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

An Gie Yong,[1,*] Louise Lemyre,[1] Celine Pinsent,[2] and Daniel Krewski[3]

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 analyzed the ratings on natural disaster risk perception beliefs and preparedness behaviors 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 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.

KEY WORDS: Canada; disaster preparedness; immigrants; natural disasters; risk perception

1. INTRODUCTION

Immigrants tend to suffer more negative consequences from natural disasters in comparison to their native-born counterparts.[1,2] 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 compare to the general population. Accordingly, we investigated risk perception and disaster preparedness in immigrants and Canadian-born individuals.

1.1. Natural Disasters in Canada: Considerations for Immigrants

The varied geographic landscape, population growth, and urbanization in Canada have increased

[1]School of Psychology, University of Ottawa, Ottawa, ON, Canada.
[2]Groupe d'Analyse Psychosociale de la Santé, Ottawa, ON, Canada.
[3]McLaughlin Centre for Population Health Risk Assessment, University of Ottawa, Ottawa, ON, Canada.
[*]Address correspondence to An Gie Yong, GAP-Santé, Social Sciences Building, FSS5006-120 University Street, University of Ottawa, Ottawa, ON K1N 6N5, Canada; ayong089@uottawa.ca.

the risks of Canadian residents experiencing a significant loss from natural hazards.[3] 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 postdisaster.[4] Although disaster preparedness is a salient theme in Canada, individual disaster preparedness remains low.[5] There is also a lack of targeted and tailored risk communication and management to address the heterogeneity of the Canadian population, despite studies having demonstrated that risks are not equally distributed in a population.[6,7] One group that requires special considerations is the immigrant population. The immigrant population is a significant (21%) and growing social group in Canada.[8] 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.[9]

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.[2,10] Risk communication and management that do not accommodate to immigrants' unique social, cultural, structural, and contextual factors may increase their risks.[11,12] 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-focused disaster education, low hazard awareness, and barriers to access to resources required to take action.[12–17] 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 compare to the general population.

1.2. Disaster Preparedness and Risk Perception

Effective risk communication and management require an understanding of how lay individuals perceive risks.[18] Although there are different theoretical explanations used to explain lay individuals' risk perception,[19,20] most theorists agree that individuals must first believe that the hazard is valid before any actions can occur.[6,21] Indeed, research has demonstrated that individuals' subjective evaluation of natural hazards is an important factor in their disaster preparedness.[22–24] However, the direct link between risk perception and disaster preparedness has not been consistently reported in the literature.[25,26] The mixed findings could be attributed to how risk perception and disaster preparedness are operationalized. For instance, Ozdemir and Yilmaz[27] demonstrated that how different dimensions of individuals' risk perception for earthquakes (e.g., perceived likelihood of earthquake versus beliefs about responsibility for earthquake mitigation) predicted different types of preparedness behaviors. Likewise, other studies have demonstrated that risk perception consists of multiple dimensions and different risk perception dimensions are associated with different behavioral responses.[28–30] 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.[31] Accordingly, we defined individuals' risk perception for natural disasters as a multidimensional structure consisting of beliefs about natural disaster risks and issues.

1.3. Impact of 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.[16,32,33] For example, Maldonado *et al.*[16] 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 behaviors vary by social group,[34] disaster preparedness in immigrants may be different from their native-born counterparts.

The fundamental assertion of the cultural approach is that 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."[35] According to the cultural-identity-protective cognition thesis,[36] 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).[34,37,38]

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 modulate 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.[14,16] 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.[39] Lemyre *et al.* propose a socioecological approach to risks and resilience that asserts that individuals' risk perception and disaster preparedness are influenced by the interaction between the individual and the multilevel, nested social environment.[4]

1.4. Towards a Targeted and Tailored Approach

Because immigrants may experience natural disaster risks and issues differently, they may benefit from culturally-focused 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 program that are identified to be important and unique for the target group.[40] Theorists have posited that there is a universal experience with risks due to globalization and shared human experience, as well as that there are unique experiences due to the diversity of life.[41] Accordingly, we compared immigrants to the Canadian-born population to identify core similarities for a standard program 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.[42] 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.

2. METHOD

2.1. 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. Tables I and II present the sociodemographic characteristics of the respondents.

2.2. 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, nonrepresentative 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

Table I. Frequencies and Valid Percentages for Sociodemographic Characteristics

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	2	0
Gender*		
Male	442 (48.0%)	97 (59.5%)*
Female	479 (52.0%)	66 (40.5%)*
Would prefer not to say	0	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	6	0
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	114	20
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	0	0
Residential location*		
Rural	228 (24.9%)	26 (16.1%)
Urban	687 (75.1%)	135 (83.9%)
Would prefer not to say	6	2
Duration in neighborhood*		
< 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	7	1

Note: Chi-square analyses: column proportions were compared using z-test with Bonferroni adjusted p-value.
*$p < 0.05$.

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 > 0.05.

Table II. Frequencies and Valid Percentages for Sociocultural Characteristics

Variable	Canadian Born ($n = 921$)	Immigrant ($n = 163$)
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	2	0
Ethnic /cultural background*		
European[a]	813 (95.6%)	108 (72.5%)*
Non-European[b]	37 (4.4%)	41 (27.5%)*
Would prefer not to say	71	14
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		0

[a]North American (non-Aboriginal), European, and Oceania (non-Pacific Islander).
[b]Caribbean, African, Pacific Islander, Asian, South American, and Aboriginal.
Note: Chi-square analyses. Column proportions were compared using z-test with Bonferroni adjusted p-value.
*$p < 0.05$.

2.3. Measures

The NSHRP 2012 is part of an ongoing research program aiming to assess the Canadian public's evaluations and decision making on a variety of hazards.[43]

2.3.1. Individual Disaster Preparedness

Respondents rated their level of agreement with five preparedness behaviors using a five-point scale (1 = "Do not agree at all," 5 = "Agree completely"; see Table IV). Items were selected because they were considered to be common and important preparedness behaviors by the Canadian public and government.[5,44]

2.3.2. Natural Disaster Risk Perception Beliefs

Respondents rated their level of agreement with 18 natural disaster risk perception beliefs using a five-point scale (1 = "Do not agree at all," 5 = "Agree completely"; see Fig. 1). These statements included threat and response evaluations generated based on previous work.[29,30] They reflected a variety of constructs, including perceived consequences, perceived control, perceived knowledge, social norm,

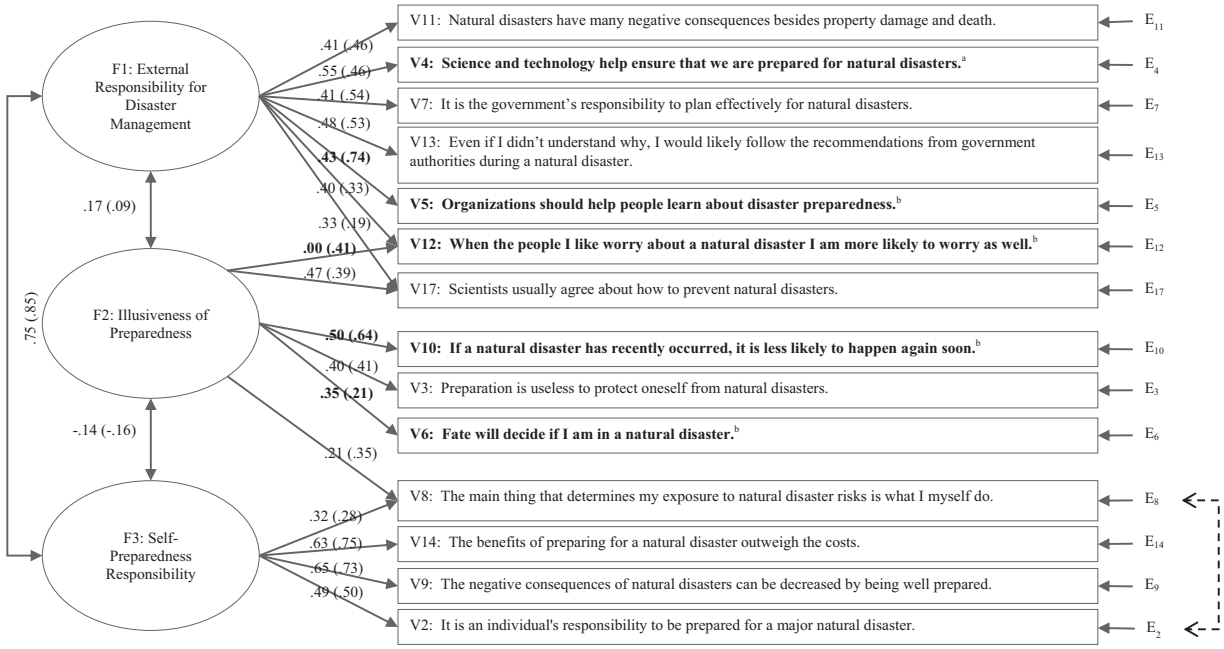

Fig. 1. Three-factor psychological dimensions of risk perception for natural disasters in Canadian-born individuals and immigrants (in parentheses). Noninvariant items (bolded) were excluded from the factor score calculation, $p < 0.05$:
[a]Noninvariant item intercept (Canadian-born = 3.39, immigrant = 3.15).
[b]Noninvariant factor loading.
Note: 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.").

perceived uncertainty, risk tolerance and acceptance, and perceived likelihood.

3. DATA ANALYSES AND RESULTS

Respondents' sociodemographic and sociocultural characteristics are presented in Tables I and II. Chi-square analyses revealed that the immigrant sample and Canadian-born sample significantly differed in age, gender, education, region, location, time in neighborhood, language, and ethnocultural background. However, the samples were similar such that a 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 neighborhoods, Anglophones, and Europeans. The majority of the immigrant respondents were long-term residents.

3.1. 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 factory 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 $\chi^2(179) = 220.70$, $p = 0.02$, robust comparative fit index = 0.95, and robust residual mean-square error of approximation = 0.03 (95% CI, 0.015–0.043) and partial measurement invariance with five noninvariant items (Fig. 1).[4]

[4]Detailed results are available as supplemental material upon request.

Table III. Intercorrelations between Sociodemographic, Risk Perception Dimensions, and Disaster Preparedness

	Risk Perception Dimension			Disaster Preparedness		
Sociodemographics	External Responsibility for Disaster Management	Illusiveness of Preparedness	Self-Preparedness Responsibility	Emergency Planning	Intent to Evacuate	Post-disaster Search
Age	0.04	0.02	0.03	0.05	**0.07***	**−0.18****
Gender (0 = male, 1 = female)	**0.11****	<0.01	<−0.01	0.03	**0.21****	**0.11****
Education level	−0.01	**−0.20****	**−0.08***	−0.06	−0.02	<0.01
Annual household income	**−0.09****	**−0.21****	−0.04	0.01	−0.01	**0.11****
Residential location (0 = urban, 1 = rural)	0.02	0.05	0.04	**0.08***	−0.05	0.04
Duration in neighborhood	0.03	−0.02	0.02	0.06	0.04	**−0.08***
Spoken home language (0 = English, 1 = others)	**0.09****	**0.08***	**−0.13****	−0.05	−0.02	**−0.10****
Ethnic or cultural background (0 = European, 1 = others)	**0.07***	0.02	−0.01	0.06	0.04	0.06
Immigrant status (0 = Canadian born, 1 = immigrant)	0.03	−0.01	−0.02	−0.03	<0 .01	**−0.06***
Time in Canada (immigrants only)	**0.15**	−0.07	0.10	−0.07	0.03	<−0.01

$^{*}p < 0.05$; $^{**}p < 0.01$.

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 nonequivalence. We named one factor "external responsibility for disaster management" as it was 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.

Because education and language were significantly associated with the risk perception dimensions (see Table III) and significantly different by sample (see Tables I and II), we included these variables as covariates. Multivariate analysis of covariance (MANCOVA) using Pillai's criterion revealed immigrants and Canadian-born individuals did not significantly differ in their level of risk perception dimensions, controlling for education and language (see Table IV): $V < 0.01$, $F(3, 948) = 0.241$, $p = 0.87$.

3.2. 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 IV).[5] We named this factor "emergency planning" because the items reflected activities individuals engage in before the event. P4 ("intent to evacuate") and P5 ("postdisaster search"), both revealed to be single-item measures.

Because age and gender were significantly associated with disaster preparedness (see Table III) and significantly different by sample (see Tables I and II), we included these variables as covariates. MANCOVA using Pillai's criterion revealed immigrants and Canadian-born individuals did not significantly differ in their level of disaster preparedness, controlling for age and gender (see Table IV): $V < 0.01$, $F(3, 1023) = 1.02$, $p = 0.38$.

Correlations between risk perception dimensions and preparedness behaviors are presented in Table V. We used sequential linear multiple regression analyses to predict disaster preparedness with

[5]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 ($N = 1{,}089$).

Table IV. Descriptive Statistics for the Risk Perception Dimensions and Disaster Preparedness

	Canadian Born			Immigrant		
Variable	*M*	*SD*	α	*M*	*SD*	α
Risk perception dimension						
External responsibility for disaster management	3.53	0.65	0.46	3.59	0.65	0.46
Illusiveness of preparedness	2.33	0.70	0.33	2.32	0.80	0.35
Self-preparedness responsibility	3.54	0.73	0.60	3.51	0.83	0.66
Disaster preparedness						
Emergency planning factor	2.40	1.08	0.71	2.27	1.07	0.73
P1: I discuss with others the information I get on preparing for natural disasters. ($\lambda = 0.48, h^2 = 0.23$)						
P2: I have an emergency supply kit for natural disasters. ($\lambda = 0.77, h^2 = 0.60$)						
P3: I have an evacuation plan for natural disasters. ($\lambda = 0.78, h^2 = 0.61$)						
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: $p > 0.05$.

Table V. Intercorrelations between Risk Perception Dimensions and Disaster Preparedness

	Emergency Planning		P4: Intent to Evacuate		P5: Postdisaster Search	
Risk Perception Dimension	*r*	95% CI [*LL*, *UL*]	*r*	95% CI [*LL*, *UL*]	*r*	95% CI [*LL*, *UL*]
Full sample						
F1: External responsibility for disaster management	**0.16****	[0.09, 0.22]	**0.44****	[0.38, 0.49]	**0.16****	[0.09, .23]
F2: Illusiveness of preparedness	**0.18****	[0.12, 0.25]	0.05	[−0.01, 0.11]	< 0.01	[−0.06, .06]
F3: Self-preparedness responsibility	**0.38****	[0.32, 0.44]	**0.24****	[0.18, 0.29]	**0.18****	[0.11, .24]
Canadian born						
F1: External responsibility for disaster management	**0.14****	[0.06, 0.21]	**0.44****	[0.39, 0.50]	**0.16****	[0.09, .22]
F2: Illusiveness of preparedness	**0.16****	[0.09, 0.22]	0.06	[−0.01, 0.13]	0.01	[−0.06, .07]
F3: Self-preparedness responsibility	**0.36****	[0.29, 0.43]	**0.23****	[0.17, 0.30]	**0.18****	[0.11, .24]
Immigrant						
F1: External responsibility for disaster management	**0.29****	[0.16, 0.42]	**0.40****	[0.25, 0.52]	**0.19***	[< 0.01, .36]
F2: Illusiveness of preparedness	**0.33****	[0.17, 0.48]	−0.01	[−0.18, 0.15]	−0.02	[−0.20, .14]
F3: Self-preparedness responsibility	**0.49****	[0.35, 0.60]	**0.24****	[0.10, 0.38]	0.15	[-0.03, .33]

$^{*}p < 0.05$; $^{**}p < 0.01$.

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 behaviors by the risk perception dimensions.

3.2.1. Predicting Emergency Planning

As shown in Table VI, self-preparedness responsibility was a unique predictor of covariates-adjusted emergency planning: adjusted $R^2 = 0.15$, $F(6, 932) = 29.32$, $p < 0.001$. Self-preparedness responsibility was positively associated with emergency planning ($\beta = 0.38$, $t = 11.18$, $p < 0.001$), controlling for all other factors. In the final model, the interaction terms were nonsignificant, controlling for all other factors: ps > 0.05.

3.2.2. Predicting Intention to Comply with Evacuation Recommendations

Table VI shows all risk perception dimensions as unique predictors of covariates-adjusted intention to comply with evacuation recommendations: adjusted

Table VI. Sociodemographic, Risk Perception Dimensions, and Disaster Preparedness

	Emergency Planning		P4: Intent to Evacuate		P5: Postdisaster Search	
Predictor	B (SE B)	β	B (SE B)	β	B (SE B)	β
Step 1						
Gender (0 = male)	0.08 (0.07)	0.04	0.33 (0.05)	**0.21*****	0.30 (0.09)	**0.11****
Age	0.05 (0.02)	**0.07***	0.05 (0.02)	**0.09****	−0.16 (0.03)	**−0.18*****
Immigrant status (0 = Canadian born)	−0.05 (0.10)	−0.02	−0.02 (0.07)	−0.01	−0.13 (0.12)	−0.04
Adjusted R^2	<0.01		**0.05*****		**0.05*****	
Step 2						
Gender	0.07 (0.06)	0.03	0.26 (0.04)	**0.17*****	0.25 (0.08)	**0.09****
Age	0.03 (0.02)	0.05	0.03 (0.01)	**0.07***	−0.17 (0.03)	**−0.19*****
Immigrant status	−0.08 (0.09)	−0.03	−0.04 (0.06)	−0.02	0.15 (0.12)	−0.04
External responsibility	0.03 (0.06)	0.02	0.58 (0.04)	**0.47*****	0.42 (0.07)	**0.20*****
Illusiveness	0.03 (0.05)	0.02	−0.24 (0.04)	**−0.22*****	−0.32 (0.07)	**−0.17*****
Self-preparedness	0.56 (0.05)	**0.38*****	0.24 (0.03)	**0.23*****	0.42 (0.06)	**0.23*****
Adjusted R^2	**0.15***** (ΔR^2 = **0.15**)***		**0.30***** (ΔR^2 = **0.26**)***		**0.13***** (ΔR^2 = **0.09**)***	
Step 3						
Gender	0.06 (0.06)	0.03	0.26 (0.04)	**0.17*****	0.24 (0.08)	**0.09****
Age	0.04 (0.02)	0.05	0.03 (0.01)	**0.07***	−0.17 (0.03)	**−0.19*****
Immigrant status	−0.07 (0.10)	−0.02	−0.04 (0.06)	−0.02	−0.15 (0.12)	−0.04
External responsibility	0.02 (0.06)	0.01	0.58 (0.04)	**0.47*****	0.43 (0.08)	**0.20*****
Illusiveness	< −0.01 (0.06)	<−0.01	−0.23 (0.04)	**−0.20*****	−0.33 (0.08)	**−0.17*****
Self-preparedness	0.57 (0.05)	**0.38*****	0.24 (0.04)	**0.23*****	0.44 (0.07)	**0.24*****
Immigrant status × External responsibility	0.14 (0.19)	0.03	0.01 (0.11)	<0.01	−0.07 (0.23)	−0.01
Immigrant status × Illusiveness	0.23 (0.15)	0.06	−0.08 (0.10)	−0.03	<−0.01 (0.18)	< −0.01
Immigrant status × Self-preparedness	−0.10 (0.16)	−0.03	0.01 (0.09)	−0.01	−0.11 (0.18)	−0.02
Adjusted R^2	**0.15***** (ΔR^2 < 0.01)		**0.30***** (ΔR^2 < 0.01)		**0.13***** (ΔR^2 < 0.01)	

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

$R^2 = 0.30$, $F(6, 942) = 69.68$, $p < 0.001$. External responsibility for disaster management ($\beta = 0.47$, $t = 15.54$, $p < 0.001$) and self-preparedness responsibility ($\beta = 0.23$, $t = 7.41$, $p < 0.001$) 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 ($\beta = -0.22$, $t = -6.79$, $p < 0.001$), controlling for all other factors. In the final model, the interaction terms were nonsignificant, controlling for all other factors: ps > 0.05

3.2.3. Predicting Having Someone Search for Me 48-Hour Postdisaster

All risk perception dimensions were unique predictors of covariates-adjusted 48-hour postdisaster search (see Table VI): adjusted $R^2 = 0.13$, $F(6, 940) = 24.57$, $p < 0.001$. External responsibility for disaster management ($\beta = 0.20$, $t = 5.78$, $p < 0.001$) and self-preparedness responsibility ($\beta = 0.23$, $t = 6.72$, $p < 0.001$) were positively associated with individuals having someone to search for them postdisaster, controlling for all other factors. Illusiveness of preparedness was negatively associated with individuals having someone to search for them postdisaster ($\beta = -0.17$, $t = -4.66$, $p < 0.001$), controlling for all other factors. In the final model, the interaction terms were nonsignificant, controlling for all other factors: ps > 0.05.

4. 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.

4.1. 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,[28–31] our findings demonstrated the multidimensional 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.[45] 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.[25,46,47] Finally, illusiveness of preparedness supported previous studies showing that individuals may respond to risks by fatalistic attitudes, denial, and wishful thinking.[48–50]

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 noninvariant risk perception beliefs represent actual differences in how immigrants and Canadian-born individuals experience natural disaster risks and issues.[42] 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.[41] Methodologically, our results were unlikely an artifact of the measures used since we excluded noninvariant 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 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 < 0.001.

4.2. 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.[25,27] Consistent with the literature,[46,50] our findings demonstrated that individuals who felt personally responsible for mitigating the risks were more likely to take 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 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.[45] Consistent with the literature,[49,50] our findings showed that fatalism, denial, and wishful thinking were associated with nonprotective 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.[5] Although emergency planning was low, results showed that immigrants and Canadian-born individuals might be ready to evacuate and have someone search for them postdisaster. 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.

4.3. 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, and age rather than immigrant status, at least in the subgroup of immigrants recruited in this study. It is important to underscore that a majority of the immigrant respondents have similar sociodemographic 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;[51] 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 suggesting that immigrants' risk perception and disaster preparedness for natural disasters are different from their native-born counterparts.[14,16,32,52–55] Bourhis and colleagues[56] 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.[57] Because natural disasters magnify preexisting social inequities,[2,6,10,17,58] the lack of major natural disasters may detract from 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.[59] Therefore, the Canadian context may provide immigrants with a sense of safety, and trust towards the Canadian society.

Social positions are experienced based on the simultaneous combination of various social categories.[60] 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 it intersects with other sociodemographic characteristics that mediate inequities in the receiving community.[32,61] Therefore, future research should segment the immigrant population to test the validity of the model such as by socioeconomic status (e.g., low socioeconomic status), ethnocultural identity (e.g., language minorities), and mode of entry (e.g., refugees).

4.4. Considerations for Programming and Policy

Based on our findings, programming and policy aiming to increase disaster preparedness in the Canadian public would 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 noninvariant risk perception beliefs. It is important to emphasize that some sociodemographic factors (e.g., language) do require cultural modifications. Finally, researchers and practitioners should investigate the context and meaning surrounding the noninvariant risk perception beliefs and how to incorporate these beliefs in programming.

4.5. 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.[62] Although a modest percentage of variance explained is expected when predicting complex human behaviors,[63] 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.

5. 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 for 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 important.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher's website:

Table I. Descriptive statistics of disaster preparedness items in the NSHRP 2012.
Table II. Descriptive statistics of the risk perception belief items in the NSHRP 2012.
Table III. Exploratory factor analysis of the natural disaster risk belief statements in Canadian-born individuals.