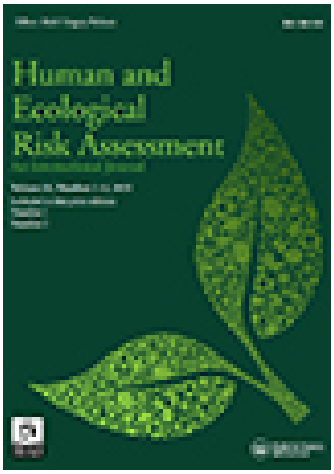

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Predicting Emergency Response Intentions Among the Canadian Public in the Context of Terrorism Threats: Examining Sociodemographics and the Mediating Role of Risk Perception

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ABSTRACT

Much research in emergency preparedness is dedicated to exploring differences in behavior based on sociodemographic attributes. It has been suggested that these differences may be partially explained by cognitive threat appraisals; however, this relationship is rarely tested empirically in the literature. This study investigates the mediational role of cognitive threat appraisals on the relationship between sociodemographic attributes and anticipated emergency response in a representative sample of the Canadian public (n = 1502). Findings reveal that a number of sociodemographic characteristics such as gender, age, education, and income were significantly related to anticipated emergency response. Cognitive threat appraisals—including two measures of risk perception for terrorism threats—were similarly found to differ significantly by sociodemographic attributes, and were significantly related to anticipated emergency response. However, with the exception of gender, these differences in risk perception did not significantly explain the sociodemographic differences in anticipated response. These results suggest that while individual-level differences in appraisal are important considerations in emergency preparedness and response, further research should consider the broader contextual factors relevant to at-risk demographic groups to better explain these relationships. Implications for future research and policy are discussed.

Key Words: risk perception, emergency response, terrorism, mediation, sociodemographics, social vulnerability, Canadian public.

INTRODUCTION

As with many emergency events, terrorist attacks usually occur with little or no warning. The unpredictable quality of these threats is compounded by the fact that

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terrorist attacks can take a number of forms: Chemical, biological, radiological, nuclear, and other explosive attacks (CBRN-E); agricultural terrorism; and even cyberterrorism. In order to ensure that physical, psychological, and material damage to the public is minimized, emergency managers and public safety officials must be able to respond with diverse measures; this may include orders of evacuation, sheltering-in-place, mass decontamination, and quarantine, among others. While unique obstacles threaten the successful execution of each of these actions, their effectiveness is commonly hinged on the public's willingness and ability to respond to such emergency directives. Past research has identified a number of related factors that may hinder the uptake and execution of response directives: These include cognitive components, such as risk perception and coping efficacy (Lee and Lemyre 2009; Gibson *et al.* 2007; Riad *et al.* 1999; Rogers *et al.* 2007), and sociodemographic attributes including age, gender, income, education, and ethnicity (Riad *et al.* 1999; Bateman and Edwards 2002; Phillips *et al.* 2010; Ablah *et al.* 2009). Links between sociodemographic features and cognitive threat appraisals for emergency events have also been established (Vaughan and Nordenstam 1991; Botzen *et al.* 2009). However, few studies to date have explicitly examined the nature of these interconnected relationships—for instance, whether the association between sociodemographic factors and emergency response might actually be *explained* by differences in cognitive threat appraisals. The goal of this study is to explore the direct and indirect relationships between various sociodemographic factors, cognitive threat appraisals, and emergency response intentions in the context of terrorism threats.

Links Between Sociodemographics and Emergency Response

The successful implementation of official instructions provided by emergency managers is an important mitigating factor in the reduction of personal negative consequences following emergencies. This may be especially salient for those social groups who are more susceptible to the negative consequences of emergency events, such as those with lower income, lower education, women, the elderly, and visible minorities (Ng 2009; Botzen *et al.* 2009; Lemyre *et al.* 2009). Unfortunately, research on natural disasters suggests that emergency warnings and directives can be less effective in mobilizing these at-risk groups (Lasker 2004; Phillips *et al.* 2010; Perry *et al.* 1982; Fothergill and Peek 2004). For example, studies have found that evacuation following flood or hurricane warnings is less likely among certain ethnic and socioeconomic groups, including ethnic minorities, those with lower education or income, and the elderly (Fothergill and Peek 2004; Gladwin and Peacock 1997; Perry *et al.* 1982). In other instances, however, these lower response rates are not found (Zhang *et al.* 2004; Bateman and Edwards 2002).

Researchers argue that social group differences in disaster-related susceptibility, consequences, and behaviors are rooted in more general social vulnerability. Thus, it is not the sociodemographic feature in and of itself that produces this vulnerability, but rather, the related social inequalities imposed on individuals belonging to these social groups (Phillips *et al.* 2010). These social determinants of disadvantage have been widely studied in related research on health, and their link to health behaviors has been well established (Hobfoll 2002; King *et al.* 2005; Cooper and Guthrie 2007). The term *vulnerability* should be interpreted with caution, however. While

increased risks and susceptibilities may be present in these groups, it stands that each disadvantaged social group also has the potential to act as a valuable resource in the mitigation process, through the knowledge and experiences of its members. The term *vulnerable* potentially and inadvertently ignores these assets, and shifts the focus of this increased risk from the pathways to the individual (Lemyre *et al.* 2009). Therefore, the terms *at-risk* and *higher-risk* are more appropriate in the context of this study and will be used instead.

As mentioned earlier, the decision to respond to official emergency messages and warnings is made in the context of pre-existing psychosocial, physical, and economic circumstances that may hinder effective response. For example, low-income families must dedicate more financial resources to basic necessities, so that the required resources for emergency response (*i.e.*, transportation, finding alternative shelter, staying home from work) are more difficult to manage (Dash *et al.* 2010). Likewise, some at-risk groups, such as the elderly, are more prone to isolation (Klinenberg 2002; Fernandez *et al.* 2002), making it more difficult to ensure they receive and can respond to emergency messages. Social conditions can also lead to differential affective reactions to the emergency messages themselves, which may influence individual responses. For instance, a large-scale study on potential individual reactions to a smallpox outbreak, including one's willingness to follow vaccination protocols, revealed that trust in officials was a major component in this decision-making process, and that at-risk groups reported higher levels of distrust (Lasker 2004). Such research shows that individuals do not make emergency response decisions based solely on the content of warning messages, nor exclusively on their material resources, but also on the manner by which they interpret their personal circumstances and the information available to them (Sagala *et al.* 2009). A major component of this process often studied by researchers in emergency preparedness involves examining individuals' cognitive threat appraisals, such as their perceptions of the inherent risk associated with the hazard in question and their ability to cope effectively with it. This research is described below.

The Role of Cognitive Threat Appraisals in Preparedness and Response

While it is important to acknowledge the complexity of emergency response behaviors and its determinants, it remains that how one perceives a threat is an important indicator of how they will respond in an emergency (Fischhoff *et al.* 2004; Lee and Lemyre 2009). As Perry and his colleagues (1982, p 98) argue, "For any adaptive response to be defined as necessary, the individual must perceive the threat described in the hazard warning as real. Unless the warning is *believed* to be valid, individuals are not likely to undertake protective measures." Indeed, research on emergency preparedness in the face of terrorism threats has shown that risk perception is a major factor in people's decisions to engage in preparedness behaviors (Lee *et al.* 2009; Lee and Lemyre 2009; Rogers *et al.* 2007). This has also been demonstrated in research on various natural disasters (Miceli *et al.* 2008; Mulilis and Duval 1997). In emergency management the role of risk perception thus features prominently, as the current goal of most emergency preparedness campaigns is to increase knowledge and awareness about hazards and their mitigation (Basolo *et al.* 2009).

As with research on emergency response behaviors, some evidence suggests that socially disadvantaged groups interpret the risk of emergencies differentially (Stevens *et al.* 2009; Botzen *et al.* 2009; Fothergill and Peek 2004; Vaughan 1995). For instance, studies have reported that when marginalized individuals are more skeptical of warning messages, they may also perceive the messages as conveying a lower level of danger (Perry *et al.* 1982; Fothergill and Peek 2004). It should be noted, however, that the size and direction of these differences in risk perception has not been consistent in empirical studies (Vaughan and Nordenstam 1991; Dash *et al.* 2010): There have also been reports of higher perceived risk among economically and ethnically diverse groups in emergency events, while other research has found no such difference (Fothergill and Peek 2004; Phillips *et al.* 2010; Fothergill *et al.* 1999).

Some researchers believe that differences in the operationalization and measurement of threat appraisals could account for such inconsistent findings (Vaughan and Nordenstam 1991). To begin, there is a great deal of evidence that individuals' risk perceptions differ depending on who is targeted by the risk. In particular, individuals have a pervasive tendency to perceive lower risks to themselves than they perceive for others—a phenomenon referred to as *optimistic bias* (Weinstein 1987; Sjöberg 1999). Along these lines, it is possible that individuals primarily consider the impact of more widespread societal consequences—such as indirect effects and psychosocial sequelae in others—as opposed to their own *personal* risk when judging the risk of events such as terrorism (Lee *et al.* 2010).

Over the past three decades, research in risk perception has explored the qualitative nature of threat appraisals, and underlined the need to look beyond probabilistic judgments of harm or mortality when conducting research on risk perceptions (Lee and Lemyre 2009; Fischhoff *et al.* 1978; Slovic 1987). Lee and colleagues (2009) found that terrorism risk perceptions could be represented by four inter-related cognitive dimensions: Perceived Probability, Seriousness, Personal Impact, and Coping Efficacy. The first three dimensions roughly correspond to the extent to which the consequences of terrorism are understood and viewed as serious, while taking into account both personal and societal targets; the last (perceived coping efficacy) reflects the degree to which these consequences are perceived as controllable. Additional analyses revealed that these cognitive threat dimensions were differentially associated with related affective and behavioral outcomes, further demonstrating the complex nature of this much-researched construct.

Toward a Better Understanding of Risk Perception and Emergency Response in Higher-Risk Groups

The research reviewed above suggests that in order to effectively provide emergency response instructions to higher-risk groups, the potential accompanying barriers must be considered. As outlined above, two factors often examined in the literature include sociodemographics and cognitive appraisals, such as risk perception. As of yet, few attempts have been made to determine whether differences in cognitive appraisals may explain the behavior differences between sociodemographic groups, despite this pathway being suggested in the literature (Bateman

and Edwards 2002; Riad and Norris 1998; Lindell and Hwang 2008). The differentiation between personal and societal risk, or whether the individual is considering the likelihood, the severity, or the controllability of the hazard in question, are also important distinctions that must be specified; hence, examining the mediating effects of various threat appraisal elements in combination would also be warranted. These much needed investigations would help to improve our theoretical understanding of these relationships, while having critical applicability for evaluating current mitigation strategies targeting higher-risk groups.

Goals and Objectives

In order to better understand the barriers to effective mobilization, the goal of the current study is to examine the role of risk perception in the relationship between sociodemographic attributes and emergency response behaviors, using data from a previously conducted national survey on Canadians' perceptions regarding terrorism threats (Lemyre *et al.* 2007). The objectives of the present study are to first predict emergency response intentions from a series of sociodemographic attributes (gender, age, income, education, and visible minority status). The relationship between these sociodemographics and multiple cognitive threat appraisals will similarly be explored. Finally, the mediating effects of these cognitive dimensions in the relationship between sociodemographics and emergency response intentions will be explicitly tested via multiple mediation analyses. The conceptual diagram for these objectives, in the context of the literature review presented above, is presented in Figure 1.

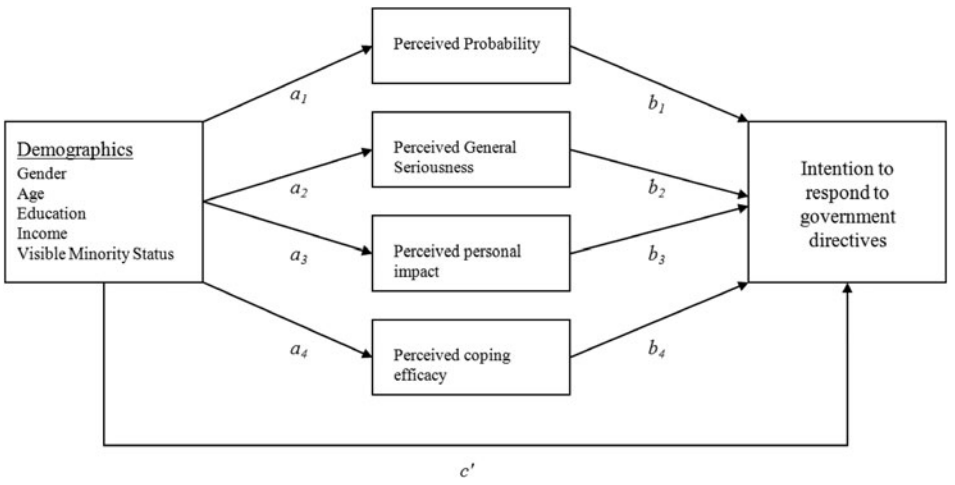

Figure 1. Model specifying relationships between sociodemographic variables, threat appraisal items, and emergency response intentions.

METHOD

Participants

Respondents to the *National Public Survey of Perceived Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Terrorism Threat and Preparedness* (Lemyre *et al.* 2007) included 1502 individuals over the age of 18 years (51.3% women and 48.7% men), as part of a stratified random sample of the Canadian public. The final sample was weighted to be representative of the population in terms of residential region (*i.e.*, Atlantic region [Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick]; Quebec; Ontario; Prairies [Manitoba and Saskatchewan]; Alberta; and British Columbia. Territories were not included in this sample), age group (18–24, 25–34, 35–44, 45–54, 45–54, and 55–over), and gender for each region, as reflected in 2001 Census data.

Measures

All measures used in the present study were created during the original development of the survey (Lemyre *et al.* 2007). A description of the variables selected for use in the present investigation is provided below.

Emergency response intentions

Respondents rated their willingness to follow government-issued emergency instructions in reference to a potential future terrorist attack. The behavioral responses in question included: Evacuation of the city or region; receiving vaccination; taking prescribed medication such as antibiotics; undergoing decontamination treatment, such as a public shower; agreeing to remain inside a building for protection (sheltering-in-place); agreeing to strictly isolate oneself from others (quarantine); and going to a public shelter. Respondents answered on a five-point Likert-type scale as follows: 1 = Not at all; 2 = A little; 3 = Moderately; 4 = Very much; 5 = Extremely. These variables were then pooled by averaging respondents' ratings for each of the items.

Cognitive threat appraisals

Based on previous analyses examining the factor structure of cognitive appraisals for terrorism threats (Lee and Lemyre 2009), perceptions of terrorism were assessed on four cognitive factors: Perceived probability, perceived seriousness, perceived personal impact, and perceived coping efficacy. Perceived probability was calculated by averaging respondents' scores on their attitudes about both the perceived likelihood and the perceived uncertainty of five different terrorist events (*i.e.*, chemical, biological, radiological, nuclear, and explosives terrorism). The remaining scales were created by averaging the scores of respondents' attitudes regarding each factor (perceived seriousness, perceived impact, and perceived coping efficacy) on the same five terrorist events (*i.e.*, chemical, biological, radiological, nuclear, and explosives terrorism). Ratings for all items were based on a five-point Likert-type scale (1 = Not at all, 5 = Extremely).

Sociodemographics

Gender was measured by having the interviewer note the gender of the respondent during the interview. Respondents were asked to identify their age category (18–24, 25–34, 35–44, 45–54, 45–54, and 55–over), education category (some/completed elementary school, some/completed high school, some/completed community college [CEGEP in Québec], some/completed university, some/completed graduate school), and income category (under $19,999, $20,000–$29,999, $30,000–$39,999, $40,000–$49,999, $50,000–$59,999, $60,000–$69,999, $70,000–$79,999, $80,000 and over) at the end of the interview. If a respondent refused to answer these questions, it was duly noted. As well, respondents were asked whether they were a visible minority. If respondents answered yes, they were asked to specify the group as a follow-up question. If respondents did not know the answer, the interviewer noted the response.

Procedure

The nationally representative *National Survey of Perceived CBRNE Terrorism Threat and Preparedness* was originally conducted via telephone interviews between November 15 and December 15, 2004. Stratified random sampling was achieved by using random digit dialing. The 1502 interviews completed represented 9.7% of valid answered calls. During administration of the survey, lists of items within sections were sequenced randomly to balance for possible order effects. Interviews lasted approximately 35 min.

Analyses

All analyses were conducted using PASW Statistics 18 (formally SPSS). Variables were first screened for missing data, outliers, and normality, as well as for violation of assumptions related to regression analysis. One variable (income) was found to be higher in missing values (11.5%), relative to other variables; these cases were subsequently estimated using the multiple imputation (MI) feature.[1] Survey weights were used throughout all analyses, to ensure that the sample would be representative of the Canadian population. Design effects related to the stratified sampling procedure were examined in a random subsample of variables and found to be close to 1 (ranging from 0.99 to 1.00), suggesting that analyses of the data using simple random sample variances would be adequate.

The relationships between sociodemographics, cognitive threat appraisal items, and emergency response intentions were examined using the SPSS macro and accompanying syntax for multiple mediation tests, as introduced by Preacher and Hayes (2008). In this particular method, multiple mediators can be tested simultaneously, which allows for a comparison of the combined and individual mediating effects, while reducing possible error relating to multiple inferential tests.

[1]MI produces several datasets on which to perform analyses (in this case, five datasets), with results pooled by data analysis software. Since this pooling option was not available for the current analysis, each dataset was examined to rule out major discrepancies in the results, with the first imputed dataset being used in this analysis.

Unlike the widely used causal steps approach made popular by Baron and Kenny (1986), this approach *directly* calculates mediated effects by calculating the product of the coefficients for the *a* and *b* paths (*ab*) in each mediation model (Figure 1). This is widely accepted as a logical way to quantify mediated effects (Hayes 2009; Preacher and Hayes 2008; MacKinnon *et al.* 2007). Significance testing of the effects is then conducted via bootstrapped bias-corrected confidence intervals for each indirect effect. This method is considered a powerful and valid strategy to directly test indirect (mediated) effects (MacKinnon *et al.* 2004; Haye 2009).

In calculating the mediation tests, the syntax also provides results for each individual path in the model. These unmediated results are presented initially below, followed by the mediation results.

RESULTS

Since this analysis utilizes listwise deletion for all missing cases on predictor, mediator, and outcome variables, a total of 50 participants were removed from all subsequent analyses. Frequencies for each of the socioeconomic variables are presented in Table 1.

Bivariate correlations for all the variables of interest, including emergency response intentions, cognitive threat appraisal items, and sociodemographics, are provided in Table 2. In terms of emergency response intentions, participants reported agreement with the response category that they would be quite likely to follow emergency directives ($M = 4.82$, $SD = 0.88$). Results revealed small but significant correlations between emergency response intentions and all sociodemographics except for visible minority status; this could be related to sampling restrictions. Since meaningful conclusions about this potential relationship cannot be established, this variable was not considered in subsequent analyses.

Predicting Emergency Response Intentions for Terrorism Threats

Sociodemographic factors

The linear combination of the four sociodemographic variables explained 4% of the variance in emergency response intentions, with an adjusted R^2 of 0.04, $F(5, 1463) = 15.59$, $p < .001$. In terms of the residual of each sociodemographic variable (after controlling for the other predictors), it was found that higher age ($\beta = .06$, $t = 4.06$, $p < .01$), female gender ($\beta = .11$, $t = 2.39$, $p < .05$), higher level of education ($\beta = .08$, $t = 3.52$, $p < .01$), and higher income ($\beta = .04$, $t = 4.19$, $p < .001$) all contributed significantly to the prediction of emergency response intentions, with squared semi-partial correlations ($\underline{sr}_i^2$) of 0.011, 0.004, 0.008, and 0.011, respectively; thus, the unique contributions of each of these variables, as represented by the sum of their squared semi-partial correlations, represented 3% of the variance in emergency response intentions, while the combination of these variables contributed an additional 1% in shared variance. A summary of these relationships is provided.

Table 1. Frequencies of sociodemographic variables (n = 1502).

Variable	Categories	Frequency	Percentage
Age	18–24	175	11.7
	25–34	251	16.8
	35–44	340	22.7
	45–54	292	19.5
	55–64	197	13.2
	65 and over	241	16.1
Noted Gender	Male	731	48.7
	Female	771	51.3
Income	Under $19,999	158	11.9
	$20,000–$29,999	167	12.
	$30,000–$39,999	166	12.5
	$40,000–$49,999	159	11.9
	$50,000–$59,999	151	11.3
	$60,000–$69,999	129	9.7
	$70,000–$79,999	88	6.6
	$80,000 and over	314	23.6
Education	Some/completed elementary school	57	3.8%
	Some/completed high school	379	25.4
	Some/completed community college or CEGEP	433	29.0
	Some/completed university	443	29.7
	Some/completed graduate school	182	12.2
Visible Minority Status	Yes	95	6.4
	No	1379	93.6
	Don't know	28	2

Frequencies do not sum to N due to missing data.

Cognitive threat appraisal dimensions

With the cognitive threat appraisal items subsequently added to the equation in a second step, the full (total effects) model, which included all sociodemographics and cognitive appraisal variables, explained 10% of the variance in emergency response intentions, with an adjusted R^2 of 0.10, $F(8, 1454) = 21.31$, $p < .001$. Cognitive threat appraisal dimensions contributing to the prediction of emergency response intentions, over and above the sociodemographic variables, included higher perceived general seriousness of terrorism threats ($\beta = .18$, $t = 5.05$, $p < .001$), and higher perceived personal impact of terrorism threats ($\beta = .09$, $t = 2.91$, $p < .01$). Perceived probability of terrorism threats and perceived coping efficacy did not significantly predict emergency response intentions (Table 3). The unique contributions of perceived seriousness ($\underline{sr}_i^2 = 0.016$) and perceived impact ($\underline{sr}_i^2 = 0.005$), represented 2% of the added variance in emergency response intentions, meaning the combination of the cognitive appraisal variables contributed an additional 4% in shared variance to the final model, over and above the sociodemographic variables.

Table 2. Intercorrelations between emergency response intentions, sociodemographics, and threat appraisal variables.

	1	2	3	4	5	6	7	8	9	10
1. ERI (M = 4.83, SD = 0.88)	—	.09**	.06*	.13***	.13**	.00	.11***	.20***	.23***	.03
2. Age		—	.08**	−.07**	−.11***	.01**	.02	−.11***	.01	−.08**
3. Gender			—	.03	−.09**	−.09**	.15***	.19***	.18***	−.09***
4. Education				—	.34***	−.06*	−.15***	−.08**	−.07**	.09**
5. Income					—	.05	−.05*	−.01	−.03	.09**
6. Visible minority status						—	−.02	−.06*	−.02	−.01
7. PP (M = 2.19, SD = 0.77)							—	.35***	.36***	−.05
8. PPI (M = 3.55, SD = 0.99)								—	.64***	−.04
9. PGS (M = 4.02, SD = 0.83)									—	.00
10. PCE (M = 2.86, SD = 1.06)										—

*$p < .05$, **$p < .01$, ***$p < .001$.
ERI = Emergency response intentions; PP = perceived probability; PPI = perceived personal impact; PGS = perceived general seriousness; PCE = perceived coping efficacy.

Predicting threat appraisals for terrorism threats

An examination of the relationship between the sociodemographic variables and the various threat appraisal variables revealed mixed results, which are presented in Table 3. It should be reiterated that the results in this section represent the independent contribution of each sociodemographic variable in predicting the threat appraisal items while controlling for the other sociodemographic variables in the model. Since the threat appraisal items were mediators and not analyzed as outcome variables in this analysis, the unique variance contributions of each sociodemographic variable in the prediction of each cognitive appraisal variable ($\underline{sr}_i^2$), as well as the combined variance for the sociodemographics in predicting each cognitive appraisal item were not calculated. Such a task would involve a considerable number of separate analyses that are beyond the scope of this article. Instead, the significance tests for each of the *a* paths in the four mediation analyses are subsequently presented.

In terms of each sociodemographic variable, it was found that age predicted lower perceived personal impact for terrorism threats ($\beta = -.08$, $t = -4.90$, $p < .001$), as well as lower perceived coping efficacy ($\beta = -.04$, $t = -2.25$, $p < .05$), but was not found to significantly predict perceived probability or perceived general seriousness of terrorism threats. By contrast, it was found that gender was significantly related

Table 3. Total (unmediated) and indirect (mediated) effects of threat appraisals on the association between the unique contributions of sociodemographic factors and emergency response intentions.

Independent variable (IV)	Mediator (M)	Effect of IV on M (a)	Effect of M on DV (*b*)	Total effect of IV on DV (*c*)	Indirect effect (*ab*) BCa[a] 95% CI
Age	Total			.06(.01)***	−.01 (−.02, .00)
	Probability	.00(.01)	.05(.03)		.00 (.00, .00)
	Seriousness	−.01(.01)	.18(.04)***		.00 (−.01, .00)
	Impact	−.08(.02)***	.09(.03)**		−.01* (−.01, .00)
	Coping	−.04(.02)*	.02(.02)		.00 (.00, .00)
Gender[b]	Total			.11(.05)*	.10* (.07, .13)
	Probability	.24(.04)***	.05(.03)		.01 (.00, .03)
	Seriousness	.31(.04)***	.18(.04)***		.05* (.03, .09)
	Impact	.40(.05)***	.09(.03)**		.03* (.01, .07)
	Coping	−.18(.06)**	.02(.02)		.00 (−.01, .00)
Education	Total			.08(.02)***	−.03* (−.04, −.01)
	Probability	−.12(.02)***	.05(.03)		−.01 (−.01, .00)
	Seriousness	−.06(.02)**	.18(.04)***		−.01* (−.02, .00)
	Impact	−.10(.03)***	.09(.03)**		−.01* (−.02, .00)
	Coping	.07(.03)**	.02(.02)		.00 (.00, .01)
Income	Total			.04(.01)***	.00 (.00, .01)
	Probability	.05(.01)	.05(.03)		.00 (.00, .00)
	Seriousness	.01(.01)	.18(.04)***		.00 (.00, .01)
	Impact	.02(.01)	.09(.03)**		.00 (.00, .00)
	Coping	.02(.01)	.02(.02)		.00 (.00, .00)

Standard errors are presented in parentheses; [a]bias corrected and accelerated bootstrapping confidence intervals; [b]1 = male (ref); 2 = female; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

to all four threat appraisal items. Specifically, females reported a higher perceived probability ($\beta = .24$, $t = 5.94$, $p < .001$), higher perceived general seriousness ($\beta = .30$, $t = 7.14$, $p < .001$), and higher perceived personal impact ($\beta = .40$, $t = 7.94$, $p < .001$) of terrorist threats in Canada, but a lower perceived coping efficacy for these threats ($\beta = -.18$, $t = -3.31$, $p < .001$). Education also significantly predicted threat appraisals in all sub-categories. For instance, education was negatively associated with perceived probability of terrorism threats ($\beta = -.12$, $t = -6.07$, $p < .001$), as well as the perceived general seriousness of terrorism threats ($\beta = -.07$, $t = -3.09$, $p < .01$), and the perceived personal impact ($\beta = -.10$, $t = -4.07$, $p < .001$). By contrast, education was positively associated with a higher perceived coping efficacy

for terrorism threats ($\beta = .07$, $t = 2.66$, $p < .01$). Stated otherwise, both female gender and lower education significantly predicted higher perceived risk perception (as represented by probability, personal impact, and general seriousness), and lower perceived coping efficacy.

Mediation Tests (Indirect Effects)

The bootstrapped results of the total and partial indirect (*i.e.*, mediated) effects, which include both the point estimates and the bias-corrected and accelerated confidence intervals (CIs), are presented in Table 3. As with all previous analyses, each sociodemographic variable was examined while controlling for the other predictors in the model.

For gender

A significant total indirect effect, combining all cognitive threat appraisal items, was demonstrated between gender and emergency response intentions, with a point estimate of .10 ($CI_{.95} = .07, .13$). Indirect partial effects also demonstrated specific mediation effects for two of the cognitive threat appraisal items: Perceived general seriousness, with a point estimate of .05 ($CI_{.95} = .03, .09$); and perceived personal impact, with a point estimate of .03 ($CI_{.95} = .01, .07$), meaning that the relationship between female gender and greater emergency response intentions could be explained via an increase in both the perceived impact and perceived seriousness of terrorism threats.

In a follow-up analysis, the *direct effect* of gender on emergency response intentions was calculated, to determine the magnitude change in the *total effect* after controlling for the cognitive threat appraisal items. Results demonstrated that when controlling for the cognitive threat appraisals, the relationship between gender and emergency response intentions was no longer statistically significant, ($\beta = .02$, $t = .47$, $p > .05$), signifying that the link between gender and emergency response intentions was fully mediated by the cognitive threat appraisal variables.

For education

Total indirect effects were calculated for education, and revealed a statistically significant point estimate of $-.03$ ($CI_{.95} = -.04, -.01$). Partial indirect effects for perceived general seriousness (point estimate $-.01$ $CI_{.95} = -.02, -.00$) and perceived personal impact (point estimate $-.01$ $CI_{.95} = -.02, -.00$) reflect similar results. At first glance, this would suggest that the relationship between higher education and greater emergency response intentions can be explained via *lower* overall threat appraisals. However, the presence of opposite signs between the negative indirect effect and the positive total effect (Table 3) suggest a suppression effect, rather than a mediation effect. This was confirmed in follow-up analyses, which included ruling out an interaction effect.

For age

No mediating effects were reported for age and emergency response intentions, when examining the combined (total) effect of the cognitive threat appraisal

variables (Table 3). A slight indirect partial effect for perceived personal impact was found, as reflected in a point estimate of −.01 ($CI_{95} = -.01, -.00$); the magnitude of this effect is quite small, however, and should be interpreted with caution. No other partial indirect effects were statistically significant.

For income

Total and partial indirect effect tests failed to find any mediation effect of cognitive threat appraisals, either in combination or independently, on the relationship between income and emergency response intentions (Table 3).

DISCUSSION

This study enhances current knowledge regarding the importance of sociodemographics and threat appraisals, including risk perception, as they apply to emergency response behaviors, in the context of Canadian terrorist threats, and our understanding of the process by which sociodemographic factors are linked to emergency response intentions. As expected, many sociodemographic attributes and threat appraisal dimensions were significantly related to emergency response intentions, with a few noted exceptions. Certain sociodemographic features were additionally associated with various threat appraisal dimensions, although again, the results were varied. When examining the specific mediating relationships, results were complex: Findings included full mediation effects, partial mediation effects, and no mediation effects, all involving variably significant dimensions of risk and coping efficacy. Details of these results are presented below.

Factors Associated with Intention to Follow Emergency Directives

Overall, respondents reported that they would be likely to follow emergency directives given to them, in the event of a pending terrorist threat. These results differ from a similar American study, where up to 30% of respondents stated they would not follow government emergency directives (Lasker 2004). However, these two studies were similar in that some at-risk groups, including those with lower education and lower income, did report a significantly lower likelihood of response (Lasker 2004). Although mixed results have been noted (Kim and Kang 2010; Riad *et al.* 1999), this is consistent with other studies on emergency response behaviors and at-risk groups (Fothergill 2004; Lindell and Perry 2004; Fothergill and Peek 2004). Researchers suggest that social class, which often encompasses these two indicators, may impact emergency response for a number of reasons, including possible differences in risk perceptions (Lindell and Hwang 2008; Stevens *et al.* 2009; Botzen *et al.* 2009), differences in affective reactions to warning messages (Lasker 2004), and divergent access to necessary resources, such as transportation and basic supplies, which can affect coping perceptions (Gheytanchi *et al.* 2007).

Regarding other sociodemographic factors, gender and age were also found to be associated with intention to follow emergency directives, with women and older respondents reporting a significantly higher likelihood of response. Gender differences in emergency response behaviors have been examined quite extensively

(Enarson and Morrow 1998; Riad *et al.* 1999; Bateman and Edwards 2002; Enarson 2010; Fothergill 2004; Peacock *et al.* 1997), and research has demonstrated that women are often more likely to exhibit self-protective behaviors in an emergency (O'Brien and Atchison 1998; Bateman and Edwards 2002; Stevens *et al.* 2009; Riad *et al.* 1999). Researchers argue that cognitive explanations, such as lower risk tolerance (Fothergill 1996), are important considerations. However, social circumstances, including the pivotal role women undertake as managers in their family and social contexts (Enarson 2010; Bateman and Edwards 2002) also help to explain these disparities. The finding that older respondents are more likely to respond to emergency messages is also echoed in related studies (Perry and Lindell 1997). In a review of warning responses across several man-made and natural emergency events, Perry and Lindell (1997) reported that the elderly were no less likely to respond to emergency directives, and in some cases, were more likely than younger individuals.

While these findings suggest that women and the elderly are not at higher risk in terms of lowered emergency response intentions in the current context, it must be noted that, despite the *intention* to respond, practical obstacles exist that can limit the ability of these individuals to take action. For instance, the elderly face higher rates of isolation, mobility issues, and medical conditions that may inhibit successful response behaviors (Klinenberg 2002). Likewise, in some circumstances, socially constructed gender roles leave women at a disadvantage in terms of their ability to respond: The prominent caregiving role that many women assume in their social environment, for instance, may preclude their taking immediate personal action (Enarson 2010). In other cases, women may have disproportionate limitations in terms of the needed resources in emergency response (Bateman and Edwards 2002). Thus, while these groups may not be at risk due to lower response intentions, consideration should still be given to the socially based obstacles these individuals face.

The only sociodemographic group that was not significantly correlated with the intent to follow emergency directives in the current study was visible minority status. This contrasts with results of some studies on visible minorities and emergency response (Lasker 2004; Riad *et al.* 1999), but supports others wherein these racial and ethnic differences are not found (Smith and McCarty 2009; Ablah *et al.* 2009). Since the sample of visible minority respondents was quite low relative to the visible minority population in Canada, results should be interpreted with caution. Any follow-up investigations regarding the emergency response intentions of visible minority groups in Canada should strive to obtain a more representative sample, in order to minimize such issues.

It should be noted again that the analyses conducted in the current study examined the differences unique to each particular demographic characteristic while adjusting for shared variance in the other sociodemographic traits. In practical terms, sociodemographic profiles are more complex, involving interactions between many of these variables. The findings reported here suggest that the unique contributions of the sociodemographic factors independently contributed to the prediction of emergency response intentions; however, shared explanatory power of the combined profiles also contributed to this outcome. Indeed, individuals at increased risk can, and often do, belong to more than one at-risk social group, and this cannot be ignored in the context of these findings. Thus, while studying the interaction

effects of these sociodemographic factors was beyond the analytic scope of this article, researchers and policy-makers should take this point into consideration when interpreting the results of studies involving sociodemographic groups.

Beyond the associations involving sociodemographics, the intent to follow emergency directives was significantly predicted from some of the threat appraisal variables, and overall, these items accounted for a greater proportion of variance in emergency response intentions than the sociodemographic variables; this reflects the importance of considering cognitive processes in behavior intentions. Not all dimensions contributed equally to the model, however. Specifically, the intent to follow emergency directives was successfully predicted from a higher perceived personal impact and a higher perceived general seriousness regarding the risk of terrorism threats. These items concern the relative consequences of terrorism threats as they relate personally to the individual, as well as society in general (Lemyre *et al.* 2007). Perceived probability was not associated with intent to respond, which is not entirely surprising, for two reasons: Firstly, the reported perceived probability of terrorist threats was quite low overall, and previous analyses on this dataset showed that reported preparedness for these events was also very low (Lemyre *et al.* 2007; Lee and Lemyre 2009). Secondly, past research has demonstrated that in decision-making, the likelihood of a hazard's occurrence is less important than the perceived consequence (Sjöberg 1999; Lion *et al.* 2002). Our findings provide new supportive evidence that in the case of terrorism threats, focusing risk messaging to address and underscore the mitigation of consequences (*i.e.*, impact and seriousness) may be more motivating for individuals acting within a traditional probabilistic approach to risk management.

As with perceived probability, one's perceived ability to cope was not associated with government-issued emergency response intentions. This differs from earlier work (Lee and Lemyre 2009), which found that coping efficacy was positively related to individual preparedness behaviors, which focused on actual behaviors such as assembling an emergency kit, and seeking information. One explanation for this difference is that individuals who have already completed preparedness behaviors may subsequently believe they are better equipped to cope with such events. By contrast, this study focuses on response intentions that would be directed by external sources. Thus, if an individual believes they would respond to these prescribed directions, the importance of their own personal ability to manage the event may be considered irrelevant.

While our study focuses primarily on cognitive factors in threat appraisals, other factors, such as affect, are also known to play an important role (Lerner *et al.* 2003). In fact, previous work by the authors has examined the role of affect as a mediating factor in the relationship between risk perceptions and various other forms of preparedness (Lee and Lemyre 2009). The current study did not investigate the role of affect, for two reasons: First, an examination of affect in addition to the multiple factors included in these mediation analyses would have been outside the reasonable scope for a single study. Second, understanding and framing messages in relation to the public's risk perceptions has been considered an important component of effective risk communication for public health emergencies (Glik 2007); as such, the choice was made to focus on factors that are particularly informative for developing targeted risk communication messaging.

The varying predictive power of these threat appraisal dimensions demonstrates the importance of considering more than traditional probabilistic judgments of harm or mortality when conducting research on risk perception (Lee and Lemyre 2009). For instance, the differentiation of the risk target (*i.e.*, the self versus society) should be an important consideration for risk communication strategies. Since the current aim of many risk-reducing interventions is to reduce knowledge deficit and change perceptions of risk (Renner and Schwarzer 2003), these facets must be understood and accounted for in future research and policy.

Explaining Sociodemographic Differences in Response Intentions via Threat Appraisals

The interceding role of threat appraisals in the relationship between sociodemographics and the intention to follow emergency directives was tested via multiple mediation analysis. With regards to gender, it was found that women had higher threat appraisals regarding the consequences of terrorism threats, which in turn contributed to their increased intention to respond. These findings are consistent with other studies on women and risk perception as well as response behaviors (Bateman and Edwards 2002), which suggest that it is a lower tolerance for risk that drives women to a higher likelihood of response.

Results initially suggested that threat appraisals were also found to explain differences in response with regards to education level, given the statistically significant indirect effects; however, subsequent analyses determined that this conversely reflected a suppression effect. Both suppression and mediation effects are assessed using the same statistical technique, in that each is quantified by measuring the change in the relationship between an independent and dependent variable once it is included in the analysis (McKinnon 2000). A mediator variable will account for some or all of the predictive validity in an independent variable when it is added to the model, resulting in a reduced direct effect compared to the unmediated total effect. By contrast, a suppressor variable's inclusion in the model increases the predictive validity of an independent variable by suppressing some of the predictor's remaining error variance, resulting in an increased regression weight in the direct model in comparison to the unmediated model (Tzelgov and Henik 1991).

In the present study, the relationship between higher education and higher emergency response intentions was not explained by cognitive threat appraisals; rather, the magnitude of this relationship was actually masked to some extent by concomitantly lower levels of risk perception. These opposing relationships may seem counterintuitive, but they have been previously demonstrated in separate analyses (Stevens *et al.* 2009; Botzen *et al.* 2009), and make sense in the current context since the threat appraisal in this study concerns terrorism specifically. The threat of terrorism was given exceptional attention by policy-makers following the attacks of September 11, 2001, which may have amplified its perceived threat among the general public (Lee and Lemyre 2009; Botzen *et al.* 2009); nonetheless, the threat of terrorism in Canada is relatively low compared to many other large-scale hazards (Lee *et al.* 2010), and the perceived risk of an attack has been tied to larger sociopolitical attitudes (Gibson *et al.* 2007). Thus, it is possible that individuals with higher levels of education had greater access to information delineating these

relative risks. Secondly, while lower risk perception was linked to lower levels of response intentions overall, it is entirely possible that other factors were more saliently linked to response intentions and education level. It has been shown that individuals with higher education demonstrate greater confidence in institutional responses in emergencies (Lasker 2004), which may explain the higher rate of response intentions relative to education level. Furthermore, as mentioned earlier, sociodemographic characteristics do not operate in isolation from one another. Those with higher education are more likely to have higher incomes and this increased social privilege may dispose them to greater instrumental means for undertaking the activities in question, making it easier to assert their intentions to respond in future events.

The relationship between higher age and higher likelihood of response was not well explained by differences in cognitive threat appraisals. Older respondents did report a lower perceived impact and lower coping efficacy, and there was a partial indirect effect reported for perceived impact on response intentions; however, the magnitude of this effect was so small that further interpretations of this result were abandoned. Otherwise, there were no significant mediating effects found for income. Since respondents consisted of a greater proportion of individuals in the higher income categories relative to the Canadian general population, there may have been a ceiling effect at the highest end of the distribution. These factors may have complicated the analyses.

Limitations and Future Directions

As often reported with complex social psychological research, a few methodological limitations should be noted. First, the nature of the cross-sectional design makes it impossible to delineate the temporal order of some of the predictors and mediators in these analyses. Also, while mediation analysis is a powerful tool for examining possible causal relationships, this study design cannot definitively confirm these causal assertions. Secondly, the outcome measured in this study focused on intentions to respond, which may not predict the actual response in the future. A longitudinal study could explore this possible difference but would require substantial resources. Third, the data was self-reported, resulting in the possibility of related biases. The limited response rate also affects the generalizability of the findings regarding less widely sampled demographic groups (such as visible minorities, and those with lower income). While the sample was stratified to resemble the Canadian population on a number of dimensions, using 2001 Census data, doing so may not have accounted for all possible differences between respondents and non-respondents. Finally, the findings reported here are varied, complicating their subsequent interpretation; however, this is not surprising given that both sociodemographic attributes and risk perception dimensions are equally extensive in their distinctive qualities, and results from past research examining the role of these phenomena in preparedness have been equally mixed. Similarly, while effect sizes for the significant findings noted above may appear modest, they are in fact congruent with other studies looking at complex individual-level factors and preparedness (Lindell and Hwang 2008; McFarlane *et al.* 2011). Thus, deconstructing 10% of the variance in such a perplexing construct such as preparedness is not unsubstantial.

On a theoretical level, this study is generally concerned with individual-level characteristics. The relatively modest explanatory power of the full model, along with the fact that most relationships between sociodemographics and emergency response intentions were not significantly explained by cognitive threat appraisals, suggests that other factors should be emphasized when attempting to explain and improve risk perceptions and response among high-risk groups. While cognitive factors such as risk perception are important considerations when predicting behaviors, they do not take into consideration the social conditions that make responding possible. For instance, having access to pertinent information, as well as the instrumental means to respond are also important requirements for a successful individual emergency response. These resources may be facilitated or hindered by access to social networks, social support, material resources, and individual health, as well as higher-order contextual factors, such as neighborhood characteristics and community resources (Klinenberg 2002; Riad *et al.* 1999; Kim and Kang 2010). Since these resources are sometimes less prominent in the social environments of at-risk groups (Li *et al.* 2003; Cacioppo and Hawkley 2003; Saegert *et al.* 2001), they should be considered carefully in future research when attempting to understand the mechanisms by which emergency directives are successful.

While the limitations described above may appear to diminish the impact of this study, they actually provide an important and powerful contribution to the field of emergency management. Currently, most emergency preparedness campaigns focus on changing risk perceptions to encourage protective action. Low levels of reported preparedness persist despite these campaigns, however (Lemyre *et al.* 2007; Public Safety Canada 2010), drawing criticism that limiting the focus to risk perceptions alone is not a sufficient strategy (Ablah *et al.* 2009; Basolo *et al.* 2009). Our findings provide evidence to support these criticisms in the context of higher-risk groups, for whom the mitigation of emergency threats is especially needed. In the present study, risk perceptions did not explain reported sociodemographic differences in emergency response intentions. Rather than relying on changing risk perceptions to improve behavior in socially disadvantaged groups, our results suggest that more emphasis should also be given to improving the underlying social environmental barriers to preparedness and response, as discussed above. Indeed, calls for this type of fundamental shift in mitigation strategies have been echoed elsewhere (Uscher-Pines *et al.* 2012; Phillips *et al.* 2010).

CONCLUSION

This study offers a significant contribution to the literature on emergency response and at-risk groups. First, it provides a novel investigation of the relationship between social and cognitive factors related to emergency response, as it relates to various at-risk groups in the realm of the Canadian context. While past research on decision-making in emergencies has examined both cognitive appraisals and sociodemographics, the pathways involving these factors have not been explicitly examined. This study directly tested the nature of these relationships, thereby moving beyond the traditional analysis of sociodemographics to begin identifying the "active ingredients" in underlying psychological processes. For example, gender effects in preparedness and response were explained here by a greater sensitivity to the

perceived seriousness and impact of potential threats. While the potential impact of risk perception was not demonstrated here with regard to other sociodemographics, this research is an important first step in developing more sophisticated analytical strategies to clarify the complexity of these intertwined concepts.

Finally, this study examines perceptions in the anticipatory stage of the disaster cycle, which is an important contribution to emergency management. Certainly, if discrepancies in emergency response intentions exist even before an event occurs, policy-makers should take the opportunity to address the unique needs and circumstances of individuals within these groups. Focusing on determinants that may impact both the social and cognitive processes by which differences occur may help reduce stigmatization in emergencies, and improve current emergency plans and educational preparedness materials. Indeed, if researchers and emergency managers wish to mitigate the negative outcomes of emergencies—including the added harm sustained by socially disadvantaged groups—existing strategies must consider these precursors to successful emergency response behaviors.

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