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ARTICLE

Disaster Awareness and Preparedness Among Older Adults in Canada Regarding Floods, Wildfires, and Earthquakes

Evalyna Bogdan[1] · Rachel Krueger[3] · Julie Wright[3] · Kyle Woods[2,3] · Shaieree Cottar[2,3]

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Abstract

Older adults are significantly impacted by natural hazards and disasters that are exacerbated by climate change. Understanding their awareness and preparedness is essential for enhancing disaster resilience. This study investigated the attitudes, actions, and recommendations of older adults regarding natural hazards that pose risks in their geographic area—specifically floods, wildfires, and/or earthquakes in Canada. Methods for this study included survey and focus groups with older adults (n = 161 and n = 10, respectively) and other high-risk groups from across Canada, that are vulnerable to these natural hazards. The main findings from this study are that current awareness and preparedness among older adults is low, though stronger perceptions of risks are associated with risks specific to geographic locations where respondents live. Several barriers, such as hazard vulnerability misperceptions, cost-related reasons, and lack of hazard awareness have resulted in low awareness and preparedness among these populations. The two main recommendations arising from this research are: (1) improve awareness and preparedness with tailor-made emergency preparedness materials for older adults; and (2) adopt community-based approaches to disaster preparedness through existing community groups to strengthen social connections with a focus on locally specific hazards. The findings from this research can be applied to other hazards, including heatwaves and pandemics.

Keywords Canada · Community-based disaster risk management · Disaster awareness and preparedness · Disaster resilience · Natural hazards · Older adults

1 Introduction

Canada is experiencing an increase in the severity and frequency of natural hazards, in part due to human-induced climate change (Bush and Lemmen 2019). Across Canada, changes in extreme weather events and natural hazards are exposing more communities to intensifying floods, wildfires, extreme heat, droughts, coastal erosion, and storms, leading to a rise in disasters (PSC 2021). Disasters are disruptions to a community's or society's functioning; the extent of the disruption is dictated by the social and physical characteristics of a community (UNDRR n.d.a). In this research, we focused on three natural hazards of particular concern to Canadians: floods, wildfires, and earthquakes.

In 2014, the Survey of Emergency Preparedness and Resilience in Canada (SEPR) study was conducted with 32,171 Canadians from 10 provinces (Taylor-Butts 2015).[1] The SEPR found that an estimated 12.4 million Canadians aged 15 and above had endured a significant emergency or disaster in their local area during their life (Ibrahim 2016). Approximately 73% of the respondents expressed that the incident greatly interrupted their normal daily activities. Despite that almost three-quarters of respondents had experienced such disruptions, less than half were disaster prepared (Taylor-Butts 2015). The low level of preparedness is especially concerning among Canadians who are considered at high risk: "seniors; persons with a disability; [I]ndigenous communities; medically dependent persons;

✉ Evalyna Bogdan
ebogdan@yorku.ca

1 School of Administrative Studies, Disaster and Emergency Management Program, York University, Toronto, Ontario M3J 1P3, Canada

2 Department of Geography and Environmental Management, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

3 Partners for Action, Faculty of Environment, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

[1] The SEPR study's target population included all persons 15 years of age or older, and excluded full-time residents of institutions (for example, nursing homes, group homes, hospitals) (Taylor-Butts 2015).

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low-income Canadians, persons with lower levels of educational attainment, women-only households, newcomers, and cultural minorities already vulnerable" (PSC 2021, para. 7).[2] Existing disparities in income, health, and equity lead to disproportionate impacts of disasters on these high-risk populations, especially older adults (McDermott-Levy et al. 2019; Melton et al. 2023).

Older adults, often defined as people 65 years and older, are a high-risk population because of existing social and age-related challenges, leading to increased vulnerability and negative consequences in the wake of disaster (O'Sullivan et al. 2012; Bunker et al. 2016; Oostlander et al. 2022). Although the disproportionate impact of natural hazards on older populations has been well-documented in the scholarly literature, most of the research was conducted outside of Canada. There is limited literature in the Canadian context on disaster awareness and preparedness that provides analysis by age and includes older adults, and was conducted within the last decade as the impacts of climate change have worsened. The report by the Canadian Red Cross and National Institute on Ageing (CRC and NIA 2020) is worth noting because it briefly summarizes the findings on a few Canadian disasters between 1998 and 2020 and their impact on older adults. Furthermore, both academic research (Melton et al. 2023) and journalistic publications on disasters (Oostlander et al. 2022) tend to exclude the voices and perspectives of older adults. This research shares the perspectives of older Canadians on disaster awareness and preparedness.

The disproportionate effect of disasters on older adults in Canada suggests that the needs and voices of older adults in the context of awareness and preparedness have been neglected in Canada. More effective and widespread efforts are needed to enhance older adults' resilience to disasters at a time when natural hazards are intensifying and becoming more common, meanwhile, Canada's population is rapidly aging. The proportion of older adults 65 years and older is expected to be almost a quarter (23%) of the Canadian population by 2030 compared with 17% in 2018 (Statistics Canada 2020).

Given their high vulnerability, this article focuses on older adults' awareness of, and preparedness for floods, wildfires, and earthquakes in Canada, to identify the most effective means to increase awareness and preparation actions for these hazards, while also providing a better understanding of how participants perceive preparedness messages (that is, communications assets such as posters, pamphlets, videos). Older adults are one of five high-risk populations identified by the Canadian Red Cross (CRC) as part of a larger project, *Driving Risk Awareness to Action and Building Resiliency for Vulnerable Canadians in High-Risk Areas* referred to as the *Inclusive Resilience* project (Wright et al. 2022). The other populations are women, people with low income, Indigenous peoples, and newcomers to Canada (lived in Canada for 5 years or less). This article highlights the results from the *Inclusive Resilience* project pertaining to older adults and also expands on the literature about this population in the context of disasters to contribute to this Special Issue on Promoting Older Adults' Engagement in Post-Disaster Reconstruction and Recovery and to the scholarship on enhancing older adults' disaster resilience. This study contributes to the literature through mixed methods (survey and focus groups) to better understand older Canadians' awareness of, preparedness for, and actions to minimize flood, wildfire, and earthquake risks.

2 Literature Review

The literature review begins by defining resilience and provides a review of the impact of disasters on older Canadians. Next, a broader review is conducted of empirical studies, which found that several prominent factors help or hinder older adults' resilience to disasters, with a focus on the North American context. Disaster resilience among older adults (ages 65+) is described based on several factors such as demographic characteristics, proximity to social networks, and access to emergency preparedness resources.

Resilience is a concept used across many disciplines and its definition, conceptualization, and measurement vary widely (Cutter 2016; Ungar 2021). In this study we abide by the United Nations' definition of disaster resilience: "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management" (UNDRR n.d.b). One of the four priorities of the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNDRR 2015, para. 11) is "enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation and reconstruction." Hence, disaster preparedness strengthens resilience.

A meta-analysis on the impacts of wildfires on the elderly found 75 articles published between 2001 and 2021, of which only eight were focused on Canada and of those, six were focused on fires on First Nation lands (Melton et al. 2023). Although some of the findings concerning First Nation Elders are applicable to non-Indigenous older adults such as mobility challenges, there are findings that are

[2] The Public Safety Canada (PSC 2021) study conducted in 2020 had 2,022 participants and only included those aged 25 to 55 (considered "low risk" meaning less vulnerable), to understand perceptions on various emergency preparedness awareness campaigns (see Sect. 1.3.1. of the PSC report). Further explanations on why this demographic was chosen and others excluded are not provided.

specific to the socio-cultural contexts of Elders. The study on the 2015 wildfire smoke exposure in Calgary, Alberta, found that older adults experienced increased respiratory issues and elevated morbidity from respiratory diseases due to poor air quality from wildfires, especially if they had other underlying illnesses (Mahsin et al. 2022). The 2017 floods in Quebec impacted older adults the hardest, and a quarter of the people who sought help from the Canadian Red Cross were older adults (Roslin 2018). During the 2021 heatwave in British Columbia, 619 deaths were heat-related, of which 67% (or 415) were aged 70 years or older (BCCS 2022). More than half (56%) of those who died lived alone and tended to live in homes without adequate air conditioning (BCCS 2022). Approximately 97% of the first 10,000 deaths due to COVID-19 were Canadians 60 years or older (CRC and NIA 2020). Additionally, Canadians 65 years and older were more likely (36%) to have to evacuate their homes during emergencies (Ibrahim 2016). Seniors were also the second most likely (60%) demographic (after youth under 25 years old), to receive assistance during or immediately following an emergency (Ibrahim 2016).

2.1 Demographic Characteristics

Individuals' disaster resilience is influenced by demographic and socioeconomic characteristics such as finances, gender, age, and housing (Kohn et al. 2012; Benevolenza and DeRigne 2019). Older adults experience financial barriers in the context of disaster preparedness due to fixed incomes and lack of financial support from family members, which limit the resources they can dedicate to purchasing emergency supplies, putting property upgrades in place (for example, sump pumps for flood risk mitigation) and other measures to prepare for disasters. As a result, older adults with lower incomes are less prepared for disaster events than those with higher incomes (Kim and Zakour 2017).

In studies about gender and disaster preparedness, women were found to have a heightened risk perception relative to men, and further, older women were more likely to have an intention to evacuate in a disaster due to their increased vulnerability (Cvetković et al. 2018; Tyler and Fairbrother 2018; Castañeda et al. 2020). Similarly, social barriers can include the lack of strong support networks pre-, during, and post-disaster, which can be exacerbated by social isolation among older adults (Tuohy et al. 2014; Tilstra et al. 2022). The described factors lead to increased vulnerability to disasters for the older adult population, and as a result, lead to greater negative outcomes (for example, age-related frailty, cognitive changes) as compared to other population groups (Tuohy et al. 2014).

Older people who live independently outside of an institutional or congregate setting can be constrained by fixed incomes and barriers related to physical and mental well-being, disability, communication difficulties, social isolation, and low uptake of modern technologies (Rubenson et al. 2007; Tuohy et al. 2014; Cox and Kim 2018). Furthermore, preparedness declines among older people who live alone or are encumbered by physical disability (Cox and Kim 2018). Age also affects literacy with cognitive changes creating barriers to perceiving, understanding, and acting on hazard-related information (Rubenson et al. 2007; Tuohy et al. 2014).

A study by Benevolenza and DeRigne (2019), however, provided promising findings in the ability for emergency preparedness plans to improve the quality of life for vulnerable populations. Further, older adults place an emphasis on "social preparedness," which is characterized by an investment in relationships that contribute to overall personal and community resilience in a natural hazard event (Tuohy et al. 2014).

2.2 Hazard Types and Geography

Natural hazard-related disasters can act as a driver for older populations to make certain decisions (Smith and Cartlidge 2011). All of the natural hazards can impact people directly, but wildfires have additional negative outcomes away from the immediate impact areas due to smoke. While a less obvious hazard from wildfires, intense wildfire smoke leads to disproportionate impact on older adults due to impaired lung functions (Melton et al. 2023). Earthquakes and the subsequent damage from disasters can have lasting impacts on communities, which go beyond structural and can disconnect older adults from the community fabric (Ngo 2001; Tuohy et al. 2014). Older adults are likely to suffer the most and experience significant physical and psychological damage during and after a flood disaster (Cherry et al. 2011; Cherry et al. 2023).

The role of geography and its connection to social capital begins to emerge when considering social isolation experienced by seniors, newcomers' lack of social networks and unfamiliarity with local hazards, and the importance of culturally rooted, place-based responses of Indigenous peoples (Yong et al. 2017; Cox and Kim 2018; Asfaw et al. 2019). For example, during the 2011 Sandy Lake First Nation wildfire evacuation in Canada, Elders in the community were separated from their families due to the absence of a community evacuation plan further disrupting social ties (Asfaw et al. 2019). Regarding risk communication, its efficacy is often a result of it being integrated into community-level systems, increasing overall access to it locally as well as its appropriateness and credibility (Neuhauser et al. 2013).

2.3 Risk Awareness

Broadly, risk awareness is defined as the range of knowledge and the appropriate precautionary behavior taken as a response to a risk (Morsut et al. 2022). Research on Canadians' level of risk awareness analyzed according to age is limited but research is available on the general population. Risk awareness among the general Canadian population is low regarding risks to their communities: "Most Canadians (74%) believe they live in a low- (53%) or moderate-risk (22%) area. Two in ten (21%) don't know about the specific level of risk (12%) or have never thought about it (9%). Only 4% of Canadians believe they live in an area that is at high risk" (PSC 2021, para. 17). The Public Safety Canada study (PSC 2021) also found that more than three-quarters (76%) of participants are unconcerned (29%) or unaware (47%) of specific risks of weather-related emergencies and natural hazard-related disasters. An even more concerning finding is that 94% of Canadians who are living in designated flood risk areas do not know that their home is at risk and 47% are not concerned about flood risk to their home (Ziolecki et al. 2020). In contrast, the earlier 2014 SEPR study found that 86% of Canadians surveyed identified winter storms as the greatest risk for their community followed by extended power outages (76%), disease outbreak (51%), industrial or transportation accidents (50%), heatwaves (49%), contamination or shortage of food or water (44%), and floods (42%) (Taylor-Butts 2015). These studies highlighted the need for increased disaster awareness and preparedness among Canadians.

Public awareness campaigns can be used to target at-risk communities to educate them about their risk portfolio and provide them with the necessary information to adopt the right protective behavior to increase their household resilience (Morsut et al. 2022). For example, the Government of Canada (2023) recently released the National Risk Profile, a public awareness initiative, with the intent to help Canadians understand their disaster risk to help them prepare for, manage, and recover from potential disasters. Though, it is important to note that individual risk awareness does not directly correlate to a willingness to implement protective measures (Wachinger et al. 2013). Similarly, older adults who live in hazard-prone areas may be aware of their risk but unable to adopt the correct behavior due to mobility issues, insufficient funds, or a lack of support from others in implementation.

2.4 Risk Preparedness

Disaster preparedness among Canadians is low. Only one in 10 Canadians (11%) have taken action to protect their home from natural hazard risks (PSC 2021). Less than 30% of Canadians living in designated flood areas have taken action to protect their home (Thistlethwaite et al. 2017). These statistics are similar to findings from other Canadian studies that less than 50% of the population are disaster prepared (Taylor-Butts 2015; Ibrahim 2016).

Proactive planning, early dissemination of emergency information, and previous hazard experience are critical factors in influencing disaster preparedness attitudes and behaviors among the older population (Rosenkoetter et al. 2007; Kohn et al. 2012; Cherry et al. 2023). As noted earlier, less than half of Canadians are disaster prepared. However, the highest proportion of individuals (49%) that had completed three to four emergency planning activities were seniors aged 65 and over (Taylor-Butts 2015). Statistically significant findings[3] on the preparedness of Canadians aged 55–64 and 65 and older (respectively) are: 62% and 62% had an emergency exit plan, 53% and 51% had contact plan for household members, 53% and 52% had an emergency supply kit, 49% and 50% had extra copies of important documents, and 70% and 73% had a list of emergency contact numbers (Taylor-Butts 2015). Other statistically significant findings are that older adults were more likely to have battery-operated or wind-up radio (65% for ages 55–64 and 64% for ages 65+), an alternative heat sources (46% for ages 65+), and other emergency precautions (23% for both ages 55–64 and 65+) such as checking and replenishing supplies, extra supply of fuel, keeping exist clear, and having arrangements for pets (Taylor-Butts 2015).

Disaster preparedness for older adults is often associated with social capital and demographic characteristics (Dynes 2006; Reininger et al. 2013; Kim and Zakour 2017). Exhibiting high social capital via civic engagement or having strong communal support networks is crucial for emergency information dissemination (Kim and Zakour 2017). Hence, establishing connections with family members, neighbors, community organizations, and religious institutions were proven to be useful for older adults especially in the aftermath of the disaster when they are likely to need assistance for medical attention, emotional support, shelter, transportation, or financial help (Aldrich and Benson 2008; Kim and Zakour 2017). Also, older adults who are able to survive a disaster are likely to be more resilient to future disasters (Cherry et al. 2009; Cherry et al. 2023).

The importance of social networks for strengthening resilience is clear. Consequently, it is concerning that only one in five (21%) Canadians have a high degree of social support (Taylor-Butts 2015; Ibrahim 2016). Even more concerning is that only 13% of seniors said they have at least five people they can contact for help in an emergency, compared to

[3] In the SEPR study, statistical significance is based on $p < 0.05$ and the reference categories are households with seniors and households with children (Taylor-Butts 2015).

over 25% for those aged from 15 to 34, and 18% for those aged 35 to 64 (Taylor-Butts 2015). The same study found that "seniors, immigrants, people with a long-term activity-limiting health condition and those living in low-income households were less likely to have large social support networks they could rely on in an emergency" (Taylor-Butts 2015, p. 3). Although the 2014 SEPR study did not examine intersectional identities, this finding is important because some seniors fall into more than one of these groups. It is also important to note that the SEPR study did not survey residents of nursing homes and long-term facilities, who may have even fewer social supports. Overall, challenges to older adults' disaster preparedness and limited natural hazard risk literacy can be related to limited pre-disaster preparedness, cognitive, mobility, and health limitations, lack of social and healthcare support networks, as well as recovery resources (Rubenson et al. 2007; Tuohy et al. 2014; Cox and Kim 2018).

2.5 Risk Perception and Communication

Risk perceptions, risk communication, and previous hazard experience may contribute to preparedness for future disasters (Babcicky and Seebauer 2017; Becker et al. 2017; Scovell et al. 2022). An individual's risk perception is heavily influenced by the proximity to the hazard and the magnitude of the disaster (Bateman and Edwards 2002). Accordingly, several studies (Rosenkoetter et al. 2007; Almazan et al. 2019) suggest that older adults' perception of risk to life and property directly influences their willingness and capacity to evacuate in the event of a disaster. Though, the relationship between past disaster experience and risk belief are often tied to personal loss or injury, or knowing someone who was negatively impacted (Becker et al. 2017).

Risk communication is an essential component of disaster risk management in several models that examine relationships between communication, awareness, and preparedness. The Protective Action Decision Model (PADM) by Lindell and Perry "integrates the processing of information derived from social and environmental cues with messages that social sources transmit through communication channels to those at risk" (2012, p. 616). In the PADM, the information source, preference for information channels, warning messages, and characteristics of the receiver (including demographics) all influence the decision processes, including the subsequent behavioral response such as taking action for preparedness.

In Covello et al.'s model, risk communication is "any purposeful exchange of information about health or environmental risks between interested parties" (Covello et al. 1986, p. 172), and includes (1) levels of risk, (2) significance of risks, or (3) decisions, actions, or policies to manage or control risks. In this model, risk communication goes beyond the conventional mediums and looks at the use of evacuation planning, disaster preparedness courses, and signalling, especially for those at heightened risk. The medium used for circulating information that is pertinent to the public helps them understand their risk so they can make informed decisions. A European study found that older adults preferred emergency information to be disseminated through radio, television, and SMS messaging and in-person visits were preferred over websites (O'Sullivan et al. 2012). Unsurprisingly, Canadian seniors were least likely to use online news (Taylor-Butts 2015). This study also examined seniors' ideas and preferences on information sources (for example, which institution is sending the message), content of the message, channel (for example, face-to-face or social media platform), and medium (for example, images or spoken language) for disaster messaging.

3 Materials and Methods

This study addressed a gap in the research on older adults in Canada and their resilience to natural hazards, and how they learn about and prepare for floods, wildfires, and earthquakes in their communities. Our survey design was informed by previous surveys such as the 2014 SEPR study (Taylor-Butts 2015). The study integrated both quantitative and qualitative research methods to create a baseline of understanding about awareness and preparedness via a telephone survey, and then tested a selection of communications assets via a series of focus groups.[4] This approach enabled the exploration of individual and group attitudes towards disaster-related issues. The results and emergent themes from the survey informed the design of the focus group questions.

The integration of quantitative and qualitative data in a mixed methods approach facilitated a deeper understanding of the relationships between variables (Creswell 2021). In this study, the variables are demographic, awareness, and preparedness indicators. Triangulation of quantitative and qualitative data enriched understanding by comparing and contrasting findings (Creswell 2021). In this research, we triangulated findings between the survey, focus group, and literature review.

The overall study sought to identify ways to effectively improve awareness of and preparedness for natural hazards (that is, floods, wildfires, and earthquakes—the hazard(s) discussed depended on the geography) while also providing better understanding of how participants perceive preparedness resources (that is, communications assets). Several core

[4] Interviews were also conducted with nine newcomers but only one was an older adult; thus, the data from the interview were omitted from this article.

Table 1 The five chosen study regions across Canada, including specific natural hazards of each region, and the number of older adult respondents included in the survey

Region	Natural hazards in the region	Older adults (n = 161)
Ottawa, Ontario (ON)	Flood, earthquake	28
Renfrew County, Ontario (ON)	Flood, wildfire	50
Thompson, Manitoba (MB)	Flood, wildfire	15
Richmond, British Columbia (BC)	Flood, earthquake	37
Bay St. George region, Newfoundland and Labrador (NL)	Flood, wildfire	31

themes were studied: individuals' awareness about natural hazard risks in their communities, their levels of, and methods for preparing for these risks, and their barriers to risk literacy and risk preparedness. While considerable focus was applied to these three core research themes (risk awareness, preparedness, and barriers), further attention was given to investigating additional themes, including information and messaging of hazards, social networks and relationships, and community-based disaster resilience activities.

Risk perception was used as an indicator to measure individuals' awareness of natural hazard risks in their respective communities because in order for people to perceive risk, they must first be aware of the risk, in that they recognize that a hazard can occur, and then assess whether that risk poses a threat to their well-being.

Risk preparedness was measured by assessing individuals' current preparedness actions for natural hazards they could potentially be exposed to, as well as the time they have spent on preparedness activities, and how well they believe they could respond (that is, their self-efficacy) to a real natural hazard emergency event. The participants were also asked to identify any barriers to preparedness activities in their regions, including specific factors such as finances, lack of time, and lack of knowledge on where to access preparedness information.

3.1 Survey

Design: Environics Analytics conducted a telephone survey of 500 Canadians between July and August 2021 across five regions of Canada: Richmond, British Columbia (BC); Thompson, Manitoba (MB); Renfrew County, Ontario (ON); Ottawa, Ontario (ON); and the Bay St. George region, Newfoundland and Labrador (NL).[5] The five regions identified by the Canadian Red Cross for this study comprise both urban and rural settings. These regions were selected due to their elevated exposure to floods and/or earthquakes and/or wildfires (Table 1). Within each region, communities were defined by postal-codes and participants were recruited through random-digit dialing to landlines, because landlines are connected to postal codes whereas cellular phones are not. The survey consisted of 25 closed-ended questions that sought to determine participants' levels of risk awareness and risk perception to natural hazards, their current preparedness measures, including their self-efficacy to prepare, and any barriers to preparedness. Preferences for relevant information, including preferences on digital and physical formats, as well as messaging were also evaluated. After the survey was closed, Environics Analytics analyzed the data and measured statistical significance using independent *T*-Test for means (equal variances) and independent Z-Test for percentages (unpooled proportions), and 95% confidence level (p value of < 0.05).

Participants: Of the total 500 participants within the larger study, 161 older adults were surveyed. The selected demographics were defined by the categories used by Statistics Canada. Quotas were set for the study's five target demographics (older adults, women, people with low income, Indigenous peoples, and newcomers to Canada), and participants who identified solely as men and met no other criteria were screened out of the subsequent interview. The number of participants from each region in the study are shown in Table 1.

Oversampling was done in communities where populations of the desired demographic was higher to accommodate for smaller demographics in some communities. Further, results were weighted to their incidence in the general population (Wright et al. 2022). This study was reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB#42933). Informed consent was obtained from all subjects involved in the study.

3.2 Focus Groups

Design: The online focus groups were designed to be small, comprising three to eight participants, and highly interactive. While the focus groups were not recruited from the same sample as the survey, they were recruited from the

[5] Results of the survey conducted by Environics Analytics referenced in this study are available at: https://uwaterloo.ca/inclusive-resilience/sites/default/files/uploads/documents/uwaterloo_p4a_climate_change_survey_report_revised_nov_16.pdf

same geographic communities using identical screening criteria. Specifically, focus group recruitment was targeted to the geographic communities within the study with the highest ratio of older adults, demographically: Thompson, MB and Bay St. George region, NL; as well as an additional focus group drawing from all geographies within the study. The focus groups were structured, with facilitators guiding participants through three thematic sections.

Part 1 involved polls and discussion that probed participants' awareness of and preparedness for natural hazard risk, building on previous survey questions about how, and from whom, participants prefer to receive emergency preparedness-related messaging, what barriers they experience in accessing this kind of messaging, and what they think would help to achieve community resilience to natural hazards. Part 2 of the focus groups tested relevant messaging communications assets in different digital (that is, GIF and video) and physical (that is, pamphlet and poster) formats and from various sources (that is, Canadian Red Cross, Public Safety Canada, FireSmart Canada, and BC Earthquake Alliance). Part 3 involved a "visioning exercise" that allowed participants to suggest, through team-based critical and creative thinking, ways to achieve disaster resilience in their community.

The questions in Part 1 of the focus groups were organized by the same themes as the survey, therefore, it was possible to thematically code focus group responses in a way that built upon the survey responses. The focus groups were designed to allow for the sequential integration of participant voices reflecting on the main themes of the study, and to capture their perceptions of the efficacy of communications assets tailored to their hazard exposure. It was theorized that the explanations offered by focus group participants would provide greater insight into the baseline perceptions and attitudes captured in the previous survey and contribute to a series of recommendations about refining both future communications assets and community-level interventions.

The focus group facilitator helped participants identify themselves by their anonymous ID (and provided the option to keep video cameras turned off) and employed multiple methods to solicit feedback from each individual: Part 1 employed Zoom polls and questions that could be answered verbally or in the chat box. Participants were prompted individually so each response could be captured. Parts 2 and 3 relied on verbal and text-based responses in the Zoom chat box. Focus group sessions were audio recorded only and transcribed for analysis. The text-based chat files were cross-referenced with the audio file transcripts to create complete records for each focus group.

Thematic analysis was used to identify and understand common themes across focus groups and their relationships with the survey data. Focus group data were analyzed using Braun and Clarke's (2006) six-phase approach: (1) Familiarizing oneself with the data; (2) Generating initial codes; (3) Searching for themes; (4) Reviewing themes; (5) Defining and naming themes; and (6) Producing the report. Themes that emerged included Risk Awareness; Risk Preparedness; Communications Materials; and Community-Based Approaches to Disaster Resilience, which are described in the Results section.

Participants: Seven online focus groups were hosted between December 2021 and April 2022, involving 29 participants, of which 10 were older adults. Focus group recruitment was supported by the provincial teams at the CRC and involved outreach to community groups and community leaders, postering in community facilities, local radio interviews, and messaging via online community boards. The screening criteria included questions about the participants' access to a computer and reliable Internet connection, as well as their comfort with the specific online application.

Although the focus groups were originally conceived as an in-person activity, the study was constrained by limitations imposed by public health offices across Canada and the research ethics requirements during the COVID-19 pandemic. As a result, the focus groups relied on an online communications application that could be accessed for free anywhere in Canada and participants could participate by phone or computer. Participants were offered the package of communications assets by email in advance of the focus group in case technology access on the day-of might interrupt or hinder their participation. In at least one instance, a participant made arrangements locally for digital support that enabled participation in the focus group. The groups were composed of three to eight participants each within one of, or across several of the five regions in the study. Comparisons were measured across hazards, study areas, and demographics to identify needs and priorities, within and across groups. The results of the study are expected to help inform the design of disaster risk reduction communications assets for older adults.

4 Results

This section focuses on significant findings in four categories: (1) risk awareness; (2) risk preparedness; (3) communications materials; and (4) community-based approaches to resilience.

4.1 Risk Awareness

Out of the three types of natural hazard, floods affected the largest number of older adult respondents (15%) for this study, followed by earthquakes (12%), and wildfires (4%). Similar to the other at-risk groups, less than 50% of older adults indicated that they were somewhat or

Table 2 Awareness summary by target groups

Target Group		All respondents % (n = 500)	Women % (n = 310)	Older adults % (n = 161)	Indigenous % (n = 71)	Low income % (n = 169)
Somewhat/very concerned about natural hazards		45	48	46	39	43
Perceived high/moderate risk (%)	Flood	41	43	37	44	38
	Wildfire	34	35	31	37 ↑	33
	Earthquake	24	24	29	6 ↓	18 ↓
Home affected (%)	Flood	17	16	15	18	15
	Wildfire	3	3	4	6	1 ↓
	Earthquake	9	11	12	3 ↓	9

↑ ↓ Statistically significant results higher or lower compared to total

Table 3 Preparedness activities by target demographic group

Target group		All respondents % (n = 500)	Women % (n = 310)	Older adults % (n = 161)	Indigenous % (n = 71)	Low income % (n = 169)
Hours spent preparing	0 hours spent	57	58	58	61	65 ↑
	Any hours spent	41	40	39	37	33
Emergency preparation actions taken	First-aid supplies	70	71	62 ↓	70	62 ↓
	Emergency numbers	57	58	62	62	56
	3-day supply kit	46	45	44	44	40 ↓
	Emergency plan	39	39	39	44	36
	Meeting place	38	41	31 ↓	50	36
	Document copies	37	35	44 ↑	39	34

↑↓ Statistically significant results higher or lower compared to total

very concerned about natural hazards (Table 2). Further, when asked about perceived risks of each of the natural hazards, only 45% of all respondents perceived high or moderate risks even though they were all living in regions where these hazards pose an elevated threat. Older adults expressed lower levels of perceived risk for flooding and wildfires, but higher perceived risk for earthquakes as compared to the other demographics although these findings do not have statistical significance (Table 2). Even though this finding is not statistically significant, this may be due to the small sample size and thus may still indicate a trend that could be meaningful and serve as preliminary indications for further investigation with larger sample sizes.

Unsurprisingly, risk perceptions on specific natural hazards were statistically significantly higher among residents for those geographic risk areas. For example, respondents from Richmond, BC, a predominantly older adult demographic community in this study, had higher perceived risks of earthquakes (77% high/moderate risk) than flooding (57% high/moderate risk) or wildfires (13% high/moderate risk).

4.2 Risk Preparedness and Self-Efficacy

Other than first-aid supplies and emergency numbers, less than half of all respondents indicated that they had an emergency plan in the event of a disaster. The majority (58%) of older adults spent 0 hours preparing for an emergency (Table 3).

Older adults expressed the following barriers surrounding low self-efficacy and risk preparedness: a lack of awareness of natural hazard risks in their respective regions, a lack of knowledge on disaster preparedness practices for emergency events, hazard vulnerability misperceptions, and cost-related reasons. Overall, hazard vulnerability misperceptions were one of the greatest barriers—a result of the belief that one will not personally be affected by a natural hazard(s) in the regions to which they are vulnerable. Common responses showcasing these misperceptions include: "It won't happen to me," and "I know I should, but I haven't." Regarding cost-related barriers to preparedness, respondents identified fixed, low incomes as the barrier. The third greatest barrier was a

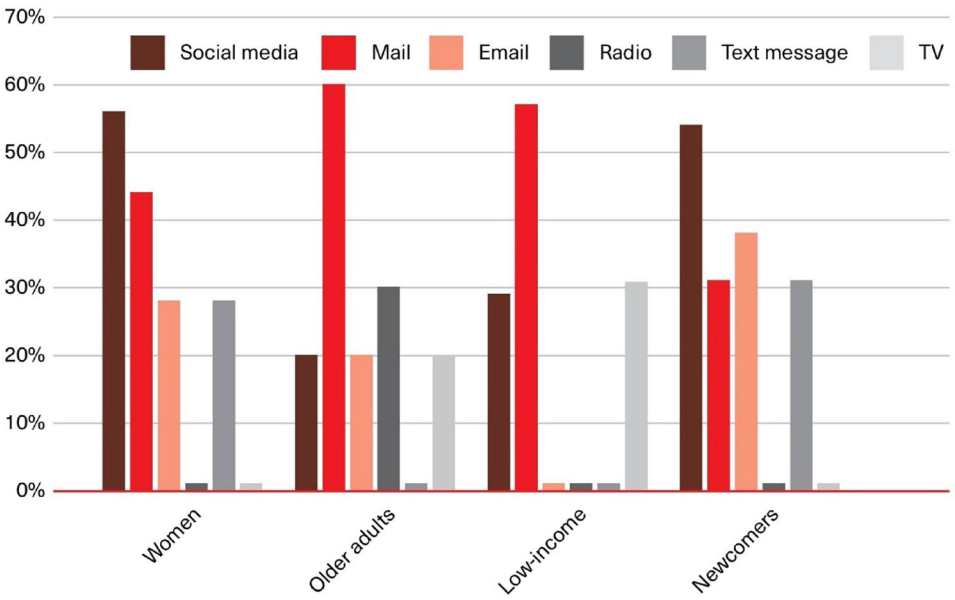

Fig. 1 Preferred communication channels by focus group demographic for preparedness information (n = 29)

lack of awareness of the risks of natural hazard(s) within their region, as well as a lack of knowledge on emergency preparedness.

As a result of these barriers, the majority of older adult respondents (58%) indicated that they had spent no time at all preparing for an emergency in the past year, similar to the other high-risk groups (57%). The statistically significant findings are that compared to the other demographics in the study, older adults were less likely to have assembled a first-aid kit (62%), or know where to go in the event of an emergency and/or evacuation (31%), though they were more likely than any other group to have copies of important documents on hand (44%). The recommended items that older adults indicated as important in first-aid kit supplies included: medical equipment, medications, and other essential supplies, such as water. Older adults who belonged to an older adults' group and/or community organization expressed confidence in their ability to learn about natural hazard risk preparedness and enact necessary changes.

4.3 Communications Assets

Results from the focus groups and survey showcased that older adults expressed a larger reliance on physical materials than digital formats for disaster communication mediums. Their preferred communication channel was physical mail (about 60%), followed by radio, newspaper, social media, text messages, and email (Fig. 1). Surprisingly, television accounted for less than 10% of respondents preferred communication channel. These results were different from the other high-risk groups, who expressed increased reliance on digital formats including social media. In contrast, many older adults indicated that they do not have social media accounts and echoed concerns about the increasing digitization of disaster communications as one respondent cautioned: "Don't depend on social media because not everyone has it."

When asked about visual preferences for communications assets, older adults in the focus groups expressed a preference for "eye-catching" mail that can be made into permanent fixtures in their homes (that is, fridge magnets or wall/door hangers) and that focus on colorful communications assets over text-heavy materials with few colors. Furthermore, several respondents indicated the need for modifications to the preparedness guides for members of the community with mobility or other difficulties, noting these as essential to providing adequate means of evacuation during an emergency event. To determine which members of the community would need these modified communications assets, members of the focus group suggested creating a needs checklist through canvassing respective neighborhoods. A more in-depth look at participants' messaging preferences can be found in the *Inclusive Resilience* report (Wright et al. 2022).

4.4 Community-Based Approaches to Resilience

In the focus groups, community disaster resilience was defined by participants as "knowing their neighbours, forming dedicated community groups for emergency preparedness (e.g., condominium committees, buddy systems with older adults) and growing their collective knowledge of emergency preparedness through annual community events" (Wright et al. 2022, p. 5). All older adults expressed concern about their ability to respond to an emergency event, regardless of whether they currently had a social/support network,

but expressed insightful ways to build resilience through existing or new community-based social networks. As some participants suggested, "maybe having free webinars and events from the community centers to spread awareness," and "educating people on what they need to do beforehand." One respondent noted that their neighborhood has changed such that they would not feel comfortable to ask their neighbors for assistance in preparing for and responding to an emergency event.

To overcome the social isolation, some of the older adults face in their communities suggestions for "knowing one's neighbor" from the focus groups' visioning exercise. Specific suggestions involved creating "buddy systems," needs checklists to locate those with special needs (for example, wheelchair accessibility, translators, and so on), and helping neighbors who are less technology savvy. While most respondents focused on increasing individual and neighbor advocacy for building community resilience rather than a top-down approach from institutions, exceptions were noted. Participants suggested that local governments, workplaces, and other institutions should coordinate directly. This community-institution collaborative approach was noted as a way to prevent people from having to search for essential information.

5 Discussion

In this section, we further analyze the findings by comparing with the scholarly literature, explore the relevance of the results, and provide further recommendations on how to improve disaster resilience through awareness and preparedness among older adults living in regions prone to wildfires, floods, and earthquakes. These hazards have unique impacts on older adults due to smoke injury, disconnection due to evacuation, and physical and psychological impacts. We also discuss the importance of community-based approaches to disaster resilience.

5.1 Risk Awareness

Result 1: The majority of older adults had low concerns about natural hazards with less than half perceiving high to moderate risk of natural hazards occurring in their community even though they live in regions at risk of floods, wildfires, and/or earthquakes (Wright et al. 2022). The low perceived risk among older adults are similar to the other high-risk groups and the general Canadian population (Wright et al. 2022). The number of respondents who reported having personally experienced any of these natural hazards was low, and these results are consistent with the 2014 SEPR study (Taylor-Butts 2015). Hence, it was unsurprising that risk awareness was also low, with only a minority of respondents believing that they will experience a natural hazard-related disaster within their region—a finding also consistent with the SEPR results (Taylor-Butts 2015). Therefore, more public awareness campaigns are needed but they need to engage, and be tailored to, specific populations (see Wright et al. 2022 for details about various groups) and be embedded in community systems and supports.

Result 2: In the broader *Inclusive Resilience* study, we found that despite low risk awareness among respondents, statistically significant differences in risk awareness and risk perceptions of region-specific natural hazards between respondents belonging to each of the regions were observed. More specifically, findings indicate that risk awareness and risk perceptions are influenced mainly by geography, rather than demographics, while lack of prior experience with a hazard(s) contributes, albeit, less than geography, to participants' low awareness and risk perceptions. This was especially evident in the community of Richmond, British Columbia (BC), a community with elevated earthquake risks and the highest prevalence of older adults in this study, who labelled their risk perceptions to earthquakes as "moderate" or "high." These elevated risk perceptions among British Columbians have also been showcased by results of past studies, including the 2014 SEPR in which 77% of BC respondents expressed concerns about the high likelihood that their community will experience an earthquake (Taylor-Butts 2015). These findings are important given that disastrous earthquakes are rarer than floods and wildfires in Canada, but their disaster potential in BC is elevated.

The lack of risk awareness among respondents poses serious safety and financial concerns given that all respondents' exposure to natural hazards in the regions studied are elevated and older adults are particularly vulnerable. Reasons for low awareness are not explored explicitly in this study, though several cognitive distortions, such as cognitive dissonance and cognitive biases towards hazard threats may play a role in risk awareness (Slovic 1987). Other likely factors influencing low awareness in older adults are barriers to cognitive changes influencing perception and understanding, and low uptake of modern technologies, which is consistent with our findings that they prefer non-digital formats even though modern technologies are becoming the more common method of communication among the general population.

5.2 Risk Preparedness and Self-Efficacy

As noted above, the main barriers to disaster preparedness and self-efficacy activities for disaster preparedness included hazard vulnerability misperceptions, cost-related reasons, and lack of hazard awareness.

Result 1: A positive finding is that older adults are more likely than any other group to have copies of important

documents on hand (44%), which is similar to the SEPR finding of 49–50%. In contrast, a concerning finding is that older adults expressed a decreased likelihood to have accessible first-aid kit supplies (62%), which is higher than 53% found in the SEPR study (Taylor-Butts 2015). Given that lower disaster preparedness for older adults is often associated with low social capital and inhibiting demographic characteristics (Dynes 2006; Reininger et al. 2013; Kim and Zakour 2017), possible additional barriers for older adults include mobility challenges, lack of space, and lack of social support from others in implementation of preparing a kit. Older adults rely heavily on social preparedness activities, which can be enhanced by improving social networks, providing inclusive disaster education, and tailored communications assets according to expressed preferences. Workshops for preparing first-aid kits together at facilities frequented by seniors could increase uptake.

Result 2: Older adults were also less likely to have a meeting place in the event of an emergency. The lack of known emergency meeting places among older adults was not unique to this study. The lowest percentage of respondents (29%) with a designated meeting place for household members were found among adults aged 55 to 64 (Taylor-Butts 2015). An American study found that only 29% of older adults had evacuation plans for emergencies, namely the location of the nearest public emergency shelter (Kim and Zakour 2017). The recommendation is for local emergency management offices to collaborate with building owners of high rises and seniors' facilities to develop and distribute easily accessible and identifiable evacuation meeting places, especially for high rises that are adapted for mobility challenges. It is also recommended to organize community disaster preparedness workshops focusing on older adults, not only in high rises and seniors' facilities, but also for those living in single-dwelling homes, focusing on developing evacuation plans.

Result 3: Older adults reported lower confidence in their self-efficacy when it comes to being able to handle an emergency event, with women and those with low income within this population being particularly less confident. Adding to these vulnerabilities, older adults were less likely to have many supports they could depend upon for help in the event of an emergency than the other high-risk groups. This is particularly concerning given that older Canadians (36%) were more likely to have to evacuate their homes during emergencies and they (60%) were the second most likely (compared to youth under 25 years old) to need or seek assistance during or immediately following an emergency (Ibrahim 2016).

However, given the finding that older adults who were part of a group or organization expressed confidence in their ability to learn about preparedness, encouraging older adults to be involved in a social group, including community disaster preparedness workshops, could increase their self-efficacy. For example, a participant from a community disaster preparedness workshop following the 2013 Alberta flood declared his insight: "It's better to be together, than alone!" (Bogdan et al. 2021, p. 7).

5.3 Communications Assets

Result 1: Only a small percentage of older adults, among the other high-risk groups, had sought information on natural hazards in the last year. For the sources of this information, older adults expressed an increased reliance on physical communications assets, such as delivered mail for information on hazard awareness and preparedness activities. Older adults also expressed an increased need for communications assets that can be placed in common areas of their home that are "eye-catching" and colorful. By providing eye-catching materials in common areas across one's home, they could re-examine the materials multiple times, creating familiarity with the information through semantic memories (Mayhorn 2005). The reliance on physical formats is important given that natural hazard events can lead to power outages—a concern also raised by older adult respondents. Many older adults experience declines in memory, and the ability to think deeply is usually masked by fear during disasters (Massazza et al. 2020). These findings emphasize the importance of continuing to provide materials in physical formats to communities vulnerable to natural hazards, despite an increasingly digital world.

Result 2: Older adults also expressed the need for alternative and inclusive communications assets for members of the community that have mobility or other disabilities, given that 73% of older adults have at least one chronic health conditions that require specific medication(s) and/or medical equipment (Public Health Agency Canada 2018). Therefore, the recommendation is to develop communications assets through inclusive approaches that incorporate older adults' ideas and feedback.

5.4 Community-Based Approaches to Disaster Resilience

Result 1: As has been echoed by other studies on increasing disaster resilience in older adult populations, the promotion of a culture of social preparedness (or continuation of social relationships following a natural hazard) among older adults can be fostered by focusing on community-based approaches to disaster management (Kwan and Walsh 2017). This may include family and neighbor care and connections pre-, during, and post-disaster, community evacuation plans and disaster management protocols, as well as preparedness education workshops. As a recent Canadian study recommends, unpaid caregivers and volunteers that assist older adults should also be included in creating and distributing

communication resources to ensure that they are culturally appropriate, are written in both English and French, and meet specific care needs (Zakour and Harrell 2003). The use of targeted policy and support systems to improve community disaster resilience is critical for older adults within communities given that almost 40% of Canadians 65 and older have at least one disability (Statistics Canada 2017).

Social preparedness can be enhanced by providing inclusive community planning and education for disaster preparedness, leveraging more of the existing community gathering places, such as community centers and the community groups that are closest to the populations and their needs. Increasing community engagement, such as through preparedness workshops, will also increase support for social networks. Examples of such workshops are: We're Ready! (by Bogdan et al. 2021); Ready Calgary!; Emergency Preparedness Training (E-Prep); Connect & Prepare Victoria; and Community Emergency Response Team (CERT). Given that respondents who were part of an older adult group and/or community organization expressed confidence in their ability to learn about natural hazard risk preparedness, community-based approaches to resilience such as these are an invaluable resource, especially for those who lack social networks.

Result 2: Risk communication also needs to be integrated into community-level system to increase efficacy. This means sending risk awareness and preparedness messaging from sources that residents are already familiar with and trust, such as community and cultural groups they are part of and the CRC. Another key source is local government, which was the most preferred choice for accurate emergency preparedness information. It is imperative that organizations and (local) governments collaborate to ensure consistent messaging, which increases trust, enhances ability to recall the information, and reduces confusion.

6 Conclusion

This study found that the majority of older adults (65 years or older) have limited disaster awareness and preparedness, which was similar to the other at-risk groups (women, people with low income, Indigenous peoples, and newcomers to Canada), and to the results of other research in Canada. While it is inevitable that natural hazards will become increasingly severe and frequent in Canada, the risk that natural hazards will become a disaster (that is, causing injuries and deaths, damaging infrastructure) can be significantly reduced by reducing exposure and vulnerability. This is especially relevant for older adults and other at-risk demographics.

A recurring recommendation from participants is for increased, and inclusive engagement concerning disaster awareness and preparedness activities at the community level in conjunction with local governments and institutions. Specific activities include community meetings and/or workshops, where evacuation plans and preparedness activities are carried out, such as the creation of tailored emergency kits. Given that cost is a notable barrier to preparedness for some older adults, preference should be given to low-cost supplies. These workshops also present opportunities for older adults to create "buddy systems" and connect with others in their communities that could help them in the event of and following a disaster. These networks are important given that many older adults have reduced or nonexistent social networks, which may occur for many reasons, including the passing of relatives, spouses, and close friends, or the inability to depend on children (Somes 2021). The findings of this study will help build inclusive resilience and meet the needs of older adults in Canada and beyond, through important insights into effective risk communication.

There are several limitations that exist in this study for potential areas of improvement and future research directions. Improvements to the study design, specifically, the recruitment of participants for the survey, could involve more leveraging of existing community groups within particular regions of study, a type of participatory action research known as Community-engaged Research (CEnR) (Reynolds and Lutfy 2018). The CEnR also provides the added benefit of empowering community decision making, a critical part of risk communication (Reynolds and Lufty 2018; Wieland et al. 2021). Due to the pandemic, all data collection had to be online. Future studies could include in-person approaches to ensure that individuals with limited access to technology or digital literacy can participate.

The generalizability of the results to older adults in Canada are an additional limitation to the study due to the small sample size despite similar findings to other studies done in Canada. Nevertheless, the findings of the study provide valuable insight into how tailored communication methods and activities aimed at increasing social capital can aid in increasing disaster awareness and preparedness. Also, those findings that are not statistically significant may provide insights into trends that can be explored in a larger future study.

While this study focused on three specific hazards—floods, wildfires, and earthquakes—there are several other hazards that can lead to disproportionate effects on older adults, for instance heatwaves. Given that Canada's mean temperature continues to rise at double the global rate (Bush and Lemmen 2019), the effects of devastating heatwaves will only worsen under continued anthropogenic climate change. While heatwaves in Canada are not uncommon, the increasing severity and frequency of heatwaves is of particular concern, given that older adults are particularly vulnerable (Benmarhnia et al. 2015). As mentioned in the literature

review, a record-breaking heatwave in June 2021 in British Columbia resulted in about 434 deaths (a 440% increase) that were directly attributable to the extreme heatwave event, of which older age, combined with material (that is, air conditioning) and social (that is, lack of social networks) deprivation played a significant role in mortality (Henderson et al. 2022). The elderly also had disproportionately high mortality rates due to the COVID-19 pandemic (CRC and NIA 2020). The findings of this study could be applied to engage older adults in disaster awareness and preparedness, increasing resilience towards heatwaves, pandemics, and other hazards capable of causing disasters in communities, worldwide.

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