
Differential perception of chemical, biological, radiological and nuclear terrorism in Canada

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Abstract: As part of the Canadian national public survey of perceived chemical, biological, radiological and nuclear (CBRN) terrorism threat and preparedness, 1502 Canadians were recently interviewed by telephone. This paper presents a descriptive examination of perceptions of the occurrence of terrorist bombings and CBRN terrorism in Canada on a number of evaluative dimensions, including perceived likelihood, uncertainty, severity, personal impact and ability to cope should such an event occur. Overall, Canadians perceived that the occurrence of terrorism in Canada was associated with serious consequences and would have a great impact on their lives. However, they also perceived that such an event was unlikely to occur. Terrorist bombings were perceived as the most likely to occur but were perceived as having the least severe consequences. The converse was found for perceptions of nuclear terrorist attacks. Perceptions varied by demographic background, with gender and education representing important determinants. The implications of findings for risk management and communication are discussed.

Keywords: Canada; CBRN; gender; risk management; risk perception; terrorism.

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1 Introduction

Emergency preparedness and disaster management have become of chief importance in current public health practice in Canada. Terrorism, specifically, has received much consideration due to recent large-scale attacks in North America and Europe. Terrorism occupies a unique place among risk issues due to considerable amounts of associated uncertainties, widespread media coverage, as well as the significant breadth of consequences associated both with an attack itself as well as the threat of a possible attack (Kunreuther, 2002). Indeed, distinguishing features such as sustained pending threat, maliciousness and moral unacceptability render terrorism a risk issue that must be carefully managed (Leiss, 2001; Lemyre et al., 2005a).

Perry and Lindell (2003, p.59) note that 'Emergency management that is not based on accurate knowledge of both the threat and principles of human response is destined to fail.'

Certainly, in the area of health risk management, public perception is a key determinant of public response to a particular threat. With respect to terrorism, previous studies have emphasised the importance of terrorism risk perceptions in relation to the adoption of related precautionary measures and travel decisions (Fischhoff et al., 2004). Increasingly, knowledge of public perception of terrorism is considered integral to the development and communication of effective terrorism-related risk management strategies. Clearly, understanding the magnitude of this issue involves more than assessing the degree of risk posed by terrorism; it also requires a thorough understanding of the public's perception of terrorism and expectations surrounding preparedness.

Much interest has been generated on the public perception and psychological impact of terrorism, particularly in relation to the occurrence of high profile terrorist attacks in the US and Europe. Surveys conducted in the US shortly following the attacks of 11 September 2001 revealed high levels of psychological stress (Schuster et al., 2001) and high levels of risk perceived for the average American to be hurt in a terrorist attack in the upcoming year (Lerner et al., 2003). Risk perceptions also remained high when followed-up one year later (Fischhoff et al., 2005). Demographic factors including gender, visible minority status and proximity to the attacks were found to influence levels of psychological stress and perceived terror risk (Fischhoff et al., 2003; Schuster et al., 2001). Surveys conducted in London following the 7 July 2005 bombings also revealed high levels of risk perceived for the occurrence of another terrorist attack in the near future (Rubin et al., 2005).

Although informative, the above studies are not necessarily insightful as to how terrorism might be perceived by the Canadian public, as no recent large-scale events have taken place on Canadian soil. The pending threat of terrorism and its potential to evoke public response warrant a better understanding of Canadians' perceptions surrounding this matter. Findings of a national survey suggest that terrorism is perceived as a low risk to the Canadian public compared with other health hazards (Krewski et al., 2005) – contrasting findings of studies from the US and London. It was also perceived as uncontrollable, unacceptable and uncertain relative to other hazards. However, the previous survey assessed perceptions of terrorism in general rather than specific scenarios such as chemical, biological, radiological and nuclear (CBRN) terrorism. It remains unclear how specific scenarios may be perceived by the Canadian public.

Results of studies from other regions suggest the existence of notable differences in perceptions of specific terrorism scenarios. A comprehensive report by the National Council on Radiation Protection and Measurements (2001) recognised radiological and nuclear terrorist threats as particularly apt to generate fear and feelings of vulnerability among members of the public compared with other threats (Becker, 2005). Findings of a series of focus groups in the US also underlined the need for different risk communication approaches across different scenarios (Becker 2004; Glik et al., 2004; Henderson et al., 2004; Wray and Jupka, 2004). Sjöberg (2002) assessed perceptions of five different terrorism scenarios among the members of the Swedish public (i.e. hijacking, spreading of dangerous contamination of illness, bombings, infiltration of important government organisations and spreading dangerous illnesses with regular mail). Similar to Canadians, Swedish respondents perceived a low level of terrorism risk overall compared with that of other hazards. The 'spreading of dangerous contamination or illness' was considered to pose the greatest personal risk from terrorism, whereas 'bombings' were considered to pose the least.

Overall, previous studies provide some indication as to how the risks associated with different terrorism scenarios are perceived relative to one another. However, perceptions of risk have been found to comprise a number of other evaluative dimensions including the perceived likelihood of occurrence, the degree of perceived uncertainty surrounding the event, the perceived severity of the consequences and the perceived level of personal control (Fischhoff et al., 1978; Slovic, 1987). At an individual level, factors such as personal impact (i.e. direct exposure to an attack or the injury or death of a friend or family member) and poor coping have been associated with increased risk perceptions (Rubin et al., 2005; Schlenger et al., 2002; Silver et al., 2002). In an effort to further understand this matter, the current paper presents findings of a national survey of public perception of terrorism-related risk and preparedness among Canadians (Lemyre et al., 2005b). Specifically, perceptions of different terrorism scenarios are compared across various evaluative dimensions. Differences are also presented across specific population subgroups in order to take into account the diverse nature of the Canadian population.

2 Methods

2.1 Participants

Respondents were 1502 adult Canadians (48.7% men and 51.3% women), grouped into the following age categories:

- 18–34 years (28.4%)
- 35–54 years (42.1%)
- 55 years or greater (29.2%).

A total of 29.0% of respondents had at most a high school education and 70.4% had at least some college education. The majority of respondents lived in an urban area (76.1%) as opposed to a rural area. Most respondents were born in Canada (85.2%) and did not consider themselves a member of a visible minority group (91.8%).

2.2 Materials

The design of the questionnaire used for the Canadian national survey of perceived CBRN terrorism threat and preparedness was largely based on pilot work (Lee et al., 2004), on concepts emerging in group interviews (Lemyre et al., 2004) and on a previous national health risk perception survey (Krewski et al., 2005, 2006). The survey protocol is described in detail elsewhere (Lemyre et al., 2005b). In brief, the questionnaire was designed to ascertain perceptions regarding the threat of terrorism, levels of individual and institutional preparedness and terrorism information gathering practices. The study protocol was approved by the Research Ethics Board of the University of Ottawa.

Respondents were asked to indicate how likely they think terrorist bombings as well as chemical, biological, radiological and nuclear terrorism will occur in Canada. In addition, respondents indicated how uncertain they feel about the possibility of each in Canada, how serious it would be if each occurred in Canada, to what extent each would have an impact on their lives and how well they think they would be able to cope. In order

to ensure that respondents were considering the appropriate terrorism scenario, respondents were primed with the following examples of specific CBRN agents:

- “the release of harmful chemicals or gases such as Sarin nerve gas or Mustard gas” for chemical terrorism
- “the intentional spread of diseases such as Smallpox or Anthrax” for biological terrorism
- “the use of ‘dirty bombs’ to spread radioactive materials (dirty bomb was described as a conventional explosive, such as dynamite, with radioactive material, if needed)” for radiological terrorism
- “the use of nuclear bombs” for nuclear terrorism.

Respondents provided answers using a five point Likert-type scale (1 = not at all, 5 = extremely). A sixth choice was also available as respondents could also decline to respond (0 = do not know/no opinion). A variety of demographic information on respondents was also collected. Results from other survey components are reported elsewhere (Lemyre et al., 2006, 2007).

2.3 Procedure

Respondents were identified by random digit dialing and interviewed between November 15 and December 15, 2004. The sampling procedure was stratified by region (Atlantic, Quebec, Ontario, Prairies, Alberta and British Columbia), age and gender according to the 2001 Canadian census population. Telephone interviews were conducted in both official languages (English 77.2% and French 22.8%) and were approximately 35 minutes in length. Lists of items associated within particular sections were administered in a random sequence in order to avoid potential ordering effects. Upon first household contact, the birthday method was used to select the resident to complete the survey. Of the total 28,648 phone numbers dialled, 4910 were not valid and 8284 were unanswered. Of the valid answered calls, the remainder resulted in a refusal (77.9%), required a call back (9.6%), or were addressed to individuals with demographic characteristics of quotas already met (2.8%).

2.4 Statistical methods

Survey weights were used throughout analyses in order that the sample be representative of the Canadian population. Design effects due to the stratified sampling procedure were examined and found to be close to 1 (greater than 0.99 but less than 1.00), indicating that analysis of the data with variances estimated assuming a simple random sample would be reliable.

A series of within-subjects multivariate analyses of variance (MANOVAs) were performed in order to examine whether perceptions of terrorism scenarios differed in terms of the evaluative dimensions of perceived likelihood, uncertainty, severity, personal impact and personal ability to cope (terrorist bombings or CBRN terrorism). A threat index was computed by summing response values for perceived likelihood, uncertainty, severity and personal impact, while deducting that for perceived ability to cope for each

terrorism scenario in order to consider multiple aspects of CBRN terrorism simultaneously (Fischhoff et al., 1978, Rubin et al., 2005; Schlenger et al., 2002; Silver et al., 2002; Slovic, 1987). *Post-hoc* paired *t* tests were used to examine pairwise differences across evaluative dimensions if a significant within-group effect was found. Finally, a series of between-subjects multivariate analyses of variance (MANOVAs) were performed to examine demographic differences in perceptions (gender, age group, educational status, area of residence, whether the respondent was born in Canada or a member of a visible minority group). A significance level of $p < 0.01$ was used throughout the analysis.

3 Results

3.1 Perceptions of CBRN terrorism

The level of perceived likelihood, uncertainty, severity, personal impact, personal ability to cope and the overall threat index differed significantly by terrorism scenario (Table 1). Significant pairwise differences were found across nearly every evaluative dimension.

Although perceptions regarding the likelihood of occurrence of specific scenarios were fairly low, respondents indicated that terrorist bombings were the most likely to occur in Canada. This was followed in order by biological, chemical, radiological and nuclear terrorism.

Perceived uncertainty appeared to mirror perceptions of the likelihood. Specifically, respondents indicated they felt the greatest uncertainty about potential terrorist bombings and biological terrorism in Canada, whereas they felt the least amount of uncertainty about nuclear terrorism.

Relative to other evaluative dimensions, the magnitude of responses was greater for the perceived level of severity and personal impact. Perceived severity and personal impact were greatest for nuclear terrorism, lowest for terrorism bombings, and similar for radiological and biological terrorism.

Respondents indicated that they felt they would be best able to cope if a terrorist bombing occurred in Canada, whereas they felt they would be least able to cope if a nuclear terrorist attack occurred in Canada. Perceived ability to cope was similar for attacks of biological, chemical and radiological nature.

Based on the composite threat index, respondents reported the greatest level of threat from biological and nuclear terrorism, followed by chemical and radiological terrorism. Terrorist bombings were perceived as the lowest threat overall.

3.2 Demographic differences

3.2.1 Gender

Perceptions of terrorism varied significantly by gender for each evaluative dimension (Table 2). Specifically, women perceived all terrorism scenarios as more likely (p values ranging from < 0.0001 to < 0.001). They also reported greater perceived severity (p values ranging from < 0.0001 to < 0.001), personal impact (all p values < 0.0001) and overall threat (all p values < 0.0001) for all scenarios than did men. Finally, women reported greater uncertainty about terrorism bombings, $F(1,1448) = 7.95$, $p < 0.01$; biological terrorism, $F(1,1462) = 16.84$, $p < 0.0001$; nuclear terrorism, $F(1,1457) = 25.49$, $p < 0.0001$. Conversely, men reported a greater ability to cope with all scenarios (p values ranging from < 0.001 to < 0.01).

Table 1 Mean response scores for CBRN terrorism perceptions (standard deviation (SD) shown in parentheses)

	Terrorist bombing	Chemical terrorism	Biological terrorism	Radiological terrorism	Nuclear terrorism	df	F
How likely do you think it is that (a) _____ will occur in Canada?	2.55 (1.11)	2.17 (0.99)	2.43 (1.07)	2.05 (0.98)	1.86 (0.96)	4, 1446	191.58***
How uncertain do you feel currently about possible _____ in Canada?	2.32 (1.09) _a	2.14 (1.06) _b	2.30 (1.07) _a	2.10 (1.08) _b	1.97 (1.04)	4, 1389	52.19***
How serious do you think it would be if (a) _____ did occur in Canada?	3.71 (1.15)	3.94 (1.08)	4.03 (1.06) _c	4.07 (1.04) _c	4.33 (1.01)	4, 1420	105.29***
If (a) _____ occurred in Canada, to what extent do you think it would have an <i>impact</i> on your life?	3.10 (1.28)	3.45 (1.24)	3.59 (1.20) _d	3.59 (1.23) _d	4.02 (1.16)	4, 1380	196.36***
If (a) _____ occurred in Canada, how well do you think you would be able to <i>cope</i> with it?	3.06 (1.24)	2.89 (1.27) _e	2.85 (1.27) _{e,f}	2.81 (1.26) _f	2.66 (1.35)	4, 1327	31.06***
Threat index	8.63 (3.58) _g	8.84 (3.46) _{g,h}	9.52 (3.53) _i	9.00 (3.36) _h	9.50 (3.20) _i	4, 1193	38.86***

Notes: *** $p < 0.0001$;** $p < 0.001$;* $p < 0.01$

mean response scores represent positive responses only.

Similar subscripts indicate no-significant difference in *post-hoc* paired *t* test found ($p \geq 0.01$)

Table 2 Mean response scores for CBRN terrorism perceptions among men and women (SD shown in parentheses)

	Terrorist bombing (men, women)	Chemical terrorism (men, women)	Biological terrorism (men, women)	Radiological terrorism (men, women)	Nuclear terrorism (men, women)	df	F
How likely do you think it is that (a) _____ will occur in Canada?	2.48 (1.11), 2.62 (1.11)	2.02 (0.94), 2.31 (1.02)	2.24 (1.01), 2.60 (1.10)	1.93 (0.96), 2.16 (0.98)	1.66 (0.89), 2.04 (1.00)	5,1444	15.74***
How uncertain do you feel currently about possible _____ in Canada?	2.24 (1.06), 2.40 (1.11)	2.07 (1.05), 2.20 (1.06)	2.18 (1.04), 2.41 (1.09)	2.05 (1.08), 2.15 (1.08)	1.83 (1.01), 2.11 (1.06)	5,1387	6.29***
How serious do you think it would be if (a) _____ did occur in Canada?	3.50 (1.21), 3.90 (1.05)	3.76 (1.14), 4.11 (0.98)	3.88 (1.12), 4.17 (0.98)	3.95 (1.11), 4.19 (0.95)	4.24 (1.10), 4.42 (0.91)	5,1418	11.08***
If (a) _____ occurred in Canada, to what extent do you think it would have an impact on your life?	2.86 (1.28), 3.33 (1.23)	3.21 (1.29), 3.69 (1.14)	3.37 (1.26), 3.80 (1.10)	3.42 (1.28), 3.74 (1.17)	3.87 (1.25), 4.16 (1.04)	5,1378	15.60***
If (a) _____ occurred in Canada, how well do you think you would be able to cope with it?	3.19 (1.27), 2.94 (1.21)	3.00 (1.29), 2.79 (1.24)	2.96 (1.27), 2.74 (1.25)	2.91 (1.27), 2.72 (1.25)	2.76 (1.31), 2.56 (1.37)	5,1325	3.33**
Threat index	7.90 (3.49), 9.36 (3.52)	8.12 (3.45), 9.54 (3.33)	8.76 (3.47), 10.26 (3.44)	8.44 (3.37), 9.55 (3.26)	8.84 (3.15), 10.13 (3.12)	5, 1191	15.59***

Notes: *** $p < 0.0001$;
 ** $p < 0.001$;
 * $p < 0.01$
 mean response scores represent positive responses only

3.2.2 Age group

Perceptions of terrorism varied significantly by age group for each evaluative dimension with the exception of uncertainty (Table 3). Specifically, older respondents perceived radiological, $F(1,846) = 13.60, p < 0.001$ and nuclear terrorism, $F(1,858) = 7.46, p < 0.01$ as more likely to occur and perceived nuclear terrorism as more serious, $F(1,852) = 10.17, p < 0.01$ than younger respondents. In contrast, younger respondents reported that all scenarios but chemical terrorism would have a larger impact on their lives (p values ranging from < 0.0001 to < 0.01). Nevertheless, they perceived themselves as better able to cope in the event of all scenarios with the exception of nuclear terrorism (p values ranging from < 0.001 to < 0.01).

3.2.3 Education

Perceptions of terrorism varied significantly by educational status for all evaluative dimensions (Table 4). Specifically, respondents with lower education perceived the likelihood of chemical, $F(1,1473) = 21.91, p < 0.0001$, biological, $F(1,1478) = 12.06, p < 0.001$, radiological, $F(1,1472) = 21.91, p < 0.0001$ and nuclear terrorism, $F(1,1485) = 28.20, p < 0.0001$ to be greater than those with higher education. They reported more uncertainty about possible chemical, $F(1,1445) = 17.99, p < 0.0001$, radiological, $F(1,1441) = 17.85, p < 0.0001$ and nuclear terrorist attacks, $F(1,1451) = 20.89, p < 0.0001$ in Canada. They perceived the severity of consequences, $F(1,1468) = 7.55, p < 0.01$ and personal impact, $F(1,1439) = 13.14, p < 0.001$ to be greater should a terrorist bombing occur in Canada. Lastly, they perceived a greater level of overall threat for all terrorism scenarios than those with a higher level of education (p values ranging from < 0.0001 to < 0.01). In contrast, respondents with a higher level of education perceived themselves as better able to cope should a terrorist bombing, $F(1,1413) = 16.79, p < 0.0001$ or biological terrorism, $F(1,1415) = 10.81, p < 0.01$ occur.

3.2.4 Urban versus rural residence

Urban and rural residents differed in their perceptions of the likelihood of occurrence of the terrorism scenarios, $F(5, 1444) = 3.40, p < 0.01$. Significant differences were observed for chemical, $F(1, 1480) = 8.76, p < 0.01$ ($M = 2.30$ ($SD = 1.02$) versus $M = 2.12$ ($SD = 0.98$)), radiological, $F(1, 1479) = 12.11, p < 0.001$ ($M = 2.21$ ($SD = 1.04$) versus $M = 2.00$ ($SD = 0.95$)) and nuclear terrorism, $F(1, 1492) = 12.97, p < 0.001$ ($M = 2.02$ ($SD = 1.05$) versus $M = 1.81$ ($SD = 0.93$)) where rural residents perceived these scenarios as more likely to occur.

3.2.5 Country of birth and visible minority status

Respondents who were born in Canada differed from those who were not in terms of perceived likelihood, $F(5, 1444) = 3.83, p < 0.01$. Specifically, respondents born in Canada perceived the likelihood of terrorist bombings, $F(1, 1483) = 13.30, p < 0.001$ ($M = 2.60$ ($SD = 1.11$) versus $M = 2.30$ ($SD = 1.11$)), chemical, $F(1, 1480) = 8.27, p < 0.01$ ($M = 2.20$ ($SD = 0.99$) versus $M = 1.99$ ($SD = 0.95$)) and nuclear terrorism, $F(1, 1492) = 11.33, p < 0.001$ ($M = 1.89$ ($SD = 0.97$) versus $M = 1.66$ ($SD = 0.89$)) as greater. No significant differences were noted by visible minority status.

Table 3 Mean response scores for CBRN terrorism perceptions by age group (years) (SD shown in parentheses)

	Terrorist bombing (34 or less, 55 or greater)	Chemical terrorism (34 or less, 55 or greater)	Biological terrorism (34 or less, 55 or greater)	Radiological terrorism (34 or less, 55 or greater)	Nuclear terrorism (34 or less, 55 or greater)	df	F
How likely do you think it is that (a) _____ will occur in Canada?	2.49 (1.09), 2.50 (1.14)	2.04 (0.92), 2.17 (1.04)	2.42 (1.10), 2.36 (1.10)	1.88 (0.93), 2.14 (1.07)	1.72 (0.90), 1.90 (1.03)	5,818	5.46***
How uncertain do you feel currently about possible _____ in Canada?	2.25 (1.07), 2.33 (1.15)	2.09 (1.03), 2.12 (1.10)	2.28 (1.10), 2.21 (1.09)	2.00 (1.09), 2.14 (1.11)	1.91 (1.03), 1.97 (1.08)	5,795	2.28
How serious do you think it would be if (a) _____ did occur in Canada?	3.69 (1.10), 3.75 (1.16)	3.86 (1.09), 3.96 (1.12)	3.96 (1.09), 4.04 (1.09)	4.06 (1.02), 4.06 (1.08)	4.41 (0.95), 4.18 (1.14)	5,812	5.37***
If (a) _____ occurred in Canada, to what extent do you think it would have an impact on your life?	3.21 (1.18), 2.94 (1.36)	3.46 (1.18), 3.35 (1.35)	3.65 (1.10), 3.43 (1.31)	3.68 (1.15), 3.41 (1.34)	4.16 (1.05), 3.66 (1.33)	5,778	9.67***
If (a) _____ occurred in Canada, how well do you think you would be able to cope with it?	3.16 (1.18), 2.87 (1.31)	3.05 (1.18), 2.73 (1.33)	2.95 (1.20), 2.66 (1.30)	2.90 (1.20), 2.65 (1.29)	2.65 (1.32), 2.64 (1.35)	5,774	4.90**
Threat index	8.58 (3.34), 8.59 (3.84)	8.44 (3.19), 8.89 (3.77)	9.39 (3.44), 9.39 (3.70)	8.67 (3.24), 9.13 (3.62)	9.52 (2.91), 9.05 (3.62)	5, 664	5.21**

Note : *** $p < 0.0001$;
 ** $p < 0.001$;
 * $p < 0.01$
 mean response scores represent positive responses only

Table 4 Mean response scores for CBRN terrorism perceptions by education (SD shown in parentheses)

	Terrorist bombing (high school or less, at least some college)	Chemical terrorism (high school or less, at least some college)	Biological terrorism (high school or less, at least some college)	Radiological terrorism (high school or less, at least some college)	Nuclear terrorism (high school or less, at least some college)	df	F
How likely do you think it is that (a) ___ will occur in Canada?	2.57 (1.13), 2.55 (1.10)	2.35 (1.08), 2.09 (0.93)	2.58 (1.12), 2.37 (1.04)	2.24 (1.05), 1.98 (0.94)	2.06 (1.03), 1.77 (0.93)	5,1439	9.64***
How uncertain do you feel currently about possible ___ in Canada?	2.41 (1.15), 2.28 (1.06)	2.32 (1.11), 2.07 (1.02)	2.39 (1.13), 2.25 (1.05)	2.29 (1.13), 2.02 (1.05)	2.17 (1.05), 1.89 (1.03)	5,1382	7.11***
How serious do you think it would be if (a) ___ did occur in Canada?	3.83 (1.14), 3.65 (1.15)	4.02 (1.09), 3.91 (1.07)	4.13 (1.00), 3.99 (1.08)	4.10 (1.05), 4.06 (1.03)	4.28 (1.04), 4.35 (1.00)	5,1412	3.89*
If (a) ___ occurred in Canada, to what extent do you think it would have an impact on your life?	3.29 (1.28), 3.02 (1.27)	3.54 (1.27), 3.42 (1.22)	3.69 (1.20), 3.55 (1.20)	3.58 (1.26), 3.58 (1.22)	3.98 (1.19), 4.03 (1.14)	5,1372	4.68**
If (a) ___ occurred in Canada, how well do you think you would be able to cope with it?	2.85 (1.30), 3.15 (1.21)	2.76 (1.30), 2.94 (1.26)	2.67 (1.33), 2.92 (1.23)	2.69 (1.30), 2.86 (1.24)	2.63 (1.41), 2.66 (1.32)	5,1319	3.82*
Threat index	9.27 (3.48), 8.37 (3.58)	9.58 (3.39), 8.54 (3.44)	10.14 (3.39), 9.27 (3.54)	9.54 (3.30), 8.79 (3.36)	9.90 (3.20), 9.34 (3.19)	5, 1187	5.57***

Notes: *** $p < 0.0001$;** $p < 0.001$;* $p < 0.01$

mean response scores represent positive responses only

4 Summary and discussion

The findings presented above are consistent with those of previous studies in Canada (Krewski et al., 2005, Lemyre et al., 2004). There was a tendency for Canadians to perceive CBRN terrorism and terrorist bombings as not particularly likely to occur. A recent study comprised of group interviews revealed that many individuals who were not concerned about terrorism in Canada cited their geographic area of residence as a rationale for their beliefs, specifying that attacks were more likely to occur elsewhere (Dallaire et al., 2005). The present findings may therefore be indicative of the view that the terrorism threat is low in Canada due to the nation's image in the world as a friendly, pacifist country (Lemyre et al., 2004). Alternatively, it may be difficult for Canadians to entertain the notion that such an event could take place as no large-scale events have occurred in Canada in recent years. In either instance, the finding that Canadians perceived CBRN terrorism scenarios as relatively unlikely may be associated with risk management implications as investments in terrorism planning may not be considered worthwhile by the public. Similarly, efforts to promote terrorism preparedness may also be associated with limited success, despite their apparent necessity.

Relative to perceived likelihood of occurrence, higher ratings were assigned to the evaluative dimensions of severity and personal impact. Indeed, terrorist attacks are typically associated with great catastrophic potential, both in terms of life lost as well as economic difficulties that arise from their social and psychological effects (Lemyre et al., 2004, Slovic, 2002). Given that Canadians clearly distinguish the consequences of terrorist events from their likelihood, risk management directed at psycho-social outcomes may represent an important and well-received area for further research and development.

In addition, there was a tendency for respondents to differentiate general consequences from those on their personal lives. Specifically, higher ratings were assigned to the severity of the consequences of terrorism in Canada relative to their impact on respondents' personal lives. This finding mirrors those of previous studies on perceptions of societal versus personal risk (Krewski et al., 2005; Lemyre et al., 2006; Sjöberg, 2002). Although the reasons for this finding are not clear, results from other studies suggest it may relate to a sense of personal control over the effects of terrorism (Sjöberg, 2000). In addition, it is not entirely clear which consequences of terrorism respondents considered when rating the scenarios and whether they were exclusively negative. Results of another survey revealed that Canadians experienced positive life changes following the attacks of September 11, 2001 which were sustained over time (Davis and Macdonald, 2004). Therefore, it is possible that respondents considered both negative and positive consequences while rating the scenarios, perhaps considering a greater number of negative consequences while producing ratings at the societal level.

Despite these overall trends, perceptions of likelihood, uncertainty, severity, personal impact and ability to cope varied greatly across different terrorism scenarios. The finding that terrorist bombings were perceived as most likely may relate to the fact that the majority of terrorist events that have occurred in Canada have involved bombs (Leman-Langlois and Brodeur, 2005). Although unexpected, the observation that respondents were most uncertain about possible terrorist bombings might suggest that they feel confident that alternative terrorism scenarios are not likely to occur in Canada. Not surprisingly, respondents indicated that a terrorist bombing would have the least serious consequences or impact on their lives and that they would be best able to cope should such

an event occur in Canada. In addition, terrorist bombings scored the lowest on the composite threat index.

Canadians' perceptions of nuclear terrorism were in complete contrast to those of terrorist bombings. More specifically, nuclear terrorism was deemed the least likely and uncertain but was associated with the most serious consequences, personal impact and the least ability to cope should such a scenario occur in Canada. Next to biological terrorism, nuclear terrorism also evoked the greatest degree of threat based on the overall index, perhaps reflecting its potential to result in substantial death and destruction. Indeed, catastrophic potential and the size of the population at risk have been identified as factors associated with public concern over risk (Fischhoff et al., 1978; Slovic, 1987). Additionally, nuclear and radioactive hazards have occupied a special place as topics in risk research and management as they are associated with high levels of fear, dread and stigma (Becker, 2004, 2005; Flynn et al., 1994, Krewski et al., 1995a,b, 2006; Sjöberg, 2000; Slovic 1987). Canadians may also have held biological terrorism as a high threat due to the recent 2003 Severe Acute Respiratory Syndrome (SARS) outbreak in Toronto, Ontario. Although not of terrorist origin, such experience with a fatal infectious agent and its associated consequences, including large scale quarantine efforts (DiGiovanni et al., 2004), may have rendered the threat of biological terrorism of greater salience in respondents' minds.

Given that respondents differentially perceived the five scenarios considered in the present survey, it would also be useful to determine if perceptions also vary according to specific CBRN terrorism agents. Results from another survey component revealed that respondents did not think about CBRN agents such as Anthrax or Smallpox to the same extent, suggesting that their views of specific agents may differ (Lemyre et al., 2006). However, it is unclear whether understanding of different CBRN agents is presently sufficient to investigate this matter. In the present study, respondents' initial degree of understanding surrounding each scenario was assessed by asking them to indicate which specific type of attack they first had in mind in relation to the five scenarios prior to being provided with their definition. In many cases, agents were referred to in a general fashion or different types of attacks were confounded; namely biological with chemical attacks and radiological with nuclear attacks (Etchegary et al., 2006).

In view of the public's potential unfamiliarity with certain CBRN terrorism scenarios, it is of chief importance that emergency managers provide the public with prompt information about their associated risk and suggested coping mechanisms in the event of an attack (Perry and Lindell, 2003). It was also suggested that communications related to radiological/nuclear terrorism be accurate, complete, provided early in a proactive manner and not dismiss public concerns in order to be effective (Becker, 2005). In a series of focus groups among the US public, the provision of information associated with the potential health effects of attacks involving radioactive materials was identified as an important requirement, as was the need to address a potentially fatalistic public response (Becker, 2004). Unfamiliar situations can exacerbate anxiety in disaster scenarios and it is important to address the public's uncertainty as efficiently as possible. Framing CBRN risk communication messages in relation to forms of terrorism that are more readily understood by the public (e.g. terrorist bombings) may help reduce this unfamiliarity and improve their effectiveness.

Perceptions of terrorism were strongly associated with gender. Specifically, women perceived terrorist bombings as well as CBRN terrorism as more likely and uncertain

compared to men. They also perceived that the different scenarios would have more serious consequences and a greater impact on their lives. On the other hand, men perceived themselves as better able to cope should an attack occur in Canada. Finally, women scored greater on the overall threat index for every terrorism scenario. Although gender differences are well established in risk perception research (particularly with regards to terrorism-related risk), the mechanisms responsible for this phenomenon remain unclear (Dosman et al., 2001; Finucane et al., 2000; Krewski et al., 1995a, 2006; Slovic et al., 1995). While the tendency for men to underreport their perceptions may contribute to gender differences, a range of socio-political factors (Finucane et al., 2000), differences in information processing (Constans, 2001; Mogg et al., 1990) or emotion-related factors may also be involved (Lerner et al., 2003). For instance, Lerner et al. (2003) observed that women reported greater fear and pessimism in relation to terrorism-related risks, whereas men reported greater levels of anger and optimism. In turn, differences in emotional response were associated with policy preferences, with fear leading to preferences for conciliatory policies and anger leading to preferences for punitive policies. Thus, gender differences may also partly account for differences in the degree of support for various terrorism-related risk management policies.

Level of educational attainment was also strongly related to perceptions of terrorism. Specifically, respondents with a lower level of education reported greater perceived likelihood, uncertainty, severity, impact and overall threat as well as a reduced ability to cope. Similar findings have been reported in previous studies on perceptions of health risk in general (Krewski et al., 1995a, 2006), as well as perceptions of terrorism (Sjöberg, 2002). In a US study, respondents with a lower level of education reported more worry about anthrax exposure compared to those with a higher level of education (Jones, 2001; Zarcadoolas et al., 2005). Similarly, a UK study revealed that respondents of lower income were twice as likely to experience substantial distress and were more apt to alter their intentions of travel following the London bombings on July 7, 2005 (Rubin et al., 2005). Although factors associated with these findings are likely complex and multifaceted, one important contributor may be health literacy. For example, Zarcadoolas et al. (2005) examined health literacy in relation to anthrax communication efforts in the US in late 2001. Potential difficulties identified were instances where communications aimed at the public were complex, where a high level of fundamental and health literacy was needed, where high levels of prior knowledge were assumed by the communicators and where information was communicated in the midst of scientific uncertainty. Along with a potential perceived lack of ability to control such risks (Dosman et al., 2001), these factors may contribute to a heightened perceived threat of CBRN terrorism among individuals with lower education.

Although fewer differences were observed by other demographic characteristics, some interesting findings were noted. Given that an opposite result might have been expected, the fact that the perceived likelihood of an attack was greater among respondents born in Canada is worthy of discussion. It may be that respondents who chose to make Canada their home did so because they felt unsafe in their native country. Indeed, refugees represent a fair proportion – approximately 14% in 2004 (Citizenship and Immigration Canada, 2005) of new Canadians and it seems reasonable that such respondents would consider the occurrence of terrorism less likely in Canada in the context of their past experience. Unfortunately, it was not possible to examine this specifically. Since urban centres are typically identified as or have been actual targets of major attacks in the past,

the observation that rural residents perceived the occurrence of terrorism as more likely than did urban residents was also surprising. Older Canadians also perceived themselves as less able to cope with the occurrence of a terrorist attack. Therefore, it may be important to provide members of these demographic groups with resources that will enable them to better cope with the after effects of disasters. Identification of individuals who perceive themselves as most vulnerable can enable proactive measures to be taken, thereby ensuring that their needs are more efficiently met should such an event occur.

In considering the findings presented in the current paper, some study limitations must be acknowledged. Carried out in late 2004, the survey followed most closely the Madrid bombings. However, it was conducted in the absence of any recent attack on Canadian soil. As such, the evaluative dimensions assessed represent anticipations regarding the occurrence of an attack in Canada. Given the dynamic nature of risk perceptions, perceptions of terrorism are likely to change over time and with the occurrence of events, signalling a need to document the public's ever-changing views and attitudes. A second limitation might involve self-selection bias due to high rates of non-response and refusals common in telephone surveys. It should nevertheless be emphasised that the final sample consisted of a broad range of Canadians with varying backgrounds, reflecting the multicultural nature of the Canadian population.

In conclusion, although Canadians do not presently believe that terrorism is likely to occur in Canada, they acknowledge that such events are associated with severe consequences. Individual preparedness may be difficult to achieve in this context. However, it is reasonable to assume that Canadians expect the government to be well prepared to manage the consequences of such an attack. According to Waeckerle et al. (2001), improving emergency preparedness is not a function of the likelihood but rather a matter of proactively addressing the magnitude and severity of the consequences should an event occur. The present findings suggest that special consideration should be given to nuclear and biological terrorism in the design of risk management and communication strategies in order to avoid further exacerbating the public's overall feelings of threat in the event of attacks of this nature. Moreover, women and individuals of lower educational status are noted as potentially vulnerable population subgroups, emphasising the need to address their concerns. Further research is needed in order to examine how perceptions of CBRN terrorism change over time so that risk management and communication strategies remain relevant and appropriate for all Canadians.

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