

**A Social-Ecological Approach to Understanding Natural Disaster Preparedness and Risk  
Perception amongst Immigrants: A Multi-Method Inquiry**

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### **Abstract**

To increase disaster preparedness in immigrants, risk communication and management need to be tailored to their needs and concerns. To this end, research needs to uncover how immigrants construe natural disaster risks and issues in the context of the receiving community's social environment, and how their experiences compared to the general population. The goal of this thesis was to understand how risk perception and the social environment relate to immigrants and Canadian-born individuals' disaster preparedness. The relationship between risk perception and disaster preparedness was investigated in the first study. Analyses of the data from a national survey revealed that both groups shared three core risk perception dimensions: external responsibility for disaster management, self-preparedness responsibility, and illusiveness of preparedness. However, they differed in the salience of five risk perception beliefs. For both groups, external responsibility for disaster management and self-preparedness responsibility were positively associated with preparedness behaviours, whereas illusiveness of preparedness was negatively related to preparedness behaviours. In the second study, the relationship between community social capital and individuals' preparedness behaviours was investigated. Analyses of two conceptually-linked national surveys revealed that neighbourhood contact and societal trust predicted during-disaster preparedness behaviours in both groups. Interestingly, societal trust positively predicted emergency planning in Canadian-born individuals but the reverse was true for immigrants. To provide a comprehensive social-ecological perspective, twenty-two individual interviews were conducted to explore immigrants and Canadian-born individuals' lived experiences of natural disaster risks and issues. A unifying thread across five emergent themes showed that individuals did not perceive natural disaster risks as a valid threat and disaster preparedness as relevant to their daily lives because they believed that the positive social

environment in Canada would mitigate the risks. For immigrants, the immigrant condition and culture shaped how they construed natural disaster risks and issues. Overall, findings suggest that risk communication and management need to focus on building human capital and social capital, use an all-of-society engagement approach, and reframe all-hazards preparedness as relevant for daily stressors. Specific for immigrants, disaster initiatives need to be tailored to the timeline of experience of being an immigrant within the context of their receiving communities.

### **Acknowledgments**

This thesis is dedicated to my mother, Alicia Goh Kwi Chuen (06/18/1955 – 01/07/2012), who was a caring, talented, and beautiful woman – thank you for teaching me how to appreciate life and be compassionate towards others even during difficult times.

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Approximately 10 years ago, I flew for more than 24 hours with two bags and \$150 cash to a country where I did not know anyone so that I could pursue a degree in Psychology. Back then, the thought of pursuing graduate school, let alone a doctoral degree, never crossed my mind. My goal was simple – to complete my undergraduate degree so that I could have a better life like many immigrants before and after me. The thought of pursuing a doctoral degree did not seem possible – expensive tuition fees and limited funding opportunities due to my international student status – despite my growing passion for understanding and modifying human behaviour and mental processes. Serendipitously, I fell into research and one thing led to another, here I am, 10 years later finishing my doctoral degree. Looking back, the key factor that profoundly shaped my experience was the wonderful social support system that encouraged me every step of the way. Therefore, I want to express my gratitude to all the supportive relationships in our lives.

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### **Preamble**

In September 2011, I joined an interdisciplinary research team, called Groupe d'Analyse Psychosociale de la Santé (GAP-Santé), which investigated the psychosocial aspects of risks and resilience in health and well-being. I was given the opportunity to participate in the development of the National Survey of Health Risk Perception (NSHRP) 2012 (Krewski et al., 2009; Krewski, Slovic, Bartlett, Flynn, & Mertz, 1995). Led by Dr. Louise Lemyre and Dr. Daniel Krewski, this 20-year research programme aims to contribute to risk communication and management through a better understanding of how the Canadian public perceives and makes decisions about risks. My main contribution to the NSHRP 2012 was the case study on natural disaster risks and issues.

Recent natural disasters have rekindled the focus on natural disasters and disaster preparedness in the Canadian public (Insurance Bureau of Canada, 2017). The Canadian government has disaster preparedness as a part of its mandate (Government of Canada, 2016). The increasingly diverse Canadian population provides an added challenge to risk communication and management given that risks are not equally distributed in the population (Lemyre, Gibson, Zlepnig, Meyer-Macleod, & Boutette, 2009; Thomas, Phillips, Lovekamp, & Fothergill, 2010). Indeed, the immigrant population is recognized as one of the 10 higher-risk populations in disasters in Canada (Canadian Red Cross, 2007). The immigration increase in Canada in recent years underscores the importance to improve risk communication and management to increase disaster preparedness and resilience for this social group.

The goal of this thesis was to understand how risk perception and the social environment relate to immigrants' disaster preparedness for natural disasters in comparison with Canadian-born individuals. In this thesis-by-article, the sections are presented in the following order: (i) general introduction, (ii) manuscripts for the three empirical studies, (iii) general discussion, (iv)

summative references, and (v) appendices. This thesis aimed to inform best practices for targeted and tailored risk communication and management to increase disaster preparedness. Findings contribute to the research and application of risk and psychological science in higher-risk populations.

## **Chapter 1: Theoretical Foundations and Context**

Natural disasters are catastrophic events caused by natural processes that occur in human populated areas (Burnham, 2008). Examples of natural disasters include tropical storms, earthquakes, and tsunamis. Canada has diverse landforms and weather types which increase the possibilities of natural disasters and weather-related emergencies. Common natural disasters in Canada are floods, earthquakes, and severe storms (Public Safety Canada, 2015b). From 2000 to 2013, the rate of mortality due to natural disaster was 1.3 million and 4.4 billion people were impacted by natural disasters worldwide (United Nations Development Programme, 2014). In addition to physical damage, natural disasters also weaken the social fabric of society such as social disruptions, economic losses, and poorer community health and well-being. The impacts of natural disasters are expected to worsen over the years due to human population growth, ageing infrastructure, urbanization, human intervention of nature (e.g., deforestation), and climate change (Burnham, 2008; United Nations Development Programme, 2014). The importance of sustaining the well-being of individuals and integrity of communities highlights the need to prevent and mitigate natural disaster risks. To this end, communities need to employ effective risk communication and management strategies to increase individual and collective disaster preparedness.

The introduction of this thesis will present the topic of natural disasters in Canada; then, it will be followed by a literature review on: (1) disaster preparedness, (2) risk communication and management, (3) risk perception, (4) the role of the social environment in the disaster cycle, and (5) psychosocial considerations for immigrants in the disaster cycle. The limitations of existing research will be presented. The review provides the theoretical foundation and rationale for the three empirical studies.

**Natural Disasters in Canada**

Canada is at risk of a number of natural disasters, such as earthquakes, floods, and severe storms, due to the varied geographic landscape (Hwacha, 2005; Public Safety Canada, 2017). The increasing population growth and urbanization in Canada have increased the risks for the Canadian public to experience significant negative consequences from natural disasters and weather-related emergencies (Hwacha, 2005; Shrubsole, 2000). For example, the Fort McMurray wildfire was one of the most significant natural disasters in recent Canadian history as it cost \$3.6 billion in insured damages and displaced approximately 90,000 residents (Insurance Bureau of Canada, 2017). Other significant natural disasters that occurred in Canada in recent years were the 2013 Southern Alberta floods, 1998 eastern ice storm, and 2013 Toronto flood. In addition to significant economic losses, these events also disrupted the daily functioning of individuals and communities. The Survey of Emergency Preparedness and Resilience in Canada (2014) found that 12.4 million Canadian residents experienced a major disaster in their lifetime and nearly three in four were severely impacted by the event (Ibrahim, 2016). Canadian residents reported that disasters caused disruptions in their daily activities (e.g., going to work), home evacuations, loss of access to roads and public transportations, property and financial impacts, and short- and long- term physical and mental health issues. These incidents highlight the value of disaster preparedness in the Canadian public.

**Disaster Preparedness**

Disasters are both physical and social events that have ripple effects on individuals, communities, and institutions (Quarantelli, 1993, 1999, 2000). The phases of disasters are conceptualized as a life cycle consisting of response, recovery, mitigation, and preparedness. The response phase occurs right after a disaster by which immediate relief activities, such as

search and rescue, emergency shelters, and damage assessment, occur. Then, rehabilitation and reconstruction in an attempt to restore the affected area back to its pre-disaster stage occur during the recovery phase. Lessons learned from the earlier phases are incorporated into risk-reduction strategies during the mitigation phase. The mitigation phase focuses on reducing and eliminating the consequences of disasters. Next, the preparation phase includes planning to handle an emergency and minimizing the effects that cannot be reduced by mitigation efforts. It is important to note that different social groups experience these phases at different rates. For instance, many impoverished communities were not able to restore the affected area back to its pre-disaster stage after Hurricane Katrina due to challenges and barriers with recovery efforts (Cutter et al., 2006). Further, activities at one phase impact activities at another phase (Neal, 1997). In specific, the degree of response and recovery required to address post-disaster impacts at the individual- and community- level depends on the degree of preparation and mitigation undertaken before the disaster (Burnham, 2008). These circumstances, therefore, highlight the importance of disaster preparedness for individuals and communities.

Disaster preparedness helps to prevent or reduce the impacts of natural disasters (International Federation of Red Cross and Red Crescent Societies, 2017). It has been documented that individuals who are the least prepared are often the most negatively affected (World Health Organization, 2008). Disaster preparedness includes protective measures that allow individuals and communities to respond, cope, and recover effectively in the event of an emergency (International Federation of Red Cross and Red Crescent Societies, 2017). Disaster preparedness involves two processes: (1) situational awareness which entails knowing the hazards that are most likely to occur in a community, and (2) preparedness actions which involves making a plan and assembling an emergency supply kit (Public Safety Canada, 2017).

Disaster preparedness protects individuals from disaster-induced harms, allows individuals to care for themselves within the first 72 hours, and reduces fear and anxiety while waiting for assistance from first responders (Murphy, Falkiner, McBean, Dolan, & Kovacs, 2005).

Individuals and communities that are adequately prepared can maintain adequate functioning and bounce back to normalcy which is known as individual and community resilience (Lemyre & O'Sullivan, 2013; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008).

Strengthening disaster preparedness at all ecological levels as a means to cultivate individual and community resilience is a priority of action in Canada and globally as illustrated by Canada's Platform for Risk Reduction, Sendai Framework for Risk Reduction, and 100 Resilient Cities (Public Safety Canada, 2016; Rockefeller Foundation, 2017; United Nations, 2015). Since 2006, the Canadian government has launched Get Prepared Canada's "72 Hours... Is Your Family Prepared?" campaign (Public Safety Canada, 2015a). This educational campaign aims to increase the uptake of disaster preparedness in the Canadian public. Further, disaster preparedness could help strengthen the Canadian economy by reducing the recovery and rebuilding cost in the event of a disaster, as well as preserving the social fabric of the Canadian society (Murphy et al., 2005). Despite the importance of disaster preparedness and availability of disaster education in Canada, the Canadian public's level of disaster preparedness remains low (Falkiner, 2003; Phoenix Strategic Perspectives, 2010; Taylor-Butts, 2016). Most Canadian households cannot sustain water and power outages for more than 24 hours. Additionally, only less than half of the Canadian households could be characterized as having a moderate-to-high level of disaster preparedness (Taylor-Butts, 2016). In 2016, the Canadian government has made disaster preparedness as a part of its mandate for public health and safety (Government of Canada, 2016).

The low level of disaster preparedness in the Canadian public corroborates the research showing that frequent exposure to risk information does not necessarily result in the adoption of preparedness practices (Mileti & Fitzpatrick, 1992). The discrepancy between how the experts and public evaluate risks often contribute to the lack of effective response in the public to risk communication and management strategies (Fischhoff, 1995). Risk communication and management strategies are often designed based on experts' objective assessment of risks and the assumption that the public would simply follow these recommendations when information is provided. In reality, lay individuals must first believe that the risk is valid before any actions can occur (Lemyre et al., 2009; Mileti & Fitzpatrick, 1992). Lay individuals' evaluation of risk is a subjective, an interpretive, and a dynamic process (Sjoberg, 2000). It plays a significant role in their subsequent behaviours. Therefore, for risk communication and management strategies to be effective, researchers and practitioners need to understand how the public construe natural disaster risks and issues.

### **Towards a Targeted and Tailored Risk Communication and Management**

Risk communication is an important aspect of risk management. Risk communication is an interactive two-way act of information exchange about how to assess and manage risks amongst individuals, communities, and institutions (Fischhoff, Brewer, & Downs, 2011; Rohrmann, 2008). The goal of risk communication is to help the receivers to understand the risks so that they can participate in the decision-making process to take actions (Fischhoff, 1995; Krinsky, 2007; Leiss, 1996). The process involves addressing the barriers to mutual understanding and empowerment to manage risks.

**Evolution of risk communication.** In 1962, Rachel Carson published an environmental science book, entitled "Silent Spring", which criticized the use of pesticides and the chemical



industry (Carson, 1962). Silent Spring was considered as the starting point of the public's awareness and concerns towards risks. This era was considered as the early stage of research in risks. Ulrich Beck coined the term "risk society" to describe the modern society's preoccupation with risks due to industrialization (Beck, 1992). Researchers and practitioners recognized that communicating the risks and benefits of these novel technologies to the public were important which led to the study of risk communication.

The seven stages of risk communication have been described by Fischhoff (1995) to group the challenges and lessons acquired at each stage:

1. *"All we have to do is get the numbers right."*
2. *"All we have to do is tell them the numbers."*
3. *"All we have to do is explain what we mean by the numbers."*
4. *"All we have to do is show them that they've accepted similar risks in the past."*
5. *"All we have to do is show them that it's a good deal for them."*
6. *"All we have to do is treat them nice."*
7. *"All we have to do is make them partners."*

Leiss (1996) furthered grouped these stages into three key phases. The first phase (stages 1 and 2) occurred around 1975 to 1984 which involved establishing accurate science and data analysis so that experts could educate the public using an accurate estimation of risks. However, experts found that providing numbers alone was not sufficient as the recipients may not understand what the numbers meant. Quantifying risks is also inherently challenging because certain risks are unquantifiable (e.g., disruptions to daily lives) or have high uncertainty (Rohrmann, 2008). Further, trust, beliefs, and values affect how the public interprets what the numbers mean (Poortinga & Pidgeon, 2003; Siegrist & Cvetkovich, 2000; Slovic, 1999). The

second phase (stages 3 to 6), which occurred around 1985 to 1994, focused on persuasive communication to encourage the public to respond in a desired way through risk messages. Therefore, experts investigated the factors that improved the effectiveness of risk messages. Experts learned that designing effective risk messages involved characterizing risks in ways that would be understandable by the public and addressing factors that would allow the public to take appropriate actions. That is, risk messages need to be clear and relevant to the public to render them effective. Currently, risk communication is at the third phase (stage 7) which emphasizes on creating partnership amongst stakeholders since risks are socially constructed. This phase involves establishing trust with the public through actions and creating a two-way communication process. Effective risk communication strategies recognize that communicating risks is an interactive process that involves the senders and receivers and is influenced by social, cultural, structural, and contextual factors.

**Process of risk communication: Key factors.** Early models of risk communication characterize the process as linear such that risk messages stem from an authority figure which then travel through a medium to reach the target audience (Krimsky, 2007). Later models employ a two-way concept such that the target audience is an active participant in risk communication and decision-making. The risk communication process is influenced by an interplay of communicator factors (e.g., who should give the message?), message factors (e.g., what key information should be included in the message?), and channel factors (e.g., how should the message be disseminated?) which depends on the receivers (e.g., who do the receivers perceive as credible? how do the receivers perceive the risks? where do the receivers normally obtain risk information?; Ajzen, 1992; Fischhoff et al., 2011). The interaction between the receivers' characteristics and the social environment contributes to the effectiveness of the risk

messages. Socio-demographic characteristics, such as gender, age, socio-economic status, language, and ethnocultural background, are associated with different risk perceptions and experiences which translate into different needs and concerns (Kahan, Braman, Gastil, Slovic, & Mertz, 2007; Lemyre et al., 2009; Satterfield, Mertz, & Slovic, 2004; Thomas et al., 2010).

***Communicator factors.*** Receivers are more likely to heed risk messages and follow recommendations if the risk messages come from information sources that are perceived to be credible, trustworthy, and benevolent (Andrulis, Siddiqui, & Purtle, 2011; Poortinga & Pidgeon, 2003; Siegrist & Cvetkovich, 2000). Importantly, the information source that is perceived to have good communicator factors depends on the receivers. Certain social groups may not necessarily view public authorities or official sources as information sources with good communicator factors. For instance, Andrulis, Siddiqui, and Gantner (2007) reported that undocumented immigrants are less likely to seek information and assistance from public authorities due to the fear of deportation.

***Message factors.*** Since risk are not equally distributed in our population in terms of susceptibility (exposure) and sensitivity (impact), some social groups may be more or less concerned about risks (Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Flynn, Slovic, & Mertz, 1994; Kahan et al., 2007). Therefore, individuals' risk perception beliefs may not agree with the experts' probabilistic risk assessment. These considerations underscore the importance of the content of the risk messages. Fischhoff et al. (2011) state that effective risk communication strategies require a value-of-information analysis which involves understanding what information should be provided so that the public will and can take actions. Constructing risk messages that are relevant to the receivers requires an understanding of the individuals' pre-existing knowledge ("indigenous technical knowledge") so that the information is not redundant

and can address knowledge gaps and misconceptions (Fischhoff, 1995; Fischhoff et al., 2011). Presentation of the risk messages, such as readability and usability, are also important because it determines whether the risk messages are accessible to the receivers. Further, risk messages need to resonate with the receivers' reality for them to take actions. For example, Eisenman, Cordasco, Asch, Golden, and Glik (2007) found that many low-income African Americans in the Lower Ninth Ward of New Orleans did not evacuate during Hurricane Katrina despite receiving warning messages because they could not afford personal transportations.

***Channel factors.*** How and where the risk messages are disseminated play an important role in the effectiveness of the risk messages to reach the target audience (Fischhoff et al., 2011). Certain social groups may not use the typical route to gain risk information (The Expert Panel on the Effectiveness Communication of Health Product Risk, 2015). For instance, Eisenman et al., (2009) found that word-of-mouth was more effective in getting Latino immigrants to uptake preparedness behaviours compared to written materials on disaster preparedness. The target audience may have difficulties accessing particular information channels due to language barriers and economic challenges (Fothergill, Maestas, & Darlington, 1999; Fothergill & Peek, 2004).

Taken together, the literature suggests that effective risk communication strategies should be tailored and targeted to meet the needs and concerns of the social group. Good risk communication practices involve converging the technical expert model (e.g., what does the target audience need to know about the hazard?) and the target audience's experience and understanding of the risks (e.g., what does the target audience already know or do not know about the hazard?; The Expert Panel on the Effectiveness Communication of Health Product Risk, 2015). Effective risk communication strategies use terminology that the target audience

understands, addresses knowledge gaps and misconceptions, establishes trust and credibility, and gives behaviourally sound advice (Leiss & Powell, 1997). Henceforth, understanding the public's risk perception and the social conditions that affect how they respond to the risks is the cornerstone of designing an effective risk communication strategy. Notably, generic risk communication strategy that is designed for the general population may not be the most effective route to empower and mobilize some social groups to take actions, especially when they have unique needs and concerns.

In Canada, risk communication and management for natural disasters can be challenging due to the diverse physical and social settings. In particular, the growing immigrant population underscores the need to consider the implications of the “immigrant condition” in risk communication and management. To increase disaster preparedness in immigrants in Canada, research needs to understand immigrants' risk perception and the psychosocial processes that impact their disaster preparedness decision-making. Further, comparisons of immigrants with the general Canadian-born population are required to document similarities and differences that help inform how to culturally-adapt risk communication and management. Accordingly, this thesis addressed these gaps for targeted and tailored risk communication and management for immigrants in Canada.

### **Risk Perception**

The public's growing interests in risks during the rise of novel technologies stimulated research that seeks to understand how lay individuals perceive risks (Slovic, 1987). While experts claimed that these novel technologies were relatively safe and low risk, the public expressed many concerns over their potential adverse effects. It then became evident that the public's perception of risk did not reflect the experts' technical estimates of risk. Experts

evaluate risks based on the notions of probability which are seen as more “objective”, whereas the public evaluates risks based on a broad and complex set of factors that are seen as more “subjective” (Sjoberg, 1999; Slovic, 1999). The disagreement between the public and experts in the evaluation of risks has stimulated a plethora of research to investigate how and why the expert-lay individual gap exists. Risk perception is defined as individuals’ subjective judgment and appraisal of risks (Committee on Foundations of Risk Analysis, 2015).

**Cognitive approaches.** The basic tenet of the cognitive approaches is individuals’ risk perception is based on basic psychological processes of how individuals quantify and qualify risks. The two main approaches are: (1) decisional heuristics and biases, and (2) psychometric paradigm.

***Decisional heuristics and biases.*** In the seminal work of Tversky & Kahneman (1973, 1974), they explained how individuals systematically depart from rationality in their decisions when judging low probabilities under uncertainty due to heuristics and biases. Heuristics are simple, efficient rules that individuals use to arrive at a solution or decision when faced with complex problems or incomplete information. Although heuristics are fast, effective, and adaptive under most conditions, heuristics could also lead to systematic cognitive biases that prevent individuals from rationality in their decisions. Evidently, heuristics have been found to impact how individuals perceive risks (Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978). Availability heuristics is a mental shortcut individuals use to judge risks based on what readily comes to mind. Risks that are “rare” or low in probability tend to be sensationalized and emotionally charged. Therefore, these risks tend to be more readily accessible in memory and easier to picture compared to “familiar” risks. Consequently, individuals tend to underestimate high mortality rates from common illness and accidents, whereas they tend to overestimate low

probability risks because of the availability heuristic. Individuals may also evaluate risks based on emotions, called affect heuristics (Slovic & Peters, 2006). Risks that trigger negative affect tends to heighten risk perception (E. J. Johnson & Tversky, 1983). Other heuristics that could impact risk perception include representativeness, anchoring-adjustment, and loss aversion (Kahneman & Tversky, 1984; Tversky & Kahneman, 1974). A main criticism of the heuristic approach is individuals' risk perception is not solely dependent on intuitive probability (Fischhoff, Slovic, & Lichtenstein, 1982). How individuals perceive risks depend on an array of personal and social-environmental factors such as beliefs, values, and social norms (Slovic, 1999). Further, they may evaluate risks based on other characteristics other than probabilistic outcomes. Despite these criticisms, this research has inspired researchers to identify additional factors to explain individuals' risk perception.

***Psychometric paradigm.*** The psychometric paradigm is considered to be one of the prominent approaches to studying risk perception (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). This approach states that individuals evaluate hazards on nine cognitive dimensions such as novelty, known to science, controllability, dreadfulness, unknown, involuntariness, immediateness, catastrophic potential, and severity. Factor analyses performed on these dimensions showed that individuals' risk perception could be explained by two to three dimensions (Sjoberg, 2000; Slovic, Fischhoff, & Lichtenstein, 1982) – dread (i.e., severity), novelty (i.e., uncertainty), and catastrophic potential (i.e., exposure). Hazards that are perceived to be high in dread and novelty were found to be associated with heightened risk perception compared to hazards that are perceived to be low in dread and novelty (Fischhoff et al., 1978; Leiss & Powell, 1997). The relationship between the ratings on the psychometric dimensions and level of risk perception depends on the hazard in question (Gardner & Gould, 1989). One of

the key criticisms of the psychometric paradigm is the psychometric dimensions may not apply to other types of hazards given that this approach is developed based on technological hazards. Another key criticism is the emphasis on the hazard characteristics rather than individual experiences (Siegrist, Keller, & Kiers, 2005). That is, the psychometric paradigm does not account for individual factors in explaining risk perception. Further, this approach only accounts for a small percentage of variance in explaining individuals' risk perception (Sjoberg, 2000).

**Social-cultural approaches.** The social-cultural approaches assert that individuals' risk perception may vary due to the social environment. That is, what is considered to be "risky" or "not risky" is socially constructed by a particular way of life.

***Cultural theory of risk.*** The cultural theory of risk perception is considered to be one of the classic social-cultural approaches to understanding risk perception based on the work by Douglas and Wildavsky (1983) and Dake (1991). Using a group-grid typology, they proposed that individuals can be categorized into four groups – egalitarians, hierarchists, individualists, and fatalists. Each grid-group possesses a set of worldviews or shared cultural biases. These shared cultural biases prescribe a way of life that is governed by a set of social structure and a particular outlook on risks. Therefore, individuals' risk perception would depend on their grid-group typology. According to this approach, hierarchists would be more likely to have a heightened risk perception for social hazards (e.g., terrorism), whereas egalitarians would be more likely to have a heightened risk perception for environmental threats of catastrophic potential (e.g., nuclear power; Marris, Langford, & O'Riordan, 1998). Research based on this approach was largely based on anthropological observations, qualitative methods, and anecdotes (Sjoberg, 2000). Empirical support using quantitative methods has been sparse. In fact, the main criticism is quantitative research using the cultural theory of risk has found a small



explanatory power in individual differences in risk perception, although the pattern of relationships between social concerns and the grid-group typology was consistent with this approach (Sjöberg, 2000; Sjöberg, 1998). Another key criticism is the grid-group typology may only represent extreme worldviews upheld by small groups of individuals rather than the average population that tends to have overlapping worldviews (Marris et al., 1998). Despite these criticisms, the cultural theory of risk provided a more ecological perspective in understanding risk perception which helped inspired contemporary social-cultural approaches.

***Cultural Identity-Protective Cognition.*** The Cultural Identity-Protective Cognition thesis was developed from the cultural theory of risks by Kahan and colleagues who combined the cultural theory of risks with motivated cognition from social psychology (Kahan et al., 2007). This approach states that individuals are motivated to process risks in ways that support their social groups' identities and the roles they play due to cultural norms. The Cultural Identity-Protective Cognition thesis has been used to explain group differences in risk perception. For example, Kahan et al. (2007) argued that the White Male Effect in risk perception could be explained by the distinctive worldviews associated with gender and race. They found that white men tended to have a lower risk perception for gun and abortion risks because they tended to benefit from these risks compared to women and ethnic minorities in the United States. One of the key criticisms of the Cultural Identity-Protective Cognition thesis is it does not explain "culture" or "cognition" per se but rather a description of specific American groups' extreme political view and perception of contemporary science issues (van der Linden, 2016). Moreover, this approach does not define "culture" and at what level "culture" (e.g., global, national, or local) influences individuals. It may not represent actual cultural difference but rather an intra-societal conflict amongst individuals with extreme political positions.

***Social Amplification of Risk Framework (SARF).*** The SARF employs a structural description of how some risks are socially constructed in a society through the processes of amplification and attenuation based on communication theory (Kasperson et al., 1988). Developed by Kasperson and colleagues, the SARF states that risks interact with psychological, social, cultural, and institutional processes in ways that may amplify or attenuate individuals' risk perception and thus affecting their behaviours. These processes occur during the information transfer about risks and response mechanisms of the society. Risk signals are processed by individuals and social amplification stations (information channels) which in turn influence the receivers' risk perception and behaviours, as well as secondary and tertiary impacts (e.g., market impacts, policy change). The SARF provides a more comprehensive perspective in understanding risk perception by recognizing the importance of the social environment in constructing the dynamic nature of risks. It explains how risks can travel through a society and trigger ripple effects. One key criticism is the SARF is too general for direct empirical testing (Pidgeon & Henwood, 2010). While it provides a coherent explanation of how risks are socially constructed, many of the concepts within the model have yet to be empirically supported as converting these concepts into empirically testable hypotheses is a challenge. Another key criticism is the SARF conceptualizes the transfer of risk information through society as a linear process, whereas it is more likely to be intertwined in the real world.

***Integrative model of risk perception.*** In an attempt to provide an integrative and a systematic perspective on risk perception, Renn and Benighaus (2016) recently developed an integrative model of risk perception based on a review of psychological, social, and cultural factors in shaping risk perception. This model consists of four contextual levels of risk perception by which each level is further divided into personal manifestations and collective

influences. The levels are nested and interdependent: Level 1 – heuristics of information processing, Level 2 – cognitive-affective factors, Level 3 – social-political institutions, and Level 4 – cultural background. The integrative model of risk perception is relatively new, and thus it has yet to be subjected to scrutiny. However, it may face similar challenges as the SARF such as the difficulties in testing the concepts of the model.

**Key limitations of the cognitive and social-cultural approaches.** A key pitfall of the cognitive approaches to risk perception is it asserts that individuals' risk perception occurs in a cognitive vacuum that is free from social-environmental influences. While the social-cultural approaches to risk perception address the relevance of the social environment, the models are too abstract for empirical testing. A common notable drawback of the aforementioned models is they do not explain behaviours.

### **Disaster Preparedness and Risk Perception for Natural Disasters**

Despite the divergences in the models used to explain lay individuals' risk perception, researchers and practitioners generally come to a consensus that risk perception is important. Risk perception is known to influence public policy, market processing, and individual behaviours including disaster preparedness (Krewski, 1993). A number of models have been used to explain individuals' preparedness behaviours including but not limited to the Person-Relative-to-Event theory (Duval & Mulilis, 1999; Mulilis & Duval, 1997), social-cognitive model of disaster preparedness (Paton, Smith, & Johnston, 2005), risk-as-feelings model (Loewenstein, Weber, Hsee, & Welch, 2001), Extended Parallel Process Model (Witte, 1992), Protection Motivation Theory (Rogers, 1975), Health Belief Model (Rosenstock, 1974), Protective Action Decision Model (Lindell & Perry, 2012), and Theory of Planned Behaviour (Ajzen, 1985). A discussion of each model is beyond the scope of this thesis (for a review, see

Ejeta, Ardalan, & Paton, 2015). An important commonality amongst these models is individuals' subjective judgment and appraisal of risks or "risk perception" is an important factor in explaining their emotional, behavioural, and various cognitive responses.

Research has demonstrated that risk perception plays a role in individuals' disaster preparedness such that heightened risk perception is associated with an increased uptake of risk mitigation strategies for natural hazards (Brenkert-Smith, Champ, & Flores, 2012; Grothmann & Reusswig, 2006; Y. C. Kim & Kang, 2010; Martin, Martin, & Kent, 2009; Miceli, Sotgiu, & Settanni, 2008; Reynaud, Aubert, & Nguyen, 2013). However, the positive risk perception-disaster preparedness relationship has not been uniformly reported in the literature. For example, some studies found that there was no significant direct relationship between risk perception and preparedness behaviours (Cliff, Morlock, & Curtis, 2009; Lindell & Hwang, 2008; Lindell & Whitney, 2000; Paton, Smith, & Johnston, 2000; Perry & Lindell, 2008).

A possible reason for the inconsistencies between risk perception and disaster preparedness reported in the literature may be due to how risk perception and disaster preparedness are operationalized. Some studies have investigated actual preparedness behaviours (e.g., Miceli et al., 2008), whereas other studies have looked at intentions (e.g., Paton et al., 2005). Likewise, some studies have measured risk perception by focusing on hazard characteristics (e.g., perceived likelihood; Cliff et al., 2009), whereas other studies have used a richer definition of risk perception by focusing on risk perception beliefs (e.g., Ozdemir & Yilmaz, 2011). Further, different forms of preparedness behaviours have been found to be associated with different dimensions of risk perception which highlights the complexity of the relationship between risk perception and disaster preparedness. For illustration, Ozdemir and Yilmaz (2011) found that different dimensions of risk perception (i.e., perceived hazard

characteristics versus risk perception beliefs about responsibility) predicted different forms of preparedness behaviours. Individuals' risk perception is value-laden as it consists of personal and societal beliefs about responsibility, control, acceptability, and response related to the risks (Rohrmann, 2008; Slovic, 1999; Solberg, Rossetto, & Joffe, 2010). Indeed, some studies have demonstrated that individuals' risk perception consists of multiple dimensions including their subjective evaluation of hazard characteristics and beliefs about risks (Y. C. Kim & Kang, 2010; Kung & Chen, 2012; Lee & Lemyre, 2009; Markon, Lemyre, & Krewski, 2011). These studies suggest the importance of defining the underlying dimensions of individuals' risk perception for natural disasters and how these risk perception dimensions explain specific preparedness behaviours.

Another possible reason for the inconsistencies between risk perception and disaster preparedness reported in the literature is there may be other mediators and moderators. A vast majority of studies assume that individuals' cognitive processes have the most explanatory power in their disaster preparedness, although this is unlikely to be true (Solberg et al., 2010). In fact, research in other fields has long recognized the role of "place" or "context" in impacting individuals' behaviours and psychological processes (Osypuk & Galea, 2007). The social environment may influence individuals' decisions and abilities to uptake disaster preparedness. That is, individuals' risk perception and disaster preparedness are influenced by the mechanisms within the social environment (Miceli et al., 2008; Slovic, 1999).

A psychosocial approach to risks refers to the interaction between psychological factors and social components (Oxford Dictionary, 2017b). Psychological factors include cognitive processes (how we think), emotions (how we feel), and behaviours (how we act). The social components include the factors, processes, and relationships within the social environment. The

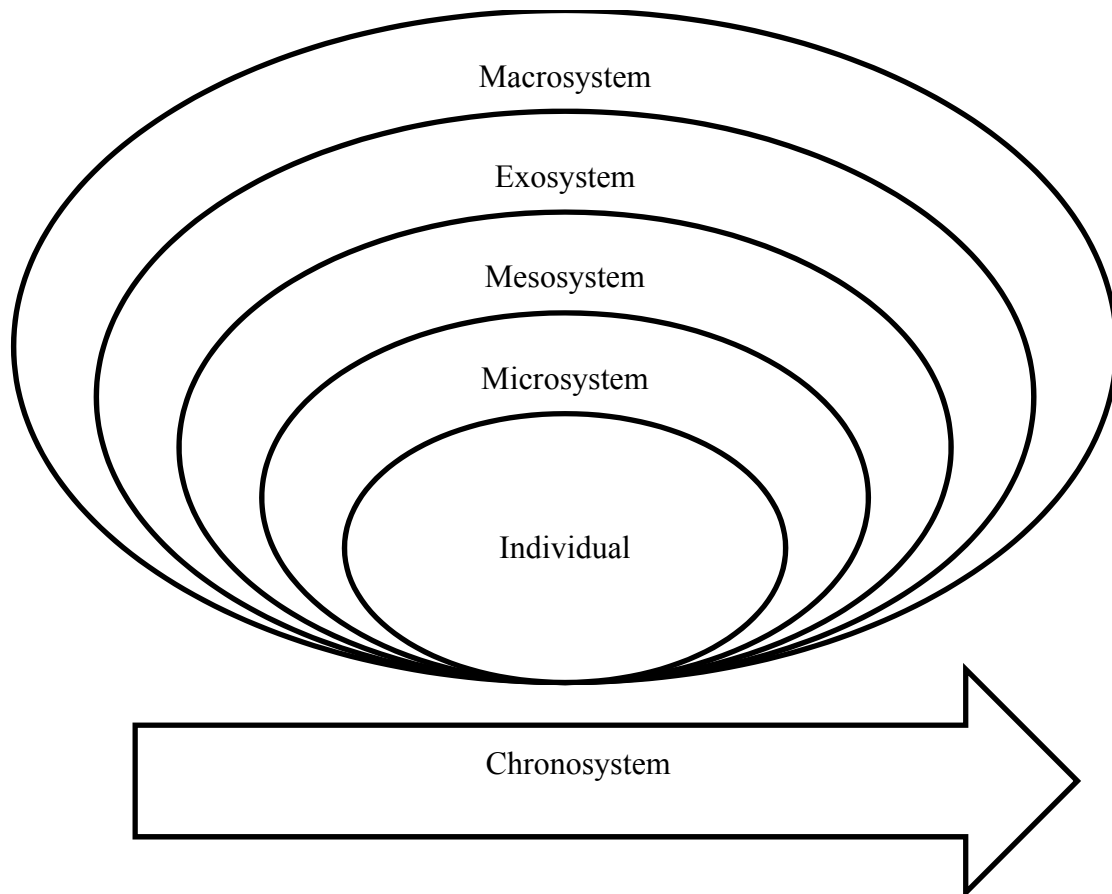
traditional approach to risks focuses on the hazard characteristics and physical impacts. A psychosocial approach to risks expands the traditional approach by considering the human experience and social factors (Lemyre et al., 2005, 2009; Lemyre & O’Sullivan, 2013). A psychosocial approach to risks applies to individuals, communities, institutions, and societies. It positions the experience with and outcomes of risks within a social-ecological framework.

### **Beyond Individual Factors: The Social Environment**

The social environment is the physical, social, and cultural settings that influence how individuals function and interact (Barnett & Casper, 2001). The social environment provides context such as the availability of resources, social norms, and social rules that govern individuals’ experiences. The mechanisms and relationships within the social environment influence psychological processes and behaviours. Individuals are less likely to uptake protective measures against natural disaster risks when their social environment is not supportive of disaster preparedness (Tobin, 1999). For example, Gaillard (2008) found that high risk perception did not influence individuals’ uptake of protective measures against volcanic debris flows but social and economic factors did. The risks imposed by the volcanoes were less important than the risks of relocation such as poverty and threat to cultural heritage. That is, these “everyday hazards” thwarted individuals’ propensity to uptake disaster preparedness. Since individuals construe risks based on their social psychological reality, it is important for researchers and practitioners to recognize the role of the social environment in modulating individuals’ risk perception and preparedness behaviours (Alaszewski, 2005; Frewer, 2004).

**The social-ecological model.** The social environment is a vast concept with many constituents that are often interconnected. One way to conceptualize the social environment is by using the social-ecological model. The social-ecological model is based on the seminal work

of Urie Bronfenbrenner, entitled “Towards an Experimental Ecology of Human Development” (Bronfenbrenner, 1977). He theorized that childhood development and behaviours are directly and indirectly influenced by five ecological systems by which each ecological system has its components and mechanisms. The five ecological systems are the microsystem (i.e., immediate social setting such as friends), mesosystem (i.e., linkages of two or more microsystems such as neighbourhood organizations), exosystem (i.e., linkages of two or more settings that indirectly influence the individual such as public policy), macrosystem (i.e., overarching context such as social-cultural factors and political climate), and chronosystem (i.e., change over time). The individual is at the centre of these nested ecological levels (see Figure 1).



*Figure 1.* The Ecological Systems Theory by Bronfenbrenner (1977)



Researchers and practitioners have begun to apply the ecological systems theory in risk management (Beaton et al., 2008; Boon, Cottrell, King, Stevenson, & Millar, 2012; Greene, 2007; Prior & Eriksen, 2013; van Kessel, Gibbs, & MacDougall, 2015). In recent years, Lemyre and colleagues used the social-ecological perspective to provide a system approach to conceptualize risk perception and disaster preparedness in individuals and communities (Gibson, 2013; Lemyre & O'Sullivan, 2013). The social-ecological system of risks and resilience posits that risk perception and disaster preparedness are a function of the property and characterization of the relationships of the four ecological systems or the social environment (see Figure 2). The four ecological systems are a complex system of components and mechanisms – the microsystem consists of an individual's close social support networks, the mesosystem consists of the individual's neighbourhood context, the exosystem includes the availability of and access to emergency resources, and the macrosystem consists of policies and social-political context. The relationships within these ecological systems are interconnected and bidirectional, and they interact with individual characteristics. These mechanisms and relationships influence intra-individual processes, such as risk perception, which in turn affect disaster preparedness at the individual- and collective- level.

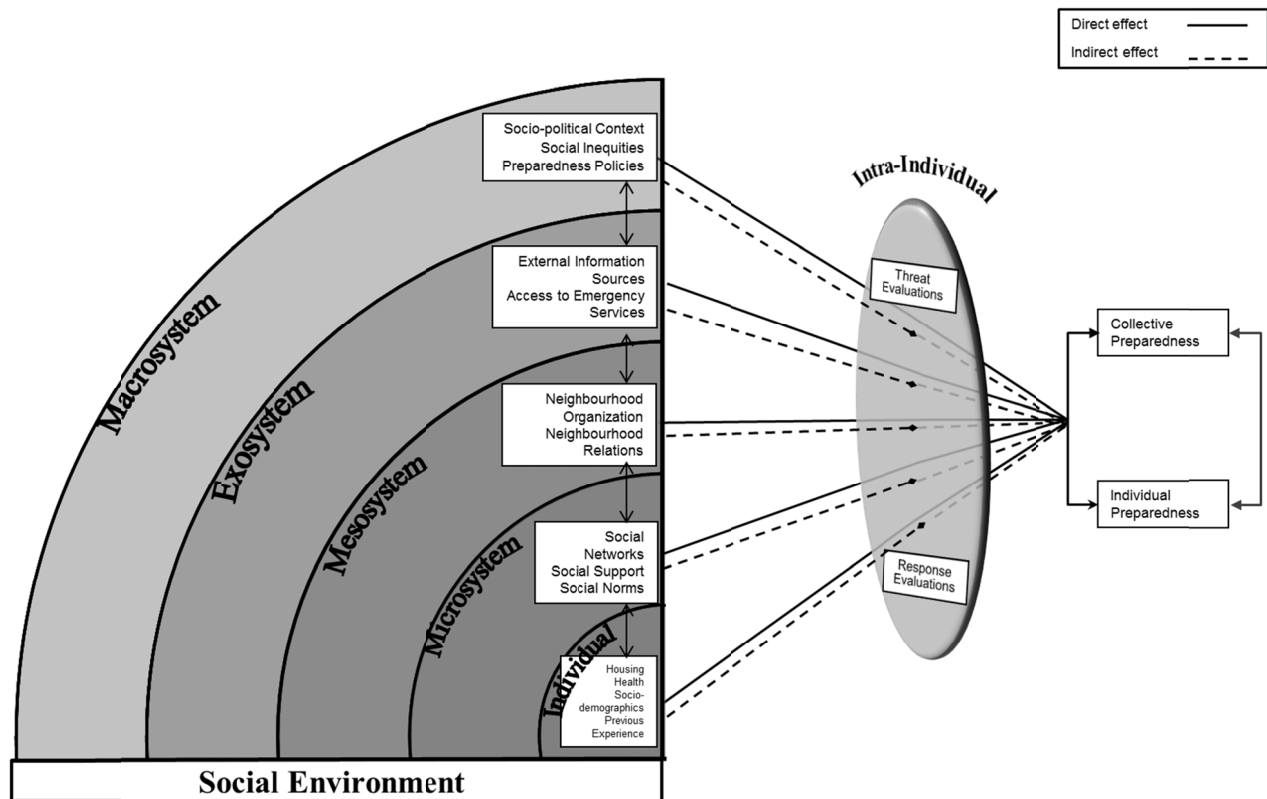


Figure 2. The social-ecological system of risks and resilience Gibson (2013) and Lemyre & O'Sullivan (2013)

The model as a whole has not been empirically tested as it would require a complex multi-level design. However, there is accumulating evidence supporting the constituents of this model. For example, Lo (2013) found that social norm, a component of the microsystem, mediated the risk perception-disaster preparedness relationship for flood risks. The relationship between perceived social norms and risk perception was bidirectional such that individuals' risk perception was influenced by their social support networks which in turn prescribed the social norm. At the mesosystem, Gibson (2013) found that neighbourhood social deprivation affected individuals' disaster preparedness using a multi-level design. She demonstrated that as neighbourhood social deprivation increased disaster preparedness at the individual-level decreased, over and above individual characteristics. For the exosystem, Y. C. Kim and Kang (2010) found that individuals who were connected to an integrated storytelling network (e.g., local media connections) were significantly more likely to uptake disaster preparedness for hurricanes. Finally, Paradise (2005) found that cultural context, a component of the macrosystem, influenced the acceptance of earthquake risks protective measures. Individuals who believed that the earthquakes were the acts of God were more likely to believe that disaster preparedness was prohibited or "haram". An exhaustive literature review of how each component within the social environment impact risk perception and disaster preparedness is beyond the scope of this thesis. Instead, the following section will discuss a component of the social environment which is the focus of this thesis – social capital.

### **Social Capital**

Social capital is a seminal concept in social sciences. It has been used in a variety of disciplines including sociology, political science, economics, psychology, and public health. Although social capital is a widely used concept, there is no single definition of social capital.

According to Coleman (1990), social capital consists of multiple entities involving social structures that facilitate individual and collective actions.

There are two main approaches in conceptualizing the entities of social capital which are the individual approach and collective approach. The individual approach to social capital started in sociology. Also known as the network theory of social capital, the individual approach states that social capital is an attribute of a social support network (Bourdieu, 1986; Coleman, 1988; Lin, 1999). It focuses on the density and quality of social support networks. The individual approach maintains that individuals or small groups benefit from the social ties that arise from group memberships. Hence, individuals benefit the most when they are connected to a large, heterogeneous social support network because they are more likely to have access to a wide variety of resources and information. The individual approach states that social capital depends on individuals' investments aimed at creating and preserving social ties that are beneficial. That is, social capital includes a level of trust that an obligation will be repaid and the expectation that the obligation will be held.

The collective approach to social capital builds on the individual approach. The collective approach began in political science and economics. It states that social capital is also an attribute of a community, city, or nation (Coleman, 1988; Putnam, 1995a, 1995b). It focuses on the "stock" that exists in a community such as solidarity and reproduction of a community through community engagement (e.g., volunteering). Although the collective approach considers social support networks as a component of social capital, the collective approach differs from the individual approach regarding who can benefit from social capital. According to the individual approach, individuals have to be directly involved in a social support network to reap its benefits. Conversely, the collective approach asserts that social capital is a "private good" and "public

good”. That is, individuals do not have to be directly connected to a social support network to benefit from living in a community with strong social capital. For illustration, a bystander is benefiting from living in a safe neighbourhood because his neighbours volunteer in the neighbourhood watch.

Theorists have made further distinctions about the type and quality of social relationships that exist in social capital – bonding, bridging, and linking (Lin, 2001; Putnam, 2000; Szreter & Woolcock, 2004). Bonding social capital represents social relationships amongst individuals who are similar to each other in their shared social identities. Bonding social capital consists of strong ties amongst family members and close friends. Bridging social capital refers to social relationships amongst individuals who are dissimilar in socio-demographic characteristics that often reflect social differences such as ethnocultural identity, socio-economic status, and age. Bridging social capital consists of weak ties amongst acquaintances. It is important to note that how individuals perceive themselves to be similar or dissimilar to others is context-dependent – that is, the nature of the social boundaries for bonding social capital and bridging social capital is highly context-specific. Bonding social capital and bridging social capital represent horizontal ties amongst individuals who are relatively similar in their position of social power. Linking social capital represents social relationships amongst individuals and public institutions with differential social power. Linking social capital consists of weak ties amongst individuals and public institutions of different social positioning.

The type and quality of social relationships have different implications on how social capital affects individuals and communities (Weenig & Midden, 1991). Bonding social capital is based on personal “inward-oriented” social relationships that have the least valuable by-product because members tend to share similar information and resources (Kay & Johnston, 2007;

Putnam, 2000; Szreter & Woolcock, 2004). The strength of bonding social capital lies in the availability of social support that allows its members to “get by”. Furthermore, individuals may be more likely to trust information and resources coming from strong ties which could positively affect behaviour change (Weenig & Midden, 1991). However, the pitfall of these strong ties includes exclusion of “outsiders” and external information and resources which may undermine the progression of its members and create social divides (Kay & Johnston, 2007; Putnam, 2000). On the other hand, bridging social capital and linking social capital are based on more impersonal and formal “outward-oriented” social relationships that have the most valuable by-product. Granovetter (1973) proposes The Strength of Weak Ties hypothesis which argues that weak ties produce the most valuable by-product because weak ties allow new information and resources to be shared. In particular, linking social capital allows members to gain advantageous access to power structures (Szreter & Woolcock, 2004). New information and resources are more likely to be diffused in weak ties, although they may not necessarily trigger behaviour change because members may not necessarily trust the sources (Weenig & Midden, 1991). However, bridging social capital and linking social capital help individuals and communities to “get ahead” by providing the catalyst for inclusion amongst diverse social groups and power structures, as well as access to diverse information and resources (Kay & Johnston, 2007).

Given the ubiquity of social capital, social capital has been applied to a variety of positive and negative consequences at the individual- and community- level (see Kawachi, Subramanian, & Kim, 2008). On the positive note, social capital has been associated with individual development and community enhancement such as employment, education, and social control (see Kay & Johnston, 2007). Conversely, the perverse outcomes of social capital have also been documented in the literature (Portes, 1998; Putnam, 2000). One perverse effect of social capital

is social exclusion and disenfranchisement. The strong social capital that is shared within a network may also be used to bar others from access which consequently produces in-group and out-group division. Social groups with lower social positioning may experience further disenfranchisement if privileged social groups have the ability to monopolize resources due to strong social capital. Another perverse effect of social capital is that it may negatively impact the progression of individuals and communities. The enforcement of social norms may produce groupthink and suppress individual mobility, and thus prevent individuals from advancing from the group. Strong social capital may also be taxing and counterproductive, especially when the needs surpass the resources available. For instance, ethnic enclaves that possess strong social capital that is bounded to the ethnic community tend to foster sharing of limited resources amongst the members which could produce ghettoization (Breton, 2003; Kay & Johnston, 2007). Social capital may also allow individuals to reach perverse goals such as antisocial behaviours by criminal gangs (Moule, Decker, & Pyrooz, 2013). Finally, communities with strong social capital may be overlooked by practitioners due to the assumptions that communities with strong social capital have the resources to address communal issues. Therefore, practitioners may be inclined to cut resources for these communities and channel resources to other communities. In actuality, social capital is not a panacea – strong social capital does not equate to free from social and community issues. For example, ethnic minority and immigrant communities often have strong social capital within their communities, but these communities tend to face multiple barriers (e.g., poverty, social exclusion from the larger society, and systemic discrimination) to social mobility due to larger systemic inequities (Breton, 2003).

Evidently, the ubiquity of social capital is intertwined with the lack of consistent definition which makes measuring social capital challenging (see Kawachi et al., 2008). That is,

different disciplines have different traditions in measuring social capital. For instance, network-based approach measures social capital by focusing on the quality and quantity of social support networks. Social capital has also been measured using a number of indicators such as crime rates, level of social trust, and volunteering. Further debate exists whether social capital should be measured at the individual- or group- level. For instance, social capital may be measured as cognitive social capital (perception and feeling) and structural social capital (actual connection). Kay and Johnston (2007) suggest that one of the ways to reduce these challenges is to carefully outline the indicators of social capital which is employed in this thesis. Despite these conceptual issues and empirical challenges, theorists generally agree that social capital centres on social relationships to promote individual and collective actions. Social capital exists in the form of trust, reciprocity, information channels, and social norms (Putnam, 1995a, 1995b). In the context of natural disasters, social capital helps build individual and community resilience (Aldrich & Meyer, 2014; Aldrich & Sawada, 2015; Kwok, Doyle, Becker, Johnston, & Paton, 2016; Lemyre & O'Sullivan, 2013).

**Social capital and natural disasters.** Studies on social capital in the context of natural disasters primarily focus on the role of social capital in the post-disaster context (Aldrich, 2012; Aldrich & Meyer, 2014; Aldrich & Sawada, 2015; H. Kim & Marcouiller, 2016; Shimada, 2015; Wickes, Zahnow, Taylor, & Piquero, 2015; Wind & Komproe, 2012; Yamamura, 2010). These studies show that individuals and communities that possess strong social capital are more resilient against natural disasters. For instance, H. Kim and Marcouiller (2016) found that counties with a higher rate of voter turnout (an indicator of strong social capital) suffered less disaster losses from hurricanes in 2000 to 2009 compared to counties with weak social capital. Likewise, Shimada (2015) conducted a longitudinal study on 47 Japanese prefectures from 1981



to 2012 on the relationship between social capital and post-disaster recovery. He used volunteer rates, suicide rates, and crime rates as proxy measures of social capital. He found that prefectures with strong social capital – as exemplified by high volunteer rate, low suicide rate, and low crime rate – were more likely to have a faster post-disaster recovery. Other benefits of social capital in the post-disaster context include lower post-disaster mortality and morbidity, less post-disaster community challenges, and lower post-disaster damage (Aldrich, 2012; Aldrich & Meyer, 2014; Aldrich & Sawada, 2015; Wickes et al., 2015; Wind & Komproe, 2012; Yamamura, 2010). Additionally, research found that different dimensions of social capital play different roles in disaster survival and recovery. For example, bonding social capital may allow individuals to respond efficiently through emergent social actions (Airriess, Li, Leong, Chen, & Keith, 2008; Hawkins & Maurer, 2010; Heller, Alexander, Gatz, Knight, & Rose, 2005; Nakagawa & Shaw, 2004). While bonding social capital may provide the first line of assistance for victims of natural disaster, bridging social capital and linking social capital may help with long-term recovery through the receipt of external support and resources (Elliott, Haney, & Sams-Abiodun, 2010). For instance, Vietnamese immigrants relied on bridging social capital and linking social capital to connect with Vietnamese communities and community agencies outside of New Orleans to help with their evacuation, relocation, and recovery from Hurricane Katrina (Airriess et al., 2008; Chamlee-Wright & Storr, 2009). Although less commonly investigated, social capital also has a dark side in the post-disaster context. For instance, social capital may increase the likelihood of mortality and morbidity as individuals may be influenced by friends and family to stay instead of evacuating (Hawkins & Maurer, 2010). Likewise, strong bonding social capital may bar access to recovery support from the larger society as experienced by African Americans during Hurricane Katrina (Elliott et al., 2010).

Conventional risk management uses a “command-and-control” approach which puts the responsibility on public authorities to provide the public with the information and resources to mitigate disaster risks (Murphy, 2012). However, a more empowering approach is to recognize, strengthen, and integrate members of the public as active agents in risk management because they tend to be more aware of the resources, needs, and concerns within their own communities. Individuals use social infrastructure to organize their lives, identities, and resources. Therefore, social capital may be a key component in risk management to increase disaster preparedness and build resilience at the individual- and community- level. Theorists argue that social capital could moderate and mediate the relationship between community vulnerability and disaster preparedness (Koh & Cadigan, 2008; Moore et al., 2004; Murphy, 2007). Therefore, cultivating social capital in a community may be useful for mobilizing individual and collective disaster preparedness.

In the pre-disaster context, research on the impact of social capital on disaster preparedness is relatively sparse. Existing studies suggest that strong social capital is associated with increased disaster preparedness (Agrawal & Monroe, 2006; Bhandari, Norio, Yokomatsu, & Ikeo, 2010; Bihari & Ryan, 2012; Buckland & Rahman, 1999; Reininger et al., 2013; Yamamura, 2010). For illustration, Reininger et al. (2013) found that fairness and trust (social capital indicators) were positively associated with disaster preparedness even after controlling for socio-demographic factors. Specific to the Canadian context, Buckland and Rahman (1999) found that communities that were prepared for the 1997 Red River Flood embodied strong social capital. These studies highlight the value of social capital in risk communication and management. Alternatively, some studies suggest that social capital may reduce individuals’ motivation to uptake disaster preparedness as social capital may allow individuals to defer

responsibilities to others and increase a (false) sense of security (Buckland & Rahman, 1999; Hawkins & Maurer, 2010; Wolf, Adger, Lorenzoni, Abrahamson, & Raine, 2010). For instance, a recent study by Babicky and Seebauer (2017) reported that social capital was associated with reduced flood risk perception. Although they did not measure disaster preparedness, they argued that social capital may reduce the propensity to uptake disaster preparedness by downplaying the risks. The reported inconsistencies and dearth of literature on this topic suggest a need for more empirical investigations to delineate the relationship between social capital and disaster preparedness. Another major gap in the literature is there are few empirical studies on this relationship in the Canadian context.

The Sendai Framework for Risk Reduction states that risk management should be people-centred, tailored to the needs and concerns of individuals and their communities (United Nations, 2015). As the risk paradigm shifts towards a system approach, it is therefore important to investigate how social capital affects disaster preparedness. Additionally, social capital is an important aspect to consider in risk communication and management for special populations that face social inequities such as immigrants (Koh & Cadigan, 2008; Lemyre et al., 2009; Levac, Toal-Sullivan, & O'Sullivan, 2012). For instance, trust towards the receiving society may have an implication on immigrants' decision to comply with disaster preparedness recommendations. Further, social isolation may preclude immigrants from receiving information and resources that allow for adequate disaster preparedness. Breton (2003) states that social capital of the receiving society plays an important role in immigrants' health and well-being. In fact, studies have demonstrated the salutary role of social capital in an array of outcomes for immigrants during normal times and in the disaster context (Eisenman et al., 2009; C. M. Johnson, Rostila, Svensson, & Engström, 2017; Zhao, Xue, & Gilkinson, 2010). The immigrant population

requires special considerations in risk communication and management because they tend to have unique experiences that increase their risks (Canadian Red Cross, 2007; Lemyre et al., 2009). There remains a gap in the literature such that it is unclear how the receiving society's social capital affects immigrants' disaster preparedness. The following sections discuss the psychosocial factors that may shape immigrants' experiences within the disaster cycle.

### **Inequities in Natural Disaster Risks: The Social Nature of Risks**

“Risk” is defined as a function of the probability and consequences of a particular hazard (Row, 1977):

$$\text{Risk} = \int \text{Prob}(\text{hazard}) \times \text{Prob}(\text{consequences})$$

The focus on the hazard produces a misconception that exposure to and consequences of the hazard are equal across a population. Society tends to believe that natural disasters are random events, and thus all individuals are equally at-risk. Nonetheless, past natural disasters have demonstrated that some social groups experience more negative consequences as they are more at-risk because of their increased exposure or limited access to resources for risk mitigation (Bolin, 2007; Lemyre et al., 2009; Thomas et al., 2010). Natural disasters are a combination of social and physical events. That is, social preconditions influence how individuals experience natural disasters. Social groups that face daily social inequality are more likely to be disproportionately affected by natural disasters (Thomas et al., 2010). Social inequities hinder these social groups' abilities to respond to and cope with natural disaster risks effectively. Consequently, they are more likely to be exposed to the natural hazards, to experience more negative post-disaster impacts, and to face complications during the recovery stage (Fothergill et al., 1999; Fothergill & Peek, 2004). These unequal distributions of risks have serious implications for risk communication and management. That is, risk communication and

management that do not acknowledge these social groups' needs and concerns could further increase their risks (Lemyre, Beaudry, & Yong, 2017; Lemyre et al., 2009).

While social groups that are disproportionately affected by natural disasters are often labelled as "vulnerable populations", Lemyre et al. (2009) argue that the label "higher-risk" is more appropriate. "Vulnerable population" puts the focus on individual characteristics and disregards how the social environment contributes to the gradient in how individuals experience risks. Social groups that are disproportionately affected by natural disasters tend to face obstacles to mitigate and prevent the risks due to their perceived lack of control, political disempowerment, lack of social trust, and normalization of everyday hazards (Andrulis et al., 2011; Finucane et al., 2000; Flynn et al., 1994; Fothergill & Peek, 2004). In addition, the term "vulnerable population" is marginalizing and disempowering because it suggests that these social groups need to be protected rather than having the capacity to contribute to risk communication and management (Lemyre et al., 2017, 2009). Accordingly, the term "higher-risk population" is more suitable because it reflects that risk inequities experienced by these social groups stem from the social environment rather than personal weaknesses. Therefore, the term "higher-risk population" is used in this thesis to describe social groups that experience risk inequities.

A pathway to address inequities in natural disaster risks is to tailor risk communication and management to meet the target social group's needs and concerns. Therefore, it is important to understand how these higher-risk populations perceive and respond to natural disaster risks in comparison to the general population. Since individuals' experience with natural disaster risks are influenced by the social environment, empirical investigations also need to consider the role of the social environment. In Canada, effective risk communication and management strategies need to address the multi-cultural population. One main social group that requires additional

attention in risk communication and management is the immigrant population (United Nations, 2015). The immigrant population has been identified as one of the 10 higher-risk populations in disasters in Canada (Canadian Red Cross, 2007). The following sections describe the psychosocial factors of the immigrant condition and their implications on the disaster cycle.

### **The Case of Immigrants**

The basic definition of an “immigrant” is an individual who moves to live permanently in a foreign country (Oxford Dictionary, 2017a). The reasons that propel immigration can be broadly classified as “pull” factors (e.g., to attain a better education) and “push” factors (e.g., to escape from war; Segal, Mayadas, & Elliott, 2006; Suárez-Orozco et al., 2012). Immigrants could be voluntarily immigrants (e.g., economic immigrants) because their decisions to immigrate are largely based on pull factors. They could also be involuntary immigrants (e.g., refugees) because their decisions to immigrate are largely based on push factors. The immigrant population is a diverse group as it can be further divided into subgroups such as by gender, ethnocultural identity, generation, and country of origin (Suárez-Orozco et al., 2012). This thesis focuses on first-generation immigrants who are foreign-born individuals who move to reside permanently in Canada (Statistics Canada, 2015b). First-generation immigrants tend to have the most salient experience of being new in a country compared to other generations of immigrants.

**Immigrants in Canada.** Immigration plays an important role in the population growth and development of Canada. Approximately one in five Canadian residents are foreign-born, and thus immigrants constitute a significant segment of the Canadian population (Statistics Canada, 2013a). Individuals immigrate to Canada as economic immigrants (63%), family class immigrants (23%), refugees (11%), and others (3%). Since most immigrants in Canada are economic immigrants, these immigrants tend to be highly educated. Immigrants in Canada

represent more than 200 ethnic origins. In recent years, the majority of new immigrants are of non-European ancestries (60%). About 73% of immigrants speak neither English nor French as their native languages. However, a majority of immigrants in Canada (94%) claim to be able to converse in at least one of the official languages. Canada has the highest proportion of immigrants amongst the G8 countries. The immigrant population is expected to grow in future years, particularly immigrants of non-European ancestries. The climate of reception for immigrants in Canada is generally positive. For example, a Canadian survey shows that the Canadian public generally values multiculturalism and immigration (CBC News, 2014). The Canadian government actively solicits immigrants and employs policies and programme that focus on equality and intercultural sensitivity (Government of Canada, 2014).

**Psychosocial considerations for immigrants.** The social environment of the receiving society plays a pivotal role in defining the social psychological reality of being an immigrant (Bourhis et al., 1997). The interaction between an immigrant's individual characteristics and the social environment define his or her immigrant condition. The following section outlines some of the common experiences associated with the immigrant condition. These experiences usually occur in combination and have implications on their experiences within the disaster cycle:

***Employment and economic disadvantages.*** Most immigrants face challenges in the labour market such as discrimination, underemployment, and unemployment (Sakamoto, Chin, & Young, 2010; Schellenberg & Maheux, 2007; Thorstensson Dávila, 2008). Some of the causal factors of labour market challenges include unrecognized credentials, language barriers, limited networking, and lack of local experience (e.g., "Canadian experience"). Immigrants who face labour market challenges are more likely to experience abject poverty, financial insecurity, and mental health issues (Health Canada, 2010; Yakushko, Watson, & Thompson, 2008).

***Downward assimilation and ethnic enclave.*** Immigrants who experience employment and economic disadvantages may find themselves living in impoverished communities in the receiving society, known as downward assimilation (Suárez-Orozco et al., 2012). These impoverished communities are often ethnic enclaves that are socially deprived and inundated with hazards (Hernandez, Collins, & Grineski, 2015; Orfield & Yun, 1999). In Canada, immigrants who experience settlement obstacles tend to live in dense, socially deprived neighbourhoods in Toronto, Montreal, and Vancouver (National Council of Welfare Reports, 2013; H. Smith & Ley, 2008). Living in ethnic enclaves also precludes immigrants from integrating into the larger society which exacerbates settlement obstacles such as difficulties in obtaining employment or learning the new official language due to having a limited social support network (Breton, 2003; Schnittker, 2002). Limited social support networks also decrease access to diverse resources and increase competition for scarce resources in the ethnic enclaves which contribute to concentrated poverty and social deprivation in these communities (Jargowsky, 2009).

***Social exclusion and isolation.*** Social support is an important protective factor against the stresses of migration and settlement (Simich, Beiser, Stewart, & Mwakarimba, 2005; Zhao et al., 2010). Immigrants who have sufficient social support are more likely to fare better in the receiving society. Unfortunately, many immigrants experience social exclusion and social isolation in the receiving society (Schellenberg & Maheux, 2007; Stewart et al., 2008). The immigration process often involves losing customary social support networks from the home country (Schellenberg & Maheux, 2007; Stewart et al., 2008). Communication barriers, cultural gaps, and discrimination prevent immigrants from building new social relationships beyond their ethnocultural community (Breton, 2003; Schnittker, 2002). Immigrants who experience



difficulties in forming meaningful social relationships in the receiving society tend to experience poorer health and well-being, feel like an outsider (a low sense of belonging), and be less informed or connected with the receiving society (Lai & Hynie, 2010).

***Language barriers.*** Language barriers are one of the most significant settlement obstacles for immigrants. Immigrants who are not proficient in the “new” language often face barriers and challenges when navigating the social environment in the receiving society. Language barriers have multifaceted economic and social implications for immigrants (McCaffrey, 2008; Sakamoto et al., 2010; Schellenberg & Maheux, 2007). Language barriers prevent immigrants from integrating into the receiving society and experiencing upward social mobility. Immigrants who have difficulties communicating in the new language often feel disempowered because they have to rely on others to navigate the system and advocate for their rights (Birman, 2006).

***Race- or ethnic- based discrimination.*** Immigrants may experience direct or indirect racial or ethnic discrimination (Dietz, 2010; Nangia, 2013). Racial or ethnic discrimination can occur at multiple ecological levels such as in employment, social relationships, and housing (Berry & Sabatier, 2010; Liebkind & Jasinskaja-Lahti, 2000; Segal et al., 2006). Immigrants who are visible minorities are most at-risk, particularly if they possess characteristics akin to socially disadvantaged groups in the receiving society (Nangia, 2013). In Canada, non-European immigrants are significantly more likely to transition into poor health compared to European immigrants (Health Canada, 2010). European immigrants do not have the challenges and barriers associated with the visible minority identity. Therefore, they are less likely to experience race- or ethnic- based discrimination unlike non-European immigrants.

**Resilience in the face of adversity.** Despite the aforementioned barriers and challenges, immigrants demonstrate incredible resilience (Segal et al., 2006; Suárez-Orozco et al., 2012). Immigrants possess a repertoire of capital that allows them to make the migration journey (Portes & Rumbaut, 2006). The migration journey and settlement process are arduous tasks that require physical assets and psychological strength. The recurrent hardships of migration and settlement in the receiving society allow for the development of perseverance and skills (Abraído-Lanza et al., 2007; Akinsulure-Smith, 2016). These experiences also contribute to their ability to adapt and continual motivation to achieve their goals. For instance, immigrants tend to outperform their native-born counterparts in education and health, despite facing multiple settlement obstacles (Health Canada, 2010; Portes & Rumbaut, 2006; Statistics Canada, 2013a). Furthermore, immigrants' repertoire of capital allows for flexibility in their performance and determination to achieve their goals in their new homes. For example, immigrants are motivated to learn the new official language and culture of the receiving society, achieve higher education, obtain respectable employment, and contribute to the receiving society through community engagement (Breton, 2003; Suárez-Orozco, Suárez-Orozco, & Todorova, 2010). Immigrants' adaptability and flexibility provide them with the resilience to thrive in the receiving society. Arguably, their resilience may act as a protective factor in the disaster cycle.

### **Immigrants and Natural Disasters: A Higher-Risk Population**

In the disaster cycle, immigrants may experience increased exposure, higher damage, and gaps and weaknesses in the emergency system. It is important to note that there is relatively less research focusing on the immigrant population in the disaster cycle. The existing literature on immigrants generally conflates immigrant status with ethnic or racial identity (Suárez-Orozco et al., 2012). However, research on ethnic minorities in the disaster cycle provides invaluable

information on how higher-risk populations construe natural disaster risks and issues, especially when a majority of new immigrants in Canada (60%) and the United States (52%) are ethnic minorities (Statistics Canada, 2013a; Zong & Batalova, 2016). Therefore, the review on immigrants' experiences within the disaster cycle will draw upon relevant research on ethnic minorities with a caveat that the experience of being new in a country is not equivalent to issues related to ethnic or racial identity.

**Increased exposure to hazards.** Increased exposure is often linked to living in hazard-prone areas that are concentrated with vulnerable physical structures (e.g., unsafe housing conditions and limited escape routes; Maldonado, Collins, Grineski, & Chakraborty, 2016; Maldonado, Collins, & Grineski, 2016; Morrow, 1999). Increased exposure is associated with increased severity of the impacts of natural disasters. For example, there was a disproportionate number of fatalities from Hurricane Katrina in the Lower Ninth Ward in New Orleans due to unsafe housing conditions (Cutter et al., 2006; Li et al., 2008). These physically vulnerable structures also made rescue and recovery effort challenging and perilous. Areas with high structural vulnerability are often inhabited by immigrants and ethnic minorities who experience recurring patterns of discrimination and economic disadvantages (Canadian Red Cross, 2007; Fothergill et al., 1999; Maldonado, Collins, Grineski, et al., 2016; Maldonado, Collins, & Grineski, 2016). For instance, Lower Ninth Ward was predominantly inhabited by Vietnamese immigrants and African Americans. Additionally, scarcity in personal assets and social resources may preclude immigrants from effective preparation and response which consequently increase their exposure (Fothergill et al., 1999). For example, the lack of personal transportation prevented immigrants and ethnic minorities from evacuation during Hurricane Katrina (Eisenman et al., 2007; Li et al., 2008). Moreover, immigrants may be exposed to the post-

disaster impacts long after the event. Recovery effort may not accommodate immigrants' needs and concerns (Cutter et al., 2006; Morrow, 1999). For instance, immigrants who are fearful of deportation and are distrustful of the government are less likely to seek for recovery aid (Andrulis et al., 2011; Fothergill et al., 1999; Lemyre et al., 2009). The increased exposure experienced by immigrants may consequently increase their sensitivity and complications during recovery.

**Increased sensitivity to hazards.** Increased sensitivity includes higher brittleness or damage experienced after the disaster. It has been documented that immigrants suffer significant negative physical and psychological consequences from natural disasters (Fothergill et al., 1999; Perilla, Norris, & Lavizzo, 2002; Scurfield, 2008; Webster, McDonald, Lewin, & Carr, 1995).

**Higher physical impact.** Individuals who have increased social vulnerabilities are more likely to be exposed to risks which in turn increases their disaster-related physical impact (Bolin, 2007). Increased physical impact leads to loss of a "sense of place", loss of a lifetime worth of belonging, and economic dislocation (Chen et al., 2007). For instance, Vietnamese immigrants suffered an enormous and a pervasive economic and property loss from Hurricane Katrina (Norris, VanLandingham, & Vu, 2009; Scurfield, 2008). Hurricane Katrina destroyed many local businesses owned by Vietnamese immigrants which resulted in unemployment and poverty. In addition, immigrants may suffer poorer physical health after the disaster (Chen et al., 2007; Vu & Van Landingham, 2012). Those who lack disposable income, insurance coverage, knowledge of the system, official language competency, and legal immigration status are less likely to receive or seek proper recovery aid (Aptekar, 1990; Lemyre et al., 2009; Peacock & Girard, 1997). Therefore, they are more likely to experience complications during recovery.

High post-disaster impact and complications during recovery altogether increase immigrants' risks of psychological morbidity (Chen et al., 2007).

***Higher psychological morbidity.*** Post-disaster psychological morbidity is often higher in terms of rate and severity in immigrants compared to the native-born population (Chen et al., 2007; Norris et al., 2009; Scurfield, 2008; Vu & Van Landingham, 2012). For example, Webster et al. (1995) found that non-English-speaking immigrants had a higher level of psychological morbidity from the 1989 Newcastle earthquake compared to Australian-born individuals. Likewise, Hispanic immigrants were found to have a higher rate of post-traumatic stress reaction after Hurricane Andrew compared to other groups (Perilla et al., 2002). Immigrants who experience complications and discrimination during the recovery phase are more likely to experience chronic displacement which in turn increases their risk of developing post-disaster mental health issues (Chen et al., 2007; Norris et al., 2009; Shelton & Coleman, 2009). Immigrants who are less acculturated and have predominantly close ties with their heritage cultures are more likely to experience negative psychological reactions due to having a limited social support network (Chen et al., 2007; Norris et al., 2009; Webster et al., 1995). Immigrants from cultures that include fatalism may be at an increased risk of developing mental health issues after a disaster as they may be less prepared for natural disasters (Perilla et al., 2002). These psychological impact may worsen and persist over time for immigrants if they experience a lack of access to adequate social support, mental health services, and recovery aid (Vu & Van Landingham, 2012).

**Discrepancy in disaster preparedness.** Immigrants may have a lack of knowledge about disaster preparedness, hazard awareness, and urgency in disaster preparedness (Burke, Bethel, & Britt, 2012; Carter-Pokras, Zambrana, Mora, & Aaby, 2007; Maldonado, Collins, &

Grineski, 2016; Matthew & Kelly, 2008; Nepal, Banerjee, Perry, & Scott, 2012). Additionally, immigrants who have a rosy view of the new country (e.g., the country is safe) and its government (e.g., the government will provide adequate disaster relief) are less likely to uptake disaster preparedness. Alternatively, immigrants who experience discrimination and political disempowerment may be less likely to follow the recommendations of public authorities to uptake disaster preparedness. Even if immigrants pay attention to these recommendations, various social-environmental factors may prevent immigrants from adequate disaster preparedness (Andrulis et al., 2011). For example, financial, time, and space constraints are barriers to gathering and storing emergency supplies for immigrants (Burke et al., 2012; Matthew & Kelly, 2008). Additionally, cultural beliefs (e.g., *fatalismo*), distrust, and lack of social support may dissuade immigrants from disaster preparedness (Burke et al., 2012; Norris et al., 2009). Risk communication and management are generally not designed to accommodate immigrants' needs and concerns and thus inadvertently create barriers and challenges to adequate disaster preparedness (Eisenman et al., 2009; James, Hawkins, & Rowel, 2007; Wilson & Tiefenbacher, 2012).

**Discrepancy in risk communication and management.** Risk communication and management are generally not tailored and targeted to meet the needs and concerns of the immigrant population. One barrier is the risk messages are presented ineffectually such as poor readability and lack of translated information (Eisenman et al., 2009; James et al., 2007; Wilson & Tiefenbacher, 2012). Moreover, these risk messages may not address knowledge gaps as immigrants may have a low hazard awareness due to being new in the receiving society (Carter-Pokras et al., 2007; Matthew & Kelly, 2008; Nepal et al., 2012). Another barrier is the ineffective dissemination of risk messages. Individuals are more likely to follow

recommendations when they perceive the information sources as credible, trustworthy, and empathetic (Fessenden-Raden, Fitchen, & Heath, 1987; Frewer, 2004; Glik, 2007; Peters, Covello, & McCallum, 1997). Immigrants who experience a recurring pattern of discrimination and lack of political empowerment may be less trusting of risk messages from public authorities (Lasker, 2004). Additionally, cultural factors may prescribe which information source is considered to be reliable. For instance, some immigrants may consider word-of-mouth and religious leaders as reliable information sources (Chen et al., 2007; Eisenman et al., 2009; Matthew & Kelly, 2008; Nepal et al., 2012). Further, cultural factors are often not considered as an important element in risk communication and management (Andrulis et al., 2007, 2011). Evidently, immigrants may be less likely to heed the risk messages that are not accessible and applicable to them and thus lowering the likelihood of disaster preparedness in this social group. Weaknesses and gaps in risk communication and management stem from a poor understanding of immigrants' risk perception and experiences.

**Discrepancy in the understanding of immigrants' risk perception.** Understanding how individuals perceive risks is the fundamental step for designing effective risk communication and management strategies (Fischhoff et al., 2011; Rohrman, 2008). There is a dearth of research on immigrants' risk perception for natural disasters. Existing research on a range of hazards shows that immigrants may perceive risks differently from the native-born population (Adeola, 2007; Cediell et al., 2012; Maldonado, Collins, & Grineski, 2016; Olofsson & Öhman, 2015; Olofsson & Rashid, 2011). For instance, Hispanic immigrants tended to perceive a higher risk of floods and hurricanes compared to American-born individuals (Maldonado, Collins, & Grineski, 2016). While these studies provide important insights regarding immigrants' risk perception, the definition of risk perception is limited to the hazard

characteristics (e.g., perceived likelihood). Moreover, research on how immigrants' risk perception affects their preparedness behaviours for natural disasters is sparse. Cross-cultural studies have demonstrated that the predictors of disaster preparedness may vary across socio-cultural groups (Paton, Sagala, et al., 2010; Paton, Bajek, Okada, & McIvor, 2010). Since immigrants bring their cultures and personal histories to the receiving society, it is possible that the predictors of disaster preparedness for them may differ from the native-born population.

### **Culture versus Immigrant Status: A Cautionary Note**

The cultural perspective posits that the disparities in immigrants' experiences within the disaster cycle are due to the clash between the heritage culture and new culture. Culture prescribes what is "risky" and "not risky", as well as the socially acceptable ways to respond to a risk (Dake, 1991; Douglas & Wildavsky, 1983; Kahan et al., 2007; Kasperson et al., 1988; Renn & Benighaus, 2016). Therefore, individuals are more likely to perceive and respond to hazards and risk messages in ways that align with their group's identity and cultural norms. Examples of cultural factors include cultural dimensions (e.g., collectivism versus individualism), traditions (*gotong royong* in Indonesia), worldviews, and beliefs (e.g., wildfires to "clean" the forest; Christianson, Mcgee, & L'Hirondelle, 2014; Gregg et al., 2008; Paton, Sagala, et al., 2010). One of the original studies on cross-cultural risk perception was conducted by Kleinhesselink and Rosa (1991). They found that Japanese perceived atomic power as dreadful, whereas Americans perceived atomic power as an unknown risk. They attributed these differences in risk perception to cultural biases such that Japanese were exposed to atomic bombs during World War II whereas Americans were not exposed to this hazard to the same extent. Further, Paton, Bajek, et al. (2010) found that community factors (e.g., community participation) predicted disaster preparedness in collectivistic culture in Indonesia, while individual factors



(e.g., individual outcome expectancy) predicted disaster preparedness in individualistic culture in New Zealand. Moreover, culture also prescribes the acceptability of disaster preparedness. For illustration, Paradise (2005) found that Moroccans who identified with their culture believed that disaster preparedness was prohibited by God. In short, the cultural perspective asserts that the discrepancy between immigrants and native-born individuals' construal of natural disaster risks and issues stems from a mismatch between their cultural frameworks.

Then again, culture is a narrow explanation. For example, the use of *fatalismo* as a cultural explanation for Hispanic immigrants' increased risk should be cautionary. Fatalism is a cultural component, but social injustice may also instil the perceived lack of control over risks (Abraído-Lanza et al., 2007). Therefore, the discrepancy between how immigrants and native-born individuals experience the disaster cycle could also be due to differences in the social environment rather than cultural dissonance alone. Disasters touch on pre-existing strata of susceptibilities and ecological barriers to access the resources required to prepare, mitigate, respond, and recover adequately (Cutter, Carolina, Boruff, & Shirley, 2003; Lemyre et al., 2009; Thomas et al., 2010). The immigrant status comes with many implications related to the immigrant condition that may hinder adequate disaster preparedness as described in the previous sections. Arguably, all immigrants regardless of cultural identity may experience some of these implications related to being new in a country. Therefore, the immigrant condition alone may affect how immigrants construe natural disaster risks and issues. The environmental (in)justice thesis states that individuals' risk perception and response are related to the disparities in hazard exposure and resources to cope with risks (Satterfield et al., 2004). For instance, immigrants' heightened risk perception and inadequate preparedness behaviours were related to their lack of knowledge about the local hazards due to being new in a country (Carter-Pokras et al., 2007;

Maldonado, Collins, & Grineski, 2016). Further, Olofsson and Rashid (2011) found that there was no gender difference in risk perception, but immigrants were more likely to have a heightened risk perception compared to the native-born Swedes. They explained that the social inequality associated with the immigrant status increased immigrants' risk perception. Taken together, any observed difference between immigrants and native-born individuals in the disaster cycle should not be attributed to culture alone as other social-environmental factors may be at play.

### **Limitations within the Field**

The reviewed literature highlights several limitations within the field. First, there is a paucity of research that focuses on the immigrant population. Most studies often lump race and ethnicity with immigrant status. While new immigrants in Canada and the United States are often ethnic or racial minorities, these social categories are not synonymous. The experience of being new in a country is unique to being an immigrant and is experienced by most, if not all, immigrants regardless of racial or ethnocultural identity. Indeed, the American Psychological Association Presidential Task Force on Immigration has begun to recognize this gap in the literature (Suárez-Orozco et al., 2012). A recent study by Maldonado, Collins, Grineski, et al. (2016) demonstrated how racial or ethnocultural identity was not synonymous with immigrant status in the context of risks. They found that Hispanic immigrants were more likely to have a lower level of disaster preparedness and hazard knowledge compared to American-born Hispanics. This study suggests that the immigrant status alone may be associated with unique experiences in the disaster cycle.

Second, there is a lack of understanding of immigrants' risk perception and disaster preparedness. There are relatively few studies that establish the link between immigrants' risk

perception and behavioural response to natural disaster risks. Existing studies generally investigate immigrants' level of risk perception or disaster preparedness without establishing how risk perception predicts disaster preparedness for immigrants. Further, existing studies utilize a narrow definition of individuals' risk perception by focusing on hazard characteristics. Individuals' beliefs about hazards are also important aspects of their risk perception (Slovic, 1999). Also, existing studies do not compare immigrants with the general native-born population. Comparative studies provide important information to help determine how we can tailor and target risk communication and management. Culturally-adapted intervention is pertinent for social groups that experience obstacles in accessing standard programme due to their unique needs and concerns (Iglehart, 2009). Individuals are less likely to participate in programmes that are "culturally blind" because these programmes are perceived to be irrelevant or inaccessible.

Third, there is a lack of research on the role of the social environment in disaster preparedness including the relationship between community social capital and individuals' disaster preparedness. Given that social capital has been associated with positive health and well-being during normal times and in the post-disaster context, its relationship with disaster preparedness should be examined. Further, a better understanding of how broader social-environmental factors impact individuals' disaster preparedness will help construct a systemic risk paradigm. It may also help address the shortcomings of existing risk communication and management in Canada at various ecological levels. Hence, a better understanding of how risk perception, social capital, and other social-environmental factors explain individuals' disaster preparedness could help improve risk communication and management. Accordingly, this thesis addressed these gaps in the literature by investigating the relationship between risk perception

and disaster preparedness in view of the social environment for immigrants compared to Canadian-born individuals.

### **Research Outline**

The overarching goal of this thesis was to understand how risk perception for natural disasters and the social environment relate to immigrants' disaster preparedness compared to the general Canadian-born population. The intended contribution was to foster disaster preparedness and resilience through targeted and tailored risk communication and management. This thesis was informed by three research objectives:

- (1) To investigate the relationship between risk perception and disaster preparedness in immigrants and Canadian-born individuals.
- (2) To establish if community social capital contributes to individual disaster preparedness in immigrants and Canadian-born individuals.
- (3) To identify the role of the broader social environment in how immigrants and Canadian-born individuals construe natural disaster risks and issues.

**Conceptual model.** A social-ecological perspective was used to illustrate the individual characteristics and social-ecological factors associated with disaster preparedness (Gibson, 2013; Lemyre & O'Sullivan, 2013). As shown in Figure 3, the social environment influences individuals' risk perception and preparedness behaviours via direct and indirect pathways.

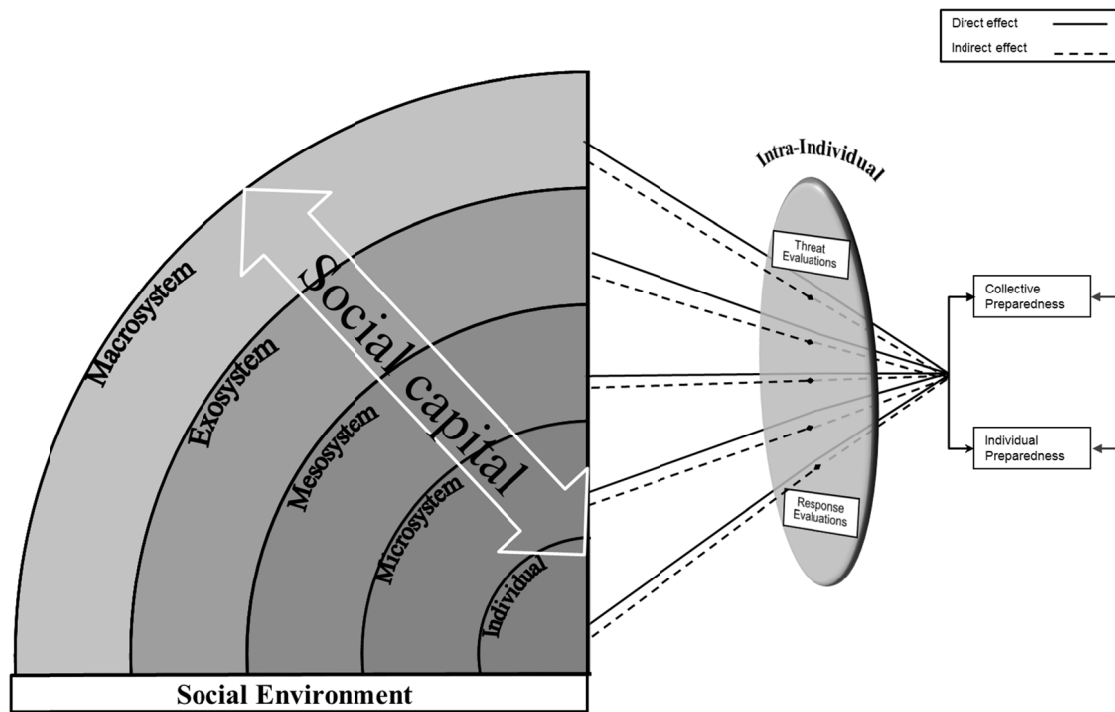


Figure 3. Social capital, risk perception and disaster preparedness [adapted from Gibson (2013) and Lemyre and O’Sullivan (2013)].

This model applies to immigrants and Canadian-born individuals, although there may be variations in the features within the social environment. For example, immigrants may be less socially connected compared to their Canadian-born counterparts. It is postulated that social capital represents the features of social relationships, such as reciprocity, trust, networks, and norms, which could facilitate coordination and cooperation for effective disaster preparedness. For instance, knowing your neighbours could provide assistance during a natural disaster (Nepal et al., 2012), and social ties may be a catalyst for information diffusion and behaviour change (Granovetter, 1973; Weenig & Midden, 1991). Social capital may instil personal responsibility for one's safety and collective commitment to respond to the risks (Prior & Paton, 2008). Social capital is an aspect of resilience (Lemyre & O'Sullivan, 2013). Individual resilience is comprised of a sense of mastery and skill building that is forged through trustworthy social relationships. Community resilience is the capacity of a community to maintain adequate functioning and return to normalcy after a perturbation from a disaster. A community that is rich with social capital has the solidarity, skills, and assets that may allow individuals and communities to regroup and recover from a disaster. To effectively demonstrate these relationships, a mixed-method approach was used.

**Thesis outline.** In light of the research goal and objectives, three studies were conducted to explore individual characteristics and social-environmental factors in explaining individuals' disaster preparedness.

***Article 1: Risk perception and disaster preparedness.*** The objective of this quantitative study was to test the relationship between risk perception and disaster preparedness in immigrants and how the risk perception-disaster preparedness relationship differs by immigrant status. This study considered factors at the individual-level. The research questions were: (1)

what is the relationship between risk perception and disaster preparedness?; and (2) how do immigrants compared to Canadian-born individuals in this risk perception-disaster preparedness relationship? This study addresses a key gap in the literature which is the dearth of understanding of immigrants' risk perception and disaster preparedness. This study provides insights regarding individuals' risk perception for natural disasters, and how immigrants and Canadian-born individuals compare in their risk perception and preparedness behaviours. The final published peer-reviewed form of this study is in Risk Analysis.

***Article 2: Community social capital and individual disaster preparedness.*** The objective of this quantitative study was to test the relationship between community social capital and individual disaster preparedness in immigrants compared to Canadian-born individuals. This study considered how factors at the ecological-level affect individual-level preparedness behaviours. The research questions were: (1) what is the relationship between community social capital and individuals' disaster preparedness?; and (2) does this relationship differ by immigrant status? This study addresses a main gap in the literature which was the lack of understanding of the relationship between community social capital and individuals' disaster preparedness by immigrant status. This study elucidates how a community's social environment vis-à-vis social capital explains immigrants and Canadian-born individuals' disaster preparedness. This study has been submitted for publication.

***Article 3: Qualitative Study on Natural Disaster Risks and Issues.*** The objective of this qualitative study was to explore how immigrants and Canadian-born individuals derive meaning from the social environment which in turn influences their risk perception and disaster preparedness. A social-ecological perspective was used to explore individuals' lived experiences with natural disaster risks and issues in Canada. This study considered broader social-

environmental factors at all social-ecological levels. The research questions were: (1) what are the social-ecological factors, processes, and relationships that have an influence on individuals' risk perception and disaster preparedness? And (2) what are the nuances between immigrants and Canadian-born individuals? This study addresses a gap in the literature which is the lack of understanding of how the social environment shapes individuals' perception of and response to natural disaster risks and issues. This study illuminates how the social environment shapes immigrants and Canadian-born individuals' risk perception and disaster preparedness. It also provides context and meaning that help explain the findings from the antecedent quantitative studies. This study has been submitted for publication.

The aforementioned studies above will be presented in the following chapters. Then, a general discussion will discuss the implications and applications of the findings.



**Chapter 2: Risk Perception and Disaster Preparedness in Immigrants and Canadian-Born  
Adults: Analysis of a National Survey**

### **Foreword**

The first article is an individual-level study that examines the relationship between risk perception and disaster preparedness for natural disasters in immigrants compared to Canadian-born individuals. Like many psychological studies on risk perception and disaster preparedness, this study examined how individuals perceive natural disaster risks and how their risk perception predicts preparedness behaviours. This study demonstrated that individuals' risk perception was cogent and multi-dimensional involving beliefs about natural disaster risks. This study involved analysing data from the National Survey of Health Risk Perception (see Appendix A). Comparison between immigrants and Canadian-born individuals provided insights for culturally-adapted risk communication and management. The final published peer-reviewed form of this study is in *Risk Analysis*. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Self-Archiving.

### **Contributions of Authors and Co-Authors**

The first author (doctoral candidate) contributed to the conceptual framework and survey questionnaire for the natural disaster risks and issues case study in collaboration with Dr. Daniel Krewski and Dr. Louise Lemyre who were the principal investigators of the National Survey of Health Risk Perception (NSHRP) 2012; and the co-researchers: Dr. Celine Pinsent, Dr. Michelle Turner, and the graduate students (Andrea Perna and Alina Dumitrescu). Dr. Krewski developed the original hazard survey in 1992, and Dr. Lemyre developed the risk appraisal survey in 2002. Dr. Lemyre and Dr. Krewski also contributed to the development of this article. The first author was primarily responsible for the natural disaster case study including developing and analysing specific survey items. She was also the project data coordinator for the NSHRP 2012. She managed the databases including cleaning the raw data, creating the data dictionary, and documenting the development of the project. She also helped prepare the research ethics application (see Appendix B).

For the manuscript, Dr. Lemyre, Dr. Krewski, and Dr. Pinsent provided feedback for the conceptual framework, analysis plan, and writing. The co-authors agreed to use this paper as part of the first author's doctoral thesis and have this paper published in a scientific journal.

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Running head: RISK PERCEPTION AND DISASTER PREPAREDNESS IN IMMIGRANTS  
AND CANADIAN-BORN ADULTS

Risk Perception and Disaster Preparedness in Immigrants and Canadian-Born Adults: Analysis  
of a National Survey

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### **Abstract**

Research has documented that immigrants tend to experience more negative consequences from natural disasters compared to native-born individuals, although research on how immigrants perceive and respond to natural disaster risks is sparse. We investigated how risk perception and disaster preparedness for natural disasters in immigrants compared to Canadian-born individuals as justifications for culturally-adapted risk communication and management. To this end, we analysed the ratings on natural disaster risk perception beliefs and preparedness behaviours from a nationally representative survey ( $N = 1,089$ ). Factor analyses revealed three underlying psychological dimensions of risk perception: external responsibility for disaster management, self-preparedness responsibility, and illusiveness of preparedness. Although immigrants and Canadian-born individuals shared the three-factor structure, there were differences in the salience of five risk perception beliefs. Despite these differences, immigrants and Canadian-born individuals were similar in the level of risk perception dimensions and disaster preparedness. Regression analyses revealed self-preparedness responsibility and external responsibility for disaster management positively predicted disaster preparedness whereas illusiveness of preparedness negatively predicted disaster preparedness in both groups. Our results showed that immigrants' risk perception and disaster preparedness were comparable to their Canadian-born counterparts. That is, immigrant status did not necessarily yield to differences in risk perception and disaster preparedness. These social groups may benefit from a risk communication and management strategy that addresses these risk perception dimensions to increase disaster preparedness. Given the diversity of the immigrant population, the model remains to be tested by further population segmentation.

*Keywords:* risk perception, disaster preparedness, immigrants, Canada, natural disasters

## **Introduction**

Immigrants tend to suffer more negative consequences from natural disasters in comparison to their native-born counterparts (Perilla, Norris, & Lavizzo, 2002; Scurfield, 2008). A targeted and tailored risk communication and management strategy may be useful to increase disaster preparedness in immigrants. A critical step is to understand how immigrants' risk perception and disaster preparedness for natural disasters compared to the general population. Accordingly, we investigated risk perception and disaster preparedness in immigrants and Canadian-born individuals.

### **Natural Disasters in Canada: Considerations for Immigrants**

The varied geographic landscape, population growth, and urbanization in Canada have increased the risks of Canadian residents experiencing a significant loss from natural hazards (Hwacha, 2005). An effective step to prevent and mitigate these risks comes through disaster preparedness. Disaster preparedness fosters resilience which is the capacity of individuals and communities in maintaining adequate functioning and returning to normalcy post-disaster (Lemyre & O'Sullivan, 2013). Although disaster preparedness is a salient theme in Canada, individual disaster preparedness remains low (Taylor-Butts, 2016). There is also a lack of targeted and tailored risk communication and management strategy to address the heterogeneity of the Canadian population, despite studies have demonstrated that risks are not equally distributed in a population (Lemyre, Gibson, Zlepzig, Meyer-Macleod, & Boutette, 2009; Thomas, Phillips, Lovekamp, & Fothergill, 2010). One group that requires special considerations is the immigrant population. The immigrant population is a significant (21%) and growing social group in Canada (Statistics Canada, 2013). In Canada, the immigrant population

has been identified to be one of the 10 higher-risk populations in disasters thus highlighting the importance to increase disaster preparedness in this social group (Canadian Red Cross, 2007).

Disasters touch on pre-existing strata of susceptibilities and systemic barriers to access the resources required to prepare, mitigate, respond, and recover adequately. Immigrants are described as the “triply disadvantaged” because the barriers and challenges they experience daily (e.g., language, economic, and cultural barriers) contribute to increased risks within the disaster cycle (Donner & Rodriguez, 2008; Scurfield, 2008). Risk communication and management that do not accommodate to immigrants’ unique social, cultural, structural, and contextual factors may increase their risks (Eisenman et al., 2009; James, Hawkins, & Rowel, 2007). Barriers that immigrants experience in disaster preparedness include the misunderstanding that the government is responsible for providing adequate relief, perceived lack of urgency in disaster preparedness due to competing life demands, shortage of culturally-adapted disaster education, low hazard awareness, and barriers to access to resources required to take action (Carter-Pokras, Zambrana, Mora, & Aaby, 2007; Cutter, Carolina, Boruff, & Shirley, 2003; James et al., 2007; Maldonado, Collins, & Grineski, 2016; Nepal, Banerjee, Perry, & Scott, 2012; Wilson & Tiefenbacher, 2012). These findings suggest that immigrants may benefit from a targeted and tailored risk communication and management strategy. A fundamental step is to understand how immigrants’ risk perception and disaster preparedness compared to the general population.

### **Disaster Preparedness and Risk Perception**

Effective risk communication and management strategies require an understanding of how lay individuals perceive risks (Rohrmann, 2008). Although there are different theoretical explanations used to explain lay individuals’ risk perception (Kasperson et al., 1988; Sjoberg, 2000), most theorists agree that individuals must first believe that the hazard is valid before any

actions can occur (Lemyre et al., 2009; Mileti & Fitzpatrick, 1992). Indeed, research has demonstrated that individuals' subjective evaluation of natural hazards is an important factor in their disaster preparedness (Brenkert-Smith, Champ, & Flores, 2012; Lo, 2013; Martin, Martin, & Kent, 2009). However, the direct link between risk perception and disaster preparedness has not been consistently reported in the literature (Lindell & Whitney, 2000; Paton, Smith, & Johnston, 2000). The mixed findings could be attributed to how risk perception and disaster preparedness are operationalized. For instance, Ozdemir and Yilmaz (2001) demonstrated that how different dimensions of individuals' risk perception for earthquakes (e.g., perceived likelihood of earthquakes versus beliefs about responsibility for earthquake risk mitigation) predicted different types of preparedness behaviours. Likewise, other studies have demonstrated that risk perception consists of multiple dimensions and different risk perception dimensions are associated with different behavioural responses (Lee & Lemyre, 2009; Markon, Lemyre, & Krewski, 2011). These studies suggest that individuals' risk perception is a cogent, rich structure that is beyond the evaluation of hazard characteristics. Individuals' risk perception is value-laden as it consists of beliefs about responsibility, control, acceptability, and response regarding the hazards (Slovic, 1999). Accordingly, we defined individuals' risk perception for natural disasters as a multidimensional structure consisting of beliefs about natural disaster risks and issues.

### **Culture and the Immigrant Condition on Disaster Preparedness and Risk Perception**

The literature suggests that immigrants may perceive natural disaster risks differently from their native-born counterparts (Maldonado et al., 2016; Olofsson & Öhman, 2015; Olofsson & Rashid, 2011). For example, Maldonado et al. (2016) found that Hispanic immigrants in the United States perceived flood risks and hurricane risks to be higher than American-born



individuals. To date, research on the predictors of disaster preparedness in immigrants compared to the native-born population is sparse. Because cross-cultural research has found that the factors and pathways predicting preparedness behaviours vary by social group (Paton et al., 2010), disaster preparedness in immigrants may be different from their native-born counterparts.

The fundamental assertion of the cultural approach is group differences in risk perception and response exist because they are influenced by a particular way of thinking and living. That is, cultural values prescribe what is “risky” or “not risky” (Douglas & Wildavsky, 1983).

According to the cultural-identity-protective cognition thesis (Kahan, Braman, Gastil, Slovic, & Mertz, 2007), individuals are motivated to respond to risks in ways that support their groups’ cultural norms. Other cultural explanations include cultural dimensions (e.g., collectivism-individualism), traditions (e.g., gotong-royong in Indonesia), and beliefs (e.g., wildfires to “clean” the forest; Christianson, Mcgee, & L’Hirondelle, 2014; Gregg et al., 2008; Paton et al., 2010). Beyond cultural factors, the experience of being new in a country includes the loss of customary social support networks, lack of familiarity with the local hazards, increase in competing life demands (e.g., finding a job and securing housing), and experience of limited resources. Hence, the “immigrant condition” alone may influence immigrants’ risk perception and disaster preparedness. For instance, immigrants’ heightened risk perception and lack of disaster preparedness were related to their lack of knowledge about the local hazards (Carter-Pokras et al., 2007; Maldonado et al., 2016). The environmental (in)justice thesis states that individuals’ risk perception and response are related to the disparities in hazard exposure and resources to cope with risks (Satterfield, Mertz, & Slovic, 2004). Lemyre and O’Sullivan (2013) propose a social-ecological approach to risks and resilience which asserts that individuals’ risk

perception and disaster preparedness are influenced by the interaction between the individual and the multilevel, nested social environment.

### **Towards a Targeted and Tailored Approach**

Since immigrants may experience natural disaster risks and issues differently, they may benefit from culturally-adapted interventions. The heterogeneity of the Canadian population suggests that a culturally-adapted perspective is an efficient approach. The culturally-adapted perspective involves modifying features of a generic programme that are identified to be important and unique for the target group (Castro, Barrera, & Holleran Steiker, 2010). Theorists have posited that there is a universal experience with risks due to globalization and shared human experience, as well as there are unique experiences due to the diversity of life (Renn & Rohrman, 2000). Accordingly, we compared immigrants to the Canadian-born population to identify core similarities for a standard programme and meaningful uniqueness for cultural modifications.

Our research goal was to investigate how risk perception and disaster preparedness in immigrants compared to Canadian-born individuals as justifications for culturally-adapted risk communication and management. To this end, we first defined the underlying psychological dimensions of risk perception for natural disasters in Canadian-born individuals. Then, we tested the risk perception dimensions for cross-cultural measurement invariance. The test of measurement invariance was considered as a prerequisite for unbiased comparisons between immigrants and Canadian-born individuals, as well as to determine which risk perception beliefs functioned differently in these groups (Byrne, 2008). Next, we assessed whether immigrants and Canadian-born individuals differed in the level of risk perception dimensions and disaster preparedness, as well as in the relationship between risk perception dimensions and disaster

preparedness. Given that the literature suggests that immigrants' experience of the disaster cycle differs from their native-born counterparts, we predicted that: (1) there are differences in the underlying structure and level of risk perception for natural disasters in immigrants and Canadian-born individuals; and (2) there are differences in the level of disaster preparedness and how risk perception predicts disaster preparedness in immigrants and Canadian-born individuals. The identified similarities and differences should help elucidate how we can better tailor and target risk communication and management for the Canadian public.

## **Method**

### **Participants**

Of the 3,263 Canadian residents that responded to the National Survey of Health Risk Perception (NSHRP) 2012, a random subsample of 1,089 adult respondents of at least 18 years old responded to the subsection on natural disaster risks and issues. Of these, 921 respondents were Canadian-born, 163 respondents were foreign-born, and five respondents did not report their country-of-birth. Table 1 and Table 2 present the socio-demographic characteristics of the respondents.

**Table 1***Frequencies and Valid Percentages for Socio-Demographic*

Variable	Canadian-born (n = 921)	Immigrant (n = 163)
Age*		
18 - 24 years	44 (4.8%)	6 (3.7%)
25 - 34 years	194 (21.1%)	21 (12.9%)*
35 - 44 years	176 (19.2%)	21 (12.9%)
45 - 54 years	178 (19.4%)	30 (18.4%)
55 - 64 years	158 (17.2%)	34 (20.9%)
At least 65 years	169 (18.4%)	51 (31.3%)*
Would prefer not to say (n = 2)		
Gender*		
Male	442 (48.0%)	97 (59.5%)*
Female	479 (52.0%)	66 (40.5%)*
Would prefer not to say (n = 0)		
Education level*		
Up till high school	157 (17.2%)	17 (10.4%)
Completed community college	236 (25.8%)	40 (24.5%)
Completed university	323 (35.3%)	55 (33.7%)
Completed graduate school	199 (21.7%)	51 (31.3%)*
Would prefer not to say (n = 6)		
Annual household income		
< \$50,000	248 (30.7%)	41 (28.7%)
\$50,000 - < \$60,000	80 (9.9%)	21 (14.7%)
\$60,000 - < \$80,000	109 (13.5%)	23 (16.1%)
\$80,000 - < \$100,000	110 (13.6%)	19 (13.3%)
\$100,000 - < \$150,000	159 (19.7%)	25 (17.5%)
\$150,000 - < \$200,000	68 (8.4%)	8 (5.6%)
At least \$200,000	33 (4.1%)	6 (4.2%)
Would prefer not to say (n = 134)		
Geographic region*		
British Columbia	124 (13.5%)	25 (15.3%)
Prairies	185 (20.1%)	17 (10.4%)*
Ontario	335 (36.4%)	92 (56.4%)*
Quebec	195 (21.2%)	22 (13.5%)*
Atlantic	82 (8.9%)	7 (4.3%)*
Would prefer not to say (n = 0)		
Residential location*		
Rural	228 (24.9%)	26 (16.1%)
Urban	687 (75.1%)	135 (83.9%)
Would prefer not to say (n = 8)		
Duration in neighbourhood*		
< 5 years	205 (22.4%)	28 (17.3%)
5-19 years	418 (45.7%)	89 (54.9%)*
At least 20 years	291 (31.8%)	45 (27.8%)
Would prefer not to say (n = 8)		

Note. Chi-square analyses: Column proportions were compared using z-test with Bonferroni adjusted *p*-value.

\**p* < .05.

**Table 2***Frequencies and Valid Percentages for Socio-Cultural Characteristics*

Variable	<u>Canadian-born</u> ( <i>n</i> = 921)	<u>Immigrant</u> ( <i>n</i> = 163)
Spoken home language*		
English	721 (78.5%)	113 (69.3%)*
French	185 (20.1%)	14 (8.6%)*
English and French	5 (0.5%)	0 (0.0%)
Others	8 (0.9%)	36 (22.1%)*
Would prefer not to say ( <i>n</i> = 2)		
Ethnic /cultural background*		
European <sup>a</sup>	813 (95.6%)	108 (72.5%)*
Non-European <sup>b</sup>	37 (4.4%)	41 (27.5%)*
Would prefer not to say ( <i>n</i> = 85)		
Time in Canada		
< 10 years		18 (11.0%)
10 - 29 years		49 (30.1%)
At least 30 years		96 (58.9%)
Would prefer not to say ( <i>n</i> = 0)		

*Note.* a = North American (non-aboriginal), European, and Oceania (non-pacific islander). b =

Caribbean, African, Pacific Islander, Asian, South American, and Aboriginal. Chi-square

analyses: Column proportions were compared using z-test with Bonferroni adjusted *p*-value.

\**p* < .05.

## Procedure

The survey was conducted via telephone ( $n = 1,694$ ; 22% response rate) and the Internet ( $n = 1,569$ ; 10% response rate) using a blended landline-cell phone sampling frame and a separate online sampling frame. Data from both samples were pooled after testing for homogeneity of variance, method effect, non-representative sample effect, and sampling effect showed no significant difference in the responses by survey method. The sample was a weighted nationally representative sample according to age, gender, and region of residence based on the 2011 Census of Canada distribution. In the natural disaster subsection, there were 509 Internet respondents ( $n_{\text{Canadian-born}} = 429$ ,  $n_{\text{immigrant}} = 80$ ) and 575 telephone respondents ( $n_{\text{Canadian-born}} = 492$ ,  $n_{\text{immigrant}} = 83$ ). Chi-square analyses showed no significant difference in the proportion of immigrant respondents and Canadian-born respondents by survey method,  $ps > .05$ .

## Measures

The NSHRP 2012 is part of an ongoing research programme aiming to assess the Canadian public's evaluations and decision-making on a variety of hazards (Krewski et al., 2009).

**Individual Disaster Preparedness.** Respondents rated their level of agreement with five preparedness behaviours using a 5-point scale (1 = "Do not agree at all," 5 = "Agree completely"; see Table 3). Items were selected because they were considered to be common and important preparedness behaviours by the Canadian public and government (Lee, Dallaire, & Lemyre, 2009; Lemyre & O'Sullivan, 2013).

**Natural Disaster Risk Perception Beliefs.** Respondents rated their level of agreement with 18 natural disaster risk perception beliefs using a 5-point scale (1 = "Do not agree at all," 5 = "Agree completely"; see Table 3). These statements included threat and response evaluations

generated based on previous work (Lee & Lemyre, 2009; Markon et al., 2011). They reflected a variety of constructs including perceived consequences, perceived control, perceived knowledge, social norms, perceived uncertainty, risk tolerance and acceptance, and perceived likelihood.

**Table 3***Natural Disaster Risks and Issues Items from the NSHRP 2012*

Item
<u>Natural disaster risk perception beliefs</u>
1. It is an individual's responsibility to be prepared for a major natural disaster.
2. Preparation is useless to protect oneself from natural disasters.
3. Science and technology help ensure that we are prepared for natural disasters.
4. Organizations should help people learn about disaster preparedness.
5. Fate will decide if I am in a natural disaster.
6. It is the government's responsibility to plan effectively for natural disasters.
7. The main thing that determines my exposure to natural disaster risks is what I myself do.
8. The negative consequences of natural disasters can be decreased by being well prepared.
9. If a natural disaster has recently occurred, it is less likely to happen again soon.
10. Natural disasters have many negative consequences besides property damage and death.
11. When the people I like worry about a natural disaster I am more likely to worry as well.
12. Even if I didn't understand why, I would likely follow the recommendations from government authorities during a natural disaster.
13. The benefits of preparing for a natural disaster outweigh the costs.
14. The likelihood that I will experience a natural disaster based on where I live.
15. It is unlikely that I will be a victim of a natural disaster.
16. Information about natural disasters is confusing.
17. It is difficult to predict the occurrence of natural disasters.
18. Scientists usually agree about how to prevent natural disasters.
<u>Individual disaster preparedness</u>
1. I discuss with others the information I get on preparing for natural disasters.
2. I have an emergency supply kit for natural disasters.
3. I have an evacuation plan for natural disasters.
4. I discuss with others to search for me within 48-hours after natural disasters.
5. In case of a natural disaster, I would comply with recommendations to evacuate.

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*Note.* Detailed scale calculations are presented in Appendix C.



### **Data Analyses and Results**

Respondents' socio-demographic and sociocultural characteristics are presented in Table 1 and Table 2. Chi-square analyses revealed that the immigrant sample and Canadian-born sample significantly differed in age, gender, education, region, location, time in neighbourhood, language, and ethnocultural background. However, the samples were similar such that majority of the respondents were from the province of Ontario, urban dwellers, university graduates, from households below \$50,000 annual income, fairly new to their neighbourhoods, Anglophones, and Europeans. The majority of the immigrant respondents were long-term residents.

#### **Psychological Dimensions of Risk Perception for Natural Disasters**

We investigated the underlying psychological dimensions of risk perception for natural disasters and then tested for measurement invariance. In line with the culturally-adapted perspective, we compared immigrants to the Canadian-born reference group to determine the degree of cultural modification to a generic risk communication and management strategy. First, we performed exploratory factor analysis (EFA) with principal axis factoring extraction and oblimin rotation using a randomly-derived 50% subsample of the Canadian-born sample ( $n_1 = 460$ ). EFA revealed a three-factor solution: eigenvalues  $> 1.0$  and 29% variance explained. Next, we conducted a multigroup confirmatory factor analysis (MGCFA) with maximum likelihood robust estimators to test for measurement invariance by comparing the three-factor model in immigrants ( $n = 163$ ) to the Canadian-born reference group ( $n_2 = 461$ ). Final results revealed a 14-item, three-factor model with adequate fit (Satorra–Bentler  $\chi^2(179) = 220.70$ ,  $p = .02$ , robust comparative fit index = .95, and robust residual mean-square error of approximation

= .03 (95% CI, .015–.043) and partial measurement invariance with five non-invariant items (see Figure 4).<sup>1</sup>

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<sup>1</sup> Detailed results are available in Appendix C.

## PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

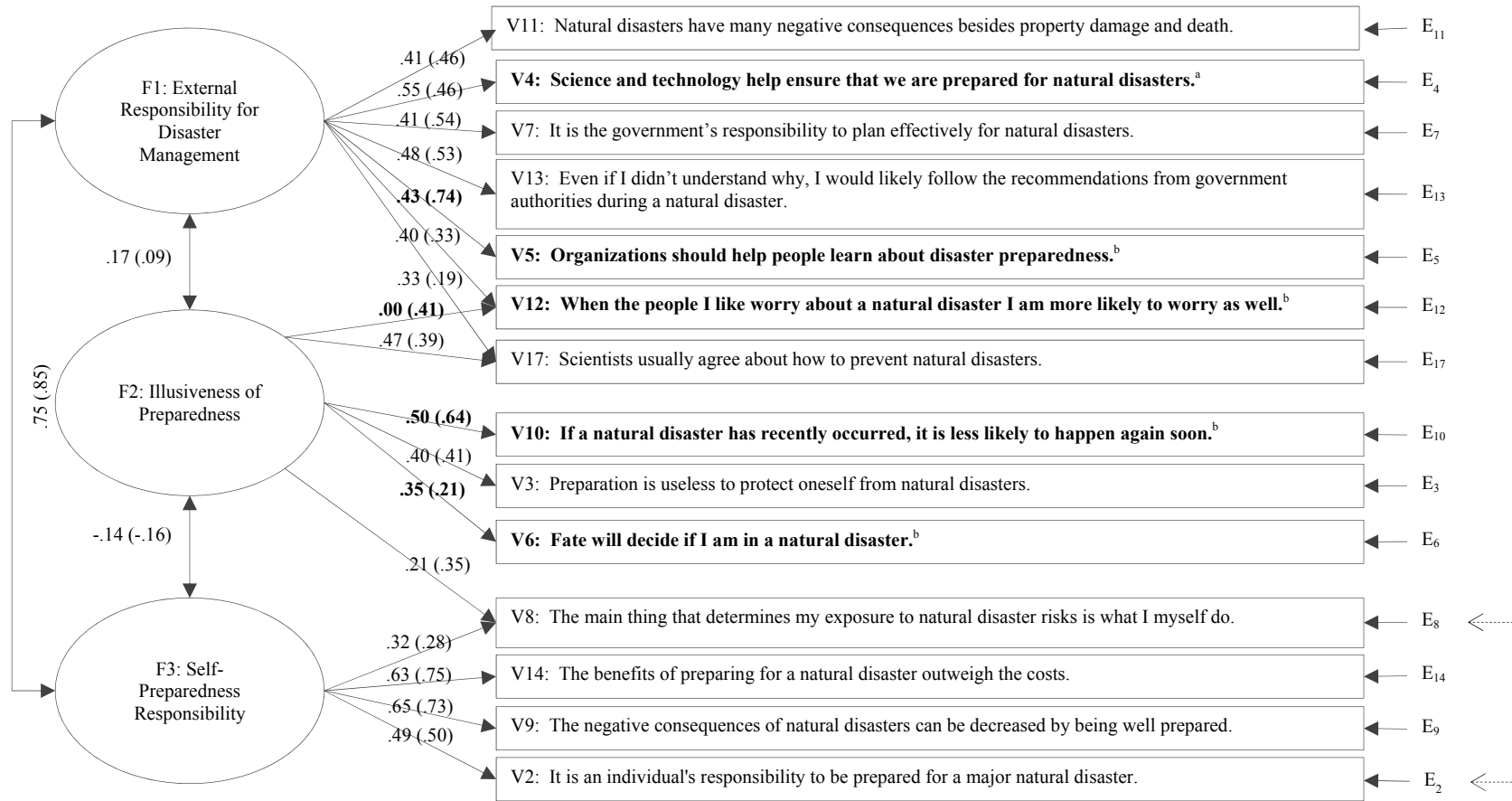


Figure 4. Risk perception dimensions in Canadian-born (and immigrants).

*Note.* Non-invariant items (bolded) were excluded from the factor score calculation,  $p < .05$ : a = non-invariant item intercept (Canadian-born = 3.39, immigrant = 3.15), b = non-invariant factor loading. Excluded items: V1 ("It is unlikely that I will be a victim of a natural disaster based on where I live."), V15 ("Information about natural disaster is confusing."), V16 ("It is difficult to predict the occurrence of natural disasters."), and V18 ("It is unlikely that I will be a victim of a natural disaster.").

We calculated composite scores for the risk perception dimensions using invariant items to ensure that the subsequent analyses involving these factors were unbiased by measurement non-equivalence.<sup>2</sup> We named one factor “external responsibility for disaster management” as it comprised of items reflecting the belief that government, organizations, and other people are responsible for disaster preparedness: V11, V7, V13, and V17. We named the second factor “illusiveness of preparedness” because it consisted of items reflecting the belief that natural disasters are fatalistic, uncertain, and unlikely events: V3, V8, and V17. We named the last factor “self-preparedness responsibility” as it included items reflecting the belief that individuals are in control and responsible for their natural disaster risks through disaster preparedness: V2, V8, V9, and V14.

Since education and language were significantly associated with the risk perception dimensions (see Table 4) and significantly different by sample (see Table 1 and Table 2), we included these variables as covariates. Multivariate analysis of covariance (MANCOVA) using Pillai’s criterion revealed that immigrants and Canadian-born individuals did not significantly differ in their level of risk perception dimensions, controlling for education and language (see Table 5):  $V < 0.01$ ,  $F(3, 948) = 0.241$ ,  $p = .87$ .

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<sup>2</sup> Non-invariant items were removed to ensure that the risk perception dimensions were equivalent across groups as one of the aims of the study was to identify a basic framework for risk communication and management that was most applicable to both groups. The decision to consider the factor cross-loadings as part of the scale calculation was based on construct validity and whether they made theoretical sense.

# PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 4**

*Intercorrelations for Socio-Demographic, Perception, and Preparedness*

Socio-demographic	<u>Risk perception dimension</u>			<u>Disaster preparedness</u>		
	External responsibility for disaster management	Illusiveness of preparedness	Self- preparedness responsibility	Emergency planning	Intent to evacuate	Post-disaster search
Age	.04	.02	.03	.05	<b>.07*</b>	<b>-.18**</b>
Gender (0 = Male, 1 = Female)	<b>.11**</b>	< .01	< -.01	.03	<b>.21**</b>	<b>.11**</b>
Education level	-.01	<b>-.20**</b>	<b>-.08*</b>	-.06	-.02	< .01
Annual household income	<b>-.09**</b>	<b>-.21**</b>	-.04	.01	-.01	<b>.11**</b>
Residential location (0 = Urban, 1 = Rural)	.02	.05	.04	<b>.08*</b>	-.05	.04
Duration in neighbourhood	.03	-.02	.02	.06	.04	<b>-.08*</b>
Spoken home language (0 = English, 1 = Others)	<b>.09**</b>	<b>.08*</b>	<b>-.13**</b>	-.05	-.02	<b>-.10**</b>
Ethnic or cultural background (0 = European, 1 = Others)	<b>.07*</b>	.02	-.01	.06	.04	.06
Immigrant status (0 = Canadian-born, 1 = Immigrant)	.03	-.01	-.02	-.03	< .01	<b>-.06*</b>
Time in Canada (immigrants only)	<b>.15</b>	-.07	.10	-.07	.03	< -.01

\* $p < .05$ . \*\* $p < .01$ .

# PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 5**

*Descriptives for the Risk Perception Dimensions and Disaster Preparedness*

Variable	<u>Canadian-born</u>			<u>Immigrant</u>		
	<i>M</i>	<i>SD</i>	$\alpha$	<i>M</i>	<i>SD</i>	$\alpha$
Risk perception dimension						
External responsibility for disaster management	3.53	0.65	.46	3.59	0.65	.46
Illusiveness of preparedness	2.33	0.70	.33	2.32	0.80	.35
Self-preparedness responsibility	3.54	0.73	.60	3.51	0.83	.66
Disaster preparedness						
Emergency planning factor	2.40	1.08	.71	2.27	1.07	.73
P1: I discuss with others the information I get on preparing for natural disasters ( $\lambda = .48$ , $h^2 = .23$ ).						
P2: I have an emergency supply kit for natural disasters ( $\lambda = .77$ , $h^2 = .60$ ).						
P3: I have an evacuation plan for natural disasters ( $\lambda = .78$ , $h^2 = .61$ ).						
P4: In case of a natural disaster, I would comply with recommendations to evacuate.	4.31	0.89		4.29	0.83	
P5: I know people who would search for me within 48-hours after a natural disaster.	3.72	1.40		3.45	1.48	

*Note.* MANCOVAs:  $p > .05$ .

### **Risk Perception Predicting Disaster Preparedness**

We performed EFA with principal axis factoring extraction and oblimin rotation on the preparedness items. EFA revealed one coherent factor: Eigenvalue = 1.42, 47.5% variance explained (see Table 5).<sup>3</sup> We named this factor “emergency planning” because they reflected activities individuals engage in before the event. P4 (“intent to evacuate”) and P5 (“post-disaster search”) both revealed to be single-item measures.

Because age and gender were significantly associated with disaster preparedness (see Table 4) and significantly different by sample (see Table 1 and Table 2), we included these variables as covariates. MANCOVA using Pillai’s criterion revealed that immigrants and

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<sup>3</sup> Initial EFA revealed a single-factor solution. Therefore, we did not conduct CFA because meaningful model fit estimates could not be produced for a just-identified model. Final EFA were based on the full sample ( $N = 1,089$ ). EFA was performed to ascertain if the preparedness items were distinct behaviours. Results suggest that three items could be considered as before-disaster preparedness behaviours, whereas the remaining two items could be considered as preparedness behaviours executed when the disaster already happens. While single-item measures are generally weak, the decision to keep the single item measures is because of the interest to investigate how different risk perception dimensions explain different preparedness behaviours as exemplified in previous studies (e.g., Ozdemir & Yilmaz, 2011). The correlation between emergency planning and intent to evacuate was low ( $r = .05, p > .05$ ), emergency planning and post-disaster search was moderate ( $r = .21, p < .01$ ), and intent to evacuate and post-disaster search was moderately low ( $r = .14, p < .01$ ). Therefore, these items were considered to measure distinct preparedness behaviours.

Canadian-born individuals did not significantly differ in their level of disaster preparedness, controlling for age and gender (see Table 5):  $V < 0.01$ ,  $F(3, 1023) = 1.02$ ,  $p = .38$ .

Correlations between risk perception dimensions and preparedness behaviours are presented in Table 6. We used sequential linear multiple regression analyses to predict disaster preparedness with gender, age, and immigrant status entered in Step 1, risk perception dimensions entered in Step 2, and interaction between immigrant status and risk perception dimensions entered in Step 3. We used the interaction terms to test for group differences in the prediction of preparedness behaviours by the risk perception dimensions.



# PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 6**

*Intercorrelations for Risk Perception and Disaster Preparedness*

Risk perception dimension	<u>Emergency planning</u>		<u>P4: Intent to evacuate</u>		<u>P5: Post-disaster search</u>	
	<i>r</i>	95% CI [LL, UL]	<i>r</i>	95% CI [LL, UL]	<i>r</i>	95% CI [LL, UL]
Full sample						
F1: External responsibility for disaster management	<b>.16**</b>	[.09, .22]	<b>.44**</b>	[.38, .49]	<b>.16**</b>	[.09, .23]
F2: Illusiveness of preparedness	<b>.18**</b>	[.12, .25]	.05	[-.01, .11]	< .01	[-.06, .06]
F3: Self-preparedness responsibility	<b>.38**</b>	[.32, .44]	<b>.24**</b>	[.18, .29]	<b>.18**</b>	[.11, .24]
Canadian-born						
F1: External responsibility for disaster management	<b>.14**</b>	[.06, .21]	<b>.44**</b>	[.39, .50]	<b>.16**</b>	[.09, .22]
F2: Illusiveness of preparedness	<b>.16**</b>	[.09, .22]	.06	[-.01, .13]	.01	[-.06, .07]
F3: Self-preparedness responsibility	<b>.36**</b>	[.29, .43]	<b>.23**</b>	[.17, .30]	<b>.18**</b>	[.11, .24]
Immigrant						
F1: External responsibility for disaster management	<b>.29**</b>	[.16, .42]	<b>.40**</b>	[.25, .52]	<b>.19*</b>	[< .01, .36]
F2: Illusiveness of preparedness	<b>.33**</b>	[.17, .48]	-.01	[-.18, .15]	-.02	[-.20, .14]
F3: Self-preparedness responsibility	<b>.49**</b>	[.35, .60]	<b>.24**</b>	[.10, .38]	.15	[-.03, .33]

\* $p < .05$ . \*\* $p < .01$ .

**Predicting Emergency Planning**

As shown in Table 7, self-preparedness responsibility was a unique predictor of covariates-adjusted emergency planning: adjusted  $R^2 = .15$ ,  $F(6, 932) = 29.32$ ,  $p < .001$ . Self-preparedness responsibility was positively associated with emergency planning ( $\beta = .38$ ,  $t = 11.18$ ,  $p < .001$ ), controlling for all other factors. In the final model, the interaction terms were nonsignificant, controlling for all other factors:  $ps > .05$ .

# PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 7**

*Socio-Demographic, Risk Perception, and Disaster Preparedness*

Predictor	Emergency planning		P4: Intent to evacuate		P5: Post-disaster search	
	<i>B</i> ( <i>SE B</i> )	$\beta$	<i>B</i> ( <i>SE B</i> )	$\beta$	<i>B</i> ( <i>SE B</i> )	$\beta$
Step 1						
Gender (0 = Male)	0.08 (0.07)	.04	0.33 (0.05)	.21***	0.30 (0.09)	.11**
Age	0.05 (0.02)	.07*	0.05 (0.02)	.09**	-0.16 (0.03)	-.18***
Immigrant status (0 = Canadian-born)	-0.05 (0.10)	-.02	-0.02 (0.07)	-.01	-0.13 (0.12)	-.04
Adjusted R <sup>2</sup>	< .01		.05***		.05***	
Step 2						
Gender	0.07 (0.06)	.03	0.26 (0.04)	.17***	0.25 (0.08)	.09**
Age	0.03 (0.02)	.05	0.03 (0.01)	.07*	-0.17 (0.03)	-.19***
Immigrant status	-0.08 (0.09)	.03	-0.04 (0.06)	-.02	0.15 (0.12)	-.04
External responsibility	0.03 (0.06)	.02	0.58 (0.04)	.47***	0.42 (0.07)	.20***
Illusiveness	0.03 (0.05)	.02	-0.24 (0.04)	-.22***	-0.32 (0.07)	-.17***
Self-preparedness	0.56 (0.05)	.38***	0.24 (0.03)	.23***	0.42 (0.06)	.23***
Adjusted r <sup>2</sup>	.15*** ( $\Delta R^2 = .15***$ )		.30*** ( $\Delta R^2 = .26***$ )		.13*** ( $\Delta R^2 = .09***$ )	
Step 3						
Gender	0.06 (0.06)	.03	0.26 (0.04)	.17***	0.24 (0.08)	.09**
Age	0.04 (0.02)	.05	0.03 (0.01)	.07*	-0.17 (0.03)	-.19***
Immigrant status	-0.07 (0.10)	-.02	-0.04 (0.06)	-.02	-0.15 (0.12)	-.04
External responsibility	0.02 (0.06)	.01	0.58 (0.04)	.47***	0.43 (0.08)	.20***
Illusiveness	< -0.01 (0.06)	< -.01	-0.23 (0.04)	-.20***	-0.33 (0.08)	-.17***
Self-preparedness	0.57 (0.05)	.38***	0.24 (0.04)	.23***	0.44 (0.07)	.24***
Immigrant status x external responsibility	0.14 (0.19)	.03	0.01 (0.11)	< .01	-0.07 (0.23)	-.01
Immigrant status x illusiveness	0.23 (0.15)	.06	-0.08 (0.10)	-.03	< -0.01 (0.18)	< -.01
Immigrant status x self-preparedness	-0.10 (0.16)	-.03	0.01 (0.09)	-.01	-0.11 (0.18)	-.02
Adjusted r <sup>2</sup>	.15*** ( $\Delta R^2 < .01$ )		.30*** ( $\Delta R^2 < .01$ )		.13*** ( $\Delta R^2 < .01$ )	

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

### **Predicting Intention to Comply with Evacuation Recommendations**

Table 7 shows all risk perception dimensions as unique predictors of covariates-adjusted intention to comply with evacuation recommendations: adjusted  $R^2 = .30$ ,  $F(6, 942) = 69.68$ ,  $p < .001$ . External responsibility for disaster management ( $\beta = .47$ ,  $t = 15.54$ ,  $p < .001$ ) and self-preparedness responsibility ( $\beta = .23$ ,  $t = 7.41$ ,  $p < .001$ ) were positively associated with intention to comply with evacuation recommendations, controlling for all other factors. Illusiveness of preparedness was negatively associated with intention to comply with evacuation recommendations ( $\beta = -.22$ ,  $t = -6.79$ ,  $p < .001$ ), controlling for all other factors. In the final model, the interaction terms were nonsignificant, controlling for all other factors:  $ps > .05$ .

### **Predicting Having Someone Search for Me 48-Hour Post-Disaster**

All risk perception dimensions were unique predictors of covariates-adjusted 48-hour post-disaster search (see Table 7): adjusted  $R^2 = .13$ ,  $F(6, 940) = 24.57$ ,  $p < .001$ . External responsibility for disaster management ( $\beta = .20$ ,  $t = 5.78$ ,  $p < .001$ ) and self-preparedness responsibility ( $\beta = .23$ ,  $t = 6.72$ ,  $p < .001$ ) were positively associated with individuals having someone to search for them post-disaster, controlling for all other factors. Illusiveness of preparedness was negatively associated with individuals having someone to search for them post-disaster ( $\beta = -.17$ ,  $t = -4.66$ ,  $p < .001$ ), controlling for all other factors. In the final model, the interaction terms were nonsignificant, controlling for all other factors:  $ps > 0.05$ .

## **Discussion**

We investigated how immigrants' risk perception and disaster preparedness for natural disasters compared to their Canadian-born counterparts as justifications for culturally-adapted risk communication and management. We found that: (1) there were differences in the salience of five risk perception beliefs, but the core underlying structure and level of risk perception were

similar in immigrants and Canadian-born individuals; and (2) immigrants and Canadian-born individuals did not differ in the level of disaster preparedness and how risk perception predicted disaster preparedness.

### **Multidimensionality of Natural Disaster Risk Perception**

Research on how immigrants and native-born individuals perceive the risks of natural disasters have been relatively sparse, particularly across two important social groups in Canada. Given that individuals' risk perception is influenced by many personal and social–environmental factors, it is interesting to observe that the three-factor structure is similar in immigrants and Canadian-born individuals. Consistent with previous research (Kung & Chen, 2012; Lee & Lemyre, 2009; Markon et al., 2011; Slovic, 1999), our findings demonstrated the multi-dimension nature of individuals' risk perception for natural disasters. External responsibility for disaster management reflected previous surveys reporting that the Canadian public believed that the government and community were responsible for disaster management (Phoenix Strategic Perspectives, 2010). Self-preparedness responsibility represented the reliance on the self in controlling one's exposure and response to natural disaster risks. External responsibility for disaster management and self-preparedness responsibility reflected the internal–external dichotomy in the attribution of responsibility to control health risks (Lindell & Whitney, 2000; Terpstra & Gutteling, 2008; Walker, 2001). Finally, illusiveness of preparedness supported previous studies showing that individuals may respond to risks by fatalistic attitudes, denial, and wishful thinking (Asgary & Willis, 1997; Becker, Paton, Johnston, & Ronan, 2013; Grothmann & Reusswig, 2006).

Our findings also showed that five risk perception beliefs differed in their salience in immigrants and Canadian-born individuals. However, it is unclear whether these non-invariant

risk perception beliefs represent actual differences in how immigrants and Canadian-born individuals experience natural disaster risks and issues (Byrne, 2008). Theoretically, our results corroborated previous cross-cultural risk research demonstrating that social groups had a complex set of similarities and differences in their risk perception (Renn & Rohrman, 2000). Methodologically, our results were unlikely an artefact of the measures used since we excluded non-invariant items when creating the risk perception composite scores. Finally, our results showed that both groups were fairly high in external responsibility for disaster management and self-preparedness responsibility and moderately low in illusiveness of preparedness. Immigrant status per se did not necessarily yield to differences in the level of risk perception – in fact, education and language covariates were more meaningful in explaining the differences in the level of risk perception dimensions:  $ps < .001$ .

### **Group Comparisons in Disaster Preparedness**

There is a dearth of understanding in the relationship between risk perception and disaster preparedness for natural disasters in immigrants compared to native-born individuals. Our results revealed that the psychological dimensions of risk perception for natural disasters were equally valid predictors of disaster preparedness in immigrants and Canadian-born individuals. Our results also corroborated previous studies showing that different risk perception dimensions were related to various forms of disaster preparedness (Lindell & Whitney, 2000; Ozdemir & Yilmaz, 2011). Consistent with the literature (Grothmann & Reusswig, 2006; Terpstra & Gutteling, 2008), our findings demonstrated that individuals who felt personally responsible for mitigating the risks were more likely to uptake self-protective measures. Individuals with strong self-preparedness responsibility may perceive the value of self-protective measures. Results also showed that individuals who believed that the public stakeholders were responsible for

mitigating the risks were more prepared to follow the emergency directives of others. The absence of a meaningful relationship between external responsibility for disaster management and emergency planning may be due to the belief that the government is responsible for providing adequate relief (Phoenix Strategic Perspectives, 2010). Consistent with the literature (Becker et al., 2013; Grothmann & Reusswig, 2006), our findings showed that fatalism, denial, and wishful thinking were associated with non-protective responses. Illusiveness of preparedness may heighten the sense of uncertainty and lack of control over risks and thus increase the view that disaster preparedness is futile. Finally, our findings corroborated the results from the Survey of Emergency Preparedness and Resilience (2014), which showed that immigrants and Canadian-born individuals were equal in their emergency planning activities (Taylor-Butts, 2016). Although emergency planning was low, results showed that immigrants and Canadian-born individuals might be ready to evacuate and have someone search for them post-disaster. Overall, our findings depicted cross-cultural comparability in the relationship between risk perception and disaster preparedness and the level of disaster preparedness in Canada. Gender and age were more meaningful than immigrant status in explaining disaster preparedness.

### **Immigrants' Experience With Natural Disaster Risks and Issues in Canada**

Our findings suggest that immigrants and Canadian-born individuals generally have a similar experience with natural disaster risks and issues in Canada. Risk perception and disaster preparedness were more accounted for by education, language, gender, income, and age rather than immigrant status, at least in the subgroup of immigrants recruited in this study. It is important to underscore that majority of the immigrant respondents have similar socio-demographic characteristics as the Canadian-born respondents. Most of the immigrant

respondents were educated English-speaking European immigrants who had been in Canada for at least 30 years. This immigrant subgroup tends to fare better than other immigrant subgroups (Health Canada, 2010); therefore, they may be less likely to encounter inequities in risks. It is possible that other immigrant subgroups, such as non-English speaking recent immigrants or refugees, may have a different experience. It is important to note that these similarities were contingent on the removal of the five non-invariant risk perception beliefs.

Our results challenge the literature which suggests that immigrants' risk perception and disaster preparedness for natural disasters are different from their native-born counterparts (Adeola, 2007; Andrulis, Siddiqui, & Purtle, 2011; Burke, Bethel, & Britt, 2012; Carter-Pokras et al., 2007; Cediell et al., 2012; Maldonado et al., 2016; Olofsson & Rashid, 2011). Bourhis and colleagues (1997) posit that immigration and integration policies define the "social psychological reality" of how immigrants experience their lives in the receiving society. Since the social environment and natural hazards differ from country to country, immigrants' experience with natural disaster risks and issues is likely to vary across communities. The socialization of immigrants to the social narrative regarding natural disasters in Canada may explain these findings, particularly the pervasive beliefs that Canada is safe from natural disasters and the government can provide adequate relief (Falkiner, 2003). Because natural disasters magnify pre-existing social inequities (Cutter et al., 2003; Donner & Rodriguez, 2008; Lemyre & O'Sullivan, 2013; Li et al., 2008; Scurfield, 2008), the lack of major natural disasters may detract the salience of disparities in risks. Furthermore, Canada's climate of reception for immigrants is generally positive as the Canadian government and public value multiculturalism and immigration (CBC News, 2014). Therefore, the Canadian context may provide immigrants with a sense of safety, security, and trust towards the Canadian society.



Social positions are experienced based on the simultaneous combination of various social categories (Collins, 2015). Our findings altogether suggest that the immigrant status alone does not necessarily imply “higher-risk.” When immigrants possess characteristics that reflect the dominant or privileged social groups, they may be less likely to experience inequities in risks. The immigrant status becomes “higher-risk” when they intersect with other socio-demographic characteristics that mediate inequities in the receiving community (Flynn, Slovic, & Mertz, 1994; Olofsson & Rashid, 2011). Therefore, future research should segment the immigrant population to test the validity of the model such as by socio-economic status (e.g., low socio-economic status), ethnocultural identity (e.g., language minorities), and mode of entry (e.g., refugees).

### **Considerations for Programming and Policy**

Based on our findings, programming and policy aiming to increase disaster preparedness in the Canadian public could benefit from translating these risk perception dimensions into meaningful risk educational and messaging activities. Risk communication and management should focus on clarifying individuals’ role in disaster preparedness and reducing fatalistic thinking towards disaster preparedness. Our findings suggest that immigrants and Canadian-born individuals could benefit from a general risk communication and management strategy after controlling for the five non-invariant risk perception beliefs. It is important to emphasize that some socio-demographic factors (e.g., language) do require cultural modifications. Finally, researchers and practitioners should investigate the context and meaning surrounding the non-invariant risk perception beliefs and how to incorporate these beliefs in programming.

### **Limitations and Future Directions**

Some common methodological limitations inherent to national sample data with hard-to-reach population should be noted. Cross-sectional data often do not inform causality, although

this does not diminish the value of demonstrating correlational relationships. Future research should consider incorporating an experimental design in risk communication to delineate the temporal sequence between risk perception and disaster preparedness. In addition, ordinal data limit the assumption of equal interval scales which may affect parameter estimations. However, the analysis techniques used are adequate given that the measured concepts are assumed to be continuous, and the assumptions of the analysis techniques are met. Next, the immigrant sample was treated as monolithic; hence, future research should segment the immigrant population into different subgroups. The low Cronbach's alpha for the risk perception dimensions suggests that there may be more risk perception beliefs to be discovered (Tavakol & Dennick, 2011).

Although a modest percentage of variance explained is expected when predicting complex human behaviours (Lindell & Hwang, 2008). It also underscores the need for future research to discover additional factors that explain disaster preparedness. It is likely that immigrants and Canadian-born individuals may differ in other factors that explain disaster preparedness as the present findings are limited to individual-level risk perception. Accordingly, we propose qualitative research and contextual analysis to better understand the experience of natural disaster risks and issues in Canada.

## **Conclusion**

We contribute to the better understanding of risk perception and disaster preparedness for natural disasters in immigrants which are an understudied group. We provide insights into natural disaster risk communication and management in Canada. That is, to insist on mutual responsibility for disaster preparedness between the Canadian public and institutions and to reduce the illusiveness of preparedness beliefs as means to increase disaster preparedness in

immigrants and Canadian-born individuals. The low level of emergency planning in the Canadian public suggests that this research area remains to be important.

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**Chapter 3: Community Social Capital and Individual Disaster Preparedness in Immigrants  
and Canadian-Born Individuals: An Ecological Perspective**

### Foreword

The previous study elucidated important insights about how immigrants and Canadian-born individuals perceived and responded to natural disaster risks. Immigrants and Canadian-born individuals were generally similar in their level of risk perception dimensions, disaster preparedness, and how risk perception predicted preparedness behaviours. The underlying three-factor psychological dimension of risk perception for natural disasters was applicable to both groups; however, there were differences in the salience of five risk perception beliefs. Findings showed that different risk perception dimensions (i.e., external responsibility for disaster management, self-preparedness responsibility, and illusiveness of preparedness) were associated with different preparedness behaviours (i.e., emergency planning, intent to evacuate, and post-disaster search) in immigrants and Canadian-born individuals. These findings demonstrated how individual-level cognitive processes predicted preparedness behaviours. Interestingly, it also showed that “immigrant status” did not necessarily yield to differences in risk perception and disaster preparedness.

Although the literature suggests that social capital is salutary for risk communication and management for disasters, there are few empirical studies that delineate the relationship between social capital and disaster preparedness in the Canadian context, especially if this relationship differs by immigrant status. Accordingly, the next study expanded the individual-level model by investigating how community-level social capital relates to individual-level disaster preparedness in immigrants compared to Canadian-born individuals. This study involved analysing data from the National Survey of Health Risk Perception (see Appendix A) and General Social Survey-Social Identity 2013 (Social and Aboriginal Statistics Division, 2015). This study provides an

ecological perspective to the existing risk paradigm, as well as insights for culturally-adapted risk communication and management. This study has been submitted for publication.

### **Contributions of Authors and Co-Authors**

In the National Survey of Health Risk Perception (NSHRP) 2012, the first author (doctoral candidate) contributed to the conceptual framework and survey questionnaire for the natural disaster risks and issues case study in collaboration with Dr. Daniel Krewski and Dr. Louise Lemyre who were the principal investigators of the National Survey of Health Risk Perception (NSHRP) 2012; and the co-researchers: Dr. Celine Pinsent, Dr. Michelle Turner, and the graduate students (Andrea Perna and Alina Dumitrescu). Dr. Krewski had developed the original hazard survey in 1992, and Dr. Lemyre developed the risk appraisal survey in 2002. Dr. Lemyre and Dr. Krewski also contributed to the development of this article. The first author was primarily responsible for the natural disaster case study including developing and analysing specific survey items. She was also the project data coordinator for the NSHRP 2012. She also helped prepare the research ethics application (see Appendix B). The General Social Survey-Social Identity (GSS-SI) 2013 and Postal Code Conversion File (2013) were conducted by Statistics Canada (Social and Aboriginal Statistics Division, 2015; Statistics Canada, 2013b).

For the manuscript, Dr. Lemyre, Dr. Pinsent, and Dr. Krewski provided feedback for the conceptual framework, analysis plan, and writing. The co-authors agreed to use this paper as part of the first author's doctoral thesis and have this paper published in a scientific journal.

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Sciences and Humanities Research Council, the Canadian Institute for Health Research, the Canadian Foundation for Innovation, and Statistics Canada. Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada. ©This data include information copied with permission from Canada Post Corporation.

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Running head: SOCIAL CAPITAL AND DISASTER PREPAREDNESS

Community Social Capital and Individual Disaster Preparedness in Immigrants and Canadian-  
Born Individuals: An Ecological Perspective

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### **Abstract**

Research on the predictors of disaster preparedness has mainly focused on individual-level factors, although the social environment plays an important role. Our goal is to provide a systemic perspective to help improve risk communication and management for natural disasters. We examined how community-level social capital influenced individual disaster preparedness in immigrants compared to Canadian-born individuals. We characterized participants' communities' social capital by conceptually linking two national surveys using postal codes. We performed sequential linear multiple regression analyses to examine the relationship between community social capital and individuals' disaster preparedness. Results revealed that neighbourhood contact positively predicted intent to comply with evacuation recommendations in immigrants and Canadian-born individuals. Societal trust and neighbourhood contact positively predicted the extent to which immigrants and Canadian-born individuals knew someone who would search for them post-disaster. Interestingly, results revealed that Canadian-born individuals were more likely to uptake emergency planning when living in a community with strong societal trust, while the reverse was true for immigrants. Results suggest that while social capital is salutary for disaster preparedness, societal trust may produce risk complacency with emergency planning amongst immigrants. Therefore, risk communication and management should consider social capital as part of the framework and tailor approaches to the target social group and its local context.

*Keywords:* social capital, risk management, disaster preparedness, immigrants, natural disasters

## **Introduction**

The Canadian public generally agrees that disaster preparedness is important, although actual disaster preparedness remains low (Taylor-Butts, 2016; Yong, Lemyre, Pinsent, & Krewski, 2017b). Research investigating the factors that predict individuals' disaster preparedness has mainly focused on individual-level cognitive processes (Lindell & Whitney, 2000). The modest relationship between individual-level processes and disaster preparedness and the need for a more comprehensive risk paradigm call for a system approach to understanding risks and behaviours (Solberg, Rossetto, & Joffe, 2010). Accordingly, we examined the role of community social capital in disaster preparedness in immigrants and Canadian-born individuals to help inform risk communication and management in Canada.

### **Beyond Individual Factors in Disaster Preparedness**

Since the mid-19<sup>th</sup> century, researchers have recognized the notion that place affects health behaviours and outcomes by providing a “context” for individuals to operate (Osypuk & Galea, 2007). This “context”, called the social environment, consists of physical, social, and cultural resources that influence how individuals function and interact (Barnett & Casper, 2001). Several theorists have posited that the social environment prescribes what constitutes a “risk” (e.g., Douglas & Wildavsky, 1983). Social-cultural factors and contextual-structural settings affect individuals' abilities and inclination to respond to risks. That is, individuals are more likely to uptake disaster preparedness when the social environment is supportive of it (Gaillard, 2008; Paton et al., 2010).

Urie Bronfenbrenner (1977) illustrated the person-environment interaction in his seminal work, called the Ecological Systems Theory, by conceptualizing how individuals are nested within their social environment comprising of the microsystem (e.g., social support networks),

mesosystem (e.g., neighbourhood organization), exosystem (e.g., public policies), and macrosystem (e.g., social-cultural context). Researchers and practitioners have begun to apply the ecological systems theory in disaster risk management (Beaton et al., 2008; Prior & Eriksen, 2013). Recently, Lemyre and colleagues proposed a social-ecological approach to risks and resilience which asserts that individuals' risk perception and disaster preparedness are influenced by the interaction between the individual and social environment (Lemyre & O'Sullivan, 2013). One component of the social environment is social capital.

### **Social Capital**

Although social capital is a widely used concept, there is no single definition of social capital. The individual approach or the network theory of social capital focuses on the size and quality of social support networks amongst individuals and small groups (Bourdieu, 1986; Coleman, 1988; Lin, 1999). The individual approach maintains that social capital arises from individuals' social support networks including strong ties (e.g., close friends) and weak ties (e.g., acquaintances). Social support networks provide access to resources and prescribe social norms which consequently affect individuals' behaviours (Weenig & Midden, 1991). The collective approach focuses on the emergent properties of a community – that is, social capital is an attribute or the “stock” of a community (Coleman, 1988; Putnam, 1995a, 1995b). The collective approach centres on community engagement such as volunteering, voting, and political engagement. According to Putnam (1995a, 1995b), social capital refers to networks, norms, and trust in social organizations that allow for co-operation, communication, and coordination amongst citizens to take collective action. Social capital is both a private and public good – therefore, individuals do not have to be directly part of a social support network to benefit from living in a community with strong social capital. Theorists have made further distinctions about

the type and quality of social relationships that exist in social capital such as bonding, bridging, and linking (Lin, 2001; Putnam, 2000; Szreter & Woolcock, 2004). The lack of consistent definition of social capital has contributed to measurement issues as social capital has been operationalized in multiple ways and at different levels of analysis (Kay & Johnston, 2007; Portes, 2000). However, a unifying theme is social capital centres on social relationships comprising of trust, reciprocity, information channels, and norms.

### **Social Capital and Natural Disasters**

Researchers have alluded to the benefits of social capital in building resilience at the individual- and community- level for risk management (Koh & Cadigan, 2008; Moore et al., 2004; Murphy, 2007; Murphy, 2012). Social capital is believed to foster individual and community resilience which is the capacity of individuals and communities to cope with external stresses and bounce back to normalcy after a natural disaster (Lemyre & O'Sullivan, 2013; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Indeed, research on previous natural disasters has found that communities with strong social capital are more likely to have faster post-disaster recovery and an increased likelihood of residents returning to the disaster-hit area (Aldrich & Meyer, 2014; Aldrich & Sawada, 2015; Flores, Carnero, & Bayer, 2014; Shimada, 2015; Wickes, Zahnow, Taylor, & Piquero, 2015; Wind & Komproe, 2012; Yamamura, 2010). Social capital is also associated with a decreased likelihood of post-disaster physical impacts, psychological morbidity, community problems, and recovery complications. Social capital may provide individuals and communities with the social infrastructure to self-organize and mobilize resources for effective emergency response; and thus, mitigating the risks. For instance, Vietnamese Americans were less likely to suffer from Hurricane Katrina compared to African Americans because they were able to receive help from their own community, from

other Vietnamese communities, and community agencies through bonding, bridging, and linking social capital (Airriess, Li, Leong, Chen, & Keith, 2008; Chamlee-Wright & Storr, 2009).

There has been increasing attention towards the role of social capital in the pre-disaster context, particularly disaster preparedness (Kawachi, Subramanian, & Kim, 2008; Levac, Toal-Sullivan, & O'Sullivan, 2012). Research suggests the salutary effect of social capital on disaster preparedness (Agrawal & Monroe, 2006; Bhandari, Norio, Yokomatsu, & Ikeo, 2010; Bihari & Ryan, 2012; Reininger et al., 2013; Yamamura, 2010). Social capital is associated with an increased likelihood of individuals participating in disaster preparedness, have higher disaster awareness, and have positive attitudes and beliefs about disaster preparedness. Social capital may allow for information exchange, resource mobilization, and collective action amongst individuals which in turn increase their disaster preparedness. Then again, some studies suggest that social capital may reduce individuals' motivation to uptake disaster preparedness as social capital may provide individuals with a false sense of security (Babcicky & Seebauer, 2017; Wolf, Adger, Lorenzoni, Abrahamson, & Raine, 2010). It is important to note that social capital has been measured in numerous ways in the disaster literature.<sup>4</sup> To date, few studies systematically examine the relationship between social capital and disaster preparedness in the Canadian context and whether the relationship differs by immigrant status.

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<sup>4</sup> Social capital indicators: Crime rates, suicide rates, social cohesion, social trust, social network, reciprocity, community organizations, activities and facilities, volunteering, political involvement, local leadership, local business sponsorship, volunteering, neighbourhood contact and interaction, political involvement, community engagement, fairness, and voter turnout.

### **Immigrants, Social Capital, and Natural Disasters in Canada**

Previous natural disasters show that immigrants are more likely to experience inequities within the disaster cycle compared to the native-born population (Donner & Rodriguez, 2008; Lemyre, Gibson, Zlepnig, Meyer-Macleod, & Boutette, 2009; Scurfield, 2008). Given that the immigrant population is a significant segment of the Canadian public (21%; Statistics Canada, 2013), it is important to understand how social capital impacts their disaster preparedness. Public health research shows that social capital is salutary for the general population and immigrants (Kawachi et al., 2008; Zhao, Xue, & Gilkinson, 2010). In the context of natural disasters, social capital may be a vital ingredient for effective risk communication and management strategies in higher-risk populations (Lemyre et al., 2009; Levac et al., 2012). Social capital may help immigrants to circumvent some of the challenges and barriers they face in the disaster cycle. For instance, social capital may function as a channel for immigrants to gain information and identify barriers and needs collectively which in turn increase their disaster preparedness. Additionally, social relationships may be more meaningful in encouraging disaster preparedness in certain social groups (Paton et al., 2010). For instance, Eisenman et al. (2009) found that disaster education utilizing social support networks was most effective in increasing disaster preparedness amongst Latino immigrants. Arguably, social capital may be more important for immigrants in disaster preparedness compared to the Canadian-born population.

### **Present Study**

Our goals were: (1) to gain a better understanding of the role the social environment plays in individuals' disaster preparedness, (2) to contribute to a systemic perspective in the risk paradigm, and (3) to support disaster preparedness in Canada via better risk communication and



management. To this end, we aimed to understand the role of community-level social capital in predicting immigrants and Canadian-born individuals' disaster preparedness. We asked: What is the relationship between community social capital and individuals' disaster preparedness? How do immigrants compare to their Canadian-born counterparts?

Accordingly, we examined how community social capital predicted individual disaster preparedness in immigrants compared to Canadian-born individuals. We linked the National Survey of Health Risk Perception (NSHRP) 2012 and the General Social Survey-Social Identity (GSS-SI) 2013. We used measures of social support network, trust, and community involvement as indicators of social capital that were aggregated at the geographic community-level. Community-level social capital scores were proxies to test for ecological effect. Then, we characterized respondents' communities' social capital using their postal codes. Finally, we performed sequential linear multiple regression analyses to examine the relationship between social capital and disaster preparedness. Findings provide theoretical and practical contributions to the field of risk.

## **Method**

### **Respondents**

Respondents were Canadian adults who were part of a larger sample from the NSHRP 2012,  $N = 3,263$ . Of these, 1,089 respondents aged 18 years and above from the 10 Canadian provinces were randomly selected to participate in the natural disaster risks and issues section. There were 921 Canadian-born respondents and 163 foreign-born respondents.<sup>5</sup> Respondents' socio-demographic characteristics are presented in Table 8 and Table 9.

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<sup>5</sup> Five respondents did not report their country-of-birth.

**Table 8***Frequencies and Valid Percentages for Socio-Demographic (NSHRP)*

Socio-demographic	<u>Canadian-born</u> % (n = 921)	<u>Immigrant</u> % (n = 163)
Age*		
18 - 24 years	4.8% (44)	3.7% (6)
25 - 34 years	21.1% (194)	12.9% (21)*
35 - 44 years	19.2% (176)	12.9% (21)
45 - 54 years	19.4% (178)	18.4% (30)
55 - 64 years	17.2% (158)	20.9% (34)
At least 65 years	18.4% (169)	31.3% (51)*
Would prefer not to say (n = 2)		
Gender*		
Male	48.0% (442)	59.5% (97)*
Female	52.0% (479)	40.5% (66)*
Would prefer not to say (n = 0)		
Education level*		
Up till high school	17.2% (157)	10.4% (17)
Completed community college	25.8% (236)	24.5% (40)
Completed university	35.3% (323)	33.7% (55)
Completed graduate school	21.7% (199)	31.3% (51)*
Would prefer not to say (n = 6)		
Annual household income		
< \$50,000	30.7% (248)	28.7% (41)
\$50,000 - < \$60,000	9.9% (80)	14.7% (21)
\$60,000 - < \$80,000	13.5% (109)	16.1% (23)
\$80,000 - < \$100,000	13.6% (110)	13.3% (19)
\$100,000 - < \$150,000	19.7% (159)	17.5% (25)
\$150,000 - < \$200,000	8.4% (68)	5.6% (8)
Would prefer not to say (n = 134)		
Spoken home language*		
English	78.5% (721)	69.3% (113)*
French	20.1% (185)	8.6% (14)*
English and French	0.5% (5)	0.0% (0)
Others	0.9% (8)	22.1% (36)*
Would prefer not to say (n = 2)		
Ethnic /cultural background of ancestors*		
European <sup>a</sup>	95.6% (813)	72.5% (108)*
Non-European <sup>b</sup>	4.4% (37)	27.5% (41)*
Would prefer not to say (n = 85)		

*Note.* a = North American (non-aboriginal), European, and Oceania (non-pacific islander). b = Caribbean, African, Pacific Islander, Asian, South American, and Aboriginal. Chi-square analyses to determine if there were significant differences in the distributions of the subsamples. Column proportions were compared using z-test with Bonferroni adjusted *p*-value.

\**p* < .05.

**Table 9***Frequencies and Valid Percentages for Geographic Factors (NSHRP)*

	<u>Canadian-born</u> % ( <i>n</i> = 921)	<u>Immigrant</u> % ( <i>n</i> = 163)
Geographic region*		
British Columbia	13.5%(124)	15.3% (25)
Prairies	20.1% (185)	10.4% (17)*
Ontario	36.4% (335)	56.4% (92)*
Quebec	21.2% (195)	13.5% (22)*
Atlantic	8.9% (82)	4.3% (7)*
Would prefer not to say ( <i>n</i> = 0)		
Statistical Area Classification*		
Census Metropolitan Area and Census Agglomeration	84.9% (730)	92.0% (138)*
Strong Metropolitan Influence Zone	4.0% (34)	3.3% (5)
Medium Metropolitan Influence Zone	6.0% (52)	2.7% (4)
Weak Metropolitan Influence Zone	4.9% (42)	2.0% (3)
No Metropolitan Influence Zone	0.2% (2)	0.0% (0)
Would prefer not to say ( <i>n</i> = 74)		
Duration in neighbourhood*		
< 5 years	22.4% (205)	17.3% (28)
5 - 19 years	45.7% (418)	54.9% (89)*
At least 20 years	31.8% (291)	27.8% (45)
Would prefer not to say ( <i>n</i> = 8)		

*Note.* The attached custom data (Table 9) at the CD-level is provided for use in accordance with the terms and conditions of the Statistics Canada Open License Agreement hereby attached.

Source: Statistics Canada Postal Code<sup>OM</sup> Conversion File (2013) which is based on data licensed from Canada Post Corporation.

\* $p < .05$ .

## Procedure

**NSHRP 2012.** The NSHRP 2012 is part of an ongoing research programme that investigates how the Canadian public evaluates and makes decisions about hazards (Krewski et al., 2009). The NSHRP 2012 was conducted via telephone ( $n_{\text{telephone}} = 1,694$ ; 22% response rate) and the Internet ( $n_{\text{Internet}} = 1,569$ , 10% response rate). Data from both samples were pooled after testing for homogeneity of variance, method effect, non-representative sample effect, and sampling effect showed no significant difference in the responses by survey method:  $ps > .05$ . In the natural disaster risks and issues section, there were 509 Internet respondents ( $n_{\text{Canadian-born}} = 429$ ,  $n_{\text{immigrant}} = 80$ ) and 575 telephone respondents ( $n_{\text{Canadian-born}} = 492$ ,  $n_{\text{immigrant}} = 83$ ). Chi-square analyses showed no significant difference in the proportion of immigrant respondents and Canadian-born respondents by survey method:  $ps > .05$ . The sample was weighted to be nationally representative by age, gender, and region based on the 2011 Canadian Census.

**GSS-SI 2013.** The national General Social Survey monitors social trends in Canada every five years by Statistics Canada (Social and Aboriginal Statistics Division, 2015). The GSS-SI 2013 focused on social identity. The target population was individuals who were aged 15 years old or older and living in the 10 provinces of Canada. The 27,695 respondents were recruited via telephone ( $n_{\text{telephone}} = 20,778$ ) and the Internet ( $n_{\text{Internet}} = 6,917$ ): 48.1% response rate. The weighted sample was representative of all households in Canada.

## Measures

We obtained the risk perception and disaster preparedness indicators from the NSHRP 2012 (see Yong et al., 2017b). We selected commonly used indicators of social capital from the GSS-SI 2013 based on the literature (Carpiano & Hystad, 2011; Fukuyama, 1996; Lin, 1999;

Lin, Fu, & Hsung, 2001; Lochner, Kawachi, & Kennedy, 1999; Uslander, 2002).<sup>6</sup> Table 10 presents the items used in this study.

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<sup>6</sup> Detailed list of items used is available in Appendix D.

**Table 10***Items from the NSHRP 2012 and GSS-SI 2013*

Item
Natural disaster risk perception beliefs
1. It is an individual's responsibility to be prepared for a major natural disaster.
2. Preparation is useless to protect oneself from natural disasters.
3. It is the government's responsibility to plan effectively for natural disasters.
4. The main thing that determines my exposure to natural disaster risks is what I myself do.
5. The negative consequences of natural disasters can be decreased by being well prepared.
6. Natural disasters have many negative consequences besides property damage and death.
7. Even if I didn't understand why, I would likely follow the recommendations from government authorities during a natural disaster.
8. The benefits of preparing for a natural disaster outweigh the costs.
9. Scientists usually agree about how to prevent natural disasters.
Individual disaster preparedness
1. I discuss with others the information I get on preparing for natural disasters.
2. I have an emergency supply kit for natural disasters.
3. I have an evacuation plan for natural disasters.
4. I discuss with others to search for me within 48-hours after natural disasters.
5. In case of a natural disaster, I would comply with recommendations to evacuate.
Social networks
1. Of these close friends, how many live in the same city or local community as you?
2. Of these other friends, how many live in the same city or local community as you?
Social network diversity
Think of all the friends you had contact with in the past month, whether the contact was in person, by telephone, by text or by email. Of all these people:
1. How many have the same mother tongue as you?
2. How many come from an ethnic group that is visibly different from yours?
3. How many are the same sex as you?
4. How many are around the same age group as you?
5. How many have roughly the same level of education as you?
6. How many have a similar level of household income as you?
Contact with friends
1. How often did you see [any of your friends/your friend]?
2. How often did you talk with [any of your friends/your friend] by telephone?
3. How often did you communicate with [any of your friends/your friend] by text message?
4. How often did you communicate with [any of your friends/your friend] by email or by Internet?
Neighbourhood social support
1. Would you say that you know...?
2. About how many people in your neighbourhood do you know well enough to ask for a favour?
Trust
1. Generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?
2. How much do you trust people in your neighbourhood?
3. How much do you trust strangers?
4. If you lost a wallet or purse that contained two hundred dollars, how likely is it to be returned with the money in it, if it was found by....
someone who lives close by?
a police officer?
a stranger?
Volunteering
1. In the past 12 months, did you do unpaid volunteer work for any organization?
2. On average, about how many hours per month did you volunteer?

*Note.* Detailed scale calculations are presented in Appendix D.

**Individual disaster preparedness.** Preparedness behaviours were measured using three items on a 5-point scale – emergency planning factor (evacuation plan, emergency supply kit, and discuss preparedness information with others; 3 items;  $\alpha = .71$ ;  $M = 2.37$ ,  $SD = 1.08$ ), intention to comply with evacuation recommendations (1 item;  $M = 4.31$ ,  $SD = 0.88$ ), and know someone who would search for them 48-hour post-disaster (1 item;  $M = 3.68$ ,  $SD = 1.41$ ).

**Psychological dimensions of risk perception for natural disasters.** Risk perception was measured using three factors consisting of nine non-invariant items on a 5-point scale – external responsibility for disaster management (4 items;  $\alpha = .46$ ;  $M = 3.54$ ,  $SD = 0.65$ ), illusiveness of preparedness (3 items;  $\alpha = .36$ ;  $M = 2.32$ ,  $SD = 0.72$ ), and self-preparedness responsibility (4 items;  $\alpha = .61$ ;  $M = 3.54$ ,  $SD = 0.75$ ).

**Social networks size.** Strong ties and weak ties were measured using number of close friends ( $M = 5.09$ ,  $SD = 10.14$ ) and acquaintances ( $M = 25.96$ ,  $SD = 57.12$ ) living in the same area.

**Social network diversity.** Social network diversity was a composite measure created using six items inquiring how many friends respondents were in contact with have a different mother tongue, ethnic background, sex, age group, education, and income on a 5-point scale ( $\alpha = .46$ ,  $M = 2.21$ ,  $SD = 0.52$ ).

**Contact with friends.** Social interaction with friends was a composite measure created using the summation of four items asking how often respondents contacted their friends in the past month via face-to-face, telephone, text messaging, and email or the Internet on a 6-point scale ( $\alpha = .66$ ,  $M = 15.74$ ,  $SD = 4.62$ ).

**Neighbourhood support.** Neighbourhood support included two items – the proportion of individuals respondents knew in their neighbourhoods (nobody [48%], a few [54.9%], many

[21.4%], most [18.9%]), and the proportion of individuals in the neighbourhood respondents could ask for help (no one [9.2%], 1 to 5 [62.1%], 6 to 10 [17.2%], over 10 [11.5%]).

**Trust.** Trust included generalized trust, social trust, and strategic trust. Generalized trust is individuals' tendency to trust. Generalized trust was measured by asking respondents whether most individuals can be trusted (54.5%) or not (45.5%). Social trust is trusting individuals who are not friends and family. Social trust was measured using a composite measure consisting of how much they trusted individuals in their neighbourhood and strangers on a 5-point scale ( $M = 3.06$ ,  $SD = 0.89$ ) and a single-item measure inquiring the proportion of individuals in the neighbourhoods respondents could trust (nobody [3.7%], a few [28.5%], many [25.0%], most [42.8%]). Strategic trust is how individuals trust others will behave. Strategic trust was measured using a composite measure consisting of three items inquiring how likely a neighbour, police officer, and stranger would return a lost wallet or purse using a 3-point scale ( $\alpha = .60$ ,  $M = 2.22$ ,  $SD = 0.47$ ).

**Volunteering.** Frequency of volunteering was created by combining two items asking whether respondents volunteered in the past 12 months and the average number of hours spent on volunteering in a month – 65.8% non-volunteer, 3.7% volunteered for less than 1 hour per month, 10.2% volunteered between 1 and less than 5 hours per month, 11.6% volunteered between 5 and less than 15 hours per month, and 8.7% volunteered for 15 hours or more per month.

## **Data Analyses**

**Selection of geographic unit.** We selected the geographic unit based on the literature (Krieger, Williams, & Moss, 1997; Macintyre, Ellaway, & Cummins, 2002; Osypuk & Galea,



2007),<sup>7</sup> data availability, and pragmatism: (1) small size to ensure homogeneity in the residents' experiences and characteristics, (2) at least a minimum unweighted sample of 15 adult respondents in the GSS-SI 2013 to ensure reliable estimates (Social and Aboriginal Statistics Division, 2015), and (3) lowest proportion of participants with missing values for the social capital estimates to maximize the use of the NSHRP 2012 sample. After examining several possible geographic units (Statistics Canada, 2015a), we selected census division (CD). CDs represent provincially legislated areas or their equivalents (e.g., counties) that are intermediate geographic areas between the province-level and municipality. There were 182 CDs in the NSHRP 2012 (982 respondents, 90.2% coverage) that corresponded to the GSS-SI 2013.

**Creation of social capital estimates.** Principal Component Analysis (PCA) using oblimin rotation showed that the social capital indicators could be reduced to three components (see Table 11).<sup>8</sup> Societal trust (4 items;  $\alpha = .77$ ) consisted of indicators involving trusting individuals outside one's close social support network. Community socializing (5 items;  $\alpha = .38$ ) entailed indicators reflecting interactions with friends and acquaintances in the community. Neighbourhood contact (2 items;  $\alpha = .65$ ) comprised of indicators involving neighbourhood support. We generated standardized social capital factor scores using Anderson-Rubin method (mean = 0, standard deviation = 1). We used the analytic survey weights in Stata 12 to estimate the CD-level social capital estimates due to the complex sampling design of the GSS-SI 2013

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<sup>7</sup> Conceptual and methodological considerations were definition of "community", operationalization of "community", and limitations of the approaches.

<sup>8</sup> The decision to conduct PCA rather than factor analysis was because the goal was to reduce the number of social capital indicators optimally rather than to investigate the underlying structure of social capital.

(Social and Aboriginal Statistics Division, 2015). We assigned the social capital estimates to the respondents in the NSHRP 2012 based on their CDs. Community social capital scores were proxies to test for ecological effect.

**Table 11***Social Capital Principal Component Scores*

Social capital indicator	Societal trust	Community socializing	Neighbourhood contact	<i>h</i> <sup>2</sup>
Social trust	.85			.71
Generalized trust	.83			.64
Trust in neighbours	.70			.62
Strategic trust	.63			.48
Social network – weak ties		.73		.53
Social network – strong ties		.66		.46
Contact with friends		.57		.33
Social network diversity		.40		.18
Frequency of volunteering		.35		.19
Knowing your neighbours			-.88	.74
Help from neighbours			-.80	.69
Eigenvalue	2.52	1.63	1.83	
% Variance explained	25.0	14.6	11.00	50.6

*Note.* Significant cut-off points: factor loading > .32, eigenvalue > 1.0, and communality > .20.

**Prediction of disaster preparedness using social capital.** Age and gender were identified to be covariates because they significantly correlated with disaster preparedness (see Table 12) and differed by immigrant status (see Table 8). Correlations between the predictors and outcome variables are presented in Table 13. We used sequential linear multiple regression analyses to test the relationship between community social capital and individuals' disaster preparedness, controlling for individual factors.<sup>9</sup> Accordingly, we entered socio-demographic covariates (age, gender, and immigrant status) in Step 1, risk perception dimensions in Step 2, and social capital components in Step 3. In step 4, we added interaction terms (immigrant status x social capital components) to examine if the relationship between social capital and disaster preparedness differed by immigrant status.

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<sup>9</sup> While hierarchical linear modelling is a more robust test of ecological effect for grouped data, we found that the sample size was insufficient for this analysis.

# PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 12**

*Intercorrelations for Socio-Demographic and Key Variables*

Socio-demographic	Individual risk perception dimension			Individual disaster preparedness			Community social capital		
	External responsibility	Illusiveness	Self-preparedness	Intent to evacuate	Post-disaster search	Emergency planning	Societal trust	Community socializing	Neighbourhood contact
Age	.04	.02	.03	<b>.07*</b>	<b>-.18**</b>	.05	<b>.16**</b>	.03	<b>-.11**</b>
Gender	<b>.11**</b>	< .01	< -.01	<b>.21**</b>	<b>.11**</b>	.03	-.01	<b>-.07*</b>	-.02
Education	-.01	<b>-.20**</b>	<b>-.08*</b>	-.02	< .01	-.06	-.03	<b>.10**</b>	<b>.12**</b>
Income	<b>-.09**</b>	<b>-.21**</b>	-.04	-.01	<b>.11**</b>	.01	.04	.07	.04
Language	<b>.09**</b>	<b>.08*</b>	<b>-.13**</b>	-.02	<b>.10**</b>	-.05	-.05	<b>.09**</b>	<b>.12**</b>
Ethnicity/culture	<b>.07*</b>	.02	-.01	.04	.06	.06	<b>-.08*</b>	<b>.12**</b>	<b>.12**</b>
Immigrant status	.03	-.01	-.02	< .01	<b>-.06*</b>	-.03	-.04	<b>.11**</b>	<b>.13**</b>
Time in Canada <sup>a</sup>	<b>.15</b>	-.07	.10	.03	< -.01	-.07	<b>.46**</b>	-.03	<b>-.38**</b>

*Note.* a = Immigrant only. Gender: 0 = Male, 1 = Female. Language spoken at home: 0 = English, 1 = Others. Ethnic or cultural background: 0 = European, 1 = Others. Immigrant status: 0 = Canadian-born, 1 = Immigrant. The attached custom data (Table 12) at the CD-level is provided for use in accordance with the terms and conditions of the Statistics Canada Open License Agreement hereby attached. Source: Statistics Canada Postal Code<sup>OM</sup> Conversion File (2013) which is based on data licensed from Canada Post Corporation.

\* $p < .05$ . \*\* $p < .01$ .

# PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 13**

*Intercorrelations for Outcome Variables and Predictors*

Variable	Disaster preparedness					
	<u>Post-disaster search</u>		<u>Intent to evacuate</u>		<u>Emergency planning</u>	
	<i>r</i>	95% CI [LL, UL]	<i>r</i>	95% CI [LL, UL]	<i>r</i>	95% CI [LL, UL]
Individual-level risk perception dimension						
External responsibility	<b>.44**</b>	[.38, .49]	<b>.16**</b>	[.09, .23]	<b>.16**</b>	[.09, .22]
Illusiveness	.05	[-.01, .11]	< .01	[-.06, .06]	<b>.18**</b>	[.12, .25]
Self-preparedness	<b>.24**</b>	[.18, .29]	<b>.18**</b>	[.11, .24]	<b>.38**</b>	[.32, .44]
Community social capital						
Societal trust	.03	[-.04, .10]	<b>.08*</b>	[.01, .14]	<b>.09***</b>	[.03, .15]
Community socializing	-.01	[-.07, .06]	.05	[-.01, .11]	.02	[-.05, .08]
Neighbourhood contact	.05	[-.03, .13]	< -.01	[-.07, .06]	-.04	[-.10, .02]

*Note.* Gender: 0 = Male, 1 = Female. Immigrant status: 0 = Canadian-born, 1 = Immigrant. The attached custom data (Table 13) at the CD-level is provided for use in accordance with the terms and conditions of the Statistics Canada Open License Agreement hereby attached. Source: Statistics Canada Postal Code<sup>OM</sup> Conversion File (2013) which is based on data licensed from Canada Post Corporation.

**\*\*** $p < .01$ .

## Results

Correlation analyses (see Table 12) revealed some significant correlations ( $r > .15$ ). Long-term immigrants were significantly less likely to live in communities with a high degree of neighbourhood contact. However, long-term immigrants and older adults were significantly more likely to live in communities with a high degree of societal trust. Multivariate Analyses of Covariance (MANCOVAs) using Pillai's criterion revealed that immigrants and Canadian-born individuals did not significantly differ in disaster preparedness, risk perception dimensions, and social capital:  $ps > .05$ .<sup>10</sup>

### Intent to Comply With Evacuation Recommendations

External responsibility for disaster management ( $\beta = .46, t = 14.12, p < .001$ ) and self-preparedness responsibility ( $\beta = .23, t = 7.03, p < .001$ ) significantly predicted an increased likelihood of individuals' intent to comply with evacuation recommendations, controlling for all other factors: adjusted  $R^2 = .29, F(6, 836) = 58.86, p < .001$  (see Table 14). Conversely, illusiveness of preparedness significantly predicted a decreased likelihood of individuals' intent to comply with evacuation recommendations:  $\beta = -.20, t = -6.00, p < .001$ . After the addition of the social capital components ( $\Delta R^2 < .01, p = .17$ ), neighbourhood contact was positively associated with intention to comply with evacuation recommendations, controlling for all other factors:  $\beta = .07, t = 1.97, p < .05$ . In the final model ( $\Delta R^2 < .01, p = .42$ ), the interaction terms were non-significant, controlling for all other factors:  $ps > .05$ .

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<sup>10</sup> Descriptives of variables are available in Appendix E.

**Table 14***Risk Perception, Community Social Capital and Disaster Preparedness*

Predictor	Intent to evacuate		Post-disaster search		Emergency planning	
	B (SE B)	$\beta$	B (SE B)	$\beta$	B (SE B)	$\beta$
Step 1						
Gender	0.29 (0.05)	<b>.19***</b>	0.29 (0.10)	<b>.11**</b>	0.10 (0.07)	.05
Age	0.04 (0.02)	<b>.09*</b>	-0.18 (0.03)	<b>-.20***</b>	0.04 (0.02)	.06
Immigrant	-0.04 (0.08)	-.02	-0.15 (0.14)	-.04	-0.1 (0.11)	-.03
Adjusted $R^2$	<b>.04***</b>		<b>.05***</b>		< .01	
Step 2						
Gender	0.24 (0.05)	<b>.16***</b>	0.26 (0.09)	<b>.09**</b>	0.08 (0.07)	.04
Age	0.04 (0.02)	<b>.08*</b>	-0.18 (0.03)	<b>-.21***</b>	0.04 (0.02)	.06
Immigrant	-0.06 (0.07)	-.03	-0.17 (0.13)	-.04	-0.10 (0.10)	-.03
ERDM	0.56 (0.04)	<b>.46***</b>	0.46 (0.08)	<b>.21***</b>	0.02 (0.06)	.01
IOP	-0.23 (0.04)	<b>-.20***</b>	-0.39 (0.08)	<b>-.19***</b>	0.04 (0.06)	.03
SPR	0.24 (0.03)	<b>.23***</b>	0.48 (0.07)	<b>.26***</b>	0.52 (0.05)	<b>.36***</b>
Adjusted $R^2$	<b>.29***</b> ( $\Delta R^2 = .26***$ )		<b>.16***</b> ( $\Delta R^2 = .11***$ )		<b>.15***</b> ( $\Delta R^2 = .14***$ )	
Step 3						
Gender	0.24 (0.05)	<b>.16***</b>	0.25 (0.09)	<b>.09**</b>	0.07 (0.07)	.04
Age	0.06 (0.02)	<b>.07*</b>	-0.20 (0.03)	<b>-.23***</b>	0.03 (0.02)	.05
Immigrant	-0.07 (0.07)	-.03	-0.21 (0.13)	-.05	-0.10 (0.10)	-.03
ERDM	0.57 (0.04)	<b>.47***</b>	0.5 (0.08)	<b>.23***</b>	0.03 (0.06)	.02
IOP	-0.23 (0.04)	<b>-.20***</b>	-0.37 (0.08)	<b>-.18***</b>	0.04 (0.06)	.03
SPR	0.23 (0.04)	<b>.22***</b>	0.42 (0.07)	<b>.23***</b>	0.51 (0.05)	<b>.36***</b>
ST	0.21 (0.11)	.07	0.72 (0.23)	<b>.14**</b>	0.18 (0.17)	.05
CS	-0.09 (0.15)	-.02	0.27 (0.29)	.04	-0.04 (0.21)	-.01
NC	0.24 (0.12)	<b>.07*</b>	0.45 (0.24)	<b>.08*</b>	0.07 (0.17)	.02
Adjusted $R^2$	<b>.29***</b> ( $\Delta R^2 < .01$ )		<b>.17***</b> ( $\Delta R^2 = .02***$ )		<b>.14***</b> ( $\Delta R^2 < .01$ )	
Step 4						
Gender	0.24 (0.05)	<b>.16***</b>	0.25 (0.09)	<b>.09**</b>	0.08 (0.07)	.04
Age	0.04 (0.02)	<b>.08*</b>	-0.20 (0.03)	<b>-.22***</b>	0.04 (0.02)	.06
Immigrant	-0.13 (0.08)	-.06	-0.29 (0.16)	-.08	-0.13 (0.11)	-.04
ERDM	0.57 (0.04)	<b>.46***</b>	0.50 (0.08)	<b>.23***</b>	0.03 (0.06)	.02
IOP	-0.23 (0.04)	<b>-.21***</b>	-0.37 (0.08)	<b>-.18***</b>	0.04 (0.06)	.03
SPR	0.23 (0.04)	<b>.22***</b>	0.43 (0.07)	<b>.23***</b>	0.52 (0.05)	<b>.36***</b>
ST	0.23 (0.12)	.08	0.83 (0.24)	<b>.16***</b>	0.31 (0.18)	.08
CS	-0.13 (0.15)	-.03	0.09 (0.3)	.01	-0.17 (0.22)	-.03
NC	0.22 (0.12)	<b>.07*</b>	0.50 (0.25)	<b>.09*</b>	0.13 (0.18)	.03
ST*immigrant	0.01 (0.37)	<.01	-0.73 (0.73)	-.05	-1.13 (0.55)	<b>-.09*</b>
CS*immigrant	0.11 (0.53)	.01	1.74 (1.04)	.07	1.14 (0.81)	.06
NC*immigrant	0.64 (0.57)	.05	-0.52 (1.18)	-.02	-0.76 (0.83)	-.05
Adjusted $R^2$	<b>.29***</b> ( $\Delta R^2 < .01$ )		<b>.18***</b> ( $\Delta R^2 < .01$ )		<b>.15***</b> ( $\Delta R^2 = .01$ )	

*Note.* Gender: 0 = Male, 1 = Female. Immigrant Status: 0 = Canadian-born, 1 = Immigrant. Risk perception dimension: ERDM = external responsibility for disaster management, IOP = illusiveness of preparedness, SPR = self-preparedness responsibility. Social capital: ST = societal trust, CS = community socializing, NC = neighbourhood contact. The attached custom data (Table 14) at the CD-level is provided for use in accordance with the terms and conditions of the Statistics Canada Open License Agreement hereby attached. Source: Statistics Canada Postal Code<sup>OM</sup> Conversion File (2013) which is based on data licensed from Canada Post Corporation.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .



### Having Someone Search for Me 48-Hour Post-Disaster

External responsibility for disaster management ( $\beta = .21, t = 5.88, p < .001$ ) and self-preparedness responsibility ( $\beta = .26, t = 7.10, p < .001$ ) significantly predicted an increased likelihood of individuals knowing someone who would search for them post-disaster, controlling for all other factors: adjusted  $R^2 = .16, F(6, 801) = 26.11, p < .001$  (see Table 14). However, the reverse was true for illusiveness of preparedness:  $\beta = -.19, t = -5.14, p < .001$ . Social capital components significantly improved the model:  $\Delta R^2 = .02, p < .001$ . Societal trust ( $\beta = .14, t = 3.22, p < .01$ ) and neighbourhood contact ( $\beta = .09, t = 2.03, p = .04$ ) were significant predictors of increased post-disaster search, controlling for all other factors. The final model with the interaction terms revealed that the interaction terms were non-significant ( $ps > .05$ ), controlling for all other factors:  $\Delta R^2 < .01, p = .30$ .

### Emergency Planning

Self-preparedness responsibility ( $\beta = .36, t = 10.29, p < .001$ ) significantly predicted an increased likelihood of individuals participating in emergency planning:  $R^2 = .15, F(6, 844) = 24.97, p < .001$  (see Table 14). Social capital components did not significantly improve the model:  $\Delta R^2 < .01, p = .70$ . The relationship between social capital and emergency planning was non-significant, controlling for all other factors ( $ps > .05$ ). In the final model ( $\Delta R^2 = .01, p = .15$ ), the interaction term for societal trust by immigrant status was significant, controlling for all other factors:  $\beta = -.09, t = -2.06, p = .04$ . Canadian-born individuals were more likely to uptake emergency planning as societal trust increased, whereas immigrants were less likely to uptake emergency planning as societal trust increased (see Figure 5).

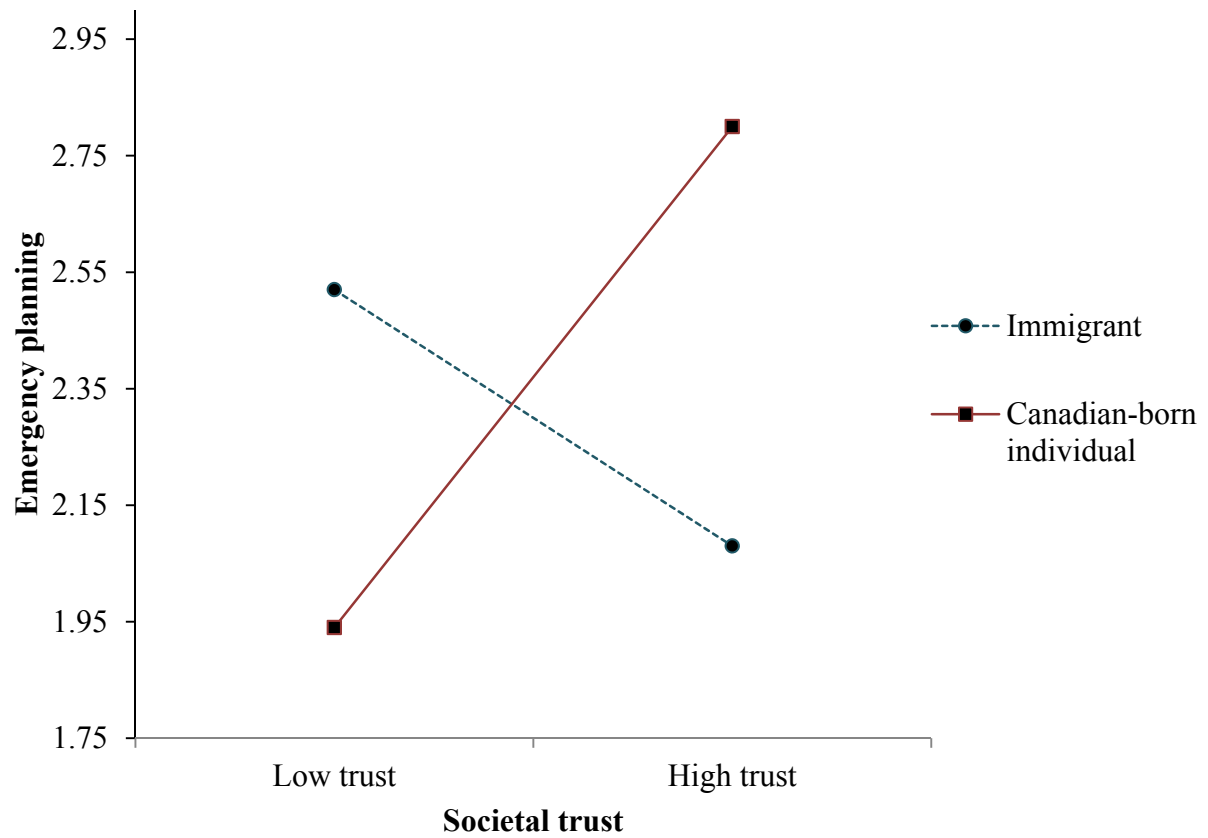


Figure 5. Societal trust by immigrant status predicting emergency planning ( $p < .05$ ).

## **Discussion**

We examined the relationship between community social capital and individual disaster preparedness in immigrants and Canadian-born individuals. The three components of social capital were neighbourhood contact, societal trust, and community socializing. We found that different components of social capital were associated with different forms of disaster preparedness. Interestingly, immigrants and Canadian-born individuals significantly differed in the relationship between societal trust and emergency planning.

### **Social Capital and Disaster Preparedness**

Research on how social capital affects individuals' disaster preparedness is sparse. Our findings revealed that individuals who resided in communities with a high degree of neighbourhood contact were more likely to comply with evacuation recommendations. Neighbourhood contact represented a form of social support which may bolster individuals' receipt of resources and moral support for evacuation. Indeed, studies showed that social support vis-à-vis social capital was associated with the decision to evacuate (Airriess et al., 2008; Parida, 2010). Furthermore, a recent survey found that Canadian residents who perceived a high level of social support felt more efficacious in handling an emergency (Taylor-Butts, 2016).

Next, findings showed that individuals who lived in communities with a high degree of neighbourhood contact and societal trust were more likely to know someone who would search for them post-disaster. Neighbourhood support and trust may facilitate individuals to reconnect with each another post-disaster. Indeed, studies have shown that search and rescue are primarily conducted by other victims who are in proximity such as neighbours (Aguirre, 1988; Hawkins & Maurer, 2010; Shaw & Goda, 2004). Neighbours also provide invaluable information to first responders to help locate entrapped victims. Our findings may explain why social capital is

associated with faster post-disaster recovery and lower post-disaster challenges (e.g., Aldrich & Sawada, 2015; Kim & Marcouiller, 2016).

Results also showed that social capital did not directly explain emergency planning, but an interaction effect was found – that is, how societal trust predicted emergency planning was moderated by immigrant status. Intent to comply with evacuation recommendations and having someone to search post-disaster are preparedness behaviours executed during a natural disaster. These during-disaster preparedness behaviours require the emergency directives of others; hence, individuals need to draw upon social relationships to take actions in a natural disaster. Then again, some studies suggest that social capital may reduce individuals' motivation to uptake disaster preparedness as social capital may provide individuals with a false sense of security (Babcicky & Seebauer, 2017; Wolf et al., 2010). Taken together, results suggest that social capital is salutary for individuals regardless of their immigrant status for *during*-disaster preparedness behaviours involving a collective effort at least in the Canadian context. However, how social capital predicts *before*-disaster preparedness behaviours depends on immigrant status (will be discussed later).

Finally, findings revealed that community socializing, which represented friendship and volunteering, was not associated with any preparedness behaviours. Results suggest that close and formal relationships are not necessary for mobilizing disaster preparedness. However, community socializing may play a vital role in the post-disaster context such as providing social support and resources. It is important to note that while social capital only added a small percentage of explained variance, this is expected when aggregating large geographic units (Prouse, Ramos, Grant, & Radice, 2014). Therefore, the reported effect size may be conservative. Importantly, the proportion of variance explained by the full model was

substantial (15% to 29%), given the complexity of predicting human behaviours (McFarlane, McGee, & Faulkner, 2011; Lindell & Hwang, 2008).

### **Immigrant Status, Societal Trust, and Emergency Planning**

Findings revealed that societal trust functioned differently in the prediction of emergency planning in immigrants and Canadian-born individuals. Canadian-born individuals were more likely to engage in before-disaster preparedness behaviours when living in a community with strong societal trust. Social capital may foster Canadian-born individuals' emergency planning by increasing their disaster awareness, sense of shared responsibility, and self-reliance (Agrawal & Monroe, 2006; Bhandari et al., 2010; Bihari & Ryan, 2012). In contrast, the reverse was true for immigrants – that is, immigrants who lived in a community with a high degree of societal trust were less likely to uptake emergency planning. These findings are interesting given that the literature suggests that social capital is salutary for disaster preparedness in general (e.g., Bihari & Ryan, 2012; Reininger et al., 2013), while our findings show that this is conditional on immigrant status. Results suggest that immigrants may be reliant on the community for effective disaster response, and thus they may not perceive the urgency of emergency planning.

It is important to highlight that the immigrant sample was similar to the Canadian-born sample in several socio-demographic characteristics. Immigrants who participated in the national surveys were often educated English-speaking European immigrants who were long-term residents. A key distinction between these social groups is the country-of-birth and timeline of experience as an immigrant. The immigrant condition may modulate how societal trust impacts emergency planning. The climate of reception for immigrants in Canada is generally positive (CBC News, 2014; Government of Canada, 2014). Indeed, most immigrants in Canada expressed that living in Canadian society embodied freedom, rights, safety, and

security (Statistics Canada, 2011). Also, immigrants are supported by immigrant-serving organizations as part of their settlement process (Government of Canada, 2014). Communities with a high degree of societal trust may be more inclusive and supportive; therefore, immigrants who live in these communities may perceive emergency planning as unnecessary because they are confident in the Canadian society. Instead, communities with weak societal trust may encourage self-preservation through emergency planning for immigrants.

Societal trust represents social capital that spans beyond the immediate neighbourhood, whereas neighbourhood contact refers to more limited immediate and direct neighbourhood experiences. PCA results suggest that communities with strong societal trust may have an extensive social infrastructure but low neighbourhood interaction, whereas communities with strong neighbourhood contact may have a social infrastructure that is mostly bounded within the immediate neighbourhoods. Correlation results suggest that immigrants may be more likely to live in communities with extensive social infrastructure with increasing time spent in Canada. Indeed, immigrants seek to build social connections with the larger society as they integrate into the receiving community (Breton, 2003). Findings also suggest that long-term immigrants and new immigrants may respond to disaster preparedness differently due to the tendency to reside in different neighbourhood context. Nonetheless, future qualitative investigations are important to substantiate these speculations regarding group differences such as by country-of-origin and time of immigration.

### **Programming and Policy Recommendations**

Our study suggests that mere contact through neighbourhood support and trust have a salutary effect on individuals' disaster preparedness. Social capital could be used to support risk communication and management as individuals are more likely to heed risk messages that are

transmitted through trusted social infrastructure (Lemyre et al., 2009). Importantly, the difference between immigrants and Canadian-born individuals in the relationship between societal trust and emergency planning calls for culturally-adapted risk communication and management as they may have different expectations regarding risk mitigation. In fact, findings highlight a dilemma in risk communication and management – that is, to identify who is responsible and how should risk uncertainties be communicated amongst stakeholders (Markon, Crow, & Lemyre, 2013). It is important to include immigrants as active agents in risk management to create joint partnership, open exchange, and mutual responsibility. Further, risk management should aim to establish clear roles and responsibilities, identify barriers and needs, and reduce a false sense of security in the public.

Despite the modest proportion of variance social capital added to the models (< 3%), there are more gains than losses in cultivating social capital because social capital benefits the health and well-being of a society beyond the context of disasters (see Kawachi et al., 2008). The literature on the benefits of social capital in the post-disaster context further highlights the value of social capital (e.g., Kim & Marcouiller, 2016; Wickes et al., 2015). Since our findings also suggest that social capital could cut both ways, this further underscores the criticality of considering social capital in risk management to ensure that social capital supports rather than undermines efforts to increase disaster preparedness. Taken together, we recommend that programming and policy need to consider social capital as part of the risk communication and management framework. Embedding disaster preparedness in existing social infrastructure through community-based programming may be most effective to encourage preparedness behaviours. One way to build neighbourhood support and trust is to host community events and festivals that encourage individuals to make contact and ultimately build social relations

(Putnam, 1995a, 1995b; Uslaner, 2002). The built environment should also consist of “third space” (e.g., coffee shops and parks) to allow social capital to flourish (Oldenburg, 1999).

### **Limitations and Future Directions**

The current study defined “community” based on physical boundaries, whereas individuals may define “community” based on shared interests, values, and identity (Cummins, Curtis, Diez-Roux, & Macintyre, 2007). The different forms of “community” may affect disaster preparedness differently. Hence, future research should employ qualitative investigation to understand the context and meaning surrounding natural disaster risks and issues in Canada. In particular, how individuals perceive and respond to natural disaster risks and issues in view of their social environment. The present study used Census Division as the geographic unit for analysis which was a relatively broad geographical area. A smaller geographic unit was not possible due to the sample size distribution. Therefore, a trade-off of using a relatively broad geographic unit was it may hide meaningful local variations and lead to problems with ecological validity. Then again, a more precise geographic unit does not prevent the problems that come from scaling (the level of analysis) and grouping (the shape of the zone) spatial data, called Modifiable Areal Unit Problem (MAUP), which is inherent to spatial studies (Gehlke & Biehl, 1934). Therefore, future research should sample a sufficient number of respondents by a smaller geographic unit. A sufficient number of immigrant respondents and Canadian-born respondents by geographic unit should be determined in advance so that hierarchical linear modelling could be performed as a more robust test of ecological effect for grouped data (see Huta, 2014). Next, the low Cronbach’s alpha for some of the measured concepts suggests that the relationships involving these variables may be attenuated. It also suggests that there may be more indicators to be discovered for the measured concepts as Cronbach’s alpha is a lower-bound estimation that



is influenced by the number of items (Tavakol & Dennick, 2011). Finally, the cross-sectional design does not allow us to delineate the temporality and causality of the relationships as social and physical characteristics of a community can change over time. Future studies could benefit from a longitudinal design to document how social capital and disaster preparedness for a community change over time. For immigrants, a development perspective encompassing time since immigration and duration in the receiving neighbourhood may also demonstrate how immigrants develop social capital in their communities and how these processes influence their disaster preparedness. Future research should also segment the immigrant population into different subgroups as different immigrant subgroups may experience different climates of reception from their receiving communities which in turn could affect social capital, risk perception, and disaster preparedness (Putnam, 2007).

## **Conclusion**

Despite these limitations, this work contributes to the better understanding of the role of the social environment in immigrants and Canadian-born individuals' disaster preparedness which is an understudied topic. The study underscores the value of social capital in risk communication and management for natural disasters. Further, it elucidates the importance of targeting and tailoring risk communication and management for two major social groups in Canada. Given that disaster preparedness in Canada is low, our study provides an empirical basis to help improve risk communication and management. Finally, the low level of disaster preparedness in Canada emphasizes that this topic continues to be a major area of investigation at the individual- and community- level.

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**Chapter 4: Qualitative Study on Natural Disaster Risks and Issues in Immigrants and Canadian-born Adults: A Social-Ecological Perspective on Gaps and Challenges**

### **Foreword**

The first study offered an important insight such that immigrants and Canadian-born individuals generally perceived and responded to natural disaster risks similarly. However, there were differences in the salience of five risk perception beliefs. Expanding on the individual-level model, an ecological perspective was utilized in the second study by examining the role of community-level social capital in individuals' disaster preparedness. The second quantitative study offered two important insights – first, community social capital was a valid predictor of individuals' disaster preparedness; and second, societal trust predicted emergency planning differently in immigrants and Canadian-born individuals. In specific, immigrants who lived in communities with strong societal trust were less likely to uptake emergency planning, whereas the relationship was reverse for Canadian-born individuals. While the antecedent quantitative studies offered important insights, these studies were not able to fully capture the complex social-ecological processes, relationships, and factors that shaped individuals' risk perception and behaviours. In an attempt to provide a supplemental take on the meaning and context of the antecedent studies and explore the breadth of higher-order contextual factors of the social environment, a qualitative study was conducted. Accordingly, individual interviews (see Appendix E) involving eight new immigrants, seven long-term immigrants, and seven Canadian-born individuals were conducted to capture their lived experiences of natural disaster risks and issues in Canada using a social-ecological perspective. This final study depicts how immigrants and Canadian-born individuals construe natural disaster risks and issues in view of the social environment. This study has been submitted for publication.

### **Researcher Standpoint**

Reflecting on my standpoint as a researcher, two aspects are salient to me. The first aspect is my lived experience as an immigrant has taught me what it is like to be new to a community. I can reflect on my experiences learning about natural disasters and disaster preparedness in Canada which was unheard of before my move to Canada. I can also reflect on the importance of the social environment in shaping human experience. For instance, contrasting what it is like in Malaysia compared to Canada, I am cognizant that the social environment provides the tools and context that influence how we think, feel, and act. These experiences allow me to relate to some of my participants through empathic knowledge and provide me with a unique lens through which to examine this issue. However, I am conscious that my experiences are not universal so my “in-group” knowledge is limited. The second aspect is my academic knowledge about this topic. Given that the qualitative study is my final study, it is evident that I do not have a “blank slate” when conducting the qualitative study. However, I think this is a strength because it allows me to be aware of the limits of the literature and ask questions and explore concepts that need further investigations. Therefore, conducting my final study using qualitative method allows me to identify the “unknowns” that are left to be discovered.

Taken together, I attempt to put aside my beliefs, feelings, knowledge, and experience through bracketing, for example: (1) at the pre-research stage – I reflect on my motives, assumptions and personal experiences that may skew the research; (2) at the data collection stage – I ask questions that are not leading and biased, and I recruit participants from diverse backgrounds; and (3) at the data analysis stage – I recruit the help of a second coder, who is a Canadian-born, for peer audit and inter-rater reliability check. My goal is to allow the story to

emerge from the interview data and the results to reflect what is true of the participants' lived experiences.

Finally, I want to acknowledge the fact that the qualitative study is often the first study in the sequence of a thesis endeavour as it contributes to identifying core issues that are then developed further in subsequent studies. In my case, two factors led the epistemology of my thesis. First, the research programme itself was engrained in an epidemiological paradigm on risks based on a tradition of survey questionnaires since 1992. The National Survey of Health Risk Perception 2012 was the natural sequel to the prior work. Second, I am more of a quantitative researcher. The doctoral training and interdisciplinary research experiences have taught me how to appreciate and value the unique contributions of qualitative research because it conveys a richer and more complex understanding of people's lives. This third study is, therefore, a tribute to the complex dynamics of immigration and adaptation to risks in the Canadian context.

### **Contributions of Authors and Co-Authors**

The first author (doctoral candidate) designed the interview study, developed the interview schedule, conducted the study, performed the analyses, and wrote the manuscript. She also helped prepare the research ethics application (see Appendix B). Dr. Lemyre provided supervision and feedback for all stages of the study including the writing of the manuscript. The co-author has agreed that this paper will be part of the first author's doctoral thesis and this paper to be published in a scientific journal.

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Running head: QUALITATIVE STUDY ON NATURAL DISASTER RISKS

Qualitative Study on Natural Disaster Risks and Issues in Immigrants and Canadian-born Adults:  
A Social-Ecological Perspective on Gaps and Challenges

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### Abstract

Natural disaster risks are a salient public health and safety issue in Canada. To help increase disaster preparedness in Canada through risk communication and management, we conducted a qualitative study to explore immigrants and Canadian-born individuals' lived experiences of natural disaster risks and issues using a social-ecological perspective. Interview topics included risk perception, disaster preparedness, social factors, and risk management in Canada. New immigrants, long-term immigrants, and Canadian-born individuals from an urban cosmopolitan city were interviewed ( $N = 22$ ). Findings revealed five themes: *Canada is Able to Adapt and Respond*, *Downplaying the Risks*, *Gaps in Risk Communication and Management*, *Perceived Individual Preparedness*, and *Perceived Collective Preparedness*. A unifying thread across these themes was immigrants and Canadian-born individuals believed that the positive social environment ("Canadian way") would mitigate the risks; therefore, disaster preparedness was unnecessary. Daily priorities, gaps in risk communication and management, and risk uncertainties made disaster preparedness impractical for daily life. The immigrant condition and culture shaped immigrants' illusiveness of preparedness beliefs, low hazard awareness, perceived resilience, mental preparedness, evacuation concerns, and overconfidence in first responders. Findings highlight how individuals derive meaning from the social environment which in turn affects their risk perception and preparedness behaviours. Therefore, risk communication and management need to be tailored to the target social group and local context; particularly, reframing "all-hazards" preparedness behaviours as a social-cultural practice of being resourceful for daily stressors.

*Keywords:* risk perception, disaster preparedness, social-ecological model, social environment, immigrant

## **Introduction**

Recent natural disasters in Canada underscore the need to prevent and mitigate natural disaster risks (Kohut, 2017; Government of Canada, 2016). Disaster preparedness reduces harms from natural disasters, so individuals and communities can maintain adequate functioning and bounce back to normalcy, known as “resilience” (Lemyre & O’Sullivan, 2013; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). We aimed to understand the context and meaning surrounding risk perception and disaster preparedness for natural disasters in immigrants and Canadian-born individuals. Accordingly, we investigated immigrants and Canadian-born individuals’ lived experiences of natural disaster risks and issues in Canada using a social-ecological perspective. Findings would help improve risk communication and management in Canada.

## **The Canadian Context**

Numerous studies over the years have demonstrated that disaster preparedness in the Canadian public remains low (Taylor-Butts, 2016; Yong, Lemyre, Pinsent, & Krewski, 2017b), although disaster education (e.g., Get Prepared Canada) is available to the Canadian public (Public Safety Canada, 2017; Taylor-Butts, 2016). The low level of disaster preparedness confirms that exposing individuals to risk information alone is insufficient to encourage preparedness behaviours (Mileti & Sorenson, 1987). Furthermore, the increasingly diverse Canadian population provides an added challenge in designing an effective risk communication and management strategy.

One social group that requires special attention is the immigrant population which is a significant segment of the Canadian public (21%; Statistics Canada, 2013). In Canada, the immigrant population has been identified as one of the 10 higher-risk groups in disasters

(Canadian Red Cross, 2007). Studies conducted in disaster-prone developed countries showed that immigrants tended to suffer more negative consequences compared to their native-born counterparts (Norris, VanLandingham, & Vu, 2009; Scurfield, 2008; Webster, McDonald, Lewin, & Carr, 1995). Pre-existing daily challenges and barriers immigrants experience in the new society (e.g., language, cultural, and economic obstacles) often increase their risks within the disaster cycle (Lemyre, Gibson, Zlepnig, Meyer-Macleod, & Boutette, 2009; Scurfield, 2008). A step towards better risk communication and management for immigrants requires an understanding of how they perceive and respond to natural disaster risks and issues compared to the general native-born population. However, risk studies on immigrants are sparse. Quantitative survey studies have revealed a mix of similarities and differences in how immigrants and Canadian-born individuals perceive and respond to natural disaster risks and issues (Taylor-Butts, 2016; Yong, Lemyre, Pinsent, & Krewski, 2017a). Therefore, a better understanding of this phenomenon requires an understanding of the context and meaning through qualitative investigations.

### **A Qualitative Study Guided by the Social-Ecological Model**

A shift in emphasis from the individual-level cognitive processes to a multi-level ecological model in the understanding of risk perception and disaster preparedness is required (Solberg, Rossetto, & Joffe, 2010), given the social environment affects individuals' experience within the disaster cycle (Satterfield, Mertz, & Slovic, 2004; Gaillard, 2008; Lemyre et al., 2009; Paton et al., 2010; Thomas, Phillips, Lovekamp, & Fothergill, 2010). For instance, social groups that live in a socially deprived environment are more likely to suffer from natural disasters (Scurfield, 2008; Cutter et al., 2006). Although quantitative studies have found that social factors shape risk perception and disaster preparedness (e.g., Heller, Alexander, Gatz, Knight, &

Rose, 2005; Kahan, Braman, Gastil, Slovic, & Mertz, 2007; Yong et al., 2017a), qualitative research affords greater opportunities to illustrate the complex psychosocial processes that influence how individuals perceive and respond to risks.

Bronfenbrenner (1977) describes the social environment as a nested multilevel ecological system, known as the ecological systems theory. The ecological systems theory has been utilized in disaster research (e.g., Boon, Cottrell, King, Stevenson, & Millar, 2012; Prior & Eriksen, 2013). Inspired by Bronfenbrenner's social-ecological model, Lemyre and colleagues proposed a social-ecological system of risks and resilience (Gibson, 2013; Lemyre & O'Sullivan, 2013). This model describes that risk perception and disaster preparedness are a function of the property and characterization of the relationship of the four ecological systems with the individual nested within these systems: microsystem (e.g., social support network), mesosystem (e.g., neighbourhood organization), exosystem (e.g., access to emergency services), and macrosystem (e.g., policies).

In this study, we explored immigrants and Canadian-born individuals' lived experiences with natural disaster risks and issues in Canada using a social-ecological perspective. We sought to identify – first, the social-ecological factors, processes, and relationships that have an influence on individuals' risk perception and disaster preparedness; and second, the differences between immigrants and Canadian-born individuals. A qualitative approach will allow us to capture how individuals derive meaning from the social environment, and how these processes impact risk perception and preparedness behaviours. Since immigrants are a hard-to-reach population in national surveys, a qualitative approach would allow immigrants to be active agents in knowledge production.

## **Method**

### **Participants**

The 22 interview participants were adults of at least 18 years old who resided in Ottawa, Ontario, Canada; the national capital of Canada. Ottawa is regularly exposed to severe weather events and is at-risk of earthquakes, flooding, and tornadoes, although there have not been any major natural disasters at the time of the interview (Public Safety Canada, 2015b). The participants were eight new immigrants (less than 10 years in Canada), seven long-term immigrants (at least 10 years in Canada), and seven Canadian-born individuals (see Table 15). All Canadian-born individuals were born in Ottawa except for two participants. At the time of the interview, one Canadian-born participant moved to Ottawa approximately 40 years ago and one Canadian-born participant moved to Ottawa four months ago from another Canadian city.

**Table 15***Interviewees Characteristics (N = 22)*

	<u>New immigrant</u>	<u>Long-term immigrant</u>	<u>Canadian-born</u>
Socio-demographic	<i>n</i> = 8 (%)	<i>n</i> = 7 (%)	<i>n</i> = 7 (%)
Gender			
Male	5 (63%)	2 (29%)	2 (29%)
Female	3 (37%)	5 (71%)	5 (71%)
Age (years)			
18 – 24 years old	1 (13%)	0 (0%)	3 (43%)
25 – 64 years old	7 (87%)	6 (86%)	3 (43%)
At least 65 years old	0 (0%)	1 (14%)	1 (14%)
Education			
Less than high school	1	0 (0%)	0 (0%)
College or university graduate	7	6 (86%)	5 (71%)
Graduate school	0	1 (14%)	2 (29%)
Household income			
Up to \$50,000	3 (37%)	0 (0%)	2 (29%)
\$50,000 to \$100,000	1 (13%)	3 (43%)	2 (29%)
At least \$100,000	0 (0%)	0 (0%)	0 (0%)
Unemployed	2 (24%)	1 (14%)	1 (13%)
Not in labour force	1 (13%)	1 (14%)	2 (29%)
Prefer not to say	1 (13%)	2 (29%)	0 (0%)
Cultural background			
European	2 (25%)	3 (43%)	4 (57%)
Non-European	6 (75%)	4 (57%)	3 (43%)
Language spoken most often at home			
English	1 (13%)	4 (57%)	6 (86%)
French	2 (25%)	0 (0%)	0 (0%)
Other	3 (37%)	0 (0%)	0 (0%)
Mixed	2 (25%)	3 (43%)	1 (14%)

## Procedure

**Recruitment.** We designed the recruitment strategy to recruit English-speaking adults in the community. Therefore, participants were recruited using purposeful sampling technique with the collaboration of an immigrant-serving organization and through the distribution of posters via community advertisement and online classifieds. We made efforts to balance gender and ethnocultural background.

**Interview protocol.** We developed a semi-structured interview guide with open-ended questions with inputs from previous studies (Gibson, 2013; Lee, Dallaire, & Lemyre, 2009; Yong et al., 2017a, 2017b). The interview sections covered four sections: natural disaster risks (e.g., “Have you ever thought of the possibility of a natural disaster affecting you?”); disaster preparedness (e.g., “Would you say that you are someone who is prepared for a natural disaster?”); social processes and structures (e.g., “Would you be able to trust the people in your neighbourhood in the event of a disaster?”), and risk communication and management in Canada (e.g., “Do you recall any messages you may have received about disaster preparedness?”). During the interview, the primary researcher (AGY) explained the study and obtained written informed consent from all participants. Data collection was from August 2014 to October 2015. The interviews were conducted in English and lasted approximately 60 minutes. The interviews were audio-recorded and transcribed verbatim. The Research Ethics Board of the University of Ottawa approved the procedures.

## Analytical Strategy

The analytical strategy aligned with the pragmatic realist orientation which involved inductive and deductive reasoning in discerning patterns in the data (Miles, Huberman, & Saldana, 2014). The primary researcher (AGY) developed an *a-priori* code list based on the

social-ecological model (see Lemyre & O'Sullivan, 2013) and previous studies. Accordingly, the *a-priori* coding scheme consisted of initial codes (e.g., risk perception and social support network) subsumed under the social-ecological levels (e.g., individual-level and microsystem). Then, the *a priori* coding scheme was revised using inductive and deductive reasoning. *In-vivo* codes, words, and short phrases were assigned line-by-line to chunk data during the first cycle coding. Emergent codes were consciously recognized throughout the entire process. After the primary researcher coded two interviews (approximately 10% of the interview data), peer-audit of the *a-priori* coding scheme was performed by a second coder (AC) to pinpoint any questionable or vague interpretation (Yardley, 2008).<sup>11</sup> Then, the *a priori* coding scheme was revised and used to code the remaining interview data. Similar codes were grouped into categories as part of the second cycle coding. Data saturation was achieved after analysing the fourth interview as no new information regarding the general content of the interview was being presented (Fusch & Ness, 2015). The coding cycles generated a provisional coding scheme. Then, the second coder coded a randomly selected 10% of the interview data using the provisional coding scheme. The researchers compared each other's coding process to refine the coding scheme. An inter-rater agreement was calculated for the codes – a Kappa of 96% was achieved indicating good internal consistency. Then, a final coding scheme was produced and used to synthesize the interview data as part of focused coding. Patterns (e.g., conditions,

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<sup>11</sup> Peer-audit questions: Was the coding scheme applied reasonably? Should some codes or categories be merged or deleted? Were there potential codes, categories, and themes in the data that were not identified in the coding? Were there more reasonable ways to regroup the codes or categories? Were there interpretations, relationships, themes, and disconfirming evidence that were not reasonable, given the interview data?



mechanisms, and consequences), themes, and disconfirming evidence were identified using analytical memoing as part of the second cycle coding. Categories were analysed and narrowed to five emergent themes that encapsulated the most categories and codes. Organizing the codes and categories into themes were not mutually exclusive as some elements could fall into more than one theme which was expected as they represented the inter-related components of the social environment. Differences and similarities between immigrants and Canadian-born individuals were explored by analysing categories both within and across groups. The coding process was iterative which evolved with the interview data.

NVivo 10 software was used to organize and manage the data. Trustworthiness was established based on the guidelines of Lincoln & Guba (1985): triangulation by considering how the present findings were related to the previous findings; disconfirming evidence analysis; peer audit of the interview guide, coding scheme, and interpretations; audit trails using interview summary forms and note-taking; thick descriptions of the data using exemplary quotes and detailed descriptions; and reflexivity through memoing and researcher standpoint.

## **Results**

During the interview process, many immigrants and Canadian-born individuals reported that they had not given any thoughts to natural disaster risks and issues before participating in this study. The most commonly mentioned natural disasters were related to cold weather (e.g., snowstorms) and earthquakes. However, many new immigrants were not aware of natural disasters in Canada: *“We no have the earthquake in Canada”*. The qualitative analyses revealed 15 categories representing social-ecological factors, processes, and relationships related to the construal of natural disaster risks and issues in Canada (see Table 16). These categories were clustered into five distinct yet related themes (see in Figure 6).

**Table 16***Emergent Social-Ecological Categories and Sub-Categories*


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Social-ecological level
CATEGORY
Sub-category

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Individual-level factor
1.1. RISK PERCEPTION
1.1.1. Hazard characteristics
1.1.2. Risk perception beliefs
1.2. RESPONSE EVALUATION
2.1 Perceived self-coping
2.2 Perceived other coping
2.3 Perceived readiness
Micro-level factor
1.1. SOCIAL SUPPORT NETWORK
1.1.1. Neighbourhood and community
1.1.2. Friends and family
1.2. TYPE OF SOCIAL SUPPORT
4.1 Emergency fund
4.2 Shelter
4.3 Someone search for me
1.3. SOCIAL NORMS
5.1 Do not prepare
5.2 Do not think or talk about it
5.3 Help each other
Meso-level factor
1.4. NEIGHBOURHOOD ORGANIZATION
6.1 Accessibility
6.2 Atmosphere
1.5. NEIGHBOURHOOD RELATION AND CONTACT
7.1 People
7.2 Safety and security
7.3 Connection
7.4 Belongingness
1.6. CITY CONTEXT
8.1 Physical
8.2 Social-cultural
1.7. COMMUNITY SOCIALIZING
9.1 Belongingness
9.2 Connection
1.8. SOCIETAL TRUST
Exo-level factor
1.9. INFORMATION SOURCES
11.1 Formal sources
11.2 Informal sources
1.10. ACCESS TO EMERGENCY SERVICES
12.1 Information and training needs
12.2 Gaps in risk messages
12.3 Efficient emergency services
Macro-level factor
1.11. CANADIAN IDENTITY
13.1 Helpful
13.2 Strong
1.12. CANADIAN SYSTEM IS PREPARED
14.1 Government and institution support
14.2 Modern science and technology
1.13. CANADA IS SAFE
15.1 Geographically safe
15.2 Organized social infrastructure

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## PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

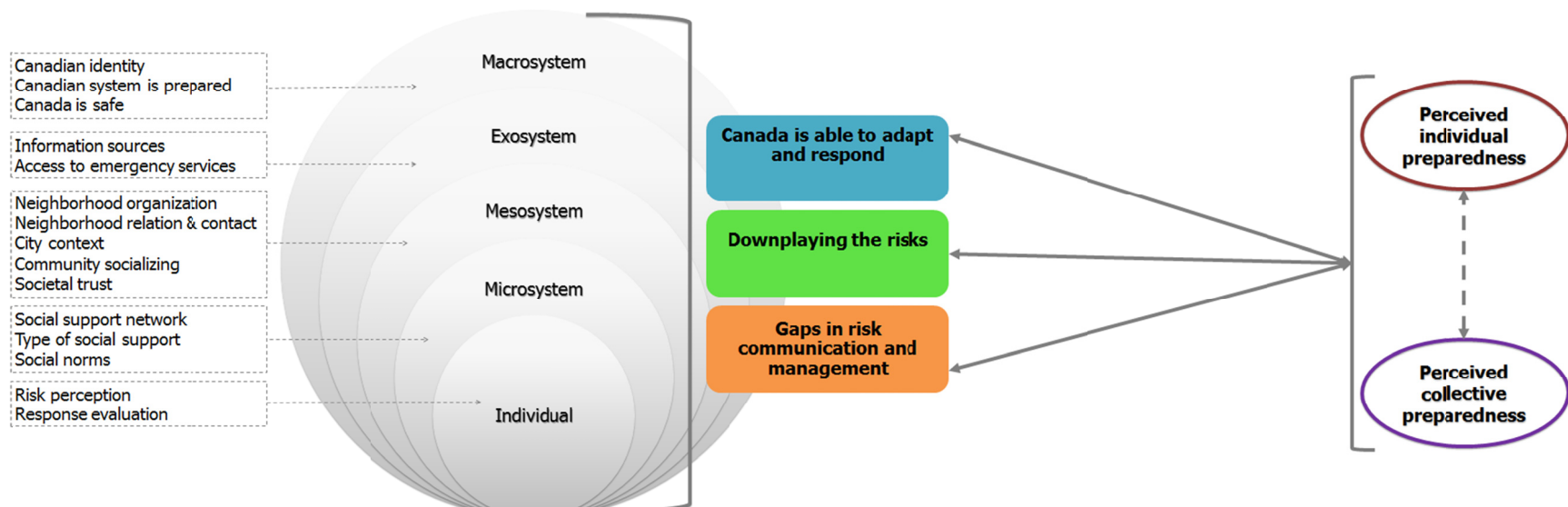


Figure 6. Visual representation of the emergent themes.

**Theme 1: Canada is Able to Adapt and Respond**

Participants reported that Canada as a whole would be able to adapt and respond to natural disaster risks effectively, so they felt safe and secure. This theme included data on social support network, meso-level factors, and macro-level factors. Many immigrants and Canadian-born individuals believed that they were able to adapt and respond effectively because of the availability of various sources of social support. They were confident that they would receive help (e.g., emergency funds, shelter, and search-and-rescue) from their personal social support networks, neighbours, and the larger Canadian society: *“I know, starting from my neighbours to the larger community, I feel I'm well connected to access any help”* (long-term immigrant). Interestingly, participants' confidence in receiving help from their neighbours in a natural disaster did not necessarily depend on the quality of their neighbourhood. Many immigrants and Canadian-born individuals characterized their neighbourhood connections as brief, polite encounters. Those who expressed negative attitudes towards their neighbourhood were also confident in receiving help from their neighbours. They stated that there is an underlying trust that individuals in Canada would pull together in a natural disaster: *“During like sort of peaceful good times it's more likely that we do not connect with others... like people are joined under disaster. And this is where I have that trust in that we would just help each other”* (long-term immigrant).

Their confidence in receiving help from various sources was related to their ability to form various social connections. Many immigrants and Canadian-born individuals viewed Ottawa and Canada favourably. They expressed a sense of belonging: *“Yes, I belong to where I am living because what I have realized here in Canada, there is no segregation. Everybody are family. I mean, everybody are kind in Canada”* (new immigrant). Many participants also

expressed a high degree of societal trust and reciprocity in the Canadian society: *“I would trust that we would work together... so we can all get out of the situation. Of course we would all help out to deal with what’s going on”* (Canadian-born).

Participants’ confidence in Canada was related to the positive macro-level characteristics. New immigrants, in particular, talked about readiness to help as part of the Canadian identity: *“Canada have everybody will volunteer because it will be now the time to volunteer for the vulnerable people. I know that Canadians are well prepared for that”*. New immigrants also said that being strong is part of the Canadian identity, and thus Canadians are prepared: *“The Canadian people is very strong, is very prepared for the different situations”*. Immigrants formed these beliefs based on their observations of how Canada responded to past disasters (e.g., Ice Storm of 1998) and their settlement experiences (e.g., *“The Canadians help a lot”* [new immigrant]). Many immigrants and Canadian-born individuals expressed that the Canadian system was prepared because Canada was a developed country. Long-term immigrants and Canadian-born individuals tended to report that the government and institutions would provide support: *“Most certainly there’re all kinds of groups, government organizations or private groups, that if something severe, serious happens”* (long-term immigrant). New immigrants tended to state that Canada as a developed country owned modern science and technology to address natural disaster risks: *“This house was built by like Canadian engineers... so we always knew that things here are done to the best that they could be done... Canada’s very well prepared”* (new immigrant). Many immigrants and Canadian-born individuals described Canada as a safe country. New immigrants tended to believe that Canada was geographically safe: *“No, the place is safe”*. Many immigrants and Canadian-born individuals expressed that the organized social and physical infrastructure or the *“Canadian system”*, consisted of helpful

Canadians, charitable organization, efficient emergency services, and supportive government agencies, would be able to handle a natural disaster:

*Like we have the infrastructure, the social net, to, you know, pick up all these people.*

*We're always going to be okay here because we're a developed country. We're not going to lack for water or food or heat or anything. It's not a big deal in Canada. (Canadian-born)*

The positive social environment bolstered participants' perceived safety, security, and resilience against natural disaster risks. However, it also contributed to participants' underestimation of natural disaster risks and overestimation of perceived preparedness and coping in Canada.

## **Theme 2: Downplaying the Risks**

Participants downplayed the risks of natural disasters, while they emphasized the ability to cope with the consequences if a natural disaster happened. This theme embodied individuals' low level of risk perception and high level of perceived coping. This theme included data on risk perception, perceived self-coping, and perceived social norms. Many immigrants and Canadian-born individuals expressed that the perceived likelihood of a natural disaster occurring in Canada, especially in Ottawa, was low. They further stated that even if a natural disaster happened, the magnitude and impact would be small: *"Because the likelihood of something happening is not very high and if there was an ice storm the stores in Chinatown are still going to be probably open"* (Canadian-born). Many participants, particularly immigrants, were uncertain about what and when a natural disaster would happen. They claimed that these uncertainties made disaster preparedness challenging, costly, and futile: *"And to put a resource into something that just may or may not happen, it's a very expensive ordeal"* (long-term

immigrant).

Many immigrants and Canadian-born individuals expressed beliefs regarding external sources (i.e., government and community) are responsible for disaster management. New immigrants tended to believe that the community, science, and technology would help mitigate the risks: *“I mean like a community centre, immigration centre, it’s a kind of place where you can ask any questions. If they don’t know, they can refer you to someone who knows”* (new immigrant). Long-term immigrants and Canadian-born individuals tended to state that the government would take action: *“If it did happen I would trust the government would get involved”* (Canadian-born).

Participants’ illusiveness of preparedness beliefs were related to risk uncertainties. Many new non-European immigrants expressed illusiveness of preparedness beliefs such that their outcomes were pre-determined: *“We have to admit it or to accept it as it is because we believe that that happened because God wanted it to happen”* (new immigrant). Furthermore, only immigrants questioned the effectiveness of disaster preparedness, and thus they perceived the costs outweighed the benefits: *“Because I don’t think it would be necessarily helpful”* (long-term immigrant). Many immigrants and Canadian-born individuals stated that one could never prepare for everything: *“You are never prepared enough. First of all, you never know what’s coming. Second of all, I always think if something happens, who knows if you even have access to what you’ve stored? It’s just so many uncertainties that you can think you’re prepared”* (long-term immigrant).

Many immigrants and Canadian-born individuals expressed self-preparedness responsibility beliefs such that disaster preparedness is important, and individuals are responsible for their own safety. However, they stated that these beliefs are only applicable “in theory”

because disaster preparedness is not practical in reality because there are other priorities:

*But if something happens, it's important to know. But... and you need to buy things, or to put the things in one place and wait, and maybe it's not good if you leave water a long time in this place... Yes, sometimes you have other priorities to everyday things to have to do.* (new immigrant)

Despite their lack of disaster preparedness, many immigrants and Canadian-born individuals were confident that they would be able to cope with a natural disaster because of their ability to stay composed: *"When an earthquake happens you have to be calm"* (Canadian-born). Immigrants tended to cite past difficulties experienced in the home country, migration journey, and settlement process as sources of strength and resilience to help them stay calm and deal with loss: *"Through my travels and moving and transitioning from one place to the next, I've been able to start from scratch several times"* (long-term immigrant). Canadian-born individuals tended to say that they could *"rely on people"* to figure things out. Paradoxically, many participants stated that they had *"no idea"* of what to do in a natural disaster, so they would respond with *"instinct mostly"* and *"deal with it as it happened"*.

The social norms of participants' social support network also perpetuated their low level of risk perception and high level of perceived coping. Many Canadian-born individuals articulated that Canadians were generally not prepared and thus implying the threat is not imminent: *"But more people don't. So I would just say yeah, sure, you know. It's a nice day. Everything will be okay"*. Long-term immigrants particularly talked about how people in Canada usually would not think or talk about natural disasters: *"Just because I don't think people are usually thinking about what's going to happen in natural disaster"*. Many immigrants and Canadian-born individuals said that the social norms of helping in Canada was a



protective factor; therefore, individuals should not have to be worried and fearful: *“Yeah, that people will pull together and assist each other in the form of groups of people and in terms of individuals and so no, I don't think we're overly concerned about that”* (long-term immigrant).

Taken together, participants did not perceive that natural disaster risks in Canada as a valid threat and disaster preparedness as applicable to their daily lives. Therefore, they perceived disaster preparedness as unnecessary.

### **Theme 3: Perceived Collective Preparedness**

Participants perceived that Canada was prepared for natural disasters. This theme included data about the perceived other-coping and efficient emergency services in Canada. Many immigrants and Canadian-born individuals perceived that the collective preparedness in Canada as high. They expressed that the Canadian society would be able to cope with a natural disaster. Long-term immigrant and Canadian-born individuals, in particular, said that Canadians would help each other to cope: *“I think there are in general significant numbers of people who would immediately be very concerned and devoted to do what needs to be done to assist those who are in difficulty”* (long-term immigrant). Many immigrants and Canadian-born individuals expressed that the Canadian system was ready to deploy help during a natural disaster:

*“Happened in Ottawa, people from Montreal will come and assist people of Ottawa”* (new immigrant). This was related to the social norms of helping in Canada, sense of belonging, and social connections: *“When you feel you can rely on your community for support that's really what gives you the sense of belonging that this is home”* (long-term immigrant).

Many immigrants and Canadian-born individuals believed that there was a system in place to deal with the risks because of the availability of efficient emergency services.

Immigrants tended to be confident that first responders would help them immediately in a natural

disaster: *"I see always the firefighter, the ambulance, the police arrive fast when something happen"* (new immigrant). New immigrants tended to state that first responders are their main emergency contact. Participants' perception that the Canadian system was prepared created a sense of safety and security; however, it also cultivated risk complacency which was detrimental to their disaster preparedness.

#### **Theme 4: Perceived Individual Preparedness**

There was a discrepancy between participants' perceived and actual disaster preparedness. Many immigrants and Canadian-born individuals admitted that they did not prepare for natural disasters. They explained that they performed a variety of measures that could be described as disaster preparedness, but they did not consciously perform these measures for natural disasters: *"Well, it's my girlfriend has always a lot of food in the shelves and whatever, in the fridge too. But we have that, but we don't think for emergency"* (new immigrant). Despite the lack of disaster preparedness, these participants perceived themselves to be prepared. Immigrants tended to express that they were *"mentally prepared"* which was described to be most important: *"This building can collapse, and what will you do when you are not prepared? Will you say that now the police will come and rescue us? No, you have to be prepared by yourself in your mind"* (new immigrant). Some participants expressed that they were prepared *"in principle"* because they would be able to cope based on their personal circumstances (e.g., skills and positive social environment):

*Oh, I think it's not unfair to say probably basically prepared in principle. Like, we would find our ways as to what to do and what not to do when you are in that situation. Well, to the extent that my wife is a nurse by profession, so we certainly are ready to look after physical things that might happen.* (long-term immigrant)

Several participants perceived that they were not prepared, although they were not concerned about natural disaster risks because of the positive social environment.

Many immigrants and Canadian-born individuals would comply with evacuation recommendations, provided they *“have like 20 minutes to pack a few things”*. Many immigrants said that identification documents were the most important items, whereas Canadian-born individuals said that clothing, food, drinks, and health and hygiene items were the most important items. One Canadian-born participant would not evacuate without her dog. Four participants reported that packing was not a priority as their families were most important. However, all participants indicated that they were unsure about where they would relocate because they did not have an evacuation plan. When probed, immigrants tended to say that they would return to their home countries or go to public places (e.g., hotel). Some new immigrants were concerned about relocation: *“I don't know where to go or what I have to do”*. Canadian-born individuals would go to familiar places such as a friend's house.

Conclusively, many immigrants and Canadian-born individuals did not see the urgency of disaster preparedness. They also expressed that if they wanted to uptake disaster preparedness, gaps in risk communication and management were barriers: *“I'm not educated as to what to do and that's something that needs to be brought forward”* (Canadian-born).

### **Theme 5: Gaps in Risk Communication and Management**

Participants acknowledged some gaps and challenges in the existing risk communication and management. This theme included data on the availability and access to emergency information sources and services in Canada. Many immigrants and Canadian-born individuals did not recall receiving information about disaster preparedness in Canada. For those who did, Canadian-born individuals tended to receive information from formal sources (e.g., school, and

traditional media), whereas immigrants tended to receive information incidentally from informal sources (e.g., friends and family). However, participants claimed that the information was conflicting: *“It’s kind of like diets and food. Like you hear different things from different people”* (long-term immigrant). They also stated that the information was deficient because it did not apply to their circumstances: *“You have to use stairs. Now with the wheelchair, what can I do? So there’s still some problems with those kinds of plans”* (new immigrant). These gaps in risk communication and management rendered disaster preparedness challenging.

When participants were asked about what type of information and training they would need to help them with disaster preparedness, many immigrants and Canadian-born individuals stated better dissemination: *“They have to write them everywhere, everywhere to maybe doing more workshops, information in the families and community centres, things like that”* (new immigrant). They also requested for better quality information by providing information on the type of natural disasters and why a particular precautionary measure was effective and necessary: *“So it’s always important to not only know what to do but know why you’re doing those things”* (Canadian-born). Participants commented that providing the information alone would not be sufficient. They would like to see collaborations amongst individuals, communities, and the government:

*Bring things, and then you would make a kit, for example, for this, or a kit for that. So we’d put it together. Because usually I go to workshops and then I hear it and it’s great, and then I go home and I forget about it, and I never do any of the things that we thought to do.* (long-term immigrant)

*I think it is but, yes, I do think the government could do more like within communities. So like maybe getting people to go door by door and kind of inform people, oh do you guys*

*have your evacuation plan set up, do you guys have three days' worth of food, things.*

(Canadian-born individual)

Participants emphasized on empowering individuals and communities in disaster preparedness as part of effective risk communication and management strategies.

### **Discussion**

We aimed to understand the context and meaning surrounding risk perception and disaster preparedness for natural disasters through the immigrants and Canadian-born individuals' lived experiences. Five themes captured the social-ecological factors, processes, and relationships related to natural disaster risks and issues in Canada. A unifying message across these themes was immigrants and Canadian-born individuals believed that the positive social environment would mitigate the risks. Therefore, they did not perceive the urgency of disaster preparedness. There were some similarities and differences between immigrants and Canadian-born individuals in the construal of natural disaster risks and issues. Table 17 provides a snapshot of key findings that highlight the agreements and disagreements between immigrants and Canadian-born individuals.

## PREPAREDNESS, RISK PERCEPTION, AND SOCIAL ECOLOGY

**Table 17**

### *Summary of Agreements and Disagreements*

Immigrants and Canadian-born individuals generally agreed:
<ul style="list-style-type: none"><li>• Canada could adapt and respond effectively because of the strong social capital. Long-term immigrants and Canadian-born individuals were particularly confident in receiving support from the government, institutions, and community.</li><li>• The likelihood of a major natural disaster is low.</li><li>• Although disaster preparedness is important, it is only applicable in theory.</li><li>• Individuals could not prepare for everything.</li><li>• Actual disaster preparedness was low, although perceived preparedness and coping were high.</li><li>• High perceived coping was due to the ability to stay composed and social norms of helping in Canada, although there was a lack of foresight about what to do during a natural disaster.</li><li>• The Canadian system is prepared and ready to help.</li><li>• Willingness to evacuate provided that they could bring personal belongings, although there was a lack of foresight about where to relocate.</li><li>• Did not recall receiving quality information on disaster preparedness which made disaster preparedness challenging.</li><li>• Risk communication and management could be improved by focusing on better dissemination of quality information, collaboration amongst various stakeholders, and empowering the public.</li></ul>
Immigrants' unique needs and concerns:
<ul style="list-style-type: none"><li>• Lack of hazard awareness as many new immigrants believed that Canada is geographically safe.</li><li>• Confident that Canadians and modern science and technology would mitigate the risks.</li><li>• Believed that disaster preparedness is challenging, costly, and futile because of the high uncertainty, beliefs that their fates are pre-determined (particularly amongst non-European immigrants), and doubts about the effectiveness of risk mitigation strategies.</li><li>• Felt mentally prepared, strong, and resilient due to past difficulties.</li><li>• Long-term immigrants believed that most Canadians do not think or talk about natural disasters; hence, the risks must be low.</li><li>• Confident in first responders as the main emergency contact.</li><li>• Identification documents were the most important items to take during an evacuation.</li><li>• Would relocate to the home country or a public place during an evacuation.</li><li>• Received risk information from informal sources.</li></ul>
Canadian-born individuals' unique needs and concerns:
<ul style="list-style-type: none"><li>• Emphasized they would be able to work with others to cope.</li><li>• Stated that Canadians are generally not prepared; hence, the risks must be low.</li><li>• Clothing, food, drinks, and health and hygiene were the most important items to take during an evacuation.</li><li>• Would relocate to friends and family's place during an evacuation.</li><li>• Received risk information from formal sources.</li></ul>

### **The Beneficial and Perverse Effects of Social Capital**

The social-cultural approach posits that risks are socially constructed (Dake, 1991; Kahan et al., 2007; Kasperson et al., 1988). Indeed, our findings showed that the social environment contributed to immigrants and Canadian-born individuals' low level of risk perception and low perceived urgency of disaster preparedness. Many participants did not feel threatened by natural disasters, despite their overall lack of disaster preparedness. They believed that Canada's positive social environment could reduce the risks such that the Canadian society and government would provide them with immediate adequate relief. Canada's positive social environment could be characterized as rich with social capital according to participants. Participants alluded to a sense of trust, norms, reciprocity, and social connections spanning across horizontal (i.e., bonding social capital with friends and family; and bridging social capital with neighbours and community members) and vertical (i.e., linking social capital with community organization and governmental agencies) ties. Indeed, studies showed that overconfidence in external emergency response attenuated feelings of personal susceptibilities and thus reducing disaster preparedness (Becker, Paton, Johnston, & Ronan, 2012; Falkiner, 2003). Furthermore, participants felt that they could rely on the social infrastructure in Canada to respond effectively during a natural disaster. These findings may explain why previous studies showed that community social capital and individuals' external responsibility for disaster management beliefs positively predicted intent to evacuate and post-disaster search (Yong et al., 2017a, 2017b). Contrasting with previous studies (e.g., Kim & Kang, 2010), how immigrants and Canadian-born individuals identified with their neighbourhood was not vital in disaster response because they felt that they would receive help from the larger society. Participants believed that the underlying thread of trust, solidarity, and benevolence in Canada or the

“Canadian way” would allow for collective action to mitigate the risks. Our findings support the notion that individuals must believe that the risk is valid and applicable to them for any preparedness behaviours to occur (Fischhoff, 1995; Lemyre et al., 2009; Mileti & Fitzpatrick, 1992). Research has shown that social capital could have undesirable consequences such as high-risk behaviours (e.g., Kaljee & Chen, 2011) and low motivation for disaster preparedness (e.g., Babcicky & Seebauer, 2017; Wolf, Adger, Lorenzoni, Abrahamson, & Raine, 2010). Our findings suggest that while social capital may allow individuals to respond effectively to natural disasters by mobilizing resources and social support, it may also foster risk complacency by providing a heightened sense of safety and security and perpetuating social norms that discourage disaster preparedness.

### **Context and Meaning of Disaster Preparedness**

Participants’ actual disaster preparedness was inadequate as demonstrated by previous studies (Taylor-Butts, 2016; Yong et al., 2017b). Immigrants and Canadian-born individuals defined disaster preparedness based on their personal circumstances. While the Canadian government views natural disaster risks as concerning (Government of Canada, 2016; Public Safety Canada, 2017), our results suggest that immigrants and Canadian-born individuals do not. In fact, the gap between experts and lay individuals’ evaluation of risks has been recognized in the literature (Krewski, Turner, Lemyre, & Lee, 2012; Sjoberg, 2000). Results also revealed another concern which was immigrants and Canadian-born individuals may not be willing to abandon their belongings during an evacuation. While previous surveys show that Canadian residents are generally willing to evacuate in a natural disaster (Taylor-Butts, 2016; Yong et al., 2017b), our findings suggest that they may not evacuate safely.



Immigrants and Canadian-born individuals generally believed that disaster preparedness was important, but daily priorities, gaps in risk communication and management, and risk uncertainties made disaster preparedness impractical for daily life. Our findings may explain why disaster preparedness in Canada remains low; despite many Canadian residents agree with its importance (Falkiner, 2003; Phoenix Strategic Perspectives, 2010). Our findings may also elucidate why individuals with illusiveness of preparedness beliefs are less prepared such that risk uncertainties reduce individuals' perceived control, effectiveness, and benefits of disaster preparedness (Yong et al., 2017b). Our results support that what constitutes a risk worth preparing for depends on the context of participants' daily lives in view of the social environment (Donahue, Eckel, & Wilson, 2014; Gaillard, 2008; Matthew & Kelly, 2008). While the previous study shows that self-preparedness responsibility is an important predictor of emergency planning (Yong et al., 2017b), the present study suggests that individuals must also perceive that disaster preparedness applies to them presently. Our results suggest that initiatives aiming to increase disaster preparedness should reframe preparedness behaviours as applicable for daily stressors of daily life rather than for a rare event.

### **Immigrants' Unique Construal of Natural Disaster Risks and Issues in Canada**

Results identified several unique construals of natural disaster risks and issues by immigrants due to the immigrant condition and culture. New immigrants tended to believe that Canada was safe from natural disasters and considered first responders as their main emergency contact. They also expressed concerns about relocation during an evacuation. These findings may be related to a lack of familiarity with the physical setting and social environment due to being new. Immigrants were more likely to express risk uncertainties associated with the illusiveness of preparedness beliefs, especially related to the effectiveness and cost of disaster

preparedness. Further, non-European immigrants were more likely to express the role of God in the illusiveness of preparedness beliefs due to their cultures. The previous study found that the illusiveness of preparedness dimension consisted of the most non-invariant risk perception beliefs between immigrants and Canadian-born individuals (Yong et al., 2017b). The present study suggests that the immigrant condition and culture may contribute to the variations in risk perception beliefs. The experience of difficulties in the home country, migration journey, and settlement process confirmed for immigrants of their resilience and mental preparedness. These processes altogether reduced their perceived urgency of disaster preparedness.

Theorists have argued that risk inequities experienced by immigrants stem from social injustice (Lemyre et al., 2009; Satterfield et al., 2004; Thomas et al., 2010). However, immigrants in this study did not express experiencing social injustice in Canada. They considered the social environment as positive, lack of segregation, freedom to integrate, and sense of belonging. They reported that they received community support upon arrival and trusted the Canadian system. These experiences instilled their confidence in the Canadian system for providing help in a natural disaster. The overconfidence towards the Canadian system in immigrants may explain why immigrants are less likely to have emergency planning when living in a community with strong societal trust (Yong et al., 2017a). It should be noted that immigrants in this study were mostly educated English-speaking immigrants who were a relatively privileged immigrant subgroup compared to other immigrant subgroups that may face more unique obstacles (e.g., refugees and linguistic minorities; Health Canada, 2010; Sakamoto, Chin, & Young, 2010; Suárez-Orozco et al., 2012).

### **Implications for Risk Communication and Management for Natural Disasters**

Our findings underscore that providing risk messages alone does not necessarily encourage disaster preparedness (Donahue, Eckel, & Wilson, 2014; Gaillard, 2008; Matthew & Kelly, 2008). Immigrants and Canadian-born individuals did not take action because these messages failed to meet their needs and concerns. Accordingly, effective risk communication and management need to be “people-centred” such that it is tailored to the target social group within its local context. First, information needs to clear the public’s misunderstandings about natural disaster risks and issues so that individuals and communities can develop situational awareness to better know and assess the risks and available resources. Disaster preparedness programme should be embedded in community organizations that have pre-existing relationships with the community members (McLeroy, Norton, Kegler, Burdine, & Sumaya, 2003). For instance, disaster preparedness programme could be part of a school programme so that students could participate in exercises on risks and asset mapping. These activities could serve multiple purposes including increasing students’ knowledge about their communities and hazards so that they can transfer this knowledge to their families and friends. Murphy (2007) posits that risk management should place focus on building a more resilient community by cultivating social capital. Our results highlight that such endeavour should ensure that the social narrative about natural disaster risks support disaster preparedness because social capital could undermine preparedness efforts by fostering risk complacency.

Second, risk messages need to frame preparedness behaviours as relevant to individuals’ daily lives by reframing “all-hazards” preparedness behaviours as part of a social-cultural practice of being “all-resourcefulness” for more probable daily stressors. When individuals view disaster preparedness as relevant to their daily lives, they are more likely to practise it as part of the Canadian social norms. For example, having an emergency food supply is useful when the

individual may not be able to run errands due to illness (daily stressor) and is also useful in a natural disaster. This “all-resourcefulness” aspect emphasized by the Canadian residents in this study reflects the “no regrets” approach to climate change adaptation and preparedness (de Loe, Kreutzwisr, & Moraru, 2001; Smith, Ragland, & Pitts, 1996;). The “no regrets” approach states that preparedness actions should produce near-term benefits even if the disaster does not occur. Therefore, individuals are more likely to uptake these behaviours. For immigrants, the implications of the immigrant condition and culture need to be considered in risk communication and management. Individuals and communities would feel empowered to uptake disaster preparedness when it involves a community-based approach that involves joint partnerships and open exchange amongst individuals, communities, and the government (Jardine & Driedger, 2014).

### **Limitations and Future Directions**

A limitation of this study was we used purposeful sampling, so our findings were context-specific. Although typical of qualitative research, our results may not be extrapolated to certain social groups such as non-English-speaking immigrants and refugees. Additionally, we conducted this study in Ottawa which had a low incidence of natural disasters. Results may differ if the study was conducted in other parts of Canada with recent major natural disasters (e.g., Fort McMurray). The potential for selection bias exists, given recruitment was conducted in a purposeful manner. Further, social desirability and effects of recall might affect the interview process.

Despite these limitations, this study has some noteworthy contributions. It is one of the few studies that empirically investigate how immigrants and Canadian-born individuals construe natural disaster risks and issues in view of the social environment using qualitative method.

Therefore, we were able to capture the context and meaning surrounding their risk perception and disaster preparedness for natural disasters. Importantly, this study provides explanations through Canadian residents' lived experiences to why disaster preparedness in Canada remains low. This study reveals social-ecological factors that may help build a comprehensive model for effective risk communication and management strategies.

### **Conclusion**

This study underscores the importance of considering the social environment in the effort to increase disaster preparedness in immigrants and Canadian-born individuals. The social environment shapes individuals' risk perception and preparedness behaviours. For immigrants, risk communication and management need to consider their illusiveness of preparedness beliefs, low hazard awareness, perceived resilience, mental preparedness, evacuation concerns, and overconfidence in first responders. The Canadian social environment that is rich with social capital acts as a resilience factor but also a risk factor due to the public's misunderstandings and gaps in risk communication and management. Risk communication and management need to take advantage of the existing social infrastructure to increase individual and collective preparedness through a people-centred and community-based approach that involves an all-of-society engagement.

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## **Chapter 5: General Discussion**

The overarching goal of this thesis was to understand the relationships amongst risk perception for natural disasters, the social environment, and disaster preparedness in immigrants compared to Canadian-born individuals. This thesis aimed to inform practices for targeted and tailored risk communication and management to increase disaster preparedness and resilience. A psychosocial approach was considered as guided by the social-ecological model. To this end, the three objectives were: (1) To investigate the relationship between risk perception and disaster preparedness in immigrants and Canadian-born individuals; (2) To establish if community social capital contributed to individual disaster preparedness in immigrants and Canadian-born individuals; and (3) To identify the role of the broader social environment in how immigrants and Canadian-born individuals construe natural disaster risks and issues.

First, a quantitative study was conducted to examine the risk perception-disaster preparedness relationship in immigrants compared to Canadian-born individuals. To provide an ecological perspective, a second quantitative study was performed to investigate the relationship between community-level social capital and individual-level disaster preparedness in immigrants compared to Canadian-born individuals. Finally, a qualitative study was conducted to capture the context and meaning surrounding immigrants and Canadian-born individuals' risk perception and preparedness behaviours using a social-ecological perspective.

### **Risk Perception and Disaster Preparedness in Light of the Social Environment**

Lay individuals' subjective evaluation of hazards has been an important area of research since the 1970s because of its implications on how individuals and communities respond to risks (Krewski, 1993; Slovic, 1987). In the context of natural disasters, the predominant research approach defines risk perception based on the hazard characteristics (e.g., perceived likelihood). While an important aspect of risk perception, a growing body of research has elucidated that

individuals' subjective evaluation of natural disaster risks also includes risk perception beliefs (Y. C. Kim & Kang, 2010; Kung & Chen, 2012; Lee & Lemyre, 2009; Markon et al., 2011). In the first quantitative study, this thesis demonstrated that individuals' risk perception for natural disasters consisted of beliefs about responsibility, control, effectiveness of response, consequences, uncertainty, and cost-benefit analysis. These risk perception beliefs were explained by three underlying psychological dimensions – external responsibility for disaster management, self-preparedness responsibility, and illusiveness of preparedness. These risk perception dimensions were valid predictors of preparedness behaviours. Immigrants and Canadian-born individuals did not differ in their level of risk perception dimensions and disaster preparedness.

The core three-factor structure was applicable to immigrants and Canadian-born individuals. Interestingly, group differences were observed in the salience of several risk perception beliefs explained by the risk perception dimensions. Indeed, cross-cultural risk research has recognized that social groups have similarities and differences in their risk perception (see Renn & Rohrman, 2000). Globalization and shared human experience contribute to a global representation of risks, and the variations in the social groups' immediate social environment contribute to nuances in risk perception. Findings of this thesis revealed a three-factor global representation of natural disaster risks with nuances in some risk perception beliefs in immigrants and Canadian-born individuals. That is, the model achieved partial invariance. While an alternative approach was to keep the non-invariant risk perception beliefs to calculate the risk perception dimension scores, the decision to remove the non-invariant items was to obtain a basic model that was applicable to both groups and to ensure that any group differences in predicting preparedness behaviours were not due to measurement biases.

Therefore, results involving the risk perception dimensions were only applicable in the context when immigrants and Canadian-born individuals were equivalent in their risk perception beliefs. The identified equivalent and non-equivalent risk perception beliefs would help design risk communication and management strategies that are both complementary and differentiated. It is also important to note that the purity of the risk perception dimensions may be reduced due to the cross-loadings. However, the decision to keep the cross-loadings was to preserve construct validity and was supported by theoretical reasoning. Arguably, scientific agreement regarding natural disaster prevention (V17) and exposure to natural disasters (V8) reflected external responsibility and self-responsibility, respectively, but these items also reflected some degree of uncertainty and lack of control.

The predominant research perspective tends to treat individuals' cognitive processes occurring in a mental vacuum (Solberg et al., 2010); however, this thesis suggests a complex, interactive relationship between individuals' cognitive processes and the social environment. Two perspectives have been proposed in the literature to explain discrepancies in how immigrants and native-born individuals experience the disaster cycle – the cultural explanation and environmental (in)justice explanation. Interview results supplemented findings from the first study by demonstrating that both perspectives were valid in explaining the differences in immigrants and Canadian-born individuals' risk perception and disaster preparedness. The cultural explanation was most salient for non-European immigrants who believed in predetermined outcomes and trust in God. Interestingly, both European and non-European immigrants suggested that the timeline of experience as an immigrant or the "immigrant condition" in Canada shaped their risk perception and preparedness behaviours.



External responsibility for disaster management reflects that external sources are responsible for mitigating natural disaster risks. Interview findings revealed that these external sources were the “Canadian system” comprising of the Canadian citizens, communities, and government. Further, immigrants and Canadian-born individuals’ reliance on the Canadian system was due to the confidence in the positive social relationships which were rich with bonding, bridging, and linking social capital. The positive social environment also bolstered individuals’ confidence in the Canadian system’s collective preparedness. External responsibility for disaster management was associated with increased likelihood of compliance with evacuation recommendations and post-disaster search in immigrants and Canadian-born individuals. These findings make sense, given these during-preparedness behaviours require the emergency directives of others. Additionally, the second quantitative study showed that individuals living in a community with a high degree of neighbourhood contact and societal trust were more likely to perform during-disaster preparedness behaviours. Indeed, the literature shows that social factors are important in individuals’ decisions to evacuate and search-and-rescue behaviour (Aguirre, 1988; Airriess et al., 2008; Hawkins & Maurer, 2010; Parida, 2010; Shaw & Goda, 2004). The findings suggest that community social capital plays an important role as living in a community with a lack of neighbourhood contact and societal trust may hamper individuals’ during-disaster preparedness responses. Altogether, results suggest that immigrants and Canadian-born individuals who have strong external responsibility for disaster management beliefs are more likely to participate in during-disaster preparedness behaviours, especially when living in communities with strong neighbourhood contact and societal trust.

Two non-invariant beliefs related to external responsibility for disaster management were identified in the first quantitative study. The role of organizations was more salient in

immigrants compared to Canadian-born individuals, whereas the role of science and technology was more salient in Canadian-born individuals compared to immigrants. Interview results shed light on the context surrounding these non-invariant risk perception beliefs. The positive climate of reception experienced by immigrants in Canada may shape how they perceive the role of organizations in natural disaster risks and issues. Many immigrant participants drew from their positive settlement experiences to deduce that they would receive disaster help from the Canadian system which consequently lowered their risk perception and disaster preparedness. Further, many participants believed that Canada as a developed first world country owns modern science and technology that could help mitigate the risks – this may be more salient for Canadian-born individuals because this may be part of their social identity.

Self-preparedness responsibility reflected personal responsibility and control over natural disaster risks. The first quantitative study showed that self-preparedness responsibility was the only valid predictor of emergency planning which was a form of before-disaster preparedness behaviours. Indeed, research shows that individuals who feel personally responsible for disaster risks mitigation are more likely to value self-protective measures which in turn increase their propensity to uptake disaster preparedness (Lindell & Whitney, 2000; Terpstra & Gutteling, 2008). However, interview results revealed a paradox related to how individuals construe disaster preparedness. Immigrants and Canadian-born individuals generally agreed that disaster preparedness was important, although they did not consciously perform emergency planning. They explained that disaster preparedness was important “in theory”, but the context of daily life made actual preparedness impractical. Indeed, theorists have suggested that disaster preparedness needs to be relevant and easily implemented to daily life for individuals to uptake these behaviours (Becker, Paton, Johnston, & Ronan, 2012, 2013; Donahue, Eckel, & Wilson,

2014). Interview data showed that immigrants and Canadian-born individuals had other life priorities or “daily stressors” that hindered their uptake of disaster preparedness. That is, responding to a low probability event did not seem practical and logical for participants. Overall, the findings suggest that cultivating personal responsibility is insufficient because the social environment needs to be supportive of disaster preparedness. Individuals may be more likely to engage in disaster preparedness when it is part of the social-cultural practices during normal times (Heller et al., 2005; Solberg et al., 2010). Interestingly, self-preparedness responsibility was equivalent in immigrants and Canadian-born individuals as it did not contain any non-invariant risk perception beliefs. Therefore, findings suggest that immigrants and Canadian-born individuals share the same similar notion of self-preparedness responsibility for disaster preparedness.

Interestingly, the second quantitative study revealed that how societal trust predicted emergency planning was contingent on immigrant status. Canadian-born individuals were more likely to uptake emergency planning when living in a community with strong societal trust, while the reverse was true for immigrants. Moreover, long-term immigrants were more likely to reside in communities with strong societal trust which suggests that they are less likely to engage in emergency planning. Thus, findings suggest that immigrants may be more reliant on the community for disaster risks mitigation with increasing time spent in Canada. Conversely, communities with weak societal trust that are particularly inhabited by new immigrants may foster self-preservation to navigate the new social environment. Canada actively supports immigrants with the settlement process through an array of services (Government of Canada, 2014). Therefore, it is possible that immigrants may misconstrue the role of the Canadian system in disaster risk mitigation due to their timeline of experience in Canada. The positive

social environment may increase their risk complacency for emergency planning. Taken together, results suggest that cultivating self-preparedness responsibility is useful to increase individuals' emergency planning. However, the community's social environment and immigrant status of the receivers need to be considered as part of targeted and tailored risk communication and management. In specific, immigrants may be inclined to uptake emergency planning, but their efforts may be hampered if they live in a community with strong societal trust as they may not perceive the urgency of emergency planning.

Illusiveness of preparedness represented beliefs about fatalism, denial, and wishful thinking. The interview results showed that immigrants and Canadian-born individuals thought that disaster preparedness was illusiveness because one could not prepare for everything. This was related to risk uncertainties due to the gaps in existing risk communication and management as many individuals did not recall receiving any helpful information. Hence, the findings suggest that there is a lack of understanding and awareness regarding the "all-hazards" approach to disaster preparedness. Interestingly, immigrants were more likely to mention that disaster preparedness was illusive because it was costly and ineffective. Indeed, immigrant participants alluded to having to deal with housing issues, learning a new language, and securing employment as valuable. Therefore, immigrants may not see the value of disaster preparedness, given they tend to have more competing life demands.

The first quantitative study demonstrated that illusiveness of preparedness was associated with a lack of during-disaster preparedness in immigrants and Canadian-born individuals. Fatalism, denial, and wishful thinking are often associated with maladaptive behaviours due to individuals' perceived lack of control and increased uncertainty to mitigate the risks (Asgary & Willis, 1997; Becker et al., 2013; Grothmann & Reusswig, 2006). Thus, the findings suggest

that individuals who have strong illusiveness of preparedness beliefs do not feel confident in responding in a natural disaster. Interestingly, this risk perception dimension was not associated with a lack of before-disaster preparedness behaviour. Therefore, the findings suggest that cultivating self-preparedness responsibility in the Canadian public would be helpful in increasing emergency planning regardless of their illusiveness of preparedness beliefs. Furthermore, the second quantitative study showed that individuals living in communities with strong neighbourhood contact and societal trust were more likely to participate in during-disaster preparedness behaviours. Henceforth, mobilizing during-disaster preparedness behaviours, particularly for individuals with illusiveness of preparedness beliefs, should involve community-level interventions that flourish trust and neighbourhood support.

Three non-invariant risk perception beliefs related to illusiveness of preparedness were identified in the first quantitative study. The role of other people and the likelihood of reoccurrence were more salient in immigrants compared to Canadian-born individuals. The interview results showed that immigrants tended to state that social norms (i.e., nobody in Canada thinks or talks about natural disasters) affected their perceived low risk and urgency of disaster preparedness. Results suggest that immigrants may be more inclined to construe natural disaster risks and issues based on the social context. Since being new in a country is associated with a lack of hazard awareness (Carter-Pokras et al., 2007; Nepal et al., 2012), immigrants may be more likely to rely on social cues to evaluate natural disaster risks. Furthermore, the interview results showed that some immigrants, particularly those with non-European backgrounds, were more likely to believe that their fate in a natural disaster depended on God. This may explain why immigrants may believe that natural disasters may be less likely to reoccur. Conversely, the belief in fate was more salient in Canadian-born individuals compared

to immigrants. This may be due to the belief that natural disasters in Canada are rare events, and therefore, it would require “bad luck” to be affected by them as alluded to by a Canadian-born participant: “*Bad luck if you're involved, yeah*”.

Taken together, this thesis adds to the literature by demonstrating that individuals’ risk perception for natural disaster is beyond hazard characteristics. That is, it consists of three psychological dimensions related to risk perception beliefs. Further, these risk perception dimensions are valid predictors of preparedness behaviours. It demonstrates that the core three-factor structure is valid for immigrants and Canadian-born individuals with nuances for several risk perception beliefs. Importantly, it also adds to the literature by showing that the social environment plays a pivotal role in individuals’ risk perception and preparedness behaviours.

### **Community Social Capital in the Pre-Disaster Context**

Many studies on the psychological aspects of disaster preparedness tend to focus on individual-level cognitive processes (Solberg et al., 2010). This thesis extends the individual-level model by investigating social-environmental processes in disaster preparedness. The salutary role of social capital on individual and community health has been established in the literature (Kawachi et al., 2008; Kay & Johnston, 2007), although its impacts on individual behaviours before a natural disaster are unclear. Proponents of social capital have argued that social capital is salutary because trust, reciprocity, information channels, and social norms could facilitate individuals and communities to mobilize information and resources for disaster preparedness (Koh & Cadigan, 2008; Moore et al., 2004; Murphy, 2007, 2012). The findings of this thesis demonstrated positive and negative influences of social capital on disaster preparedness. The findings suggest that while individuals’ risk perception is important in predicting disaster preparedness, the community’s social environment may facilitate or impede

disaster preparedness. Therefore, increasing individuals' disaster preparedness may require a two-pronged approach – first, to address individuals' cognitive processes; and second, to foster a social environment that allows individuals to succeed in disaster preparedness.

The second quantitative study showed that community social capital, measured using neighbourhood contact and societal trust, was associated with immigrants and Canadian-born individuals' during-disaster preparedness behaviours that required a collective effort. The interview data showed that immigrants and Canadian-born individuals felt that they could rely on the Canadian system for help during a natural disaster. The “Canadian way” consists of an underlying thread of trust, solidarity, and benevolence amongst citizens and between the public and government. Interestingly, the interview results showed that neighbourhood organization, relation, and contact did not matter as much for participants as they felt that they would receive help from many sources outside of their immediate neighbourhoods. In fact, participants who had unfavourable views about their neighbourhood settings were still inclined to believe in the “Canadian way” because they felt a sense of belonging to the larger Canadian society. Then again, relying on sources outside of one's neighbourhood for help, particularly for post-disaster search, may be detrimental as help may be delayed. While immigrants and Canadian-born individuals were likely to have during-disaster preparedness behaviours because of the positive social environment, interview results showed potential flaws. Many participants did not know exactly where they would take temporary shelter during an evacuation as they did not consciously devise an evacuation plan, particularly amongst new immigrants. Additionally, many participants stated that they would need time to pack and figure things out during an evacuation. Therefore, the findings suggest that while the Canadian public may feel supported to

execute during-disaster preparedness behaviours, there may be challenges when they perform these behaviours.

Theoretically, social capital could be considered as a form of “disaster preparedness” as trust, reciprocity, information channels, and social norms could contribute to better disaster response and recovery. Then again, this thesis also demonstrated a perverse side to social capital. Interview results showed that the positive social environment produced risk complacency in individuals such that they were overconfident in the Canadian system to mitigate the risks. Social capital also provided a sense of safety and security, as well as perpetuated social norms that discouraged disaster preparedness. Accordingly, immigrants and Canadian-born individuals did not see natural disaster risks as valid and applicable for them to take actions. Additionally, immigrants may be more susceptible to the perverse effect of social capital as societal trust was negatively associated with emergency planning. During the interview, they reported that first responders were their main emergency contact. Therefore, immigrants may over-rely on the community for disaster risk mitigation. Taken together, the findings suggest that having strong social capital alone is not sufficient for disaster preparedness; on the contrary, it may be counterproductive if the social narrative surrounding natural disaster risks and issues does not support disaster preparedness. Indeed, some studies suggest that strong social capital may impede individuals’ disaster preparedness and evacuation because individuals may be inclined to transfer the responsibility for disaster mitigation to trusted others and be overconfident in the community’s capacity to address the post-disaster consequences (Babcicky & Seebauer, 2017; Becker et al., 2012; Brenkert-Smith et al., 2012; Buckland & Rahman, 1999; Hawkins & Maurer, 2010; Wolf et al., 2010). Therefore, risk communication and management need to address the social narrative related to natural disaster risks and issues as simply



providing information about the hazard is insufficient. The findings from the second quantitative study also suggest that meaningful and formal relationships as represented by community socializing were not important for disaster preparedness. Indeed, the interview participants explained that they did not need to have meaningful relationships, such as neighbourhood friendships, to receive help because of the “Canadian way”. Therefore, creating opportunities for mere contacts, such as hosting community events and constructing “third spaces”, may be helpful to increase disaster preparedness.

Altogether, this thesis adds to the literature by demonstrating the role of social capital in the pre-disaster context. It shows that social capital could act as a resilience factor and also a risk factor. It suggests that social capital is salutary for disaster preparedness only when the social narrative supports these practices. While individuals may feel confident in deploying during-disaster preparedness behaviours due to the positive social environment, the lack of conscious planning may deter the effectiveness of their response in actuality. Then again, some cautionary note should be mentioned regarding social capital. As discussed in the general introduction, social capital can accrue both productive and undesirable outcomes. Indeed, the findings of this thesis highlight the beneficial and perverse effects of social capital on natural disaster resilience and preparedness in immigrants and Canadian-born individuals. Therefore, integrating social capital into risk communication and management should be done with finesse. In particular, practitioners need to ensure that efforts to build social capital are not exclusionary, are helpful in achieving productive goals, and are not halting individual and community innovativeness. A second cautionary note is the allocation of resources to cultivate social capital in a community. This thesis does not condone that practitioners should only allocate resources to communities with weak social capital at the expense of communities with strong social capital.

Social capital is dynamic – it can be produced and destroyed. Hence, different forms of support should be given to all communities such that one is to cultivate social capital whereas the other is to preserve social capital. In addition, strong social capital does not protect individuals and communities from social and community issues that stem from macro-level social inequities. Social capital is not a panacea, and thus should be considered with a balanced perspective.

### **Immigrants and Natural Disasters: Defining Higher-Risk**

Immigrants are considered as a higher-risk population as previous natural disasters show that they suffer many negative post-disaster consequences (Canadian Red Cross, 2007; Scurfield, 2008). It has been postulated that immigrants' experience within the disaster cycle may differ from their native-born counterparts. Overall, the results showed that immigrants in Canada had some differences in their construal of natural disaster risks and issues compared to Canadian-born individuals, but both social groups were generally similar. They were similar in the level of risk perception dimensions, level of disaster preparedness, global representation of natural disaster risks, relationship between social capital and during-disaster preparedness behaviours. However, these social groups differed in the salience of five risk perception beliefs and the relationship between social capital and emergency planning. Further, interview results revealed several unique aspects in immigrants' lived experiences of natural disaster risks and issues in terms of illusiveness of preparedness beliefs, low hazard awareness, perceived resilience, mental preparedness, evacuation concerns, and overconfidence in first responders.

It is important to note that the immigrant samples in this thesis consisted of relatively privileged immigrants who shared many similar socio-demographic characteristics as their Canadian-born counterparts – that is, university or college educated, English-speaking, and European descent. Immigrant participants also had resided in Canada for a relatively long period

of time. These characteristics are often associated with better settlement experiences and integration outcomes (McCaffrey, 2008; Sakamoto et al., 2010; Schellenberg & Maheux, 2007). The similarities between the samples may have attenuated the group differences. Nevertheless, the findings underscore an important issue which is what it means to be “higher-risk” for immigrants. The discrepancy in experience within the disaster cycle often stems from social inequality that is associated with certain socio-demographic characteristics (Lemyre et al., 2009; Thomas et al., 2010). Hence, the lack of observed differences may be due to the sampling of relatively privileged immigrant subgroups. For instance, European immigrants are less likely to face discrimination as they possess characteristics that are considered to be “valuable” (Montreuil & Bourhis, 2001), whereas non-European immigrants are more likely to transition into “higher-risk” with increasing time spent in Canada (Health Canada, 2010). Immigrant status alone does not necessarily yield to differences in risk perception and disaster preparedness. Immigrants may experience inequities in the disaster cycle when they possess socio-demographic characteristics that mediate inequities (Andrulis et al., 2011; Collins, 2015; Flynn et al., 1994; Murphy et al., 2005; Olofsson & Rashid, 2011). That is, the immigrant status alone does not mediate inequities, but the cumulative unjust situations of individuals and groups increase their risks. Findings also showed that language and education were more important predictors of differences in risk perception compared to immigrant status. Hence, building human capital may be an important aspect to reduce inequities in the disaster cycle and increase uptake of disaster preparedness.

Another possible explanation for the lack of observed differences is the socialization of immigrants to the Canadian culture. As indicated by the interview data, the social narrative surrounding natural disaster risks and issues in Canada was the public did not consider natural

disasters as a valid and an applicable threat worthy of disaster preparedness. Additionally, interview results suggest that the positive social environment in Canada that is receptive to newcomers increases immigrants' confidence in the Canadian way. Bourhis et al. (1997) state that immigration and integration policies shape the "social psychological reality" of being an immigrant in the receiving society. Canada actively welcomes and supports immigrants with their settlement and integration through inter-culturally sensitivity and inclusive programming and policies (CBC News, 2014; Government of Canada, 2014). Evidently, immigrant participants in the qualitative study stated that they could rely on the "Canadian way" for help in a natural disaster which rendered their low level of risk perception and lack of disaster preparedness. Further, the lack of major natural disasters may detract the salience of disparities in risks as natural disasters touch on pre-existing strata of susceptibilities and ecological barriers to access the resources required to prepare, mitigate, respond, and recover adequately (Cutter, Carolina, Boruff, & Shirley, 2003; Donner & Rodriguez, 2008; Lemyre & O'Sullivan, 2013; Li et al., 2008; Scurfield, 2008).

There were several identified meaningful differences between immigrants and Canadian-born individuals that require psychosocial considerations for targeted and tailored risk communication and management. First, external sources and risk uncertainties may be more important in influencing immigrants' preparedness behaviours. Second, immigrants may misconstrue that they could rely on their communities for emergency planning, particularly amongst long-term immigrants. Long-term immigrants may be less likely to have someone search for them post-disaster and to evacuate as they are less likely to live in communities with strong neighbourhood contact. Third, immigrants may have low hazard awareness such as the type of natural disasters that could occur in Canada. Furthermore, they may be more likely to

believe that immediate and adequate relief will be provided in a natural disaster, particularly for new immigrants who may over-rely on first responders. The perceived sense of safety and security may instil a sense of risk complacency, especially to uptake disaster preparedness. Fourth, immigrants may perceive themselves to be resilient and mentally prepared due to their timeline of experience as an immigrant. While perceived resilience and mental preparedness may contribute to positive mental health and well-being, it may also contribute to the belief that disaster preparedness is not necessary.

This thesis contributes to the literature by providing some important insights for tailoring risk communication and management to the needs and concerns of immigrants. It suggests that increasing resilience and disaster preparedness in immigrants requires a focus on building social capital and also human capital. A cautionary note is the transferability of the findings of this thesis to other social groups. Social identity is intricate and multi-faceted which has complex implications on social positioning (Collins, 2015). Immigrants and Canadian-born individuals in this study were mostly privileged individuals (e.g., educated, European, and middle class who could afford access to a telephone or the Internet). Hence, their experiences with risks, resilience, and disaster preparedness may not necessarily represent more at-risk social groups (e.g., non-educated, visible minority, and lower class). As such, the validity of the proposed framework for other subgroups requires further population segmentation, particularly for immigrant subgroups that tend to have unique challenges such as refugees and language minorities. Finally, a caveat of these findings is these findings may only apply to the Canadian context as the immigrant condition depends on the state immigration and integration policies (Bourhis et al., 1997). Generalization of findings in this study and other studies to immigrants in another social-political context should be cautionary.

## Implications

**Recommendations for programming and policy.** Based on the findings of this thesis, risk communication and management aiming to increase disaster preparedness in immigrants and Canadian-born individuals could benefit from the following:

***Designing adequate risk messages.*** Findings of this thesis provide some important insights regarding the communicator (“who”), message (“what”), and channel (“how”) factors when designing risk messages. The dilemma of who is responsible for managing natural disaster risks and how risk uncertainties should be communicated were raised by participants. Indeed, this dilemma in risk communication and management has been reported elsewhere (Markon, Crowe, & Lemyre, 2013). Findings suggest that both immigrants and Canadian-born individuals consider communities, organizations, and the government as key stakeholders. Therefore, there should be clear messages about *who* is responsible for the risks and *what* actions are required for each stakeholder. Traditional risk communication and management tend to focus on educating the public about the risks by focusing on hazard characteristics (Fischhoff, 1995). While information about the hazard characteristics are important to inform the public what they are at-risk of, risk messages should also address what people believe about the risks. Therefore, the psychological dimensions of risk perception for natural disasters should be considered because they play an important role in individuals’ preparedness behaviours. Furthermore, risk messages should address the fallacies surrounding natural disaster risks and issues, particularly risk uncertainties surrounding illusiveness of preparedness beliefs such as the cost, purpose, and use of the all-hazards disaster preparedness. The findings also suggest that the social narrative and social norms play an important role in shaping individuals’ risk perception belief which in turn affected their preparedness behaviours. Therefore, social network and infrastructure are

important channels to disseminate risk messages. For instance, community-based disaster education may be an efficient approach to increase immigrants and Canadian-born individuals' situational awareness and engagement with disaster preparedness.

***Community-based programming.*** Community-based refers to the community as the context, target, resource, and agent for interventions (McLeroy, Norton, Kegler, Burdine, & Sumaya, 2003). Community-based disaster education involves collaborating with the members of a community to help design, implement, and assess risk communication and management to meet their specific needs and concerns. Disaster preparedness programme should be embedded in pre-existing social infrastructure (Murphy, 2007, 2012). Community-level interventions allow for better cultural adaptation to the needs and concerns of the communities. Therefore, a fundamental step is to identify “unit of solutions” within the community such as schools, workplaces, and immigrant-serving organizations. For instance, a school-based intervention involving disaster preparedness as part of a school assignment may be useful to encourage children to influence their households to uptake disaster preparedness. Community members should be considered as active agents of change. This may involve identifying community leaders that have influences on the target social group. Community members can provide insider knowledge and locate key information channels, and thus help identify barriers to and resources for adequate disaster preparedness. Successful community-based disaster education involves joint partnership, open exchange, and mutual responsibility amongst individuals, organizations, and government (Jardine & Driedger, 2014). Indeed, the Canada’s Platform for Risk Reduction and Sendai Framework for Risk Reduction put forth that disaster risk mitigation should be “people-centred” and “all-of-society engagement” (Public Safety Canada, 2016; United Nations, 2015).

Addressing the social environment is essential to create a context that is supportive of disaster preparedness. Successful community-based disaster education needs to consider existing social infrastructure at various ecological levels. The social-ecological system of risks and resilience shows a nested, multilevel system that is characterized by interrelated relationships (Lemyre & O'Sullivan, 2013). Given that the ecological systems are nested and interrelated, targeting one ecological level may have an impact on other ecological levels. Furthermore, community-based disaster education should include components of building a healthy, sustainable, and strong community infused with strong social capital and human capital (Bhandari et al., 2010). Designing architectural structures that support social interactions and funding community activities could help flourish social capital. These initiatives should also seek out the participation of higher-risk social groups that may not necessarily be connected to these resources to prevent further marginalization (Driedger, Cooper, Jardine, Furgal, & Bartlett, 2013; Murphy, 2012; Murphy et al., 2005). Further, addressing factors related to social inequities may help foster human capital which in turn could positively contribute to disaster preparedness and resilience. It is worth noting that despite the small percentage of variance explained by the social capital indicators, there are more gains than losses in building social capital as social capital is generally salutary to the health and well-being of individuals and communities which is the cornerstone of resilience (Kawachi et al., 2008; Kay & Johnston, 2007). Indeed, the 100 Resilient Cities initiative recognizes that building disaster resilient cities starts from addressing chronic stressors that weaken the social fabric of a community on a daily or cyclical basis (Rockefeller Foundation, 2017).

***Fostering Situational Awareness.*** Situational awareness is the processes involved in the understanding of factors that are critical for decision-making in a complex and dynamic



environment (Tremblay, 2004). In the context of risk communication and management, cultivating situational awareness by raising individuals and communities' awareness of the local hazards and resources should be part of disaster preparedness. Findings of this thesis suggest that new immigrants may be particularly at-risk of low situational awareness regarding the receiving community. One way to foster situational awareness is through mapping communities in terms of "soft spots" and assets by conducting vulnerability inventories (Lemyre et al., 2009). Vulnerability inventories allow individuals and disaster responders to take actions based on the knowledge about their communities in terms of hazard sites (e.g., flood zones), community resources (e.g., immigrant-serving centres and shelters), and at-risk social groups or individuals (e.g., individuals living alone who may lack social support networks). Another means to increase situational awareness is to clear the public's misunderstandings and address knowledge gaps about natural disaster risks and issues through "adequate" risk messaging. Fischhoff et al. (2011) state that risk messages should meet the standard of materiality which includes containing accessible and comprehensible information that allows for effective decision-making by the target group. Situational awareness should also be raised at the community-level by getting community members to engage with their communities. Community engagement through volunteering has been found to increase individuals' knowledge about their communities such as meeting other residents and learning about the resources available in the community (Lai & Hynie, 2010). Success in raising situational awareness requires active engagement, collaboration, and open exchange amongst various stakeholders.

***Introducing "all-resourcefulness" to the "all-hazards" approach.*** The "all-hazards" approach to disaster preparedness involves preparing for and responding to all manmade, technological, and natural threats (Office of Public Health Preparedness and Response, 2013).

While an important practice to cultivate in individuals and communities, findings suggest that individuals do not see the incentive of disaster preparedness when they are perceived to be irrelevant to the present context of their daily lives. That is, other life priorities or “daily stressors” often get in the way of individuals performing preparedness behaviours successfully. Therefore, disaster education needs to reframe “all-hazards” preparedness behaviours as part of a social-cultural practice of being “all-resourcefulness” to cope with daily stressors. This involves demonstrating that a step that is useful for a low probability emergency is also useful for a high probability daily stressor. For instance, having a designated person to pick up your children should you become unavailable in a disaster (a low probability, foreign stressor) is also useful when you are unavailable due to a schedule conflict (a high probability, daily stressor). Another example is knowing your neighbours is useful for evacuation during a disaster, as well as when you need someone to watch your house while you are away. The “all-resourcefulness” aspect underscored by participants in this thesis is analogous to the “no regrets” approach to disaster risk adaptation and preparedness that is utilized in the climate change sector (De Loe, Kreutzwiser, & Moraru, 2001; J. B. Smith, Ragland, & Pitts, 1996). According to the “no regrets” approach, preparedness behaviours need to have current and future benefits even if the disaster does not happen. Further, these preparedness behaviours need to be embedded in current useful practices. Henceforth, individuals are more likely to uptake these preparedness behaviours because they perceive these actions as accruing immediate benefits to them. To this end, researchers and practitioners need to first understand the social-cultural practices of the target social group – that is, what is the normative way a particular social group responds to daily stressors, and how can we reframe disaster education to be relevant to the context of the target social group’s daily life. This approach aligns with the “people-centred” and “multi-hazards”

aspects of disaster risk mitigation which are part of Canada's Platform for Risk Reduction and Sendai Framework for Risk Reduction (Public Safety Canada, 2016; United Nations, 2015).

When individuals perceive these preparedness behaviours to be relevant and accessible to their daily lives, they are more likely to perform these behaviours, as one participant says: *I do have in the winter like things in the car just in case you're caught for safety. Especially because I have children, a child* (long-term immigrant). Ultimately, this may change the social norms such that adopting disaster preparedness as being all resourceful is part of life.

***Culturally-adapted disaster education for immigrants.*** The culturally-adapted approach involves modifying features of a generic programme that are identified to be important and unique for the target group (Castro, Barrera, & Holleran Steiker, 2010). Findings of this thesis suggest that immigrants and Canadian-born individuals could benefit from a basic risk communication and management strategy with cultural modifications of specific features. Immigrants and Canadian-born individuals differed in five risk perception beliefs, the influence of societal trust, their hazard awareness, their perceived risk uncertainties related to illusiveness of preparedness beliefs, their perceived resilience and mental preparedness, their reliance on first responders, and their evacuation concerns. Furthermore, immigrants were more likely to use informal sources, whereas Canadian-born individuals were more likely to use formal sources. The immigrant condition and culture have implications on how immigrants construe natural disaster risks. Therefore, psychosocial considerations are important when designing a risk communication and management strategy for immigrants. Then again, it is important to note that the findings suggest that immigrants and Canadian-born individuals want similar aspects to risk management – people-centred, multi hazards, and all-of-society engagement. Taken together, policy and programming aiming to increase disaster preparedness in these social groups should

focus on identifying unique needs and concerns and similarities between immigrants and Canadian-born individuals to create complementary yet differentiated initiatives.

*Timeline considerations.* The timing to educate immigrants about natural disaster risks and issues should be at their early stage of the settlement process such as in orientation workshops. Since it is common for immigrants to have many competing life demands during the early stage of settlement, preparedness recommendations should highlight that the “all-resourcefulness” aspect is relevant and economical for settlement. For instance, new immigrants tend to seek social connections at the early phase of settlement, so disaster education could encourage them to assemble an emergency supply kit at a community networking event with long-term residents and other new immigrants. A challenge is to transform these findings into meaningful activities, particularly when the immigrant population is a diverse social group. Methods to address this challenge are to recruit community leaders to validate and tailor the existing framework to their communities. Implementing the “all-resourcefulness” aspect for immigrants will require an understanding of their social-cultural practices from their reference points and how these processes interact with the Canadian social environment. For example, immigrants may be less likely to uptake emergency planning if an aspect of their culture involves strong beliefs in natural disasters as an act of God. Evidently, success in designing and implementing culturally-adapted disaster education for immigrants require a community-based approach and support from the immigrant communities.

*Considerations for other social groups.* While not the main research agenda of this thesis, findings have identified other social groups that may require further considerations for targeted and tailored risk communication and management. Correlation analyses from the second quantitative study (see Table 12, pp. 122) showed several moderately strong correlations

( $r_s \approx .20$ ) that may be worth investigating in future research. First, level of education and household income were negatively correlated with illusiveness of preparedness beliefs. Thus, the findings suggest that individuals with low socio-economic status are more likely to uphold illusiveness of preparedness beliefs which in turn could reduce their likelihood of during-disaster preparedness behaviours. Second, male gender and older age were associated with a lowered likelihood of during-disaster preparedness behaviours. Therefore, the findings suggest that men and the elderly are less likely to evacuate and have someone search for them post-disaster. Finally, time in Canada as an immigrant was positively associated with societal trust but negatively associated with neighbourhood contact. Hence, the findings suggest that long-term immigrants are less likely to have emergency planning as they are more likely to live in communities with strong societal trust. Further, they are less likely to comply with evacuation recommendations because they are less likely to live in communities with strong neighbourhood contact. Taken together, the findings suggest that these socio-demographic factors should be taken into further considerations for targeted and tailored risk communication and management.

**Implications for research.** This thesis has four important contributions to risk research:

*Insights on natural disaster risk perception and behaviours.* Studies on how individuals perceive natural disaster risks tend to focus on hazard characteristics which is a limited way to conceptualize how lay individuals perceive risks. This thesis offers a multi-dimensional approach to how individuals perceive natural disasters with a focus on the beliefs related to the risks. A fundamental approach to changing human behaviours is to understand and change the underlying beliefs (Fischhoff et al., 2011; Rosenstock, 1974). This thesis shows that beliefs about norms, responsibility, and control play an important role in individuals' decisions to uptake disaster preparedness. Moreover, this thesis provides important insights that different

psychological dimensions predict different forms of preparedness behaviours. Therefore, it outlines which pathway of influence researchers and practitioners could use to induce behaviour change. Cross-cultural risk research tends to perform national comparisons of social groups' risk perception (see Renn & Rohrman, 2000). The identification of risk perception beliefs that differ by immigrant status contributes to cross-cultural risk research by demonstrating core similarities and specific differences of social groups living in the same country. There may be other risk perception beliefs that are yet to be discovered given the modest Cronbach's alpha of the risk perception dimensions. Therefore, future research should consider examining other risk perception beliefs.

***A better understanding of the timeline of the immigrant condition and risk inequities.***

Despite the negative consequences immigrants tend to experience from natural disasters (Fothergill et al., 1999; Perilla et al., 2002; Scurfield, 2008; Webster et al., 1995), research on how immigrants experience the disaster cycle is sparse. This thesis provides a better understanding of the individual-level cognitive processes and social-environmental factors in shaping immigrants' preparedness behaviours in Canada which is an understudied topic. According to intersectionality theory, social positions are experienced based on the simultaneous combination of various social categories (Collins, 2015). This thesis offers an important insight that the immigrant status does not necessarily yield to differences in risk perception and disaster preparedness when the immigrant status intersects with "valued" socio-demographic characteristics. While valued characteristics could be physical characteristics that are resistant to change, valued characteristics could also be instilled by cultivating human capital and social capital. Indeed, results showed that education and language explained differences in risk perception more than immigrant status alone, thus suggesting the importance of the social

environment to help immigrants achieve these needs. A common thread amongst immigrants is the positive social environment instilled immigrants' beliefs about whether they are at-risk of natural disaster and the assistance they would receive from the Canadian society. Therefore, results suggest the importance of the timeline of experience during immigration in shaping immigrants' risk perception and disaster preparedness. This thesis underscores that the social environment of the receiving society, the immigrant condition, and culture altogether shape how immigrants construe natural disaster risks and issues. While the positive social environment may act as a resilience factor, it may also produce risk complacency in immigrants. Therefore, the findings suggest that future research should test the framework in this thesis by further population segmentation and employ longitudinal research to better understand how the timeline of experience interacts with risk perception and behaviours. The growing number of refugees, visible minority immigrants, and language minority immigrants in Canada suggest that these immigrant subgroups require further examinations regarding how they perceive and respond to natural disaster risks. Finally, this thesis provides a methodological process that demonstrates how researchers could test for group similarities and differences in latent psychological dimensions of risk perception using factor analyses which is a robust test of group invariances. Therefore, future research examining group differences could benefit from the method employed in this thesis.

***Insights on the influence of social capital in the pre-disaster context.*** Research on the influence of social capital in the pre-disaster context is relatively sparse compared to the post-disaster context. This thesis contains the first study to-date to demonstrate the relationship between community social capital and individuals' disaster preparedness in the Canadian context. It offers an important insight on how an ecological-level factor can influence

individuals' preparedness behaviours. Accordingly, it provides important lessons about how practitioners could intervene at the ecological-level to improve immigrants and Canadian-born individuals' disaster preparedness in addition to targeting individual-level cognitive processes. This thesis also provides an important insight that social capital is not a panacea for all social groups. Depending on the local context and social groups, social capital may have perverse effects. In specific, immigrants who are less likely to uptake emergency planning when community societal trust is strong suggests a need for culturally-adapted risk communication and management. Research on group differences in the effect of social capital is relatively scarce; therefore, this thesis contributes to a better understanding of social capital by immigrant status. Finally, a key methodological contribution is this thesis shows how social capital indicators could be clustered for a meaningful analysis. The complexity of the definition of social capital and measurement inconsistencies have resulted in a plethora of social capital indicators (Kawachi et al., 2008; Kay & Johnston, 2007). This thesis shows a viable way to group key social capital indicators into meaningful components – that is, connections at the neighbourhood-level, interactions at the community-level, and trust at the societal-level. Future research on disaster preparedness should explore how these social capital indicators function in other community settings and social groups. Future research should also explore other aspects of community social capital that may be relevant for disaster preparedness.

***Further considerations for the psychosocial approach – a social-ecological perspective.***

Research on disaster preparedness has mainly focused on cognitive processes (Lindell & Whitney, 2000; Solberg et al., 2010). This thesis supports a shift in risk paradigm towards a more systemic approach to understanding risks and behaviours. It demonstrates that the interaction between the individual factors and the social- environmental factors shape how



immigrants and Canadian-born individuals perceive and respond to natural disaster risks. Therefore, interpretation of studies that solely examine individual-level cognitive processes should be within the context of the social environment where the studies are conducted. A psychosocial approach provides a comprehensive way to look at risks and behaviours while recognizing the complexity of human experiences. Furthermore, this thesis provides a system thinking to increase individuals' disaster preparedness using the social-ecological model. The application of the social-ecological approach to disaster preparedness is sparse. The social environment is a complex system; hence, a social-ecological perspective provides a cogent way to organize abstract concepts of this system. Expanding on the work of Gibson, (2013) and Lemyre and O'Sullivan (2013), the final qualitative study provides insights on the factors within the ecological levels that may impact individuals' risk perception and disaster preparedness (see Figure 6, pp. 160). Finally, this thesis offers important insights how the social environment of the receiving society plays a key role in how immigrants perceive and respond to natural disaster risks. While theorists have long recognized that risk inequities experienced by immigrants stem from the social environment (Lemyre et al., 2009; Satterfield et al., 2004; Thomas et al., 2010), this thesis identifies the factors, processes, and relationships involved in shaping immigrants' risk perception and disaster preparedness. Future studies should expand on the system approach as the model may not capture all the social-environmental factors that facilitate and hinder preparedness behaviours.

**Revised conceptual model.** The findings of this thesis helped refine the social-ecological system of risks and resilience model (Gibson, 2013; Lemyre & O'Sullivan, 2013). The revised model is presented in Figure 7.

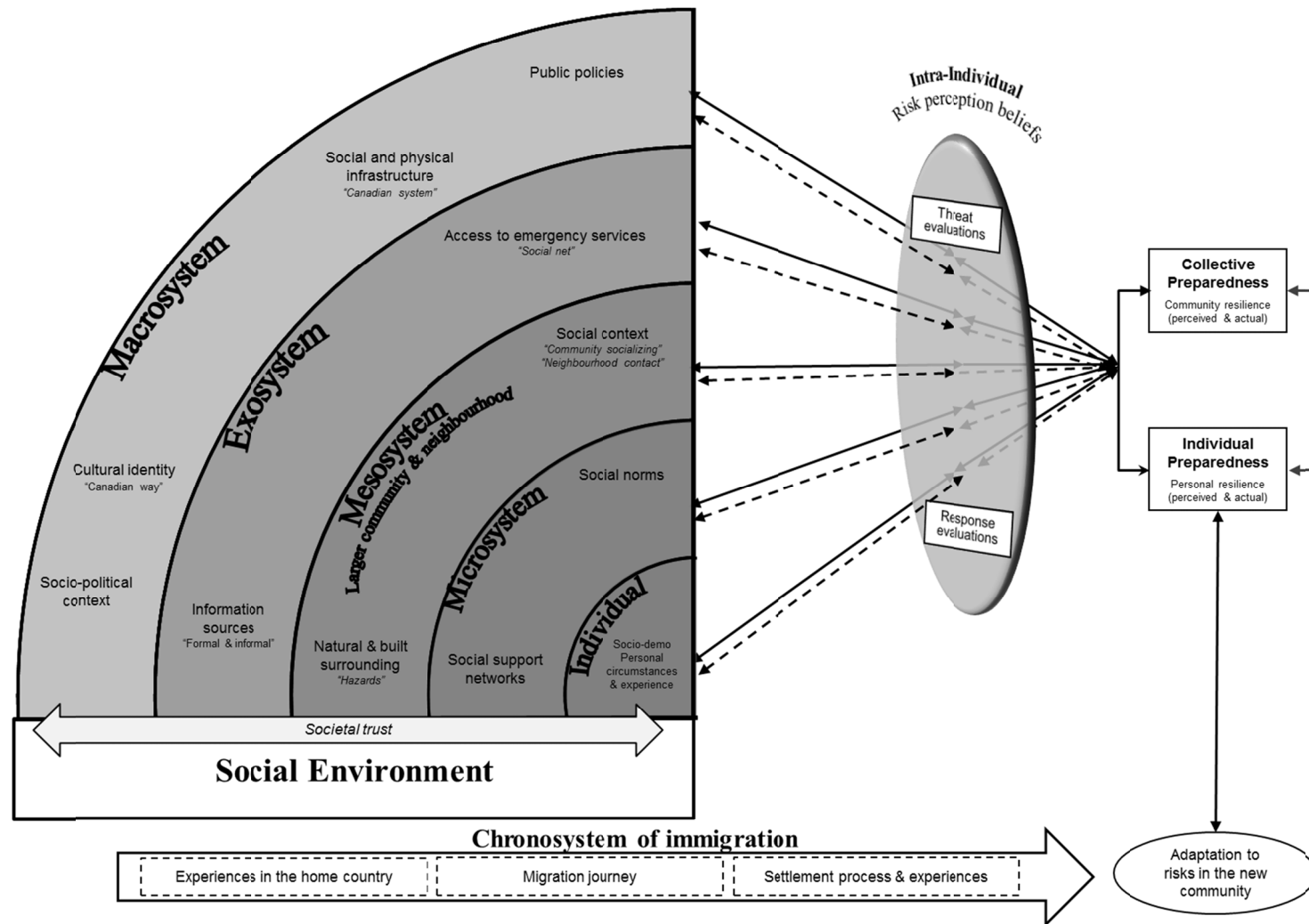


Figure 7. A revised Social-Ecological System of Risks and Resilience (SESRR)

This Social-Ecological System of Risks and Resilience (SESRR) asserts that resilience and disaster preparedness are a function of the property and characterization of the relationship and interconnectedness of the nested, multilevel system of components and mechanisms. The bidirectional relationship between the ecological systems and preparedness is partially mediated by intra-individual factors.

Based on the findings of this thesis, the natural and built surroundings and the larger community context are added to the mesosystem. Next, access to emergency services is defined as the “social net” and both formal and informal information sources are acknowledged at the exosystem. At the macrosystem, cultural identity, social and physical infrastructure, and public policies are included. Societal trust spans across the multilevel ecological systems. Aspects of social capital – specifically, societal trust, community socializing, and neighbourhood context – are embedded in the model. While not all aspects of social capital are included in the diagram, this model does acknowledge that social capital is a multifaceted concept and may manifest as vertical and horizontal ties at all ecological levels as bridging, bonding, and linking social capital. Intra-individual factors include risk perception beliefs as part of threat evaluation and response evaluation. In terms of preparedness at both the individual- and collective- level, perceived preparedness and actual preparedness matter. To represent immigrants’ experiences with risks and preparedness, the chronosystem was added to the model. The chronosystem of immigration represents the trajectory of the immigration condition over time. These processes altogether impact immigrants’ adaptation to risks in the new community which in turn is connected to their disaster preparedness and resilience.

The SESRR proposes that the experience of risks, preparedness, and resilience are socially constructed through the interaction between the individual and social environment like

other social-cultural models of risks (e.g., Dake, 1991; Douglas & Wildavsky, 1983; Kahan et al., 2007; Kasperson et al., 1988; Renn & Benighaus, 2016). However, there are some important differences between the SESRR and other social-cultural models of risks. First, this model describes the relationships within the model as more complex than a linear, unidirectional relationship. Second, a main focus of the SESRR is that it explains how risk perception impacts behaviours whereas other social-cultural models of risks do not explain behaviours. Third, the SESRR explains the social construction of risks, preparedness, and resilience through a nested, multilevel structure involving social-cultural and contextual-structural factors and processes. Finally, the SESRR has been empirically tested and supported which suggests that it does not share the same drawback of other social-cultural models of risks which tend to have concepts that may not be empirically testable. Taken together, the SESRR represents the notion that individuals and communities preparedness and resilience are embedded in mutually constitutive social-ecological systems.

### **Limitations**

The findings of this thesis provide important contributions to the theoretical and applied aspects of risk research. This thesis used two national surveys involving large samples of Canadians that were representative of the population by age, gender, and region. The percent of variance explained by the full model was substantial (up to 30%), given the complexity of predicting human behaviours (Lindell & Hwang, 2008; McFarlane, McGee, & Faulkner, 2011). Furthermore, this thesis used a mixed-method approach – triangulation of quantitative data and qualitative data provide an in-depth understanding of the topic and increase the validity of the results. Nonetheless, there were some methodological challenges that should be discussed.

First, the national surveys were subjected to limitations inherent to cross-sectional survey design. Cross-sectional design provides a snapshot of the phenomena at a specific time, although perceptions, behaviours, and social processes are often dynamic. Furthermore, a cross-sectional design does not allow us to delineate causality of the relationships. However, it is important to note that demonstrating correlational relationships is useful to attest whether the relationships exist. As the temporality and causality of the relationships could not be delineated, the observed relationships might have been attenuated. Therefore, future research could benefit from a longitudinal design to document the temporal and causal nature of these relationships. Although the samples in the national surveys were representative of the Canadian public, the sampling frame was biased towards individuals who had landlines and Internet access to participate in the surveys. These individuals may also be more inclined to participate in studies that were sponsored by federal agencies. Furthermore, the Territories of Canada were not part of sampling frame because of the sampling density, different services and jurisdictions, and different social-cultural paradigm which would deserve its own investigation.

Second, the national survey studies were designed to assess a number of topics with the collaboration of several researchers. Hence, the competing aims and needs of different researchers resulted in a survey questionnaire that was less ideal for this thesis. In specific, the natural disaster risks and issues section in the National Survey of Health Risk Perception (NSHRP) 2012 was limited by the number of items. Items that were removed could be important for this thesis. For example, the modest Cronbach's alphas of the risk perception dimensions could be due to the insufficient numbers of items and exclusion of meaningful items. While the design of the items was based on previous studies (Lee & Lemyre, 2009; Markon et al., 2011), it is important to recognize that these studies were not on natural disasters. Therefore,

the items used in this thesis may not have captured all the important beliefs that are unique to natural disaster risks. However, the studies used to generate these items were the best starting point given that other studies on risk perception tend to focus hazard characteristics.

Similarly, the second quantitative study was a secondary analysis of the General Social Survey-Social Identity (GSS-SI) 2013 as it was conducted by Statistics Canada for purposes outside this thesis. Consequently, the concepts, items, and rating scales were less ideal for this thesis. For instance, the selection of the social capital indicators was limited by what was available in the GSS-SI 2013. Since the GSS-SI 2013 was not designed to be an ecological neighbourhood study, the sample size by geographic unit was limited which led to the use of Census Divisions as the “smallest” geographic unit. This may account for the small proportion of explained variance of the social capital indicators when aggregating large geographic units (Prouse, Ramos, Grant, & Radice, 2014). Furthermore, the limited sample size by geographic unit, particularly for the immigrant sample, also precluded the use of hierarchical linear modelling (HLM; Huta, 2014). HLM is a more robust test to parcel out individual- and group-level effects on disaster preparedness. Despite the limitations above, significant findings were demonstrated in the analyses from the quantitative studies suggesting that the reported effect size may be conservative. Further, given the dearth of studies on this topic, this thesis provides insightful bases to help advance this topic.

Third, social capital and social environment are broad and abstract concepts with many definitions. Therefore, there is a variety of measures for these concepts in the literature. These measurement inconsistencies made the selection of indicators for the quantitative studies challenging as it may not capture all the indicators of these concepts that could be relevant for disaster preparedness. However, this limitation was addressed by the qualitative study as the

codes and categories that emerged from the data provided information on other social-environmental factors that were important for disaster preparedness and risk perception. Therefore, future research should quantitatively establish the interrelated pathways identified by the qualitative study.

Fourth, the qualitative study used to provide contextual explanations and meanings was conducted in Ottawa. Ottawa is a relatively affluent city as it is the national capital of Canada. Therefore, its social environment may be more positive compared to other cities in Canada. Given that risk inequities in the disaster cycle stem from the social environment, it is important for future research to examine how residents from less affluent areas construe natural disaster risks and issues. Furthermore, past exposure to natural disasters in Ottawa was relatively minor at the time of the studies were conducted. The frequently cited natural disasters were earthquakes and the Ice Storm of '98, although interview participants did not experience any severe negative consequences from these events. Hence, future qualitative research should investigate areas with more recent major natural disasters to better understand the relationships amongst risk perception, the social environment, and disaster preparedness. While generalizability is not the goal of qualitative research, conducting qualitative interviews with participants from different areas would help us to gain a breadth of lived experience.

Finally, the immigrant samples in this thesis faced several limitations. Since the NSHRP 2012 was not designed to gather the experiences of immigrants in Canada, the sample size was relatively small ( $n = 163$ ). Although a sample size of 163 is reasonable for most psychological studies (Marszalek, Barber, Kohlhart, & Holmes, 2011), it reduces power, especially for complex statistical models. A caveat was the non-significant and small interaction effects observed in the first two studies may be due the lack of power as continuous-categorical interactions often

require a larger sample size (Aguinis, 2004). Therefore, these studies should be replicated using a larger sample size for immigrants. As discussed, HLM could not be performed as the number of immigrants at the group-level did not meet the minimum requirements, given the complexity of the model in this thesis. Additionally, the immigrant sample predominantly consisted of educated English-speaking European immigrants who had resided in Canada for a relatively long period. These characteristics are expected for national surveys as the designs of these surveys (e.g., only available in English or French) often sample for immigrants with these characteristics. Therefore, immigrants that were part of this thesis represent relatively privileged immigrants who could speak in one of the official languages, have reasonable literacy skills, and have a university education. Furthermore, the immigrant sample shared many similarities with the Canadian-born sample (e.g., predominantly from households with income less than \$50,000 annually and urban dwellers). This may explain why the observed differences were modest when compared to the Canadian-born sample. This limitation was addressed by the final qualitative study as the immigrant sample was more diverse as participants were balanced by ethnocultural background and time in Canada, although the sample only included immigrants who were fluent in English. However, the limitations of the immigrant sample do not discount the value of this thesis as it offers two important lessons: (1) immigrant status alone does not necessarily yield to different experiences in the disaster cycle, and (2) culture and the immigrant condition shape how immigrants perceive and respond to risks. Given the dearth of risk research on immigrant subgroups, future research should test the validity of the model with further population segmentation.

It is important to note that the findings of this thesis may only be valid for natural disasters and possibly not so for all other hazards. Research shows that lay individuals do



evaluate a variety of natural hazards and manmade hazards differently (e.g., Lee, Lemyre, Legault, Turner, & Krewski, 2008; Sjoberg, 2000; Slovic et al., 1982). Since hazards are perceived to have different characteristics, they are likely to differ in the psychosocial processes and implications. For instance, the 2001 U.S. Anthrax attacks roused mistrust towards public health authorities amongst African American postal workers due to the inconsistency in testing and treatment regimes (Blanchard et al., 2005). Mistrust and lack of confidence towards public health authorities eventually spread to other ethnic minority communities (Eisenman et al., 2004). The Anthrax disaster touched on pre-existing social discourse about racial or ethnic discrimination, community inequalities, and trust and confidence towards the U.S. government. Likewise, the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 roused social discourse about Chinese communities and immigration in Canada and the United States (Leung, 2008; Person et al., 2004). SARS disaster had a racial undertone which resulted in racial profiling of the disease. Chinese and Southeast Asian communities faced stigma, prejudice, and discrimination which resulted in negative social, political, and economic impacts. It is possible that the positive social environment and its implications on natural disaster risks and issues alluded to by participants could be because of the “perceived benignity” of natural disasters in Canada. Participants may consider natural disasters as random natural killers, and thus all individuals are presumed to be equally affected. Hence, it is important for future research to investigate the psychosocial processes and implications of other types of hazards.

Despite these limitations, the overall contributions of this thesis are to have documented the underlying psychological dimensions of risk perception for natural disasters in the Canadian context. It showed the importance of risk perception beliefs, social capital, and the broader social environment in explaining both immigrants and Canadian-born individuals’ preparedness

behaviours. It illustrated the similarities and differences in how immigrants and Canadian-born individuals conceptualized natural disaster risks and issues. Importantly, it explained the complex dynamics of immigration and adaptation to natural disaster risks in the Canadian context. Taken together, this thesis contributes to the field of risk research and management and help advance risk communication and management for natural disasters at least in the Canadian context.

## **Conclusion**

The overarching goal of this thesis was to understand how risk perception for natural disasters and the social environment explained immigrants' disaster preparedness compared to the general Canadian-born population. The intended contribution was to promote disaster preparedness and resilience through better risk communication and management strategies. The three research objectives were successfully achieved such that how immigrants perceive and respond to natural disaster risks were investigated and refined using a social-ecological perspective. Further, comparisons were made between immigrants and Canadian-born individuals which provided a better understanding of important similarities and differences to help inform culturally-adapted risk communication and management.

This thesis helps provide a better context to help understand how immigrants and Canadian-born individuals perceive and respond to natural disaster risks. This thesis also helps shift the risk paradigm to a more ecological perspective, particularly the role of social capital in the pre-disaster context. Therefore, the findings contribute to the area of psychology, risk, and public health. Importantly, the findings provide important and useful insights for further advancement in policy and practice for effective risk communication and management strategies. In specific, the findings may help advance the priorities for action set forth by Canada's Platform

for Risk Reduction, Sendai Framework for Risk Reduction, and 100 Resilient Cities (Public Safety Canada, 2016; Rockefeller Foundation, 2017; United Nations, 2015). Successful application of these findings should begin by designing an experimental study to test the effectiveness of culturally-adapted risk communication, and then followed by designing a quasi-experimental study to test a community-based intervention. These steps would help advance findings of this thesis to an applied setting.

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Appendix A: The National Survey of Health Risk Perception (NSHRP) 2012 – Natural Disaster  
Risks and Issues Case Study

Only items that are part of this thesis are included below.

**Phone intro:**

*Good morning/afternoon/evening. My name is \_\_\_\_ I'm calling from EKOS Research Associates. We have been hired by Dr. Lemyre and the Institute of Population Health at the University of Ottawa to conduct a survey on various health risks facing Canadians. It will likely take about 20 to 25 minutes and will help with the scientific understanding of how Canadians perceive health risks and what seems acceptable or unacceptable to them. Your participation is anonymous. While results of the study will be published, no one individual's responses to the questions will be shared. All data will be tabulated and maintained by the researchers in accordance with research ethics confidentiality standards. The questions are general and you do not have to reveal any information you do not want to. There are no right or wrong answers. We only want your opinion. As with all other surveys conducted through Probit, as a token of our appreciation Probit will enter you into our monthly draw for \$1000 and you will earn \$2 charity dollars. Do I have your consent to continue with this telephone interview? Or do you prefer we call you back later?*

**Web intro:**

*EKOS Research Associates have been hired by Dr. Lemyre and the Institute of Population Health at the University of Ottawa to conduct a survey on various health risks facing Canadians. It will likely take about 20 to 25 minutes and will help with the scientific understanding of how Canadians perceive health risks and what seems acceptable or unacceptable to them. Your participation is anonymous. While results of the study will be published, no one individual's responses to the questions will be shared. All data will be tabulated and maintained by the researchers in accordance with research ethics confidentiality standards. The questions are general and you do not have to reveal any information you do not want to. There are no right or wrong answers. We only want your opinion. As with all other surveys conducted through Probit, as a token of our appreciation Probit will enter you into our monthly draw for \$1000 and you will earn \$2 charity dollars.*

*A few reminders before beginning: On each screen, after selecting your answer, click on the "Continue" button at the bottom of the screen to move forward in the questionnaire. If you leave the survey before completing it, you can return to the survey URL later, and you will be returned to the page where you left off. Your answers up to that point in the survey will be saved. If you have any questions about how to complete the survey, please call Probit at 866.211.8881 or send an email to [online@probit.ca](mailto:online@probit.ca). Thank you in advance for your participation.*

---

**SEX**

ONLINE: Are you ...

PHONE: Record gender of respondent (DO NOT ASK)...

Male ..... (1)

Female ..... (2)

### Q3

ONLINE: Which of the following age categories do you belong?

PHONE: Before we begin, I have one question to ask you for classification purposes only. In which of the following age categories do you belong?

Under 18 ..... (1) → screened out

18-24 ..... (2)

25-34 ..... (3)

35-44 ..... (4)

45-54 ..... (5)

55-64 ..... (6)

65 or older ..... (7)

### PREQ7

ONLINE: Evaluation of health issues can be complex. People have various opinions about the conditions and issues that apply to health risks. The following lists a series of statements and ask how much you agree with each statement. Tell us how much it reflects your own personal opinion using the same 5-point agreement scale.

PHONE: Evaluation of health issues can be complex. People have various opinions about the conditions and issues that apply to health risks. I am going to read you a series of statements and ask how much you agree with each statement. Tell me how much it reflects your own personal opinion. We will be using the same 5-point agreement scale again. If you would like me to repeat it, just let me know.

### Q7Z

The likelihood that I will experience a natural disaster depends on where I live

Do not agree at all ..... (1)

Agree a little bit ..... (2)

Agree somewhat ..... (3)

Agree quite a bit ..... (4)

Agree completely ..... (5)

Don't know /no opinion ..... (99)

### PREQ10A (1/3 Sample)

If... ROTQB = 1

ONLINE: In the next section is a list of statements about natural disasters. We would like to know how much you agree with each statement. Tell us how much it reflects your own personal opinion.

PHONE: In the next section, I am going to read you a list of statements about natural disasters. I am going to ask how much you agree with each statement. Tell me how much it reflects your own personal opinion. We are going to use the same 5-point agreement scale.

Do not agree at all ..... (1)  
 Agree a little bit ..... (2)  
 Agree somewhat ..... (3)  
 Agree quite a bit ..... (4)  
 Agree completely ..... (5)  
 Don't know /no opinion ..... (99)

[illegible]

	1	2	3	4	5	99
hours after a natural disaster.						
<b>Q10AP:</b> Information about natural disasters is confusing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Q10AQ:</b> It is difficult to predict the occurrence of natural disasters.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Q10AR:</b> Scientists usually agree about how to prevent natural disasters.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Q10AS:</b> Organizations such as workplaces and schools should help people learn about disaster preparedness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Q10AT:</b> It is unlikely that I will be a victim of a natural disaster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Q10AU:</b> It is an individual's responsibility to be prepared for a major natural disaster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Q10AVZ:</b> I discuss with others the information I get on preparing for natural disasters.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

ONLINE: Now in order to categorize the responses, we will need some general information about you. All of the following information is confidential.

PHONE: Now in order to categorize the responses, I need some general information about you. I will treat all of the following information as confidential.

### Q10

In which education category do you belong?

- Some/completed elementary school ..... (1)
- Some/completed high school ..... (2)
- Some/completed community college (CEGEP in Quebec) ..... (3)
- Some/completed university ..... (4)
- Some/completed graduate school ..... (5)
- Would prefer not to say ..... (99)

### Q12

In which of the following classifications does your total household income fall before taxes?

- Less than \$50,000 ..... (1)
- \$50,000 to less than \$60,000 ..... (2)
- \$60,000 to less than \$80,000 ..... (3)
- \$80,000 to less than \$100,000 ..... (4)
- \$100,000 to less than \$150,000 ..... (5)
- \$150,000 to less than \$200,000 ..... (6)
- \$200,000 or more ..... (7)
- Don't know/no opinion ..... (99)
- Would prefer not to say ..... (98)

**Q13**

Is your residence located in a rural or urban area?

Urban ..... (1)

Rural ..... (2)

Would prefer not to say ..... (3)

**Q16**

Were you born in Canada?

Yes ..... (1)

No ..... (2)

Would prefer not to say ..... (9)

NO, Q16 → If... Q16 = 2

**Q17**

What year did you first come to live in Canada? \_\_\_\_\_

Would prefer not to say ..... (9)

**Q18**

To which ethnic or cultural background(s) did your ancestors belong? \_\_\_\_\_

An ancestor is usually more distant than a grandparent.

Phone interviewer note: As a prompt you can use, "For example, Canadian, English, French, Chinese, East Indian, Italian, German, Scottish, Irish, Cree, Mi'kmaq, Salish, Métis, Inuit, Filipino, Dutch, Ukrainian, Polish, Portuguese, Greek, Korean, Vietnamese, Jamaican, Jewish, Lebanese, Salvadorean, Somali, Colombian, etc.) / For example, Canadian, English, French, Chinese, East Indian, Italian, German, Scottish, Irish, Cree, Mi'kmaq, Salish, Métis, Inuit, Filipino, Dutch, Ukrainian, Polish, Portuguese, Greek, Korean, Vietnamese, Jamaican, Jewish, Lebanese, Salvadorean, Somali, Colombian, etc. Specify as many origins as are applicable.

Would prefer not to say ..... (99)

**Q19**

What language do you speak most often at home?

English ..... (1)

French..... (2)

Other – please specify: ..... (97)

Would prefer not to say ..... (99)

**Q20**

How long have you resided in your neighbourhood? Please specify as a unit of years or months (e.g. 2 months, 3 years...etc.): \_\_\_\_\_

Would prefer not to say ..... (99)

**Q23**

Could you please provide your postal code? \_\_\_\_\_

## Appendix B: Notice of Ethical Approval

Ethics approval was renewed during the duration of the thesis studies.

File Number: H12-02-08B

Date (mm/dd/yyyy): 03/01/2012



**Université d'Ottawa**  
Bureau d'éthique et d'intégrité de la recherche

**University of Ottawa**  
Office of Research Ethics and Integrity

### Ethics Approval Notice

### Health Sciences and Science REB

**Principal Investigator / Supervisor / Co-investigator(s) / Student(s)**

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Louise	Lemyre	Social Sciences / Psychology	Principal Investigator

**File Number:** H12-02-08B

**Type of Project:** Professor

**Title:** Risk Perception: Trends and Key Factors

<b>Approval Date (mm/dd/yyyy)</b>	<b>Expiry Date (mm/dd/yyyy)</b>	<b>Approval Type</b>
03/01/2012	02/28/2013	Ia

(Ia: Approval, Ib: Approval for initial stage only)

**Special Conditions / Comments:**  
N/A

File Number: H12-02-08B



Date (mm/dd/yyyy): 03/01/2012

**Université d'Ottawa** **University of Ottawa**  
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement and other applicable laws and regulations in Ontario, has examined and approved the application for ethical approval for the above named research project as of the Ethics Approval Date indicated for the period above and subject to the conditions listed the section above entitled "Special Conditions / Comments".

During the course of the study the protocol may not be modified without prior written approval from the REB except when necessary to remove subjects from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the study (e.g. change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, information/consent documentation, and/or recruitment documentation, should be submitted to this office for approval using the "Modification to research project" form available at:  
[http://www.rges.uottawa.ca/ethics/application\\_dwn.asp](http://www.rges.uottawa.ca/ethics/application_dwn.asp)

Please submit an annual status report to the Protocol Officer 4 weeks before the above-referenced expiry date to either close the file or request a renewal of ethics approval. This document can be found at:  
[http://www.rges.uottawa.ca/ethics/application\\_dwn.asp](http://www.rges.uottawa.ca/ethics/application_dwn.asp)

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5841 or by e-mail at: [ethics@uOttawa.ca](mailto:ethics@uOttawa.ca).

**Signature:**

Catherine Paquet  
Director  
For Daniel Lagarec, Chair of the Sciences and Health Sciences REB

### Appendix C: Supplemental Materials (Article 1)

#### Risk Perception and Disaster Preparedness in Immigrants and Canadian-Born Adults: Analysis of a National Survey

#### **Natural Disaster Risks and Issues Items in the National Survey of Health Risk Perception (NSHRP) 2012**

In the NSHRP 2012, respondents reported their level of disaster preparedness for five behaviours (see Table 18) and their level of agreement with 18 risk perception beliefs (see Table 19).



**Table 18***Descriptives for Disaster Preparedness Items (NSHRP 2012)*

Disaster preparedness item	<u>Full sample</u> <u>(N = 1,089)</u> <i>M (SD)</i>	<u>Canadian-born</u> <u>(n = 921)</u> <i>M (SD)</i>	<u>Immigrant</u> <u>(n = 163)</u> <i>M (SD)</i>
P1: I discuss with others the information I get on preparing for natural disasters.	2.64 (1.28)	2.64 (1.27)	2.66 (1.31)
P2: I have an emergency supply kit for natural disasters.	2.29 (1.47)	2.31 (1.48)	2.13 (1.37)
P3: I have an evacuation plan for natural disasters.	2.15 (1.32)	2.16 (1.32)	2.10 (1.33)
P4: In case of a natural disaster, I would comply with recommendations to evacuate.	4.31 (0.88)	4.31 (0.89)	4.31 (0.82)
P5: I know people who would search for me within 48-hours after a natural disaster.	3.68 (1.41)	3.72 (1.40)	3.48 (1.48)

**Table 19***Descriptives for Risk Perception Belief Items (NSHRP 2012)*

Risk perception belief item	Full sample	Canadian-born	Immigrant
	( <i>N</i> = 1,089) <i>M</i> ( <i>SD</i> )	( <i>n</i> = 921) <i>M</i> ( <i>SD</i> )	( <i>n</i> = 163) <i>M</i> ( <i>SD</i> )
V1: It is unlikely that I will be a victim of a natural disaster based on where I live.	3.82 (1.13)	3.82 (1.13)	3.80 (1.18)
V2: It is an individual's responsibility to be prepared for a major natural disaster.	3.65 (1.08)	3.68 (1.07)	3.48 (1.14)
V3: Preparation is useless to protect oneself from natural disasters.	1.75 (1.07)	1.74 (1.07)	1.80 (1.10)
V4: Science and technology help ensure that we are prepared for natural disasters.	3.36 (1.05)	3.37 (1.03)	3.30 (1.13)
V5: Organizations should help people learn about disaster preparedness.	3.95 (1.01)	3.93 (1.02)	4.10 (0.92)
V6: Fate will decide if I am in a natural disaster.	2.60 (1.45)	2.58 (1.46)	2.69 (1.41)
V7: It is the government's responsibility to plan effectively for natural disasters.	3.87 (1.02)	3.87 (1.01)	3.89 (1.06)
V8: The main thing that determines my exposure to natural disaster risks is what I myself do.	2.86 (1.23)	2.87 (1.20)	2.79 (1.38)
V9: The negative consequences of natural disasters can be decreased by being well prepared.	3.99 (0.98)	3.98 (0.98)	4.06 (1.00)
V10: If a natural disaster has recently occurred, it is less likely to happen again soon.	1.91 (1.09)	1.89 (1.07)	1.97 (1.20)
V11: Natural disasters have many negative consequences besides property damage and death.	4.19 (0.99)	4.17 (1.02)	4.32 (0.90)
V12: When the people I like worry about a natural disaster I am more likely to worry as well.	2.58 (1.22)	2.57 (1.22)	2.62 (1.25)
V13: Even if I didn't understand why, I would likely follow the recommendations from government authorities during a natural disaster.	3.76 (1.05)	3.756 (1.05)	3.80 (1.07)
V14: The benefits of preparing for a natural disaster outweigh the costs.	3.60 (1.15)	3.59 (1.14)	3.64 (1.20)
V15: Information about natural disaster is confusing.	2.39 (1.16)	2.40 (1.17)	2.35 (1.14)
V16: It is difficult to predict the occurrence of natural disasters.	3.70 (1.13)	3.70 (1.12)	3.69 (1.18)
V17: Scientists usually agree about how to prevent natural disasters.	2.37 (1.11)	2.37 (1.10)	2.36 (1.16)
V18: It is unlikely that I will be a victim of a natural disaster.	2.83 (1.26)	2.85 (1.25)	2.73 (1.29)

### **Factor Analyses Results for the Psychological Dimensions of Risk Perception for Natural Disasters**

**Exploratory Factor Analysis.** The purpose of the Exploratory Factor Analysis (EFA) was to hypothesize the number of underlying factors. We performed EFA using principal axis factoring extraction and oblimin rotation using a randomly-derived 50% subsample of the Canadian-born sample ( $n_I = 460$ ). Initial solutions involved the removal of four items below the .32 factor-loading cut-off. Final EFA solution revealed three factors with Eigenvalues above 1.0, at least three significant item loadings ( $> .32$ ) per factor, and most items reaching adequate communalities of .20 (see Table 20). The inter-scale correlations were low to moderate with an average inter-scale correlation of .16 suggesting reasonably distinct factors.

**Table 20***EFA for Risk Perception Beliefs in Canadian-Born*

Item	F1: External responsibility for disaster management	F2: Illusiveness of preparedness	F3: Self- preparedness responsibility	<i>h</i> <sup>2</sup>
V5: Organizations should help people learn about disaster preparedness.	<b>.66</b>	-.01	-.15	.40
V7: It is the government's responsibility to plan effectively for natural disasters.	<b>.55</b>	-.09	.18	.39
V13: Even if I didn't understand why, I would likely follow the recommendations from government authorities during a natural disaster.	<b>.54</b>	.03	-.08	.28
V17: Scientists usually agree about how to prevent natural disasters.	<b>.43</b>	.19	.09	.26
V4: Science and technology help ensure that we are prepared for natural disasters.	<b>.41</b>	-.05	.20	.26
V12: When the people I like worry about a natural disaster I am more likely to worry as well.	<b>.36</b>	.14	-.02	.16
V11: Natural disasters have many negative consequences besides property damage and death.	<b>.35</b>	-.09	.11	.17
V3: Preparation is useless to protect oneself from natural disasters.	-.03	<b>.61</b>	-.06	.37
V10: If a natural disaster has recently occurred, it is less likely to happen again soon.	-.03	<b>.59</b>	.24	.38
V6: Fate will decide if I am in a natural disaster.	.14	<b>.39</b>	-.09	.19
V8: The main thing that determines my exposure to natural disaster risks is what I myself do.	-.05	.18	<b>.55</b>	.31
V2: It is an individual's responsibility to be prepared for a major natural disaster.	< .01	-.03	<b>.53</b>	.28
V9: The negative consequences of natural disasters can be decreased by being well prepared.	.17	-.15	<b>.51</b>	.37
V14: The benefits of preparing for a natural disaster outweigh the costs.	.25	-.11	<b>.34</b>	.25
Eigenvalue	2.04	1.02	1.49	
% Variance explained (Total = 29.0)	16.4	7.4	5.3	
Inter-scale correlation				
F1: External responsibility	-	.09 <sup>†</sup>	.33***	
F2: Illusiveness of preparedness		-	-.06	
F3: Self-preparedness responsibility			-	

*Note.* V1 ("where I live"), V15 ("information is confusing"), V16 ("difficult to predict"), and V18 ("unlikely a victim") were excluded from the final EFA solution because they were below the .32 factor loading cut-off.

<sup>†</sup>*p* = .05. \*\*\**p* < .01.

**Confirmatory Factor Analysis.** To validate the EFA results, we performed Confirmatory Factor Analysis (CFA) using maximum likelihood with robust estimator on the remaining 50% Canadian-born subsample ( $n_2 = 461$ ). Given there were some evidence of univariate (i.e., skewness values ranged from -1.15 to 1.39, and kurtosis values ranged from -1.28 to 1.03) and multivariate non-normality (i.e., Mardia's coefficient of 15.60), adequate model fit was evaluated using Satorra–Bentler  $\chi^2$  scaled statistic ( $S-B\chi^2, p > .05$ ), robust Comparative Fit Index ( $*CFI \geq .90$ ), and robust Residual Mean-Square Error of Errors ( $*RMSEA < .10$ ; [Bentler, 1990]). Mis-specified parameters were identified using Lagrange Multiplier (LM,  $p < .001$ ). Post-hoc model fitting was done in an iterative fashion with the significant change in  $S-B\chi^2$  ( $p < .05$ ) and  $\Delta*CFI \geq .01$  to maintain model parsimony (Byrne, 2008; Cheung & Rensvold, 2002). The initial model fit was:  $S-B\chi^2 (74) = 176.53, p = 0.01, *CFI = .82$ , and  $*RMSEA = .06$  [95% CI (.048, .070)]. We added two cross-loadings (i.e., V8 [“what I myself do”] to F2 [“Illusive”] and V17 [“scientists usually agree”] to F2 [“Illusive”]) and an error covariance (i.e., E8-E2) according to LM test statistics. After adjustment of some parameters in the initial solutions, the model achieved an acceptable fit:  $S-B\chi^2 (71) = 108.31, p = 0.01, *CFI = .93$ , and  $*RMSEA = .04$  [95% CI (.021, .049)]. The final Canadian-born baseline model is presented in Figure 4 (pp. 70).

**Multi-Group Confirmatory Factor Analysis.** We used Multi-Group Confirmatory Factor Analysis (MGCFA) to test for cross-cultural measurement invariance and assess the degree of cultural modification required to a generic model (Byrne, 2008). Immigrant respondents were used as the comparison group, whereas Canadian-born respondents were used as the reference group. We first estimated the immigrant baseline model according to the Canadian-born model. The initial model fit was:  $S-B\chi^2 (71) = 91.80, p = 0.05, *CFI = .93$ , and

\*RMSEA = .05 [95% CI (.003, .071)]. LM statistics suggest adding a cross-loading for V12 (“people I like worry”) and F2 (“Illusiveness”). CFA revealed an adequate-fit:  $S-B\chi^2(70) = 77.39, p = .25$ , \*CFI = .98, and \*RMSEA = .03 [95% CI (.000, .058)]. The final immigrant baseline model is subsumed in Figure 4 (pp. 70).

First, we tested for configural equivalence. Results revealed evidence for configural equivalence in the model:  $S-B\chi^2(141) = 185.93, p = 0.01$ , \*CFI = .95, and \*RMSEA = .03 [95% CI (.019, .047)]. Therefore, the same pattern of free and fixed parameter was applicable to both groups suggesting that the factor structure was comparable across both groups. The subsequent model provided evidence for measurement non-equivalence ( $\Delta S-B\chi^2 = 46.34, \Delta df = 26, p < .05$ ,  $\Delta^*CFI = .02$ ) such that the V6 (“fate will decide”) factor loading on F2 was significantly higher in Canadian-born individuals and V5 (“organization should help”) factor loading on F1 was significantly higher in immigrants compared to their counterparts. After releasing the equality constraints for these non-invariant factor loadings, measurement equivalence was assumed:  $S-B\chi^2(170) = 213.01, p = 0.01$ , \*CFI = .95, and \*RMSEA = .031 [95% CI (.015, .043)]. That is, all non-standardized factor loadings were comparable across groups. Subsequent models provided evidence for structural equivalence ( $\Delta S-B\chi^2 = 2.44, \Delta df = 2, p > .05, \Delta^*CFI < .001$ ) suggesting that factor variances and covariance were equivalent across groups. Finally, scalar equivalence, the most stringent test of group invariance, was achieved ( $\Delta S-B\chi^2 = 13.56, \Delta df = 9, p > .05, \Delta^*CFI < .01$ ). However, examination of LM test statistics revealed V4 (“science and technology”) item intercept was significantly larger in Canadian-born individuals and V10 (“less likely to happen again”) factor loading on F2 (“Illusive”) was significantly higher in immigrants compared to their counterparts. After releasing the equality constraints for these non-invariant parameters, instrument equivalence was assumed:  $S-B\chi^2(179) = 220.70, p = 0.02$ , \*CFI = .95,

and \*RMSEA = .031 [95% CI (.015, .043)]. All other equality constraints were tenable indicating that all other parameters were statistically invariant across both groups. The overall results met the minimum requirements for partial measurement invariance.

#### Appendix D: Supplemental Materials (Article 2)

### Community Social Capital and Individual Disaster Preparedness in Immigrants and Canadian-Born Individuals: An Ecological Perspective

#### **Natural Disaster Risks and Issues Items in the National Survey of Health Risk Perception (NSHRP) 2012**

In the National Survey of Health Risk Perception (NSHRP) 2012, respondents reported their level of disaster preparedness for five behaviours and their level of agreement with 18 risk perception beliefs (see Table 21). The scale calculation was explained in the previous study (Yong et al., 2017b).



**Table 21***Disaster Preparedness and Risk Perception (NSHRP)*

Item	Scale type	Scale calculation
Individual disaster preparedness	5-point rating scale:	Emergency planning factor – Mean of P1, P2, P3
P1: I discuss with others the information I get on preparing for natural disasters.	1 = Do not agree at all, 5 = Agree completely	
P2: I have an emergency supply kit for natural disasters.		
P3: I have an evacuation plan for natural disasters.		
P4: In case of a natural disaster, I would comply with recommendations to evacuate.		P4 and P5 were used as single-item indicators.
P5: I know people who would search for me within 48-hours after a natural disaster.		
Psychological dimension of risk perception for natural disasters	5-point rating scale:	External responsibility for disaster management – Mean of B3, B6, B7, B9
B1: It is an individual's responsibility to be prepared for a major natural disaster.	1 = Do not agree at all, 5 = Agree completely	
B2: Preparation is useless to protect oneself from natural disasters.		
B3: It is the government's responsibility to plan effectively for natural disasters.		
B4: The main thing that determines my exposure to natural disaster risks is what I myself do.		Illusiveness of preparedness – Mean of B1, B2, B9
B5: The negative consequences of natural disasters can be decreased by being well prepared.		
B6: Natural disasters have many negative consequences besides property damage and death.		
B7: Even if I didn't understand why, I would likely follow the recommendations from government authorities during a natural disaster.		Self-preparedness responsibility – Mean of B1, B4, B5, B8
B8: The benefits of preparing for a natural disaster outweigh the costs.		
B9: Scientists usually agree about how to prevent natural disasters.		

*Note.* See Yong et al. (2017b).

**Social Capital Indicators from the General Social Survey – Social Identity (2013)**

We used indicators that tapped into the individual approach and collective approach of social capital (see Table 22 and Table 23).

**Table 22***Social Capital Indicators based on the Individual Approach (GSS-SI)*

Item	Scale type	Scale calculation
<p>Social networks</p> <p>Strong ties – SCF_Q102: Of these close friends, how many live in the same city or local community as you?</p> <p>Weak ties – CWF_Q20: Of these other friends, how many live in the same city or local community as you?</p>	Continuous	SCF_Q102 and CWF_Q20 were treated as single item indicators.
<p>Social network diversity</p> <p>Think of all the friends you had contact with in the past month, whether the contact was in person, by telephone, by text or by email. Of all these people:</p> <p>SCG_Q120: How many have the same mother tongue as you?</p> <p>SCG_Q130: How many come from an ethnic group that is visibly different from yours?<sup>a</sup></p> <p>SCG_Q150: How many are the same sex as you?</p> <p>SCG_Q160: How many are around the same age group as you?</p> <p>SCG_Q170: How many have roughly the same level of education as you?</p> <p>SCG_Q190: How many have a similar level of household income as you?</p>	5-point rating scale: 1 = All, 5 = None	Mean score of six items.
<p>Contact with friends</p> <p>CWF_Q30: How often did you see [any of your friends/your friend]?</p> <p>CWF_Q40: How often did you talk with [any of your friends/your friend] by telephone?</p> <p>CWF_Q45: How often did you communicate with [any of your friends/your friend] by text message?</p> <p>CWF_Q50: How often did you communicate with [any of your friends/your friend] by email or by Internet?</p>	6-point rating scale: 1 = Not in the past month, 6 = Everyday	Summative score of four items.
<p>Neighbourhood social support</p> <p>QIN_Q10: Would you say that you know...?</p> <p>QIN_Q50: About how many people in your neighbourhood do you know well enough to ask for a favour?</p>	<p>QIN_Q10 – 4-point rating scale: 4 = None of the people in your neighbourhood, 1 = Most of the people in your neighbourhood</p> <p>QIN_Q50 – 4-point rating scale: 4 = None, 3 = 1 to 5, 2 = 6 to 10, 1 = Over 10</p>	QIN_Q10 and QIN_Q50 were treated as single-item indicators.

*Note.* a = Reverse coded.

**Table 23***Social Capital Indicators based on the Collective Approach (GSS-SI)*

Item	Scale type	Scale calculation
Generalized trust PCT_Q10: Generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?	PCT_Q10 – Dichotomous: 1 = You cannot be too careful in dealing with people, 2 = Most people can be trusted	PCT_Q10 was treated as a single-item indicator.
Social trust TIP_Q15: How much do you trust people in your neighbourhood? TIP_Q25: How much do you trust strangers?	TIP_Q15, TIP_Q25 – 5-point rating scale: 1 = Cannot be trusted at all, 5 = Can be trusted a lot	Mean score of TIP_Q15 and TIP_Q25.
Trust in neighbours TNP_Q10: Would you say that you trust...?	TNP_Q10 – 4-point rating scale: 1 = Nobody in your neighbourhood, 4 = Most of the people in your neighbourhood	TNP_Q10 was treated as a single-item indicator.
Strategic trust If you lost a wallet or purse that contained two hundred dollars, how likely is it to be returned with the money in it, if it was found by.... RLM_Q10: someone who lives close by? RLM_Q15: a police officer? RLM_Q20: a stranger?	RLM_Q10, RLM_Q15, RLM_Q20 – 3-point rating scale: 1 = Not at all likely, 3 = Very likely	Mean score of RLM_Q10, RLM_Q15, and RLM_Q20.
Volunteering VCG_Q300: In the past 12 months, did you do unpaid volunteer work for any organization? VCG_Q310: On average, about how many hours per month did you volunteer?	VCG_Q300 – Dichotomous: Yes or No  VCG_Q310 – 4-point rating scale: 1 = 15 hours or more per month, 2 = Between 5 and less than 15 hours per month, 3 = Between 1 and less than 5 hours per month, 4 = Less than 1 hour per month	VCG_Q300 and VCG_Q310 were used to create a single-item indicator, called “frequency of volunteering”: 1 = Non-volunteer, 2 = Less than 1 hour per month, 3 = Between 1 and less than 5 hours per month, 4 = Between 5 and less than 15 hours per month, 5 = 15 hours or more per month.

**Descriptives of Predictors and Outcome Variables**

Multivariate Analyses of Covariance (MANCOVAs) using Pillai's criterion on the predictors and outcomes variables revealed no significant difference in these variables between immigrants and Canadian-born individuals, controlling for socio-demographic covariates:  $ps > .05$  (see Table 24).

**Table 24***Outcome Variables and Predictors by Immigrant Status*

Variable	Canadian-born <i>M (SD)</i>	Immigrant <i>M (SD)</i>
Outcome variable		
Individual disaster preparedness <sup>a</sup>		
Emergency planning	2.40 (1.08)	2.27 (1.07)
Intent to evacuate	4.31 (0.89)	4.29 (0.83)
Post-disaster search	3.72 (1.40)	3.45 (1.48)
Predictor		
Individual risk perception dimension <sup>a</sup>		
External responsibility for disaster management	3.53 (0.65)	3.59 (0.65)
Illusiveness of preparedness	2.33 (0.70)	2.32 (0.80)
Self-preparedness responsibility	3.54 (0.73)	3.51 (0.83)
Community social capital <sup>b</sup>		
Societal trust	.02 (.28)	-.01 (.24)
Community socializing	.02 (.20)	.07 (.16)
Neighbourhood contact	< .01 (.27)	.10 (.16)

*Note.* MANCOVAs:  $p > .05$ . a = Detailed MANCOVA results were reported in the previous

study (Yong et al., 2017b). b = Standardized factor scores ( $M = 0$ ,  $SD = 1$ ) aggregated at the

Census Division-level and covariates were ethnicity, language, age, and education. The attached

custom data (Table 24) at the CD-level is provided for use in accordance with the terms and

conditions of the Statistics Canada Open License Agreement hereby attached. Source: Statistics

Canada Postal Code<sup>OM</sup> Conversion File (2013) which is based on data licensed from Canada Post Corporation.

## Appendix E: Qualitative Study Interview Guide (Article 3)

**Community engagement and unexpected events or risks that may impact the individual, family, and community****INTRODUCTION**

*[Researcher introduces him-/her-self]*

The aim of this interview is to understand how members of the general public participate in a community and think if they can rely on the people they know in their community during an unexpected event that may impact themselves, their families, and their community. Importantly, I am interested in your personal opinion and experience – there are no right or wrong answers – to these questions.

The interview should take approximately 1 hour. The interview will be audio-recorded and handwritten notes will be taken. In conformity with the Research Ethics Board of the University of Ottawa guidelines, the interview and results collected will remain entirely confidential. Your participation is completely voluntary – there will be no consequences now or in the future attached to your decisions to skip any question, refuse to participate, and end the interview at any time of your participation.

*[Provide two copies of consent form]*

To give you an idea how the interview will proceed, the interview will be on the neighbourhood where you live and how you can rely on your community during an emergency.

Do you have any questions before we begin?

**FACESHEET**

<b>Date</b>		<b>Participant ID</b>	
<b>Start time</b>		<b>End time</b>	
<b>Recording</b>			

Before we begin, tell me about yourself

\*age, education, gender, household income, rural/urban, parent and age of youngest child, nativity (and year first come to live in Canada), ethnic or cultural background, home language

**THEMES AND QUESTIONS**

**Neighbourhood context:** *[I would like to know about the area where you live. So...]*

1. Could you describe the area where you live?
2. What are some of the likes or dislikes about the area where you live? \*Ottawa
3. Would you be able to trust the people here?
4. How socially connected do you feel with the people here?

**Unexpected events/natural disasters and disaster preparedness:** *[Sometimes, you, your*

*family and your community may be affected by an unexpected event or emergency. In this situation, you may need to rely on the help of others. I will now ask you questions on 'natural disasters' as an example of an unexpected event – this questions will be mostly on what you think about natural disasters in general, what you might do if a natural disaster happens in the area where you live in Canada, and who you can rely on for help if something like this were to happen in Canada. Everyone's experience with natural disasters such as floods and earthquakes is different, and people have different opinions. Would it be okay with you if I ask you some questions about this? We will be focusing on your time in Canada.]*

1. Have you ever thought about the possibility of a natural disaster affecting you in the next 5, 10, or 15 years? \*magnitude, worry, coping
2. Would you say that you are someone who is prepared for a natural disaster? \*importance
3. Is there something about you, your life circumstances, or about where you live that affect your preparedness?
4. List of behaviours... what is preparedness like for you in your home country?
5. What are some of the things that could be done to help you prepare?
6. Would you be ready to evacuate for a week or more if asked by authorities? \*shelter, belongings

*[People may receive information on natural disasters, such as information on the type of natural disasters in Canada, household preparedness plan, etc., from various sources such as newspapers, friends and family, public officials, etc....]*

1. Do you recall any messages you may have received about natural disasters?
2. Did the messages affect you in any way?
3. Do you recall receiving any type of resources for disaster preparedness?

*[Thinking of others you know and your community...]*

1. Have you ever thought about the possibility of a natural disaster affecting the area where you live? \*Ottawa
2. Would the people here be able to handle a natural disaster? \*people you know
3. Who would you be able to ask for help?
4. How would these people be able to help you? \*search for you within 48-hour, lend you 1000\$ emergency fund
5. Who would be isolated from help? \*Someone you know

## **CONCLUDING REMARKS**

We are at the end of the interview.

- Do you have any questions or anything else to add?

Thank you for your time. The information that you have provided is very important to better understand community health and well-being.

- Are you interested in the results from this study?

Once again, thank you for your participation.

\*Probes