (Participant 5)

> We've pretty well moved on, except for those people who are still sick. … There are still people who, who have been affected by [the outbreak] ... who were sick at the time and who are still suffering results from that. (Participant 10)

Evidently, the fear that individuals held 16 years ago at the time of the outbreak with respect to future health implications was completely warranted. This is evident as

individuals continue to experience symptoms associated with the water contamination outbreak. Many of the individuals who consumed contaminated water were left with chronic illnesses such as hypertension, kidney disease, and irritable bowel syndrome (IBS), posing a present day challenge to human capital in Walkerton, as the community's collective physical health is at risk. This puts the community at a disadvantage in the context of disaster management, as individuals need to be physically healthy to be able to mitigate, prepare for, respond to, and recover from implications of a future event.

With respect to the life course approach, the principle of historical time and place can be used to explain how the lives of community members have forever been impacted by the *E. coli* outbreak in Walkerton. This is apparent as many people will experience serious health implications for the rest of their lives as a result of ingesting *E. coli* O157:H7 and/or *Campylobacter jejuni*. Likewise, the principle of timing in lives is used to express how the health of individuals is shaped in the present day. This tenet argues that there are critical developmental periods during an individual's life that make them especially susceptible to adverse events. For instance, children under the age of five and seniors over the age of sixty-five are the most vulnerable to the effects of *E. coli* (O'Connor, 2002a). These chronic health effects threaten the long-term resilience of the community, as the physical health status of these vulnerable populations is forever changed by the 2000 water contamination outbreak.

Likewise, many participants expressed that several Walkerton community members continue to experience symptoms related to post-traumatic stress disorder (PTSD) as a result of the outbreak. Multiple individuals stated that they are subconsciously still afraid of consuming tap water, as it brings them back to a horrible time. Many of these people rely solely on bottled water. The following excerpts illustrate this theme:

> There are people who … I've heard of [that] will not touch a tap in Walkerton. (Participant 5)

> I'm not gonna drink the tap water. Every time I turn on the tap, I, I can think of, I can hear helicopters. I can think, "Do I really wanna brush my teeth with this water?" I think about my kids not being home. I think about the people who are sick and died. … And I know there's people say, "Oh well, it's long gone and passed and just forget about it." You know, well, it's not quite that easy, you know, because it

is something that was a huge impact that year. … I [also] know there are people in this town that still don't talk about their water experience, if you wanna say that. … I think it's, uh, maybe it's like a, a, um, PTSD kind of situation where it's so stressful what happened that they don't wanna talk about it. They just wanna forget it ever happened, because I don't, you know, it's hard to say whether it changed any other factors in their lives. (Participant 20)

[There] is the fear of drinking water, except, unless it's bought. They're afraid of tap water, drinking tap water. … I can understand that in families where people died or ... if the children were very ill, because they don't trust it anymore. And I don't think that'll ever go away. (Participant 10)

There are still people who buy bottled water on a regular basis and, and drink it. … [There is an] inbred fear, whatever you wanna call it, that, that people get used to the bottled water and stick with it. It sticks. (Participant 14)

There still is the emotional fear there with their little children who went through … I know it's been 16 years, but still, ... when you see it in ones that are still sick, you know, I can picture some of them that I saw in hospital rooms. (Participant 10)

That'll probably never go away like, one example is I still don't drink from a water tap (laughs). It's subconscious. See, before it was poison for a long time, what came out of the tap. Uh, you know, it killed people. …But every time I look at a tap, … it takes me back and it will to my grave. Bottled water, you don't think about it. (Participant 4)

As well, participants revealed that they are constantly reminded by the crisis whenever they hear the sound of a helicopter. For example:

It's kind of like the helicopter sounds, right? … Whenever many of us hear helicopters, [it brings us back]. It does. It really does. It's, um, especially if there's more than one, if you might be somewhere not necessarily in town, but, you know, you hear something that reminds you of that. (Participant 21)

If we're golfing and a helicopter goes out, uh, you'll see people stop at the golf course and look up. (Participant 3)

The present day resilience status of the Walkerton community continues to be challenged as a result of the *E. coli* outbreak owing to the mental health status of its residents, which continues to be impacted. Individuals must have a positive mindset and cognitive capacity in the context of disaster management to facilitate a positive and prompt response and recovery. The principle of historical time and place in the life course approach can help explain this implication, as the lives of individuals and groups are embedded in

and shaped by the historical events and factors in the geographical location where they reside (Elder Jr., 1994). The sight of water coming out of the tap, as well as the sound of helicopters, brings Walkerton members back to the time during the water contamination outbreak when the lives of all community members were negatively impacted. These two things trigger a PTSD-related response in community members due to having lived through that experience. It subconsciously causes people to recall and focus on the negative components of a historical event that occurred in the setting where they dwell.

4.3.2 – Facilitators to Community Resilience Under Non-Crisis Conditions

Participants identified a number of facilitators and enablers to maintaining community resilience in present day Walkerton. Table 4.5 outlines the major themes and subthemes that emerged from the data.

Table 4.5: Facilitators to Community Resilience Under Non-Crisis Conditions

Major Theme	Subtheme
Capacity Building	• Operation of the Walkerton Clean Water Centre
Positive Perspective	• Remaining optimistic • Pay it forward attitude

Capacity Building The WCWC plays an instrumental role in shaping the knowledge, skills, and practices surrounding proper water management, protection, and maintenance in the province. This centre was built to provide educational and practical "training for drinking water system owners, operators, operating authorities, and postsecondary students across the province" (WCWC, 2011). Since its inception, it has been positively perceived both internal and external to the community, as supported by various participants:

> It helps to have the Walkerton Clean Water Centre here. Everyone has to come here for actual training. … They've been good for the town and the community. Gives us a lot of credibility after the tragedy. (Participant 24)

> The good part that has come out of it … has resulted in the water, the water, the Clean Water Centre being here, which is good for our community, … not only for themselves, but for, it can be worldwide, because people come from many areas to train here … or they send people out to other areas to train people on water quality and, and water management. (Participant 10)

> We have the Water Centre here in town now, which is, uh, a training facility for the entire province even beyond the, the limitations of the province of Ontario. I know

that there are people who come in there to take courses to, to bring essential water services in smaller communities up to the standards that they, they should be at so that there isn't another water disaster. (Participant 14)

Walkerton has become known now because we have the Water Centre that does a lot of studies and people come in and they learn about water so that has really been a plus for Walkerton to be instrumental in, in, something good came out of something bad. (Participant 19)

The WCWC is renowned for providing training on regulatory and technology issues to the drinking water industry. The staff employed there are recognized as competent leaders in the industry, which enhances the collective human capital of the community. This is because they have the necessary skills, knowledge, education, training, functional ability, and competency to plan and manage safe drinking water procedures in Ontario. The centre also enhances the natural capital of the Walkerton community. It provides knowledge and training to its PUC operators in identifying strategies that manage, protect, and maintain the quality of drinking water in the community. This promotes the environmental status of the community's local water sources.

The WCWC is critical in the context of disaster management, particularly in relation to safe water management. It educates individuals to become leaders to effectively mitigate, prepare for, respond to, and recover from the implications of a water-related disaster. This allows them to be able to adapt to any changes in their social, economic or environmental conditions as a result of the event (Bahadur et al., 2010; Buckle, 1999; Frankenberger et al., 2013).

The historical time and place principle of the life course approach can be used to explain the rationale regarding the successful operation of the WCWC in the community today. Walkerton became universally known for its water crisis following the events of May, 2000. In response to the Walkerton Inquiry report, the province of Ontario established the WCWC in the community in an attempt to acknowledge Walkerton as a leader in responding to water-related crises.

Positive Perspective A positive perspective is another principal factor that maintains the community's current resiliency status. This is essentially fulfilled by remaining optimistic by helping those who require assistance. Many present day Walkerton residents indicated

that they have the best water in Ontario. They feel confident that a similar incident will never happen again due to the policy changes surrounding safe water management, which were enacted as a result of the outbreak. Participants noted that:

> I really feel safe that it's never gonna happen again. … I don't worry about the water not being safe. (Participant 27)

> They'll never let that happen again. It actually is a very safe place to drink the water now. (Participant 18)

> If it happened in town again, um, which it's not going to. How's that for being positive? (Participant 8)

> There's no concern over the quality of water. There's no concern over the, the, the individuals who look after it. And new people were hired. A, uh, professional company was brought in to administer our, our system. It was taken out of the hands of local people, although we did have a, uh, a coordinator who was hired who was liaison between the professional out-of-town company and town Council. … He did that job and he, he's still employed here today and doing an excellent job. (Participant 14)

> Well one thing that has happened since, in the last 16 years, I suppose we have the best water in the world … because there's a lot more checks and balances in place. … Knowing that the checks and balances are in place, [another incident] will not happen and hopefully it won't happen across the world. (Participant 19)

> Over the long term, we're stronger for it. Uh, we're more confident for it. We're more resilient. … We know who we are. We know that whatever they throw at us we'll just get together and fight it. (Participant 4)

The principle of human agency in constrained situations explains how social arrangements provide opportunities or constraints on the choices and actions that individuals have in their lives following the water contamination outbreak. Community members feel confident that the multi-barrier approach to safe drinking water is being practiced and enforced, and therefore have no concern of another similar event happening in Walkerton. The excerpts also demonstrate that residents have regained their trust in those of power, namely PUC operators and the government, primarily due to policy changes which require them to be more transparent and accountable. In turn, this maintains resiliency in the community, as its local political capital is strengthened. This is

instrumental in the domain of disaster management, as it ensures that trust, transparency, and accountability are instilled in those in power.

The Walkerton tragedy has instilled a "pay it forward" attitude in the minds of residents as they once relied on the assistance of others, and they appreciate the immeasurable assistance they received from individuals external to their community at the time of the outbreak. They recognize it would have been harder to respond to and recover from the tragedy if outsiders had not supported them. Accordingly, participants mentioned they provide aid to individuals outside of their community:

> I also really think [there is] a factor that you would find on an individual basis in this community: that there's a very generous spirit to give back. (Participant 21)

> I think that perhaps people's sensitivity to the water issues since they were living here perhaps a little bit heightened. And I suspect, uh, they might not have contributed in that amount if they hadn't lived through the crisis. We sent a donation to Flint, and it was just, just, uh, the fact that we've gone through this and we know what can happen. … I sent a letter to the Mayor, you know, just little things to show your support. (Participant 24)

> So that's part of the resilience, too, you know? We just need to make sure that- we were victims, too, that we shouldn't have been, but we were. So, what do we to do our part going forward? 'Cause thank God those things were in place for us. … Thank God for our hospital. Thank God for London. And thank God, all the people that came before us, made sure that it was equipped. So, we started actually giving to the Children's Hospital, uh, right after that, and that continues today every month. Hopefully, we never need it again, but for families that would be in our situation, then hopefully we're, we're paying it forward a little bit there. (Participant 29)

> I know shortly after Walkerton there was, I forget whether it was either in Saskatchewan or Alberta, and I remember calling the Lutheran church in the community that it happened in and they weren't long getting it cleaned up. (Participant 19)

These excerpts acknowledge that the overall resilience in the Walkerton community is strengthened, as they are able to engage in bridging social capital with other communities. This is evident as they continue to regularly provide resources and support to external communities who need it. This is important in the domain of disaster management to facilitate a more effective and efficient response to any implications.

This is relevant to the principle of linked lives in the life course approach, which looks at the interdependent nature of people's lives. The external support that citizens received at the time of the outbreak has influenced them to have a "pay it forward" attitude today by providing aid to individuals outside their community who need it. In turn, they are ultimately establishing social relationships with these individuals.

4.3.3 – Factors that Enable and Impede Community Resilience Under Non-Crisis Conditions

As previously stated, Cox (2015) states that neither resilience nor vulnerability are absolute concepts, as a community can experience both concepts concurrently. There are several factors that act as both an enabler and barrier to maintaining community resilience in present day Walkerton under non-crisis conditions. Table 4.6 outlines the major themes and subthemes that emerged from the data.

Table 4.6: Facilitators and Barriers to Community Resilience Under Non-Crisis Conditions

Major Theme	Positive Subtheme	Negative Subtheme
Economy Surviving, but Not Thriving	• Development surrounding the Walkerton Clean Water Centre • Expansion of large enterprises	• Empty storefronts in the downtown core
Wa"t"erton	• Aesthetic changes • Renown training facility	• Tragedy reflected upon by outsiders
Local Leadership	• Respected Mayor	• Unfavourable Council
Readiness	• Policies and procedures at the provincial level • Community Emergency Management Coordinator • Medical capacity • Accessible mental health counselling services • Learned experience	• Not putting theory into practice
Rural Community Characteristics	• Strong bonds among community members • Participation in community events	• Rural flight

Economy Surviving, but Not Thriving There are many ongoing factors that contribute to building Walkerton's local economy, while other aspects weaken it. On the one hand, the

development surrounding the WCWC, as well as the expansion of large enterprises, provide economic stability to the community. In contrast, there are a few closed businesses in Walkerton that need to be filled which weaken the economic capital of the community.

When asked about the community's current economic status, participants spoke positively about it. This is demonstrated through the following excerpts:

We've come back [since the *E. coli* outbreak]. People are back in town again. (Participant 19)

I think the economy here is good, I really do. (Participant 18)
The economy today is doing great. If you notice, if you look at the data from the family income, we're well above the provincial average. … 2011 census [data], we're at 70 thousand, so that's pretty good. ... The economy is at full employment. (Participant 6)

Individuals mentioned a number of sectors flourishing in Walkerton today. It is important to note that the WCWC was built in response to the *E. coli* tragedy. Due to its success, business owners saw potential in Walkerton, thus resulting in the development of commercial businesses surrounding the centre. Several participants acknowledged the WCWC as the most valuable asset to their community due to the number of jobs it has created, the number of visitors it regularly brings in, and the commercial development that has surrounded it since its construction. This is evident from the participants' responses:

[Through] the creation of this Clean Water Centre, … [the government spends] about five million dollars a year, I think their budget is about five to seven million dollars a year. It doesn't all get spent here. But they have a lot of meetings here where people do come to town, they do spend money locally, so that's an ongoing economic kind of spin off that really makes a difference. … Without [that] development, … how many of the buildings would be there today? Um, that's a good question. We have a Best Western with fifty, fifty-five rooms, uh, OPP station, um, Westario utility building. There's a research and development, small piece of land there, [and a] few other buildings. (Participant 25)

The [Walkerton] Clean Water Centre being here [is] good for our community, because it's a place of business here. … It has helped to lead to other business. For instance, the Best Western hotel. … But without the [Walkerton] Clean Water Centre, that wouldn't be here either, I don't think. (Participant 10)

The hotel right across from [the Walkerton Clean Water Centre] that probably wouldn't be here, because that was built after the centre. … All the development

[around there] has been centred around [the Walkerton Clean Water Centre]. (Participant 11)

[The Walkerton Clean Water Centre] brings a lot of revenue to the town, right? You know, you figure if there's 13 [employees], there'd be 13 families. … It's jobs and it's money that filters back through, which is what we need; what everyone needs to keep [the economy] going. (Participant 18)

The [Walkerton Clean] Water Centre potentially was the biggest [thing that helps the economy] … [It resulted] in the big new hotel, that was definitely part of that because by bringing people in to learn about water, they need a place to stay, and I would say that [it] has probably helped some of the, uh, food industry, as well as accommodations. (Participant 22)

Participants also revealed that the construction of a nearby nuclear plant called Bruce Power supplies a number of Walkerton residents with employment. This is further elaborated by a number of individuals:

There's a number of people that work at Bruce Power. It's approximately a 40 to 50-minute drive from Walkerton to Bruce Power. We have a number of people that do that every day, morning and night. So, they live in Walkerton and it's very good wage, so they're in good shape, monetarily. (Participant 23)

We're very fortunate to have Bruce Power very close, they're in our county. They brought some stability to the, uh, to the community. (Participant 24)

Um, as far as people coming into town, there's still lots of new, new faces in town. People are moving here again. I mean, a lot of that is thankful to the Bruce Power because it's booming. (Participant 18)

Bruce Power [is] planning to add 20,000 new jobs in the next few years because of their next phase. So, those people are all gonna live in this area. (Participant 20)

It was also found that individuals both internal and external to the community recognize Walkerton as an ideal location to grow their businesses. In turn, this contributes to boosting Walkerton's local economy. For instance, participants noted that:

I think the community has done well, and it's because of the confidence that, uh, some young entrepreneurs and business people … have said, "I want to do something. I'm going to start a business." [While,] the older ones are saying, "I'm going to stay here, and I'm gonna expand" (Participant 24)

A Dairy Queen is opening up in town. [A large] corporation that's willing to invest in our town. … That's amazing [and] should be [seen] as a blessing, so to speak. … There's a company out there that's willing to invest in our community. … This is a

big corporation who's done, uh, they do their due diligence, they do their studies, their demographics, they work it out. They strategically plan, and to find out that Walkerton has been on their list for some time now, and that it's finally actually happening [is] crazy. (Participant 11)

Through the participants' responses, it is evident that the development of businesses surrounding the WCWC, as well as the expansion of large corporations, contribute to maintaining the economic health and vitality in Walkerton. It has resulted in economic growth and diversity, businesses and services, and employment. This is vital in the domain of disaster management, as it provides economic opportunities enabling the community to remain flexible, resourceful, and functional in the event of a disaster (Frankenberger et al., 2013).

The principle of human agency in constrained situations can be applied to explain the economic opportunities available in the community. Factors in the social environment, such as the economy, dictate long-term community resilience. In Walkerton, the provincial government built the WCWC following the outbreak to provide educational and practical training for all drinking water owners and operators in Ontario. Business owners saw the successful operation of the centre as an opportunity to grow their businesses surrounding it, which continues to maintain the long-term resilience in Walkerton today as structural arrangements in the economy facilitate the monetary growth in the community.

However, despite significant efforts on the part of business owners and entrepreneurs, some areas of the community are still suffering financially. Participants spoke about a few empty storefronts in the downtown core:

We obviously have some storefronts that don't look too good … that [need] to be torn down and [have] something happen with [them]. (Participant 24)

When you see that there are some closed storefronts, … you think, "Oh, we still need to get those filled." (Participant 10)

The downtown's struggling with how, how to adapt to the Internet economy. (Participant 6)

Empty storefronts do not contribute economically to the Walkerton community. This reduces the economic capital of the community, as there is no fiscal growth in these closed stores. It is important to plan businesses that fit the needs of the individuals living

around them to ensure long-term profitability. This allows such businesses to have the capacity to be resilient in overcoming any hardships they may experience, such as a disaster.

Similar to the previous section on the current economic prosperity in the community, the area of economic instability in Walkerton can also be explained using the human agency in constrained society principle of the life course approach. The economy plays a significant role in determining what opportunities a business has. Since some of these stores are closed in Walkerton, it indicates that the economy constrains these businesses, as individuals are not able to achieve the financial means necessary to continue running it. However, it is difficult to determine if these store closures are a result of the 2000 water contamination outbreak.

Wa"t"erton Following the *E. coli* outbreak, the Walkerton community became known around the world as a town associated with water in a negative connotation. Several rebranding strategies have since been successfully implemented by emphasizing Walkerton's connection to water in a positive way. Participants spoke about aesthetic changes made around their town that reaffirm its water identity. They acknowledged that community leaders took ownership of their negative reputation in positively transforming its connection to water. In particular, participants said:

> [An] example is the recent move by Bruce County … for the branding of Walkerton, right? So, if you'll notice, there'll be, there's like a, uh, water droplet in the "O" of, um, "Walkerton". … [It] reaffirms the branding that this is a town for water. … [We're] never gonna get away from that. Like, we're always gonna be named, known for water. Like, that's, Walkerton equals water. Like, there's no way anything you do is gonna break that, like, so, it's important for our town to start managing that message and turn it from like, this negative thing to a positive thing. Like look at all the work we're doing with water. We have a beautiful river, … we have the Water Centre, which is like the best in Canada of, like, you know, working with Municipal water systems. Like, a lot of good things came out of this tragedy. (Participant 11)

> The town here has landed on as their big marketing thing for tourism is the [Saugeen] River. Like the fish on the bridges, painted ones; that was a tourism initiative of Walkerton Tourism Recovery Project that I was involved with to lend some positiveness to this from an art perspective. So, each of those fish has kind of

a water theme going on with it … to reinforce the whole water town and also just a positive connection to it. (Participant 12)

Initiatives such as the Walkerton Tourism Recovery Project have rebuilt the community's reputation by marketing itself as a leader in water management. This encourages individuals to look beyond the implications of the tragedy by instead focusing on the positive outcomes of the outbreak, such as the construction of the WCWC, and the policy changes surrounding proper water management, protection, and maintenance to ensure this never happens again. Such strategies signify the adaptive capacity of the Walkerton community, as they were able to modify its negative identity in a positive way to adjust to the stresses following the outbreak (Brooks, 2003; Frankenberger et al., 2013). The principle of historical time and place explains that Walkerton will forever be remembered for its *E. coli* outbreak. However, due to the initiatives of the community at large, Walkerton is now perceived as a water town in a positive and proactive way today.

The construction and operation of the WCWC is another contributing factor that further highlights the rebranding of Walkerton as a water town in a positive manner today. Participants spoke proudly of the WCWC:

> We have the Water Centre here in town now, which is, uh, a training facility for the entire province even beyond the, the limitations of the province of Ontario. I know that there are people who come in there to take courses to bring essential water services in smaller communities up to the standards that they, they should be at so that there isn't another water disaster. (Participant 14)

> Walkerton has become known now because we have the Water Centre that does a lot of studies and people come in and they learn about water so that has really been a plus for Walkerton to be instrumental in, in, something good came out of something bad. (Participant 19)

> The good part that has come out of [the outbreak], and thanks to those people who quickly saw the, um, opportunity there for having water training, proper, proper water training, you know, has resulted in the water, the water, the Clean Water Centre being here, which is good for our community. … Because people come from many areas to train here … or the training centres go out, you know, they send people out to other areas to train people on water quality and, and water management. … I think that's the big, big positive that has come out of this is the Walkerton Clean Water Centre and what it can do for other communities, not just our own. (Participant 10)

As noted under the "Operation of the Walkerton Clean Centre" subtheme, this centre employs professionals with expertise in water management, protection, and maintenance. These individuals enhance the human capital of the Walkerton community today, by having the appropriate knowledge, skill set, and competency to lead educational and practical training in the province. This ensures individuals have the capacity to mitigate, prepare for, respond to, and recover from the implications of a water-related event.

The successful operation of this industry is a direct result of the outbreak in the community. The centre was built in response to the recommendations proposed through the Walkerton Inquiry leading to the province's leading hub "for applied research, technology demonstration, and high-quality training" (WCWC, 2011). This demonstrates that a community can learn from their previous mistakes by turning something positive out of something negative. The principle of historical time and place in the life course approach is relevant here, as the WCWC is a positive outcome of a historical event (the water contamination outbreak) that occurred in a geographical area (Walkerton) (Elder Jr., 1994).

Participants indicated that the outbreak is seldom brought up and reflected upon within the community itself. However, when residents travel to areas outside of Walkerton, other individuals will often make a comment about their community in regards to at the time of the outbreak. This external perspective reminisces on Walkerton in a negative context by recalling the implications of the outbreak. For instance, participants mentioned:

> I don't know that it's brought up so often in our community, … but I think more so it comes up from outside the community. As soon as somebody says, "Walkerton," or … [if] you're somewhere and you introduce yourself as being from Walkerton and they'll say, "Oh, … that's where the people died," or whatever comment they make. They, you know, connect right away. And every once in a while, you see it in the news. There will be something, uh, comes up in the news, but totally unrelated. There's nothing to do with Walkerton, except they will say, "Now, but, when Walkerton water crisis dah, dah, dah, dah, dah." (Participant 10)

> We can be out traveling, going to Jamaica or whatever, and you run into somebody that, "You're from Walkerton. Oh, that's where that water thing happened." … Walkerton has a name of water tragedy. … I think that'll always be with us until everybody forgets about it, you know? (Participant 15)

If [I'm] out, people will ask me where I'm from, [they will respond], "Oh, that's where the water [incident was]." (Participant 19)

These quotes demonstrate that there is still an alienation or "otherness" that exists in the perceptions of outsiders to the community. They continue to dwell on the negative aspects of the Walkerton community by solely referring to the 2000 water contamination outbreak more than 16 years later. Participants indicated that this is much different from the communications about the community among residents, in which the tragedy is seldom brought up. This principle of historical time and place explains how the lives of Walkerton residents will forever be shaped by the outbreak by outsiders. However, in the context of disaster management, it is important to move forward and not solely focus on the negative components of the event. Instead, a positive mindset and a "let's keep going" attitude promote a more effective and efficient response.

Local Leadership In the Municipality of Brockton, the procedural By Law No. 2012-84 sets the rules of order and procedures for the Council and Committees (Municipality of Brockton, 2015b). In particular, the role of the Mayor is:

> to act as Chief Executive Officer of the Municipality and as Chief Executive Officer shall in [upholding] and [promoting] the purposes of the Municipality; [promoting] public involvement in the Municipality's activities; [acting] as the representative of the Municipality both within and outside the Municipality, and promote the Municipality locally, nationally and internationally; and [participating] in and foster activities that enhance the economic, social and environmental well-being of the Municipality and its residents; to preside over Council meetings so that its business can be carried out efficiently and effectively; to provide leadership to the Council; to represent the Municipality at official functions; to carry out the duties of the Head of Council under the Municipal Act or any other Act; to act as Council's representative when dealing with other levels of government, their agencies and the private sector; to serve on the Council of the County of Bruce; and to serve as an ex officio member of all committees or other body established or appointed by Council (the Mayor may vote and otherwise participate, unless prohibited by law, in the business of the committee of other body on the same basis as any other Committee member) (Municipality of Brockton, 2015b).

Whereas, the role of the Council is:

> to represent the public and to consider the well-being and interests of the Municipality; to develop and evaluate policies and programs of the Municipality; to determine which services the Municipality provides; to ensure that

administrative policies, practices and procedures and controllership policies, practices and procedures are in place to implement the decisions of Council; to ensure the accountability and transparency of the operations of the Municipality, including the activities of the senior management of the Municipality; to maintain the financial integrity of the Municipality; and to carry out the duties of Council under the Municipal Act or any other Act (Municipality of Brockton, 2015b).

The study participants have complete trust and confidence in the leadership of their current Mayor; they believe he fulfills the duties and responsibilities of his position. However, many participants are averse to the leadership of their present Council.

Participants spoke about the present Mayor in a positive and enthusiastic manner. They described him as a personable, responsible leader who facilitates the growth of their community. For instance, individuals commented:

The local Mayor right now is awesome. No issue with him. (Participant 29)

There's a total confidence in our, in, in our local, um, [Mayor] (Participant 12)

I'm quite comfortable. I mean, I like our Mayor. … The one [we] got now is super. (Participant 14)

These positive perceptions of the Mayor strengthen the political capital in the community, as they can have complete trust and confidence in, and open communication with, him. The close relationship that residents share with their Mayor also facilitates linking social capital, as the members can openly engage with the authoritative figure in their community. In the event of a disaster, these collective aspects would facilitate the response and recovery, as the Mayor would appropriately address the community's needs and priorities (Bahadur et al., 2010; Cutter et al., 2010).

Contrarily, the majority of Walkerton residents were displeased with the response of the Mayor at the time of the outbreak. The general feeling was that he did not disclose sufficient information to the community, and was therefore not transparent or accountable. This resulted in a lack of trust in the Mayor's actions. The passage of time and change of leadership has enabled the community to developed confidence and hope in the current Mayor, who is described as approachable, trustworthy, and transparent.

Contrary to their feelings regarding the current Mayor, participants were less inclined to speak positively about the present Council in Walkerton. This is evident through the following excerpts:

This isn't the favourite Council right now (Participant 18)

The only hesitation I have is right now [is that] we have an absolutely brutal Council. (Participant 29)

They didn't join to make things better. They, they joined to say, "Watch this. We're going to stop this. We're going to do this and that." (Participant 28)

There's always that honeymoon period with a new Council and then people start to say, "Okay, you're not actually dealing with my issue." (Participant 13)

These insights suggest the current Council is unfavourable, as the needs of community members are not being addressed. This reduces the community's political capital, as participants feel disregarded by the governance and institutional structure in their community. It is important that the Council can meet the needs and priorities of its community members in the event of a disaster to promote an effective response and recovery.

It is important to note the amount of trust and confidence that community members have in those of power is heavily influenced by the opportunities and constraints imposed by them. This is explained by the principle of human agency in constrained situations in the life course approach. This principle implies that if the Mayor and Council are transparent and open to addressing the needs and desires of its community members, then individuals will have confidence in their local leaders' actions. However, if the Mayor and Council present themselves as distant, unavailable, and untrustworthy, the ability of residents to feel confident in leadership is limited.

Readiness Since the outbreak, there have been numerous organizational and management strategies implemented in Walkerton to enable the community to successfully mitigate, prepare for, respond to, and recover from any disaster implications. This includes establishing policies and procedures at the provincial level, creating a Community Emergency Management Coordinator (CEMC) position, having medical expertise, delivering mental health counselling services, and a mechanism for retaining experience

from the 2000 disaster. Despite these initiatives, some individuals fail to put these theories into practice, making them vulnerable and unprepared.

The Walkerton Inquiry sought to identify strategies and solutions to the existing problems surrounding the lack of proper water management, protection, and maintenance in the province. In response to this, the provincial government has implemented four legislative changes based on Justice O'Connor's recommendations. The Ontario Safe Drinking Water Act (SDWA), 2002 ensures the province "has mandatory drinking water standards, better training and certification of operators, licensing of all municipal residential drinking water systems, regular review and revision of drinking water standards, the licensing, accreditation and inspection of testing labs, more vigilant enforcement, and greater public transparency through the annual reports issued by both the [MOE] and the Chief Drinking Water Inspector" (Abouchar and Vince, 2011). In addition, the Canadian Environmental Law Association (2011) states that the Clean Water Act (CWA), 2006 address source protection, the Nutrient Management Act, 2002 addresses agricultural issues, and the Water Opportunities and Water Conservation Act, 2010 addresses financing water systems. This is briefly mentioned by study participants:

> The province is, uh, better equipped now. … You often hear though about, about the rules and regulations that we have now. Some have said, "…We blame Walkerton for that." They're pretty strict in rules, but, uh, and regulations, but I think they're important. (Participant 24)

> There was a ton of legislation that was changed. … [We've] got source water protection plans now throughout the province. … Source water protection and the nutrient management plans were all really intensified by the province. (Participant 6)

> All the municipalities have to have a multi-barrier approach and emergency preparedness plan, I'm pretty sure, in place. So, it's exactly like who you call, what order do you call them, like all their reporting procedures. … That all has to be defined so that it's like ready to go. (Participant 9)

The new legislative changes at the provincial level ensure that drinking water operators safely manage their Municipality's drinking water system. This enhances the preparedness capital of the community, as these regulations enforce the multi-barrier approach required to protect and maintain safe drinking water. This ensures that an event

such as the 2000 *E. coli* outbreak in Walkerton is never repeated. Such legislation also promotes the natural capital of the community. It outlines regulations to ensure the quality of water, a natural renewable resource, is properly managed, protected, and maintained in the community. This promotes the environmental status of the community's local water sources.

The human agency in constrained situations principle of the life course approach explains how the Municipality (i.e. engineers, planners, operators) has the agency and capacity to manage their community's drinking water, as long as it coincides with the rules and regulations set out by the provincial government. These legislative changes are a direct result of the *E. coli* outbreak, when the responsibilities of PUC operators were not outlined or regulated at the time. Today, there are more checks and balances in place to ensure that drinking water is properly maintained and protected.

In accordance with the new provincial policy, participants indicated that the community now has a full-time CEMC. The CEMC is responsible for "[developing], [implementing], and [maintaining] emergency management programs for specific hazards and risks and/or emergency services that are complementary to the programs implemented by [the community]" (Ontario Ministry of Community Safety and Correctional Services, 2016)). Participants indicated that the Fire Chief holds this position in Walkerton:

> Provincially, the rules were tightened. Communities had to hire an emergency measures management CEMC [community emergency management coordinator] full-time, so the Fire Chief now has that job. (Participant 6)

> We have someone in charge of [emergency preparedness today], I think it's our Fire Chief. (Participant 27)

> Emergency preparedness in general is a good, you know, sort of group, but you know sort of, um, it is the responsibility and I believe it's a municipal responsibility at this point now that they have emergency preparedness in place, and it may be as a result of, you know I'm gonna say it's a result of [the] *E. coli* [outbreak]. (Participant 8)

The CEMC position further strengthens the preparedness capital in the community, as their role is to develop, implement, and maintain hazard risk assessments and emergency management plans, identify and secure resources, and ensure that the community has

adequate first response and medical response capacity in the event of a disaster (Cox, 2015; Cox and Hamlen, 2015). This position also strengthens the human capital of the community, as the CEMC ensures the Walkerton community has the internal skills, knowledge, training, and functional capacity to effectively mitigate, prepare for, respond to, and recover from any disaster implications. The CEMC ultimately provides "a strategic, coherent, and integrated approach to emergency management" (Ontario Ministry of Community Safety and Correctional Services, 2016).

With respect to the life course approach, following the *E. coli* outbreak in Walkerton, the community now has a position dedicated to developing, implementing, and maintaining emergency and disaster management plans. This ensures that the community is more prepared in the event of a disaster. However, this position is constrained by the rules, regulations, and standards set out by the Emergency Management and Civil Protection Act.

Medical capacity is another critical component of disaster management. It ensures that an appropriate number of health care workers have the proper knowledge, skill set, and training to treat those who experience health implications as a result of the catastrophe. Participants noted that health-care professionals in Walkerton are thoroughly qualified to handle any given challenge:

> I think medical health capacity wise, we're in really good shape, I think. We still have the hospital here. We formed a family health team since then. We, we've got a new health clinic since then. We have an active physician recruitment committee. And, and all of these things you know, in this context, may have, um, because we had the health crisis in 2000, perhaps we are a little more sensitive to making sure that we have those things in place. (Participant 25)

> Yeah, I think people are very qualified now. … The medical profession is now more qualified than they've ever been. … I don't know what they could throw at us right now that we couldn't handle. (Participant 4)

> Participant 17 responded "Yes" when asked, "In terms of today's day-to-day operations at the hospital, do you still think that [medical workers are] equipped to deal with, like, the things on a daily basis?"

These passages indicate that the Walkerton community continues to have a competent health care team (i.e. physicians, nurses, social workers) who have the

appropriate knowledge and training to treat patients promptly. In the context of disaster management, this enhances the preparedness capital of the community, as health care professionals have the internal capacity to respond to various health implications by providing medical services to those who require it.

At the time of the outbreak, participants stated that hospital workers were overwhelmed with the influx of ill patients which threatened the regular operations. Medical staff had to work around the clock to treat these individuals. This would most likely be the case if a similar disaster were to occur today in the community. The principle of human agency in constrained situations can explain how a disaster would impact the capacity of medical workers to respond to the needs of their patients immediately.

At the time of the outbreak, individuals mentioned the lack of mental health counselling services available to those who needed it. However, in Walkerton today, the area of mental health has significantly grown such that services are more accessible than they were in 2000. In particular, participants discussed the success of an organization called Wes For Youth that seeks to provide mental and emotional wellness support for youth (Wes For Youth, 2016):

> There's a group called Wes For Youth right now that's doing some amazing work with teens and stuff, so, kind of trying to break down the barriers and to finally talk about mental health. … It's been really positive for the community. (Participant 11)

> Wes For Youth … is doing great work with young kids, great counselling. … It's not even a referral; kids can drop in there. … Nicely located within striking distance of both high schools, quite easily you'd be able to walk. (Participant 5)

> [There are] several little private counsellors plus, uh, youth counsellors struck with issues [today]. There's more. (Participant 25)

Wes For Youth is recognized as a valuable resource in providing counselling services to young individuals. The organization recognizes the growing incidence of mental health programs among this population, and focuses on providing wellness and emotional support to these individuals. This sustains the human capital of the community, as the mental health status and well-being of the youth is being supported.

With respect to the life course approach, this organization fits with the timing in lives principle, which examines the social timing in people's lives. For instance,

chronological age dictates specific expectations, responsibilities, roles, and events (Elder Jr., 1994). Adolescence is a complex and challenging period in one's life where individuals feel immense pressure to be successful at school, at home, and in social groups (Canadian Mental Health Association, 2016). This organization recognizes the societal pressures that affect the lives of adolescents and provide suitable means to assist their transition into adulthood. In the context of the *E. coli* outbreak, this organization can provide the appropriate support to the youth over the age of 16 who were adversely affected by the event.

Many of the individuals who were affected at the time of the outbreak continue to call Walkerton home today. Accordingly, participants stated that the previous *E. coli* outbreak has provided them with the experience to become better equipped to respond to and recover from a similar event today:

> I'd say [we would] better respond to it 16 years later. (Participant 2)

> I think it would be, um, from the knowledge that we've gained, um, in what happened in 2000, um, you know, sort of there would be a faster response, um, and sort of treatment. (Participant 8)

> There's enough experience there that [individuals] should have some directions as to some of the things that should and should not be done (Participant 22)

> I think if somebody was to throw something at us again, you know, hopefully they won't, but I think everybody, everybody would, um, get involved a lot faster and the systems are now in place. (Participant 4)

> I would imagine now knowing what has happened that [residents] would certainly [be more knowledgeable] and ask for help faster. (Participant 19)

This demonstrates both the preparedness and human capital is strong among community members, as participants suggest their training from the previous *E. coli* outbreak would enhance their response and recovery if another similar event were to occur today in Walkerton. Here, the principle of historical time and place in the life course approach explains how the present day preparedness of Walkerton residents is embedded and shaped by historical events and factors in the geographical location where they reside (Elder Jr., 1994).

However, it is ultimately up to individuals to apply the knowledge they have gathered into practice. Despite the various checks and balances, skills and training, and lessons learned from the previous *E. coli* outbreak, participants mentioned there are still residents in Walkerton today who would be ill-prepared in the event of a similar disaster:

I still think at the end of the day people become very complacent. (Participant 27)

[If] something happens, I guess we'll just take it day by day. … We'll just have to wing it. (Participant 1)

This past summer out at the lake there, um, out at Lake Rosalind, um, they deemed their, you know, their water at the lake, you couldn't drink it, you couldn't swim in it, you couldn't do this, and blah, blah, blah. And there are individuals, there's councillors and different individuals that live, um, on the lake, and, um, questioned public health. And it, and, you know, I'm sitting home and I'm thinking, "My God, how soon we've forgotten, like, you guys lived through this. You lost loved ones, and yet your questioning public health with water?" I, it just struck me as odd. … So, do we learn? Yeah. Do we apply it? I think it depends [on] your circumstances. (Participant 17)

That's kinda the thing about [mental health education] is that you can promote it but you don't necessarily know how many people hear it, use it, change their thinking. Like, you don't necessarily see the results of what you do. 'Cause just because you say it to a hundred people, how many of those hundred people actually heard what you said and then make a change, right? (Participant 20)

These excerpts acknowledge the reality of people's actions where no individual is ever fully prepared to deal with the implications of a disaster, despite the number of procedures, plans, regulations, and training that can be provided. This threatens the preparedness capital of the community, as it recognizes that no current strategy can fully prepare individuals for a disaster. This fits into the human agency in constrained situations principle of the life course approach, as the type and intensity of a disaster ultimately dictates the amount of preparation required to mitigate, prepare for, respond to, and recover from its implications.

Rural Community Characteristics Living in a rural community continues to be both an enabler and barrier to maintaining resilience among Walkerton community members. Participants indicated that there is a strong community support and spirit in Walkerton,

which is common in rural areas. In contrast, the community is struggling to retain youth and recruit physicians, which is resulting in a declining population.

Participants indicated that a common component of rural towns is strong relationships among community members. The Walkerton community continues to come together to provide one another with support when needed. This includes friends, families, neighbours, community service organizations, and religious groups helping each other:

> I think the core aspect of this community is a, is a social bond, and people will, people will come together. Certainly, in the smaller communities, there … are very strong social bonds between, between people, so I think, uh, that … continues. (Participant 12)

> I think we are a close community. Um, we, um, probably have a lot of benefits being a small town, that we know people, we look out for each other. (Participant 16)

> A small community like this is naturally closer in terms of being supportive if there is an issue. Uh, for example, I do quite a bit of volunteer and fundraising work and there seems to be an awful lot of people who come together very quickly (Participant 22)

> There's still a lot of, um, helping out each other and what can we do to support each other. (Participant 23)

> [Strong social networks] certainly still exist, and they always will exist because of the nature of the community. (Participant 14)

> The community of Walkerton has been very good at being a community. … There is a strong social network in Walkerton today.… And there is a strong social network of people that still is supportive. (Participant 19)

> From my experience in our community, there's a, a friendliness, there's a, um, a health, like a social health, um, you know? There's social capital. (Participant 21)

These passages demonstrate that the relationships that Walkerton residents share with one another continue to be strong today. This strengthens the social capital of the community, as individuals can turn to each other for support if needed. This also includes sharing tangible and intangible resources with one another. In the event of a disaster, it is vital that community members support one another in facilitating a more efficient and effective response and recovery. In regards to the life course approach, the principle of linked lives explains the interdependent relationships shared amongst people. At the time

of the outbreak, participants indicated that their formal and informal social networks were the most significant contributor in assisting their recovery. Today, Walkerton residents continue to share close relationships with one another. This suggests that the *E. coli* outbreak may have brought people closer together, as they were all affected by a common factor, and in turn formed a shared identity among Walkerton residents.

Participants also stated that various events continue to occur in their community today, and are well attended by residents. Participants indicated that community spirit is alive and well in Walkerton:

> There's about 10 [events] that take place every year in the community that are all positive. … I think, uh, the tragedy, if anything, I think advanced those. (Participant 2)

> There's just some things that bring people together, like the Dirt Pigs Ball Festival, and when they have that, that's, I mean, a lot of people come up and that brings people from other communities, too, with the games, but, uh, it is also something good for this community. Uh, bringing people here and the game, that's volunteers. … The Buskers Festival on the main street here in town. So, again that requires volunteers and that brings lots of families and families from other towns. … We've got Victoria Jubilee Hall with the music events and things that happen there. (Participant 10)

> It's more timely to look at the homecoming that we had this past summer. They do it every ten years, right? It's called the homecoming. … It kind of celebrates … our anniversary, since the town became a town. … In rural communities, you know, more than half of the kids that grow up there leave to go somewhere else for work, right? So, it's literally bringing those kids back home. … I think that was a great example of yes, people definitely do come out for events. … And there's shared experiences, um, in this community. We have, uh, tons of sporting events, uh, tons of, um, you know, Santa Clause parade, anything like that where it kind of brings people out in on the streets and they get to participate in that. (Participant 11)

> We have our local town hall, Jubilee Hall. … We have amazing performances that, uh, come to that town hall. It's all through volunteers. … The groups they bring in are just amazing. So, that's something that really has, I think, um, brought some of the town together. (Participant 16)

There is a strong sense of spirit and pride in Walkerton, evidenced by the fact that individuals spend their time promoting and engaging in the arts and culture scene. This strengthens the cultural capital of the community by bringing individuals together to build

memories; it is important as humans are social beings and depend on one another for mutual aid.

The principle of linked lives of the life course approach explains how participating in events continues to bring individuals together to spend time and build relationships with one another. In the event of a disaster, it is vital that events, festivals, and occasions that bring people together are held in order to uplift spirits and ultimately assist in the recovery process. Over time, the Walkerton community has continued to feel joy and pride in their heritage, and the fact that the *E. coli* outbreak did not bring them down.

The principle of historical time and place of the life course approach also explains the continued successful operation of and participation in community events and activities among Walkerton residents today. Participants indicated that several celebrations and traditions continue to take place annually in their community with high attendance. Examples include the Dirt Pigs baseball tournament, the Longest Day of Golf, Buskers Festival, musical recitals at Victoria Jubilee Hall, and homecoming (occurs decennially), among others. Such events are embedded in today, and are shaped by historical traditions of Walkerton.

Many participants discussed that declining populations continue to be a problem in all rural communities, and Walkerton is no exception. This is because resources, health care access, economic opportunities, and post-secondary education opportunities are more easily accessible in urban areas. Participants mentioned that youth retention and physician recruitment are of particular concern:

> I think our community is facing the same challenges that rural communities around the world face. … For ten thousand years, people have been migrating to larger cities. (Participant 25)

> The declining populations in the rural areas is really an issue, and that youth retention piece is, uh, is, is a huge [issue]. … We need to get them back here or other people here to work on the kinds of things that they might be working on [in larger cities]. (Participant 12)

> Can they all stay? No. There isn't enough work for the young people. (Participant 23)

There's always a fight in every small community to attract people to the community. … It's sort of like physician recruitment. How do we get physicians to come? How do we sell our community to somebody and why do they come here instead of going [elsewhere]? (Participant 8)

Physician recruitment is a high priority for the community. … It's always a struggle in a rural community to keep [them]. (Participant 24)

A declining population suggests a loss of human capital in a community, especially when it involves a difficulty in retaining youth and physicians. It is important to propose initiatives to keep and/or bring people into the community to ensure its long-term sustainability. In turn, this would develop future leaders, build economic prosperity, and provide the opportunity to share relationships with more individuals; these components are instrumental in maintaining resilience in the event of a disaster.

With respect to the *E. coli* outbreak, some participants mentioned that a handful of individuals permanently left the community because they could no longer trust those in power in Walkerton. This provides a partial explanation to Walkerton's declining population. Using the life course approach, the principle of human agency in constrained situations also explains why individuals leave rural areas for urban centres, in that there are often more opportunities for economic growth, diversity, infrastructure, and access to health care in these areas when compared to their rural counterparts thereby promoting agency in peoples' lives. To contrast, in rural communities, there are a finite number of resources and more restrictions in place that limit peoples' opportunities.

4.4 – Life Course Approach in Disaster Management Research

This multi-disciplinary study integrated the life course approach to examine community resilience in present day Walkerton following the effects of the 2000 water contamination tragedy. It contributes to the domain of disaster management by demonstrating that the impact of a disaster on individual peoples' lives, and the community as a whole, extend long beyond the disaster itself. This study argues that disaster management program plans and strategies should encompass a proactive, long-term approach to minimize the future implications of an event on group lives.

Accordingly, a conceptual model (Figure 4.1) was developed based on the study's findings to demonstrate the application of the life course approach in an existing community resilience framework. It highlights the need to integrate a community-centred approach in disaster management to yield more effective and efficient mitigation, preparation, response, and recovery strategies. At its core are the main types of capitals that are essential in enhancing community capacity. This includes human capital, cultural capital, social capital, preparedness capital, physical capital, political capital, economic capital, and natural capital. However, this conceptual model integrates the four principles of the life course approach as an additional component to examine the later life implications of a disaster on the lives of community members under non-crisis conditions. These principles include: human agency in constrained situations, linked lives, timing in lives, and historical time and place. They complement the community capitals in recognizing the interplay of broad social, economic, structural, and environmental contexts in achieving/maintaining community resilience.
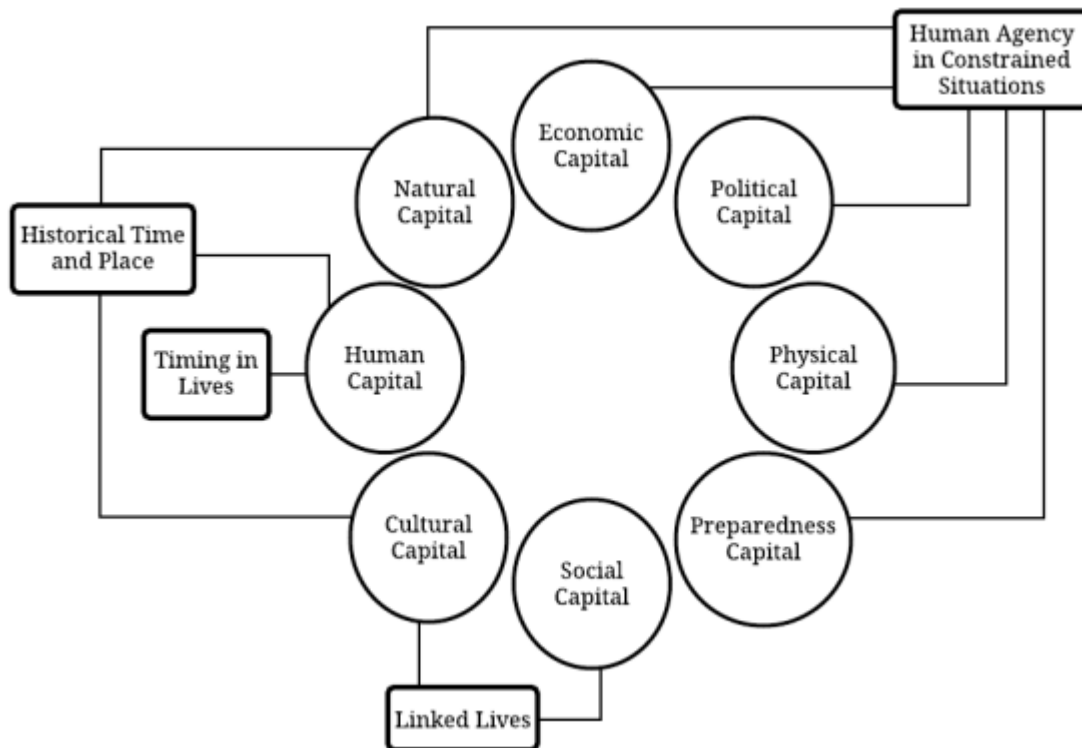
Figure 4.1: Life Course Approach and Community Resilience Conceptual Model

The following paragraphs explain how the four principles of the life course approach are useful in examining the implications of a disaster on the subsequent lives of community members in maintaining resilience under non-crisis conditions.

4.4.1 – Human Agency in Constrained Situations

As noted earlier, this principle states the autonomy of individuals is controlled by society (Elder Jr., 1994). The results of this study suggest that it can be used to explain the following capitals in maintaining community resilience under non-crisis conditions in Walkerton: economic capital, political capital, preparedness capital, natural capital, and physical capital.

Economic capital looks at the public and private cash and liquid resources within a community to achieve any financial or social objectives (Beckley et al., 2008; Frankenberger et al., 2013). Factors in the social environment, such as the economy, have a significant effect in determining what opportunities or constraints influence the later lives of individuals. At the time of the *E. coli* outbreak, the provincial government invested its money in building the WCWC in the community. Due to its immediate success, business owners saw the area surrounding the establishment as an opportunity to expand their company and ultimately the local economy in Walkerton. This has resulted in the long-term economic growth, diversity, and operation of these businesses and services, which sustains the economic health and vitality in the Walkerton community. In regards to the discipline of disaster management, this demonstrates the need to develop strategies and opportunities that promote the long-term economic capital of a community.

Political capital examines the formal and informal governance systems, structures, and processes within a community (Cox, 2015). This type of capital considers the trust, transparency, accountability, and reliability of government leadership, support, and engagement (Cox, 2015; Cox and Hamlen, 2015). Forces in the social environment, such as political leaders, significantly impact the agency of community members' lives across their life course. At the time of the tragedy, participants indicated there was a lack of communication, transparency, and accountability held by both the Mayor and the PUC operators responsible for maintaining their drinking water. This resulted in anger and

distrust among community members in those individuals of power. On the other hand, in the present day, both the current Mayor and PUC operators strive to support the needs and priorities of the community and their drinking water, respectively. This facilitates the trust and confidence that residents have in their community leaders today, which ultimately strengthens the political capital in Walkerton. It is essential to have formal and informal political leaders that support the wellbeing of communities to strengthen their capacity to mitigate, prepare for, respond to, and recover from any disaster implications in the long-term.

Preparedness capital considers the existing plans, processes, procedures, rules, and regulations of a community to mitigate, prepare for, respond to, and recover from in the event of a disaster. With respect to water management, protection, and maintenance, the standards are set out by the provincial government. The Ontario Ministry of the Environment and Climate Change (MOECC) ultimately dictates the agency that PUC operators have in their community to ensure they are abiding by the mandatory regulations. In addition, the CEMC must follow the standards put forward by the Emergency Management and Civil Protection Act. This demonstrates that there are social factors, such as the legislation set by the Canadian government, that limit the opportunities that drinking water operators and emergency management coordinators have in their community. These checks and balances maintain the preparedness capital in Walkerton today in direct response to the 2000 water contamination outbreak to ensure the community is better equipped in the event of a similar tragedy. It is vital that all disaster management plans, processes, procedures, rules, and regulations consider the long-term implications of an event to reduce any impacts on the subsequent lives of community members.

Natural capital looks at the natural resources in the biophysical system to support the lives of community members. It considers the geographic attributes, environmental status, ecological exposure, energy supply and production, and the use of water and food sources (Cox, 2015; Cox and Hamlen, 2015). The principle of human agency in constrained situations indicates that factors in the social environment, such as the regulations set out by the Ontario MOECC, maintain the natural capital in the Walkerton community. Since

the water tragedy, the provincial government has established strict policies to ensure that municipal drinking water is properly managed, protected, and maintained. In particular, the SDWA, 2002 and the CWA, 2006 include several regulations aimed at preventing a similar occurrence in the future. These legislations promote the natural capital by sustaining the quality of drinking water in the community, thus maintaining the environmental status of water in Walkerton; this ensures the drinking water is sustainable in the long-term.

Physical capital comprises the infrastructure, utilities, equipment, and services that support communities (Cox, 2015; Frankenberger et al., 2013). These dimensions are embedded in the built environment. Examples include the access, availability, and reliability of water, sanitation, energy, telecommunications, transportation, housing, and community buildings (e.g. hospitals and schools). Many of these aspects are constrained by factors in the social environment, such as the funding available from those in positions of power. At the time of the outbreak, *E. coli* and *Campylobacter jejuni* had contaminated the water and sewer lines, and the government provided financial support to update the physical infrastructure to avoid any possible cross-contamination with other infrastructure. Such changes to the infrastructure are well justified in Walkerton today, as it continues to maintain the community's physical capital. This highlights the need to make changes in the built environment that strengthen the long-term structure and functioning of communities.

4.4.2 – Linked Lives

The principle of linked lives considers the interdependent relationships that individuals share with one another (Elder Jr., 1994). The findings of this study suggest it maintains the social and cultural capitals in Walkerton today.

Social capital is a complex concept that examines social organizations. It focuses on networks of civic engagement, shared identities, and the values, trustworthiness, and reciprocity among individuals to cooperate for mutual benefit (Akamani, 2012; Putnam, 2000; Putnam et al., 1993). Aldrich (2012) proposed three forms of social capital that facilitate aid in the event of a disaster: bonding social capital, bridging capital, and linking social capital. Bonding social capital considers relationships within the same community, bridging social capital looks at relationships across different communities, and linking

social capital looks at relationships that individuals share with those in positions of power (Aldrich, 2012). When each of these three forms is present, a community is more likely to become resilient (Aldrich, 2012). Several participants indicated that community members share strong relationships with one another in each of the three forms of social capital both at the time of the outbreak and in the present day, thus demonstrating the principle of linked lives in Walkerton.

Bonding social capital exists within Walkerton as individuals have continued to share strong formal and informal relationships with each other since the tragedy. This includes bonds among family members, friends, neighbours, community service groups, and religious groups. It allows residents to depend on one another should they require any aid. With respect to building social capital in present day Walkerton, residents are grateful for the assistance they received at the time of the outbreak from external communities and continue to have a "pay it forward" attitude by contributing back to these communities, as well as to others who require assistance. This form of social capital is essential in maintaining the community's present resiliency status, as it allows them to exchange tangible and intangible resources if needed. In the event of a disaster, this is vital as it would facilitate a more effective and efficient response and recovery. Lastly, a strong linking social capital exists in present day Walkerton. At the time of the outbreak, the government took ownership for neglecting the status of the defective well by providing financial assistance to the community. This enhanced the relationships among community members with individuals in power, as they had confidence and trust that these authoritative figures would mitigate the repercussions of the outbreak. Evidently, the principle of linked lives collectively captures all three forms of social capital by demonstrating how they continue to exist in the community to maintain its resiliency status.

Cultural capital looks at the traditions, values, and beliefs embedded in a community (Cox, 2015). It is typically expressed through the participation in community events, festivals, and activities (Cox, 2015). The principle of linked lives can explain how individuals share interdependent relationships with one another when they collectively partake in such experiences. At the time of the outbreak, the trip to the Blue Jays game, the Watershed

music festival, and prayer services brought individuals together to enhance the community's spirit. This spirit is still alive and well in Walkerton today, as many individuals continue to come together to celebrate activities and events that take place in their community under non-crisis conditions. In the context of disaster management, this demonstrates that events that bring individuals together strengthen their support in assisting one another to recover from the consequences of a disaster. Disaster management strategies should identify opportunities that promote community participation in them to promote the long-term sustainability of communities.

4.4.3 – Timing in Lives

Timing in lives looks at the chronological age of individuals in relation to the roles, responsibilities, and expectations that they are associated with. Elder Jr. (1994) argues that individuals experience changes in personal and social status and identity across the life course. In the context of influencing resilience in a community, this principle pertains to human capital.

Human capital looks at the socio-demographics, distribution, and stability of a population (Frankenberger et al., 2013). Populations encompass individuals of different age groups who have different skills, knowledge, training, and functional capabilities which collectively contributes to the successful operation of society (Akamani, 2012; Cox and Hamlen, 2015; Twigg, 2009). At the time of the outbreak, adults were expected to take care of themselves, as well as their children and older parents living in the community. Adults were also encouraged to continue working to restore the collective order in the lives of community members. On the other hand, children were expected to remain in school and assist in chores around the house. Today, these same roles, responsibilities, and expectations continue to exist in maintaining order and resiliency in the community; however, many of the age groups that individuals belong to have shifted since the outbreak occurred more than 16 years ago. Children from that time are now adults, and some adults from that time are now seniors.

There are many services and organizations in Walkerton today that facilitate the ability of individuals to continue their duties and responsibilities in ultimately enhancing

the human capital of the collective community. For instance, Wes For Youth is a mental health counselling organization that provides wellness and emotional support for young people to help them cope with the various pressures they experience in their lives. There is also a long-term care facility in the community to assist seniors who may no longer be able to live independently. In relation to the adult population, the timing of lives typically situates them in their working years. Many professions provide training, education, and capacity building for such employees to become more competent. This is vital in the discipline of disaster management, as the collective skills, knowledge, educational attainment, labour, training, competency, functional ability, leadership, and physical and mental health status of community members facilitate a more effective and prompt response and recovery (Akamani, 2012; Cox, 2015; Mayunga, 2007; Twigg, 2009).

A final component of human capital considers the physical health status of the population. With respect to the timing in lives principle, there are "developmental consequences of events and transitions [that] are conditional on their timing in people's lives" (Elder Jr. et al., 2003, p. 10). There are critical periods during individuals' lives where they are more sensitive to environmental stimuli resulting in developmental implications (e.g. chronic disease and mortality). O'Connor (2002a) argued that children under the age of five and seniors over the age of sixty-five were the groups most vulnerable to the health implications of *E. coli* O157:H7. Some individuals who fall under these age groups who were sick at the time of the outbreak continue to experience adverse health effects today (e.g. IBS, hypertension, kidney disease). This impacts the collective human capital of Walkerton today, as the *E. coli* outbreak had a detrimental impact on the current health status of many community members.

In regards to the domain of disaster management, special attention should be paid to the chronological age of individuals to identify any impacts the event may have on the long-term socio-demographics, distribution, and stability of a population.

4.4.4 – Historical Time and Place

This final principle explains how the life course of individuals and groups is shaped by the historical factors and events in the geographical location where they live (Elder Jr.,

1994). In relation to the current study, the findings suggest that the 2000 *E. coli* outbreak continues to shape the lives of community members in some capacity both positively and negatively. In particular, the principle of historical time and place demonstrates how human capital, cultural capital, and natural capital impacts the present day resiliency status of the community.

Human capital considers the distribution, demographics, and stability of its community members (Frankenberger et al., 2013). It looks at the collective skill set, knowledge, educational attainment, training, competency, physical and mental health status, and functional ability of these individuals (Akamani, 2012; Cox, 2015; Cox and Hamlen, 2015; Mayunga, 2007). The physical and mental health status of many Walkerton residents is forever impacted by the 2000 water contamination outbreak. Several people continue to experience adverse health implications (as mentioned under the timing in lives principle), as well as PTSD-related flashbacks in the presence of water coming out of a faucet or hearing the roaring sound of a helicopter. These aspects threaten the collective present day physical and mental health status of the community.

This principle also explains how the community will forever be recognized for its water tragedy. Participants indicated that when they introduce themselves as being from Walkerton to outsiders of the community, such individuals solely reminisce on the community in a negative context by recalling the adverse outcomes of the tragedy. Similarly, when a similar event occurs elsewhere in the world, it is often compared to the Walkerton outbreak. This impacts the resilience of the overall community in its ability to truly move beyond the consequences of the Walkerton tragedy.

On the other hand, the principle of historical time and place promotes the human capital of the community in operating its WCWC. This establishment is a positive outcome of the Walkerton water contamination outbreak (a historical event in a geographical area) in providing educational and practical training to enhance proper drinking water management, protection, and maintenance in the province. Many WCWC employees reside in Walkerton, which enhances the collective skills, knowledge, and training of the

community in such areas. In the context of disaster management, this demonstrates the need to identify opportunities that enhance the long-term human capital of a community. *Natural capital,* as described under the principle of human agency in constrained situations section, looks at the environmental status of the community's local water source. However, the principle of historical time and place can also explain how the operation of the WCWC maintains the natural capital of the community. As explained above, the centre is a direct result of the *E. coli* outbreak that occurred in Walkerton in 2000 (a historical event in a geographical area). It provides knowledge and skill set training to PUC operators in the community to ensure its drinking water is properly managed, protected, and maintained. In the regards to the domain of disaster management, policies and procedures should look at opportunities that enhance the long-term natural capital of a community to promote the sustainability of its natural resources.

Cultural capital (as described under the principle of linked lives) can also be explained using this principle with respect to the continued participation in community events and activities among Walkerton citizens. These events are rooted in their community's origins, traditions, and values, and continue to operate today with great attendance. Such festivals, events, and activities maintain the community's spirit and pride, and in turn their resiliency status and their ability to respond to and recover from a disaster.

4.5 – Research Implications and Recommendations

The knowledge gained from this study builds and strengthens capacity to effectively address public health issues for the benefit of the population. In particular, this study contributes to an existing operational model of community resilience to better understand the multiple factors that impact community resilience and vulnerability following a disaster under non-crisis conditions. It is important to recognize that the life course principles and the community capitals in the conceptual model are not discrete entities, in which they overlap and influence one another. This is significant to the domains of both public health and public policy, as it can identify critical areas that either facilitate or hinder resilience to better understand how other rural communities can mitigate, prepare for, respond to, recover from the consequences when a disaster does strike.

The implications of this research study are also relevant in emergency management, as the findings can be integrated into existing community strategies, action plans, and programs to better anticipate, plan for, and reduce any risks in the long-term. In turn, integrating a life course approach can help protect individuals and their health, their communities and cultural heritage, their respective socioeconomic assets and ecosystems, and ultimately strengthen their overall long-term resilience.

The findings of this study were strictly descriptive; it is important to conduct subgroup analyses on a population to determine if sociodemographic variables (e.g. gender, age, education, occupation, disability, race, ethnicity, and other power inequities) play an additional role in influencing a community's collective capacity to achieve/maintain resilience post-outbreak under non-crisis conditions.

Additionally, this was a qualitative cross-sectional study that explored the factors that facilitated or hindered community resilience at only one point in the present day. Future studies should be longitudinal in nature to examine the long-term impacts of a disaster on community resilience under non-crisis conditions at various points in time. Such studies should utilize the life course approach to further determine its applicability in the domain of disaster management. In turn, this could build capacity to serve as a model such that others could adopt and adapt to their local context to promote the long-term sustainability of their community.

The development of this conceptual model creates new opportunities for the field of disaster management. It further extends the application of the life course approach to the discipline. Its principles corroborate the existing literature in this area by demonstrating that an interdisciplinary approach is required to promote long-term community resilience in mitigating, preparing for, responding to, and recovering from the effects of a disaster. This approach recognizes the interrelationship that exists between community members' lives and the various social, cultural, economic, political, preparedness, physical, and natural factors in facilitating or hindering their ability to achieve/maintain community resilience. Incorporating a life course approach to existing disaster management plans or strategies could allow CEMCs or individuals in similar positions to understand better the

various aspects of group lives that can be used to facilitate a more effective and efficient response and recovery in the event a disaster strikes. In turn, this would promote a community-centred approach to disaster management, which is argued to be an optimal approach to capacity building (Cox, 2015; Shaw, 2012).

This model could serve as the conceptual basis for the development and testing of a life course approach to measuring community resilience. Future research could enhance this conceptual model by developing a composite index or matrix to identify the specific constructs or variables to evaluate and monitor each of the life course principles in achieving/maintaining community resilience. This strategy could also systematically quantify the relationships among the life course principles to influence community resilience; no previous studies have attempted to quantify the relative weightings of the life course approach principles in the domain of disaster management. The development of a life course approach index or matrix could further strengthen capacity to better mitigate, prepare for, respond to, and recover from the repercussions of an event.

4.6 – Study Limitations

It is important to acknowledge that there were some limitations in this study. This study used a non-random sampling strategy to recruit participants. However, Patton (1990) argues that non-random sampling is appropriate in qualitative studies when the researcher is interested in seeking information-rich participants to better understand a phenomenon. In the context of the current study, the researcher was interested in examining the factors that enable or hinder the community to achieve/maintain resilience in Walkerton. The individuals who were selected in the study held a wealth of knowledge about the topic, which was instrumental in informing the findings of the study. Since data saturation was achieved, in which there were no new emerging themes at the end of all the interviews/focus groups, the researcher is confident the findings accurately represent the general understanding of community resilience in Walkerton.

This study is also at risk of selection bias due to the overrepresentation of participants over the age of 60 (59% of participants) and the underrepresentation of participants under the age of 40 (3% of participants). Therefore, the perceptions of the

individuals who participated in this study may not be representative of the overall Walkerton community. However, the 2016 Canadian Census reveals that 52.9% of the community's population is over the age of 60, while 45.3% is under the age of 40 (Statistics Canada, 2017).

Another study limitation is that all participants were Caucasian (i.e. no visible minorities were included). Racialized groups often face additional challenges in society with respect to Caucasians; the inclusion of racialized groups may have uncovered additional barriers to maintaining/achieving resilience in Walkerton. However, Walkerton Herald Times (2015) only revealed that 1.2% of the Walkerton population identified as a visible minority.

This study only included individuals who resided in Walkerton at the time of the outbreak and in the present day. It was revealed in many interviews that some people permanently left the town following the outbreak. This means that a major perspective, of those who have left, is missing. Interviewing these individuals could identify additional factors that posed a challenge to achieving community resilience at the time of the outbreak.

The mode of data collection in the study is another limitation, as two different methods were used. Twenty-three people participated in a one-on-one interview, while three groups of two individuals participated in focus group discussions. The data should have been collected using the same method to ensure consistency; however, this was not possible due to time constraints of several participants who wanted to be included in the study.

In regard to data analysis limitations, there was no subgroup analysis completed to identify trends among gender, age, or occupation categories. In addition, because this is a qualitative study, the effect of the *E. coli* outbreak on the state of present day community resilience can be described but not quantified. Thus, there were no direct associations calculated between two variables, which presents a risk of additional confounding variables.

Additional sources of bias in this study include interviewer bias, social desirability bias, and self-reported bias. Interviewer bias entails the researcher having pre-conceived beliefs about the participants' experiences as more and more interviews have been conducted. It was important that the student researcher bracketed their thoughts during the interviews to ensure the information collected accurately captured the interviewee's perceptions. Social desirability bias is a type of response bias where the participant distorts their answer to conform to social norms, which might not accurately represent their actual perceptions. It was made clear to the participants that the data collected from the interviews would be anonymized and identifying information would be removed to help individuals be comfortable in sharing their true opinions. Lastly, self-reported bias makes it difficult to determine whether the information the participant is sharing is accurate. As time passes, details are forgotten. Since this study asked individuals questions regarding their perceptions at the time of the outbreak, their responses may not accurately represent something that happened 16 years ago.

A final study limitation is the findings are susceptible to atomistic fallacy. Participants were individually asked to define and conceptualize community resilience, as well as to identify the facilitators and barriers to achieving and maintaining community resilience at the time of the outbreak and in the present day. Their perspectives were then combined and examined to reveal any trends among their responses. There is a possibility that the individual level perceptions that participants hold surrounding these categories of exploration do not accurately identify group level perspectives in the overall Walkerton community (Diez-Roux, 1998; Kirmayer et al., 2009). However, the student researcher used triangulation as a strategy to corroborate similar findings across all participants' responses; this suggests the individual characteristics capture community level perceptions.

4.7 – Knowledge Translation Strategies

Knowledge translation (KT) refers to "a dynamic and iterative process that includes the synthesis, dissemination, exchange, and ethically-sound application of knowledge" by which the findings of a research study are shared with knowledge users to help move evidence into policies, programs, and/or practices (Canadian Institutes of Health Research

[CIHR], 2016). CIHR (2016) distinguishes two types of KT: end of grant KT and integrated KT. End of grant KT involves the researcher sharing the information gained with stakeholders upon completion of the study (CIHR, 2016). In contrast, integrated KT involves engaging stakeholders in the entire research process; from deciding the research question to selecting the methodology to interpret the results of the study (CIHR, 2016).

This project utilized end of grant KT, where the interview participants were provided the findings upon completion the study. In particular, the participants were provided a summary of the results, as well as a copy of this Master's dissertation (in .pdf format via e-mail or hard copy via post depending upon preference). The researcher informed participants that the information could be shared with anyone who they believe would be interested, especially among other Walkerton residents.

The preliminary findings of this project were also presented as a poster presentation in March 2017 at the McMaster University Department of Health Research Methods, Evidence and Impact Research Day. Submissions of this study will also be made to relevant peer-reviewed journals, such as the International Journal of Disaster Risk Reduction and Disaster Prevention and Management.

Finally, the final version of this Master's dissertation will be shared with the student researcher's supervisory committee and will be made available online on McMaster University's Institutional Repository called MacSphere.

Chapter Five: Conclusion

This chapter summarizes the main conclusions drawn from this research study.

5.1 – Conclusion

Using an interpretive description qualitative study design, semi-structured interviews and focus groups were conducted with a purposeful sample of 29 Walkerton residents to identify the factors that promoted or prevented community resilience both at the time of the 2000 outbreak and in the present day. The findings corroborate with the literature to further demonstrate the interdisciplinary nature of the discipline of disaster management. In particular, a number of capitals or community assets were identified in influencing community resilience in the present day in a positive and/or negative way, including: human, physical, social, cultural, economic, political, natural, and preparedness capitals.

This study used the principles of the life course approach to understand how a disaster impacts the subsequent lives of community members. In particular, a conceptual model was developed based on the study's findings to demonstrate the application of the life course approach in an existing community resilience framework. It supports the need to integrate a community-centred approach in disaster management to yield more effective and efficient mitigation, preparation, response, and recovery outcomes. This also provides additional opportunities to build and strengthen capacity in public health and public policy.

The results of this study were solely descriptive; future research should seek to identify and quantify critical indicators to measure the relative effect of each life course principle on each of the types of community capitals. This will expand the viability of this developed model.

References

Abbott, P. L. (1996). *Natural disasters*. Dubuque, IA: W.M.C. Brown Publishers.

Abouchar, J., and Vince, J. (2011). *Ten years after Walkerton: Ontario's drinking water protection framework update*. Retrieved from http://www.cba.org/cba/cle/PDF/E NV11_Abouchar_paper.pdf

Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography*, *24*(3), 347-364.

Akamani, K. (2012). A community resilience model for understanding and assessing the sustainability of forest-dependent communities. *Research in Human Ecology, 19*(2), 99-109.

Aldrich, D. P. (2012). *Building resilience: Social capital in post-disaster recovery.* Chicago, IL: University of Chicago Press.

Ali, S. H. (2004). A socio-ecological autopsy of the E. coli O157: H7 outbreak in Walkerton, Ontario, Canada. *Social Science and Medicine*, *58*(12), 2601-2612.

Allen, K. (2003). Vulnerability reduction and the community-based approach: A Philippines study. In M. Pelling (Ed.), *Natural disasters and development in a globalizing world* (pp. 170-184). New York, NY: Routledge.

Amaratunga, C., Anderson, G., Bowles, R., Cox, R., Pearce, L., Vaughan, C., and Ursuliak, D. (2013). *Building resilience and rural health system capability for pre-disaster planning and preparedness*. Ottawa, ON: Defence Research and Development Canada.

Arya, N., Howard, J., Isaacs, S., Mcallister, M. L., Murphy, S., Rapport, D., and Waltner-Toews, D. (2009). Time for an ecosystem approach to public health? Lessons from two infectious disease outbreaks in Canada. *Global Public Health*, *4*(1), 31-49.

Bahadur, A. V., Ibrahim, M., and Tanner, T. (2010). *The resilience renaissance? Unpacking of resilience for tackling climate change disasters.* Brighton, UK: Institute of Development Studies.

Baxter, J., and Eyles, J. (1997). Evaluating qualitative research in social geography:

Establishing 'rigour' in interview analysis. *Transactions of the Institute of British Geographers, 22*(4), 505-525.

Beckley, T. M., Martz, D., Nadeau, S., Wall, E., and Reimer, B. (2008). Multiple capacities, multiple outcomes: Delving deeper into the meaning of community capacity. *Journal of Rural and Community Development*, *3*(3), 56-75.

Béné, C., Wood, R. G., Newsham, A., and Davies, M. (2012). Resilience: New utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. *IDS Working Papers*, *2012*(405), 1-61.

Bennett, R. S. (2011). *Walkerton Compensation Plan: Class action settlement final report*. Retrieved from http://www.walkertoncompensationplan.ca/Walkerton%20Report%20May%2019_11.pdf

Berkes, F., and Ross, H. (2013). Community resilience: Toward an integrated approach. *Society and Natural Resources*, *26*(1), 5-20.

Bonanno, G. A. (2005). Resilience in the face of potential trauma. *Current Directions in Psychological Science*, *14*(3), 135-138.

Breen, S. P., Minnes, S., and Vodden, K. (2015). *A regional approach to drinking water management*. Corner Brook, NL: Leslie Harris Centre of Regional Policy and Development, Memorial University.

Bridger, J. C., and Luloff, A. E. (1999). Toward an interactional approach to sustainable community development. *Journal of Rural Studies*, *15*(4), 377-387.

Brooks, N. (2003). *Vulnerability, risk and adaptation: A conceptual framework*. Norwich, UK: Tyndall Centre for Climate Change Research.

Buckle, P. (1999). Re-defining community and vulnerability in the context of emergency management. *Australian Journal of Emergency Management*, *13*(4), 21-26.

Burton, I., and Kates, R. W. (1964). The perception of natural hazards in resource management. *Natural Resources Journal*, *3*(3), 412-441.

Canadian Environmental Law Association. (2011). *Ontario Safe Drinking Water Act, 2002 and its regulations: FAQs*. Retrieved from http://www.cela.ca/sites/cela.ca/fi

les/SDWA%20FAQs-25.11.2011_0.pdf

Canadian Institutes of Health Research. (2015). *Guide to knowledge translation planning at CIHR: Integrated and end-of-grant approaches*. Retrieved from http://www.cih r-irsc.gc.ca/e/45321.html

Canadian Mental Health Association. (2016). *Mental health: Youth*. Retrieved from http: //www.cmha.ca/mental-health/your-mental-health/youth/

Centers for Disease Control and Prevention (CDC). (2016). *A primer for understanding the principles and practices of disaster surveillance in the United States* (1st ed.). Atlanta, GA: Centers for Disease Control and Prevention.

Centre for Research on the Epidemiology of Disasters (CRED). (2016). *EM-DAT the international disaster database: General classification*. Retrieved from http://www.emdat.be/classification

Chamlee-Wright, E., and Storr, V. H. (2011). Social capital as collective narratives and post-disaster community recovery. *The Sociological Review*, *59*(2), 266-282.

Chaskin, R. J. (2008). Resilience, community, and resilient communities: Conditioning contexts and collective action. *Child Care in Practice, 14*(1), 65-74.

Christensen, J. A. and Robertson, J. A. (1980). *Community development in America*. Ames, IA: Iowa State University Press.

Clark, W. F., Macnab, J. J., and Sontrop, J. M. (2008). *The Walkerton Health Study 2002-2008: Final report*. London, ON: London Health Sciences Centre.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, *94*, S95-S120.

Cork, S. (2010). *Resilience and transformation: Preparing Australia for uncertain futures*. Collingwood, Australia: CSIRO Publishing.

Cox, R. S. (2015). *Measuring community disaster resilience: A review of current theories and practices with recommendations*. Ottawa, ON: International Safety Research.

Cox, R. S., and Hamlen, M. (2015). Community disaster resilience and the rural resilience index. *American Behavioral Scientist*, *59*(2), 220-237.

Cox, R. S., Hamlen, M., Legg, R., Pearce, L., Pinette, J., and Smiechowski, C. (2012).

Rural disaster resilience planning guide: Assessing risks and building resilience for disasters in rural, remote and coastal communities. New Westminster, BC: Justice Institute of British Columbia.

Creswell, J. W., Hanson, W. E., Clark Plano, V. L., and Morales, A. (2007). Qualitative research designs: Selection and implementation. *The Counseling Psychologist*, *35*(2), 236-264

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., and Tate, E. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change, 18*(4), 598-606.

Cutter, S. L., Burton, C. G., and Emrich, C. T. (2010). Disaster resilience indicators for benchmarking baseline conditions. *Journal of Homeland Security and Emergency Management*, *7*(1), 1-22.

David, M., and Sutton, C. (2011). *Social research: An introduction* (2nd ed.). London, UK: Sage Publications Ltd.

DeWaard, J. (2016). Disaster and Life Course Processes. In M.J. Shanahan, J.T. Mortimer and M.K. Johnson (Eds.), *Handbook of the life course* (pp. 321-338). New York, NY: Springer International Publishing.

Diez-Roux, A. V. (1998). Bringing context back into epidemiology: Variables and fallacies in multilevel analysis. *American Journal of Public Health*, *88*(2), 216-222.

Drabek, T. E., and Hoetmer, G. J. (1991). *Emergency management: Principles and practice for local government.* Washington, DC: International City Management Association.

Dynes, R. R. (2005). *Community social capital as the primary basis for resilience*. Newark, DE: University of Delaware.

Elder Jr., G. H. (1994). Time, human agency, and social change: Perspectives on the life course. *Social Psychology Quarterly, 57*(1), 4-15.

Elder Jr., G. H. (1998). The life course as developmental theory. *Child Development*, *69*(1), 1-12.

Elder Jr., G. H., Johnson, M. K., and Crosnoe, R. (2003). The emergence and development of life course theory. In J. T. Mortimer and M. J. Shanahan (Eds.), *Handbook of the life course* (pp. 3–19). New York, NY: Kluwer Academic/Plenum.

Elliott, J. R., Haney, T., and Sams-Abiodun, P. (2010). Limits to social capital: Comparing network assistance in two New Orleans neighborhoods devastated by Hurricane Katrina. S*ociological Quarterly, 51*(4), 624-648.

Etkin, D., Haque, E., Bellisario, L., and Burton, I. (2004). *An assessment of natural Hazards and disasters in Canada: A report for decision-makers and practitioners*. Ottawa, ON: The Canadian Natural Hazards Assessment Project.

Federal Emergency Management Agency (FEMA). (2000). *Planning for a sustainable future: The link between hazard mitigation and livability*. Washington, DC: Federal Emergency Management Agency.

Fenton, M., Kelly, G., Vella, K., and Innes, J. (2007). Climate change and Great Barrier Reef: Industries and communities. In J.E. Johnson and P.A. Marshall (Eds.), *Climate change and the Great Barrier Reef: A vulnerability assessment.* Canberra, Australia: Great Barrier Reef Marine Park Authority and Australian Greenhouse Office.

Fielding, N., and Lee, R. (1998). *Computer analysis and qualitative research*. London, UK: Sage Publications Ltd.

Fink, D. S., and Galea, S. (2015). Life course epidemiology of trauma and related psychopathology in civilian populations. *Current Psychiatry Reports*, *17*(5), 1-9.

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environmental Change*, *16*(3), 253-267.

Frankenberger, T., Mueller, M., Spangler, T., and Alexander, S. (2013). *Community resilience: Conceptual framework and measurement feed the future learning agenda*. Rockville, MD: Westat.

Freudenberg, M. (2003). *Composite indicators of country performance: A Critical assessment*. Paris, France: OECD Publishing.

Gahin, R., Velveva, V., and Hart, M. (2003). Do indicators help create sustainable communities? *Local Environment, 8*(6), 661-666.

Garg, A. X., Macnab, J., Clark, W., Ray, J. G., Marshall, J. K., Suri, R. S., ... and Haynes, B. (2005). Long-term health sequelae following E. coli and campylobacter contamination of municipal water: Population sampling and assessing non-participation biases. *Canadian Journal of Public Health*, *96*(2), 125-130.

Godschalk, D. R. (2003). Urban hazard mitigation: Creating resilient cities. *Natural Hazards Review*, *4*(3), 136-143.

Government of Canada. (2016). *Introduction to edition 2016 of the National Occupational Classification (NOC)*. Retrieved from http://noc.esdc.gc.ca/English/noc/Introduction.aspx?ver=16

Green, J., and Thorogood, N. (2004). Analysing qualitative data. In D. Silverman (ed.), *Qualitative Methods for Health Research* (1st ed.) (pp. 173-200). London, UK: Sage Publications Ltd.

Griffiths, R., Horsfall, J., Moore, M., Lane, D., Kroon, V., and Langdon, R. (2007). Assessment of health, well-being and social connections: A survey of women living in Western Sydney. *International Journal of Nursing Practice*, *13*(1), 3-13.

Guha-Sapir, D., Hoyois, P., and Below, R. (2015). *Annual disaster statistical review 2015: The numbers and trends*. Université Catholique de Louvain, Belgium: Centre for Research on the Epidemiology of Disasters.

Haque, C. E., and Etkin, D. (2007). People and community as constituent parts of hazards: The significance of societal dimensions in hazards analysis. *Natural Hazards*, *41*(2), 271-282.

Harrington, C., Curtis, A., and Black, R. (2008). Locating communities in natural resource management. *Journal of Environmental Policy and Planning, 10*(2), 199-215.

Harris, C. C., McLaughlin, W. J., and Brown, G. (1998). Rural communities in the Interior Columbia Basin: How resilient are they? *Journal of Forestry, 96*(3), 11-15.

Hays, W. W. (1991). Hazard and Risk Assessments in the United States. *Episodes, 14*(1), 7-12.

Herreria, E., Byron, I., Kancans, R., and Stenekes, N. (2006). Assessing dependence on water for agriculture and social resilience. Canberra, Australia: *Bureau of Rural Sciences*.

Hewitt, K. (2013). Environmental disasters in social context: Toward a preventive and precautionary approach. *Natural Hazards*, *66*(1), 3-14.

Holland, J., Reynolds, T., and Weller, S. (2007). Transitions, networks and communities: The significance of social capital in the lives of children and young people. *Journal of Youth Studies*, *10*(1), 97–116.

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, *4*(1), 1-23.

Hrudey, S. E., Huck, P. M., Payment, P., Gillham, R. W., and Hrudey, E. J. (2002). Walkerton: Lessons learned in comparison with waterborne outbreaks in the developed world. *Journal of Environmental Engineering and Science*, *1*(6), 397-407.

Hrudey, S. E., and Hrudey, E. J. (2002). Walkerton and North Battleford: Key lessons for public health professionals. *Canadian Journal of Public Health*, *93*(5), 332.

Hsieh, H. F., and Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, *15*(9), 1277-1288.

International Federation of Red Cross and Red Crescent Societies. (2012). *Characteristics of a safe and resilient community: Community based disaster risk reduction study*. Geneva, Switzerland: International Federation of Red Cross and Red Crescent Societies.

International Federation of Red Cross and Red Crescent Societies. (2014). *International Federation of Red Cross and Red Crescent Societies framework for community resilience*. Geneva, Switzerland: International Federation of Red Cross and Red Crescent Societies.

Janssen, M. A., and Ostrom, E. (2006). Resilience, vulnerability, and adaptation: A cross-

cutting theme of the international human dimensions programme on global environmental change. *Global Environmental Change, 16*(1), 237-239.

Jewkes, R., and Murcott, A. (1996). Meanings of community. *Social Science and Medicine, 43*(4), 555-563.

Johnson, J., and Galea, S. (2009). Disasters and population health. In K. E. Cherry (Ed.), *Lifespan perspectives on natural disasters* (pp. 281-326). New York, NY: Springer-Verlag.

Kafle, S. K. (2012). Measuring disaster-resilient communities: A case study of coastal communities in Indonesia. *Journal of Business Continuity and Emergency Planning, 5*(4), 316-326.

Kahan, J., Allen, A., George, J., and Thompson, G. (2009). *Concept development: An operational framework for resilience*. Arlington, VA: Department of Homeland Security.

Kirmayer, L. J., Sehdev, M., and Isaac, C. (2009). Community resilience: Models, metaphors and measures. *International Journal of Indigenous Health, 5*(1), 62.

Kirschenbaum, A. (2004). Generic sources of disaster communities: A social network approach. *International Journal of Sociology and Social Policy, 24*(10/11), 94-129.

Klein, R. J., Nicholls, R. J., and Thomalla, F. (2003). Resilience to natural hazards: How useful is this concept? *Global Environmental Change Part B: Environmental Hazards, 5*(1), 35-45.

Kreps, G. (1984). Sociological inquiry and disaster research. *Annual Review of Sociology, 10*(1), 309-330.

Krewski, D., Hogan, V., Turner, M. C., Zeman, P. L., McDowell, I., Edwards, N., and Losos, J. (2007). An integrated framework for risk management and population health. *Human and Ecological Risk Assessment, 13*(6), 1288-1312.

Kuh, D., Ben-Shlomo, Y., Lynch, J., Hallqvist, J., and Power, C. (2003). Life course epidemiology. *Journal of Epidemiology and Community Health, 57*(10), 778-783.

Kusel, J. (1996). *Well-being in forest-dependent communities, Part 1: A new approach.*

Sierra Nevada Ecosystem Project: Final report to Congress (Vol. 11, Assessment and scientific basis for management options, pp. 361-373). Davis, CA: University of California, Center for Water in Wildland Resources.

Lebel, L., Anderies, J., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T., and Wilson, J. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, *11*(1), 19.

Lincoln, Y. S., and Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage Publications Ltd.

Longstaff, P. H., Armstrong, N. J., Perrin, K., Parker, W. M., and Hidek, M. A. (2010). Building resilient communities: A preliminary framework for assessment. *Homeland Security Affairs*, *6*(3), 1-23.

Magis, K. (2010). Community resilience: An indicator of social sustainability. *Society and Natural Resources*, *23*(5), 401-416.

Maguire, B., and Cartwright, S. (2008). *Assessing a community's capacity to manage change: A resilience approach to social assessment*. Canberra, Australia: Australian Government Bureau of Rural Sciences.

Maguire, B., and Hagan, P. (2007). Disasters and communities: Understanding social resilience. *The Australian Journal of Emergency Management, 22*(2), 16-20.

Marlor, C., Barsh, R., and Duhaylungsod, L. (1999). Comment on defining indicators which make sense to local people: Intra-cultural variations in perceptions of natural resources. *Human Organizations*, *58*(2), 216-219.

Mayunga, J. S. (2007). Understanding and applying the concept of community disaster resilience: A capital-based approach. *Summer Academy for Social Vulnerability and Resilience Building*, *1*(1), 1-16.

Miles, M. B., and Huberman, A.M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage Publications Ltd.

Miller, F., Osbahr, H., Boyd, E., Thomalla, F., Bharwani, S., Ziervogel, G., ... and Hinkel, J. (2010). Resilience and vulnerability: Complementary or conflicting concepts? *Ecology and Society*, *15*(3), 11.

Miller, D. C., and Salkind, N. J. (2002). *Handbook of research design and social measurement* (6th ed.). Thousand Oaks, CA: Sage Publications Ltd.

Morse, J. M. (1995). The significance of saturation. *Qualitative Health Research, 5*(2), 147-149.

Mulligan, L. (2012). *Community resilience descriptive inventory*. Retrieved from http://www.crhnet.ca/sites/default/files/library/Mulligan.Stats%20Canada.2012.Community%20Resilience%20Descriptive%20Inventory.pdf

Municipality of Brockton. (2015a). *Municipality of Brockton: Walkerton*. Retrieved from http://www.brockton.ca/en/live-here/walkerton.asp

Municipality of Brockton. (2015b). *Municipality of Brockton: Role of Mayor and Council*. Retrieved from http://www.brockton.ca/en/our-services/role-of-mayor-and-council.asp

Murphy, B. L. (2007). Locating social capital in resilient community-level emergency management. *Natural Hazards*, *41*(2), 297-315.

Nardo, M., Saisana, M., Saltelli, A., and Tarantola, S. (2008). *Handbook on constructing composite indicators: Methodology and user guide*. Paris, France: OECD Publishing.

Neergaard, M. A., Olesen, F., Andersen, R. S., and Sondergaard, J. (2009). Qualitative Description: The poor cousin of health research? *BMC Medical Research Methodology*, *9*(1), 52.

Neuman, W. L., and Robson, K. (2012). *Basics of social research: Qualitative and quantitative approaches* (2nd ed.). Toronto, ON: Pearson Education Inc.

Norris, F. H. (2002). Disasters in urban context. *Journal of Urban Health, 79*(3), 308-314.

O'Brien, G. (2008). UK emergency preparedness: A holistic response. *Disaster Prevention and Management: An International Journal*, *17*(2), 232-243.

O'Connor, D. R. (2002a). *Report of the Walkerton Inquiry: The events of the May 2000 and related issues*. Retrieved from http://www.archives.gov.on.ca/en/e_records/walkerton/report1/index.html#full

O'Connor, D. R. (2002b). *Part two report of the Walkerton Inquiry: A strategy for safe drinking water*. Retreived from http://www.archives.gov.on.ca/en/e_records/ walkerton/report2/index.html

Ontario Ministry of Community Safety and Correctional Services. (2016). *Emergency Management doctrine for Ontario: Legislation and regulation*. Retrieved from https://www.emergencymanagementontario.ca/english/insideemo/legislationandre gulation/emergency_management_doctrine.html

Ostadtaghizadeh, A., Ardalan, A., Paton, D., Jabbari, H., and Khankeh, H. R. (2015). Community disaster resilience: A systematic review on assessment models and tools. *PLoS Currents*, *7*(249127)

Oxley, M. C. (2013). A "people-centred principles-based" Post-Hyogo Framework to strengthen the resilience of nations and communities. *International Journal of Disaster Risk Reduction, 4*(1), 1-9.

Partington, G. (2001). Qualitative research interviews: Identifying problems in technique. *Issues in Educational Research, 11*(2), 32-44.

Pasteur, K. (2011). *From vulnerability to resilience, a framework for analysis and action to build community resilience*. Rugby, UK: Practical Action Publishing, Ltd.

Patton, M.Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications Ltd.

Paxton, P. (1999). Is social capital declining in the United States? A multiple indicator assessment. *American Journal of Sociology*, *105*(1), 88-127.

Perrow, C. (1984). Normal accidents: Living with high-risk technologies. New York, NY: Basic Books.

Perry, R. W. (2007). What is a disaster? In H. Rodriguez, E. Quarantelli and R. Dynes (Eds.), *Handbook of disaster research* (pp. 1-15). New York, NY: Springer International Publishing.

Pimm, S. L. (1984). The complexity and stability of ecosystems. *Nature*, *307*(5949), 321-326.

Poortinga, W. (2012). Community resilience and health: The role of bonding, bridging,

and linking aspects of social capital. *Health and Place*, *18*(2), 286-295.

Prudham, S. (2004). Poisoning the well: Neoliberalism and the contamination of municipal water in Walkerton, Ontario. *Geoforum*, *35*(3), 343-359.

Public Health Agency of Canada. (2011). *What determines health?* Retrieved from http://www.phac-aspc.gc.ca/ph-sp/determinants/index-eng.php

Putnam, R. (2000). *Bowling alone: The collapse and revival of American community*. New York, NY: Simon and Schuster.

Putnam, R. D., Leonardi, R., and Nanetti, R. Y. (1993). *Making democracy work: Civic traditions in modern Italy*. Princeton, New Jersey: Princeton University Press.

Richardson, G. E. (2002). The metatheory of resilience and resiliency. *Journal of Clinical Psychology, 58*(3), 307-321.

Rolfe, R. E. (2006). *Social cohesion and community resilience: A multi-disciplinary review of literature for rural health research*. Halifax, Nova Scotia: Saint Mary's University.

Rose, A., and Krausmann, E. (2013). An economic framework for the development of a resilience index for business recovery. *International Journal of Disaster Risk Reduction*, *5*(1), 73-83.

Russell, C. K., and Gregory, D. M. (2008). Evaluation of Qualitative Research Studies. In N. Cullum, D. Ciliska, R. B. Haynes and S. Marks (Eds.), *Evidence-based nursing: An introduction* (pp. 204-218). Oxford, England: Blackwell.

Saisana, M., and Cartwright, F. (2007). *Composite indicators: Science or artifacts?* 2007 Biannual Conference, European Survey Research Association. Prague, Czech Republic.

Sandelowski, M. (1998). Writing a good read: Strategies for re-presenting qualitative data. *Research in Nursing and Health*, *21*(4), 375-382.

Sandelowski, M. (2000). Focus on research methods: Whatever happened to qualitative description? *Research in Nursing and Health*, *23*(4), 334-340.

Sen, A. (1997). Editorial: Human capital and human capability. *World Development, 25*(12), 1959-1961.

Shaw, K. (2012). Reframing resilience: Challenges for planning theory and practice. *Planning Theory and Practice, 13*(2): 308-312.

Snider, L. (2004). Resisting neo-liberalism: The poisoned water disaster in Walkerton, Ontario. *Social and Legal Studies*, *13*(2), 265-289.

Solnit, R. (2009). *A paradise built in hell: The extraordinary communities that arise in disaster*. New York, NY: Viking.

Statistics Canada. (2001). *Walkerton [population centre], Ontario and Canada [country]: 2001 census.* Ottawa, Ontario. Analytical products, 2001 Census. Last updated August 26, 2013. Retrieved from http://www12.statcan.ca/English/profi l01/CP01/ Details/Page.cfm?Lang=E&Geo1=CSD&Code1=3541036&Geo2=PR &Code2=35&Data=Count&SearchText=Walkerton&SearchType=Begins&Searc hPR=01&B1=Population&Custom=

Statistics Canada. (2017). *Walkerton [population centre], Ontario and Canada [country]: 2016 census.* Statistics Canada Catalogue no. 98-316-X2016001. Ottawa, Ontario. Analytical products, 2016 Census. Last updated February 8, 2017.

Strauss, A. (1987). *Qualitative analysis for social scientists*. Cambridge, N.Y.: Cambridge University Press.

Szreter, S., and Woolcock, M. (2004). Health by association? Social capital, social theory, and the political economy of public health. *International Journal of Epidemiology*, *33*(4), 650-667.

Tang, Y., Wu, S., Miao, X., Pollard, S. J., and Hrudey, S. E. (2013). Resilience to evolving drinking water contamination risks: A human error prevention perspective. *Journal of Cleaner Production*, *57*(1), 228-237.

TANGO International. (2003). Socio-political analysis: Critical information needs for addressing underlying causes of poverty and marginalization. Atlanta, Georgia: CARE: PHLS Unit.

Thorne, S. (2008). *Interpretive description*. Walnut Creek, California: Left Coast Press.

Twigg, J. (2009). *Characteristics of a disaster-resilient community: A guidance note* (2nd

ed.). London, UK: University College London.

Ungar, M., and Liebenberg, L. (2011). Assessing resilience across cultures using mixed methods: Construction of the child and youth resilience measure. *Journal of Mixed Methods Research, 5*(2), 126-149.

United Nations Office for Disaster Risk Reduction (UNISDR). (2013). *Disaster impacts: 2000-2012*. Retrieved from http://www.preventionweb.net/files/31737_20130312 disaster20002012copy.pdf

Uy, N., and Shaw, R. (2013). Ecosystem resilience and community values: Implications to ecosystem-based adaptation. *Journal of Disaster Research*, *8*(1), 201-202.

Walker, B., Holling, C. S., Carpenter, S., and Kinzig, A. (2004). Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society*, *9*(2), 5.

Walker, B., and Salt, D. (2012). *Resilience thinking: Sustaining ecosystems and people in a changing world*. Washington, DC: Island Press.

Walker, B., Sayer, J., Andrew, N. L., and Campbell, B. (2010). Should enhanced resilience be an objective of natural resource management research for developing countries? *Crop Science*, *50*(S1), S10-S19.

Walkerton Clean Water Centre. (2011). *Walkerton Clean Water Centre: Ontario's water centre*. Retrieved from http://www.wcwc.ca

Walkerton Compensation Plan. (2011). *Walkerton Compensation Plan*. Retrieved from http://www.walkertoncompensationplan.ca/

Walkerton Herald Times. (2015). *Walkerton: Summary report*. Retrieved from http://ww w.ocna.org/uploads/files/Newspaper%20Profiles/Walkerton%20Herald%20Times .pdf

Wes For Youth. (2016). *Wes For Youth: About us*. Retrieved from http://www.wesforyou thonline.ca/about-us/

Wetterberg, A. (2004). Crisis, social ties, and household welfare: Testing social capital theory with evidence from Indonesia. Washington, DC: World Bank.

Witham, C. S. (2005). Volcanic disasters and incidents: A new database. *Journal of Volcanology and Geothermal Research, 148*(3), 191-233.

Woolcock, M., and Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *The World Bank Research Observer, 15*(2), 225-249.

Yamin, F., Rahman, A., and Huq, S. (2005). Vulnerability, adaptation and climate disasters: A conceptual overview. *IDS Bulletin*, *36*(4), 1-14.

Zellner, M. L., Hoch, C. J., and Welch, E. W. (2012). Leaping forward: Building resilience by communicating vulnerability. In B. Goldstein (Ed.): *Collaborative Resilience: Moving Through Crisis to Opportunity*. Cambridge, UK: MIT Press.

Appendix A – ETHICS APPROVAL

HiREB

Hamilton Integrated Research Ethics Board

30 September 2016

Project Number: 1934

Project Title: Examining Community Capacity and Resilience Post-Disaster in Walkerton, Ontario: A Qualitative Study

Student Principal Investigator: Mr. Konrad Lisnyj

Local Principal Investigator: Dr. Sarah Dickson

We have completed our review of your study and are please to issue our final approval. You may now begin your study.

The following documents have been approved on both ethical and scientific grounds:

Document Name	Document Date	Document Version
CCRPD Confidentiality Non-Disclosure Agreement	29/Jul/2016	1
CCRPD Data Collection Sheet	11/Jul/2016	1
CCRPD Email Recruitment Script_Updated	27/Sep/2016	2
CCRPD Interview Guide_Updated	27/Sep/2016	2
CCRPD_Budget	29/Jul/2016	1
CCRPD_Consent	11/Jul/2016	1
CCRPD_Protocol	29/Jul/2016	1

Any changes to this study must be submitted with an Amendment Request Form before they can be implemented.

This approval is effective for 12 months from the date of this letter. Upon completion of your study please submit a **Study Completion Form**.
If you require more time to complete your study, you must request an extension in writing before this approval expires. Please submit an **Annual Review Form** with your request.

PLEASE QUOTE THE ABOVE REFERENCED PROJECT NUMBER ON ALL FUTURE CORRESPONDENCE

Good luck with your research,

Kristina Trim, PhD, RSW
Chair, HiREB Student Research Committee
McMaster University

The Hamilton Integrated Research Ethics Board operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practices; Part C Division 5 of the Food and Drug Regulations of Health Canada, and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations; for studies conducted at St. Joseph's Hospital, HIREB complies with the health ethics guide of the Catholic Alliance of Canada

Hamilton Integrated Research Ethics Board

Amendment Approval

11 November 2016

HiREB Project #: 2016-1934,

Local Principal Investigator: Dr. Sarah Dickson

Project Submission Title: Examining Community Capacity and Resilience Post-Disaster in Walkerton, Ontario: A Qualitative Study

We have completed our review of your amendment and are pleased to issue our final approval. You may now continue your study as amended.

Document(s) Amended with version # and date:

Document Name	Document Date	Document Version
CCRPD Focus Group Interview Guide	09/Nov/2016	1
CCRPD Protocol Updated_Nov 9	09/Nov/2016	2
CCRPD_Focus Group Consent Updated	09/Nov/2016	2

Good luck with your research,

Kristina Trim, PhD, RSW
Chair, HiREB Student Research Committee
McMaster University
Health Research Services, MDCL 3308, McMaster University

Amendment Approval

June 16 2017

HiREB Project #: 2017-1934,

Local Principal Investigator: Dr. Sarah Dickson

Project Submission Title: Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario

Document(s) Amended with version # and date:

Document Name	Document Date	Document Version
CCRPD_Participant Demographic Survey	Jun-07-2017	1

Document Name	Document Date	Document Version
CCRPD_Ethics Amendment Request June 7	Jun-07-2017	2

We have completed our review of your amendment and are pleased to issue our final approval. You may now continue your study as amended.

Kristina Trim, PhD, RSW
Chair, HiREB Student Research Committee
MDCL 3308, McMaster University

The Hamilton Integrated Research Ethics Board (HiREB) represents the institutions of Hamilton Health Sciences, St. Joseph's Healthcare Hamilton, and the Faculty of Health Sciences at McMaster University and operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practices; Part C Division 5 of the Food and Drug Regulations of Health Canada, and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations; For studies conducted at St. Joseph's Healthcare Hamilton, HIREB complies with the health ethics guide of the Catholic Alliance of Canada.

Appendix B – LETTER OF INFORMATION (INTERVIEW PARTICIPANT)

Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario

Investigators:

Local Principal Investigator:
Dr. Sarah Dickson
Ph.D., P.Eng
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Purpose of the Study

You are invited to take part in this qualitative study surrounding present day community resilience in Walkerton, Ontario following the effects of the 2000 water contamination outbreak. I am conducting this research study to fulfill the thesis requirements for my Master of Public Health Degree.

I am hoping to learn about and understand the factors that either facilitated or prevented your community in achieving resiliency following the water contamination outbreak. In turn, my goal is that the information I gather can be used to establish a framework for community resiliency in rural settings under non-crisis conditions.

Procedures involved in the Research

The semi-structured interview will be one-on-one and face-to-face, and will take between 30-45 minutes to complete. It will take place at your most convenient time and location between November and December 2016. With your permission, I would like to use an audio recorder and take handwritten notes during the interview to ensure the data collected accurately represents your experiences and insights surrounding the topic. As a participant, you have the right to refuse to answer any question that you find uncomfortable, or you can end the discussion at any time. All audio recordings and notes taken will be password-protected and saved under an alias on my computer, which will be destroyed following the completion of this project.

The interview will begin by myself providing a brief overview of what the purpose of this project is. This will be followed by asking you general questions about community and resilience. For example, "What comes to mind when you think of the term "community"? "What does "resilience" mean to you?" and "Looking back, do you believe your community was able to respond to, mitigate, and adapt from the effects of the water contamination outbreak?" You will also be asked various questions that assess the role of different social, cultural, economic, political, and built factors with respect to whether they promote or prevent resiliency in your community. Some examples include "Do you think social support/networks helped or hindered the disaster response and recovery in your community?" "Did you/your community rely on any formal and/or informal social networks during the outbreak?" "How was the local economy impacted during the outbreak? How is it today?" and "What resources exist in your natural and built environment that facilitate or hinder community resilience?" The purpose of such questions is to better understand the breadth, depth, and quality of the factors that affect community resilience.

Potential Harms, Risks or Discomforts

The risks involved in participating in this study are minimal. Since this study makes you recall a negative event that occurred in your community, there is a possibility that some topics or themes brought up during the interview may cause you to feel uncomfortable or uneasy if the water contamination event significantly impacted you directly or indirectly.

However, you do not need to answer any questions or discuss any topics that may make you feel uncomfortable. As well, you can stop the interview at any time, even after you begin the interview or withdraw from the study once the interview is over, until January 1st, 2017. I describe below the steps I am taking to protect your privacy.

Potential Benefits

Although the research will not benefit you directly, it is an opportunity for you to be able to share your experiences and insights about the specific factors that either promoted or prevented resiliency in your community following the water contamination disaster. My goal is that the information gathered from you will help develop a community resilience framework for rural settings that will be beneficial in determining how to respond during a time of crisis.

This is important to the domains of both public health and public policy, as it can identify ways on how a rural community can prepare for, respond to, recover from, and mitigate the consequences associated with any type of crisis or disaster. As well, this study can help demonstrate that resilience can be achieved through local capacity building, as opposed to the common top-down approach.

Payment or Reimbursement

In appreciation of your time, you will receive $20.00 in compensation.

Confidentiality

You are participating in this study confidentially. I will not use your name, agency or any information that would allow you to be identified by others. No one but me will know whether you participated in this study unless you choose to tell them. This is also an important factor to consider when selecting your desired date, time, and location to conduct this interview, in order to ensure your participation is anonymous. Since your community is small, others may be able to identify you on the basis of references you make. Please keep this in mind in deciding what to you want to tell me.

Identifying information will be replaced with pseudonyms and generalized names in interview transcripts and study notes. Data without identifying information will be shared with my supervisory committee. The information you provide will be summarized with the information provided by other participants. The information you provide will be kept on a computer that will be protected by a password and saved under your pseudonym to ensure anonymity. Once the study has been fully completed, all of the data collected from you, as well as the other participants, will be deleted.

Participation and Withdrawal

Your participation in this study is voluntary. It is your choice to be part of the study or not. If you decide to be part of the study, you can decide to stop, at any time, even after signing the consent form or part-way through the study, until January 1st, 2017. If you decide to withdraw, there will be no consequences to you. In cases of withdrawal, any data you have provided will be destroyed unless you indicate otherwise. You can choose not to answer some questions, yet still be in the study. If you choose to withdraw from the study, you will still receive the $20.00 compensation.

You can no longer withdraw from this study after January 1st, 2017, when I expect to begin analyzing the data collected and preparing my thesis for submission.

Information about the Study Results

I expect to have this study completed by approximately August 2017. If you would like a brief summary of the results, please let me know how you would like it sent to you.

Questions about the Study

If you have questions or need more information about the study itself, please contact me by email at **lisnyjkt@mcmaster.ca** or by telephone at **(289) 880-8159**.

This study has been reviewed and approved by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB, at (905) 521-2100 ext. 42013.

Appendix C – CONSENT (INTERVIEW PARTICIPANT)

Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario

- I agree to participate in the study *Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario*
- I have read the information presented in the information letter about a study being conducted by Konrad Lisnyj, a graduate student in the Department of Clinical Epidemiology and Biostatistics at McMaster University.
- I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested.
- I understand that personally identifying information will not be used as data or published within the report.
- I understand that the one-on-one, semi-structured interview will be audio-recorded and the data I provide may be hand-written.
- I understand that if I agree to participate in this study, I may withdraw from the study at any time or up until January 1st, 2017. If I choose to withdraw, all of my data will be destroyed.
- I have been given a signed copy of this form.

Please answer the following questions:

(1) I agree that the interview can be audio recorded.
a) Yes
b) No

(2) I agree that the researcher can take notes during the interview.
a) Yes
b) No

(3) I would like to receive a summary of the study's results.
a) Yes
b) No

If yes, where would you like the results sent:

_____
E-mail address

_____
Mailing address

_____
Name of Participant (Printed)   Signature   Date

Consent form explained in person by:

_____
Name and Role (Printed)   Signature   Date

Appendix D – LETTER OF INFORMATION (FOCUS GROUP PARTICIPANT)

Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario

Investigators:

Local Principal Investigator:
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E-mail: sdickso@mcmaster.ca

Student/Principal Investigator:
Konrad Lisnyj
Master of Public Health Candidate
Department of Clinical Epidemiology & Biostatistics
McMaster University
Hamilton, ON, Canada
(289) 880-8159
E-mail: lisnyjkt@mcmaster.ca

Purpose of the Study

You are invited to take part in this qualitative study surrounding present day community resilience in Walkerton, Ontario following the effects of the 2000 water contamination outbreak. I am conducting this research study to fulfill the thesis requirements for my Master of Public Health Degree.

I am hoping to learn about and understand the factors that either facilitated or prevented your community in achieving resiliency following the water contamination outbreak. In turn, my goal is that the information I gather can be used to establish a framework for community resiliency in rural settings under non-crisis conditions.

Procedures involved in the Research

The focus group will involve 2 to 5 other individuals and will take between 60-90 minutes to complete. It will take place at the most convenient time and location for all members between November and December 2016. With your permission, I would like to use an audio recorder and take handwritten notes during the focus group to ensure the data collected accurately represents your experiences and insights surrounding the topic. As a participant, you have the right to refuse to answer any question that you find uncomfortable or can end the discussion at any time. All audio recordings and notes taken will be password-protected and saved under an alias on my computer, which will be destroyed following the completion of this project.

The focus group will begin by myself providing a brief overview of what the purpose of this project is. This will be followed by making introductions of all members participating in the focus group. The first set of questions will you general questions about community and resilience. For example, "What comes to mind when you think of the term "community"? "What does "resilience" mean to you?" and "Looking back, do you believe your community was able to respond to, mitigate, and adapt from the effects of the water contamination outbreak?" As a group, you will also be asked various questions that assess the role of different social, cultural, economic, political, and built factors with respect to whether they promote or prevent resiliency in your community. Some examples include "Do you think social support/networks helped or hindered the disaster response and recovery in your community?" "Did you/your community rely on any formal and/or informal social networks during the outbreak?" "How was the local economy impacted during the outbreak? How is it today?" and "What resources exist in your natural and built environment that facilitate or hinder community resilience?" The purpose of such questions is to better understand the breadth, depth, and quality of the factors that affect community resilience.

Potential Harms, Risks or Discomforts

The risks involved in participating in this study are minimal. Since this study makes you recall a negative event that occurred in your community, there is a possibility that some topics or themes brought up during the focus group may cause you to feel uncomfortable or uneasy if the water contamination event significantly impacted you directly or indirectly.

However, you do not need to answer any questions or discuss any topics that may make you feel uncomfortable. As well, you can stop the focus group at any time, even after you begin the focus group or withdraw from the study once the focus group is over, until January 1st, 2017. I describe below the steps I am taking to protect your privacy.

Potential Benefits

Although the research will not benefit you directly, it is an opportunity for you to be able to share your experiences and insights about the specific factors that either promoted or prevented resiliency in your community following the water contamination disaster. My goal is that the information gathered from you will help develop a community resilience framework for rural settings that will be beneficial in determining how to respond during a time of crisis.

This is important to the domains of both public health and public policy, as it can identify ways on how a rural community can prepare for, respond to, recover from, and mitigate the consequences associated with any type of crisis or disaster. As well, this study can help demonstrate that resilience can be achieved through local capacity building, as opposed to the common top-down approach.

Payment or Reimbursement

In appreciation of your time, each participant in the focus group will receive $20.00 in compensation.

Confidentiality

It is important to note that I will undertake to safeguard the confidentiality of this discussion to my full capacity. I will ask you and the other members involved in the focus group to keep what you say confidential, but I cannot guarantee everyone will do so. I will not use your name, agency or any information that would allow you to be identified by others. No one but myself and the other participants will know whether you participated in this study unless you choose to tell them. This is also an important factor to consider when selecting your desired date, time, and location to conduct this focus group, in order to ensure your participation is anonymous. Since your community is small, others may be able to identify you on the basis of references you make. Please keep this in mind in deciding what to you want to tell me.

Identifying information will be replaced with pseudonyms and generalized names in focus group transcripts and study notes. Data without identifying information will be shared with my supervisory committee. The information you provide will be summarized with the information provided by other participants. The information you provide will be kept on a computer that will be protected by a password and saved under your pseudonym to ensure anonymity. Once the study has been fully completed, all of the data collected from you, as well as the other participants, will be deleted. These precautions are taken to ensure your anonymity in the event that specific portions of the information that you provide are included in published materials resulting from this focus group.

Participation and Withdrawal

Your participation in this study is voluntary. It is your choice to be part of the study or not. If you decide to be part of the study, you can decide to stop, at any time, even after signing the consent form or part-way through the study, until January 1st, 2017. If you decide to withdraw, there will be no consequences to you. In cases of withdrawal, any data you have provided will be destroyed unless you indicate otherwise. You can choose not to answer some questions, yet still be in the study. If you choose to withdraw from the study, you will still receive the $20.00 compensation.

You can no longer withdraw from this study after January 1st, 2017 when I expect to begin analyzing the data collected and preparing my thesis for submission.

Information about the Study Results

I expect to have this study completed by approximately August 2017. If you would like a brief summary of the results, please let me know how you would like it sent to you.

Questions about the Study

If you have questions or need more information about the study itself, please contact me by email at **lisnyjkt@mcmaster.ca** or by telephone at **(289) 880-8159**.

This study has been reviewed and approved by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB, at (905) 521-2100 ext 42013.

Appendix E – CONSENT (FOCUS GROUP PARTICIPANT)

Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario

- I agree to participate in the study *Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario*
- I have read the information presented in the information letter about a study being conducted by Konrad Lisnyj, a graduate student in the Department of Clinical Epidemiology and Biostatistics at McMaster University.
- I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested.
- I understand that personally identifying information will not be used as data or published within the report.
- I understand that the focus group will be audio-recorded and the data I provide may be hand-written.
- I understand that if I agree to participate in this study, I may withdraw from the study at any time or up until January 1st, 2017. If I choose to withdraw, all of my data will be destroyed.
- I have been given a signed copy of this form.

Please answer the following questions:

(1) I agree that the focus group can be audio recorded.
a) Yes
b) No

(2) I agree that the researcher can take notes during the focus group.
a) Yes
b) No

(3) I would like to receive a summary of the study's results.
a) Yes
b) No

If yes, where would you like the results sent:

_____
E-mail address

_____
Mailing address

_____

_____
Name of Participant (Printed)   Signature   Date

Consent form explained in person by:

_____
Name and Role (Printed)   Signature   Date

Appendix F – Interview Guide

Date: _____

Interviewer/Researcher: Konrad Lisnyj; MPH Student Investigator

Participant Identification Number: _____

Aim: to engage in a 30-45 minute discussion with Walkerton residents to gain insight into the key factors that either promoted or prevented resilience in the Walkerton community following the water contamination disaster. Interviews will be one-on-one in person and will be semi-structured (not just "yes or no" answers). Because of this, the exact wording may change a little. Sometimes I will use other short, probing questions to make sure I understand what you told me or if I need more information when we are talking, such as "please tell me more," or "why do you think that?"

Part A – General Perceptions of Community and Resilience

1. In general, what comes to mind when you think of the term "community"?

2. What does "resilience" mean to you?
   - *Probe*: What characteristics do you think make a community resilient?
   - *Probe*: Which of these traits would you say are found in your community?

Part B – Effects of Outbreak on Community and Resilience

3. How did the water contamination outbreak affect your life?
   - Directly vs indirectly; they could be positive vs negative examples
   - Do you think if it happened at a different time in your life that it would have more or less of an impact?

4. Did your perception of "community" or "resilience" change in any way following the outbreak?
   - *Probe*: If so, in what ways?

5. How would you describe the community atmosphere in Walkerton before, during, and after the outbreak?
   - *Probe*: How were the lives of other community members impacted at the time of the outbreak compared to now?

6. How often is the water contamination incident brought up in your community today?
   - *Probe*: In what context?

Part C – Facilitators/Barriers during Outbreak

7. Looking back, do you believe your community was able to respond to, mitigate, and adapt from the effects of the water contamination outbreak?
   - *Probe*: What specific factors would you say helped your community recover from the tragedy?
   - *Probe*: What factors would you say made it difficult or prevented your community from recovering from the disaster?

a) Social Resilience/Capital Probes
   - Do you think social support/networks helped or hindered the disaster response and recovery in your community?
     - Did you/your community rely on any formal/informal social networks during the outbreak? (family, friends, neighbours, colleagues)
       - Can you tell me about your relationship with these individuals/groups today?
   - What role does social capital play in your community today?
     - Do you have a sense of belonging in your community?

- o Do you think residents/neighbours generally trust and value each other?
- What was the level of community participation/engagement before, during, and after the tragedy?

b) Cultural Resilience/Capital Probes
- Was the local culture affected at the time of the outbreak? (I.e. arts events, festivals, community activities) How is it now?
    - o Extra: Are there community events for residents to participate in?
    - o Extra: How are the turn-out rates at such events?

c) Human Resilience/Capital Probes
- At the time of the outbreak, did local community members have the capacity to respond? (I.e. adequate knowledge/training/skills, number of individuals, time, money)
- How would this compare to today?

d) Institutional (Political/Governance/System) Resilience/Capital Probes
- Was there any local leadership/political engagement during the outbreak that facilitated/hindered response to the outbreak? → level of trust/transparency/accountability
- What about today?
- Do you have any knowledge about how prepared the first responders were? (Police services, first aid, hospitals, communications)
    - o Were there any emergency preparedness strategies in place prior to the outbreak that helped facilitate/hinder the recovery process? (Institutional/household levels)

e) Economic Resilience/Capital Probes
- How was the local economy impacted during the outbreak? (Businesses, personal income, employment, local services [grocery store, convenience store, pharmacy])
- How is the local economy today?

f) Natural Resilience/Capital Probes
- How were natural resources including the environment impacted by the tragedy? (Water, stocks [animals/fish/wildlife], forest resources, energy sources, environmental status, soil)
- How is this domain doing today?

g) Built Resilience/Capital Probes
- What community resources were available or unavailable during the outbreak that helped the response? (transportation, communication (media), housing, infrastructure (water, sewage, sanitation, power), medical response capacity, public health response capacity, food security
- What resources in the built environment are found in your community today? What ones are missing?

Part D – Conclusion

8. Summary: Overall, based on our discussion today, which of the resilience forms do you think plays the most significant role in helping facilitate or constrain community resilience both during an outbreak and under non-crisis conditions?

9. Is there anything at all that you would like to add?

Appendix G – Focus Group Interview Guide

Date: _____
Interviewer/Researcher: Konrad Lisnyj; MPH Student Investigator
Participant Identification Number: _____

Aim: to engage in a 60-90 minute discussion with Walkerton residents to gain insight into the key factors that either promoted or prevented resilience in the Walkerton community following the water contamination disaster. Focus groups will be in person and will be semi-structured (not just "yes or no" answers). Because of this, the exact wording may change a little. Sometimes I will use other short, probing questions to make sure I understand what you told me or if I need more information when we are talking, such as "please tell me more," or "why do you think that?"

Part A – General Perceptions of Community and Resilience

1. In general, what comes to mind when you think of the term "community"?

2. What does "resilience" mean to you?
   - *Probe*: What characteristics do you think make a community resilient?
   - *Probe*: Which of these traits would you say are found in your community?

Part B – Effects of Outbreak on Community and Resilience

3. How did the water contamination outbreak affect your life?
   - Directly vs indirectly; they could be positive vs negative examples
   - Do you think if it happened at a different time in your life that it would have more or less of an impact?

4. Did your perception of "community" or "resilience" change in any way following the outbreak?
   - *Probe*: If so, in what ways?

5. How would you describe the community atmosphere in Walkerton before, during, and after the outbreak?
   - *Probe*: How were the lives of other community members impacted at the time of the outbreak compared to now?

6. How often is the water contamination incident brought up in your community today?
   - *Probe*: In what context?

Part C – Facilitators/Barriers during Outbreak

7. Looking back, do you believe your community was able to respond to, mitigate, and adapt from the effects of the water contamination outbreak?
   - *Probe*: What specific factors would you say helped your community recover from the tragedy?
   - *Probe*: What factors would you say made it difficult or prevented your community from recovering from the disaster?

a) Social Resilience/Capital Probes
   - Do you think social support/networks helped or hindered the disaster response and recovery in your community?
     - Did you/your community rely on any formal/informal social networks during the outbreak? (family, friends, neighbours, colleagues)
       - Can you tell me about your relationship with these individuals/groups today?

- What role does social capital play in your community today?
  - o Do you have a sense of belonging in your community?
  - o Do you think residents/neighbours generally trust and value each other?
- What was the level of community participation/engagement before, during, and after the tragedy?

b) Cultural Resilience/Capital Probes
- Was the local culture affected at the time of the outbreak? (I.e. arts events, festivals, community activities) How is it now?
  - o Extra: Are there community events for residents to participate in?
  - o Extra: How are the turn-out rates at such events?

c) Human Resilience/Capital Probes
- At the time of the outbreak, did local community members have the capacity to respond? (I.e. adequate knowledge/training/skills, number of individuals, time, money)
- How would this compare to today?

d) Institutional (Political/Governance/System) Resilience/Capital Probes
- Was there any local leadership/political engagement during the outbreak that facilitated/hindered response to the outbreak? → level of trust/transparency/accountability
- What about today?
- Do you have any knowledge about how prepared the first responders were? (Police services, first aid, hospitals, communications)
  - o Were there any emergency preparedness strategies in place prior to the outbreak that helped facilitate/hinder the recovery process? (Institutional/household levels)

e) Economic Resilience/Capital Probes
- How was the local economy impacted during the outbreak? (Businesses, personal income, employment, local services [grocery store, convenience store, pharmacy])
- How is the local economy today?

f) Natural Resilience/Capital Probes
- How were natural resources including the environment impacted by the tragedy? (Water, stocks [animals/fish/wildlife], forest resources, energy sources, environmental status, soil)
- How is this domain doing today?

g) Built Resilience/Capital Probes
- What community resources were available or unavailable during the outbreak that helped the response? (transportation, communication (media), housing, infrastructure (water, sewage, sanitation, power), medical response capacity, public health response capacity, food security
- What resources in the built environment are found in your community today? What ones are missing?

Part D – Conclusion

8. Summary: Overall, based on our discussion today, which of the resilience forms do you think plays the most significant role in helping facilitate or constrain community resilience both during an outbreak and under non-crisis conditions?

9. Is there anything at all that you would like to add?

Appendix H – PARTICIPANT DEMOGRAPHIC SURVEY

Examining Community Capacity and Resilience Post-Outbreak in Walkerton, Ontario

Investigators:

Local Principal Investigator:
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Student/Principal Investigator:
Konrad Lisnyj
Master of Public Health Candidate
Department of Clinical Epidemiology & Biostatistics
McMaster University
Hamilton, ON, Canada
(289) 880-8159
E-mail: lisnyjkt@mcmaster.ca

Age during Outbreak:
o < 19 years old
o 20 – 39 years old
o 40 – 59 years old
o 60 – 79 years old
o 80+ years old
o Prefer not to disclose

Age Today:
o < 19 years old
o 20 – 39 years old
o 40 – 59 years old
o 60 – 79 years old
o 80+ years old
o Prefer not to disclose

Occupation during Outbreak:
o Agriculture
o Natural resources
o Utilities
o Construction
o Manufacturing
o Wholesale & retail trade
o Transportation & warehousing
o Finance, insurance, real estate, rental &leasing
o Professional, scientific & technical services
o Business, building & other support services
o Educational services
o Health care & social assistance
o Information, culture & recreation
o Accommodation & food services
o Public administration
o Other
o Prefer not to disclose

Occupation Today:
o Agriculture
o Natural resources
o Utilities
o Construction
o Manufacturing
o Wholesale & retail trade
o Transportation & warehousing
o Finance, insurance, real estate, rental & leasing
o Professional, scientific & technical services
o Business, building & other support services
o Educational services
o Health care & social assistance
o Information, culture & recreation
o Accommodation & food services
o Public administration
o Other
o Prefer not to disclose

Gender:
o Male
o Female
o Other
o Prefer not to disclose