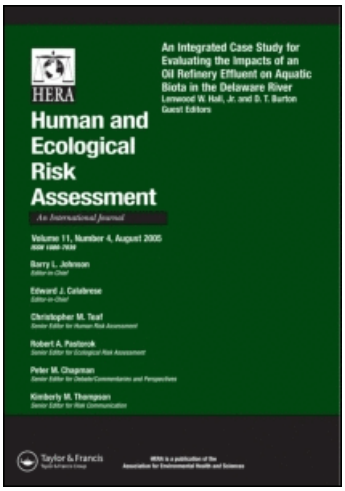

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Canadians' Representation of Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Terrorism: A Content Analysis

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Canadians' Representation of Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Terrorism: A Content Analysis

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ABSTRACT

The global threat of terrorism raises questions about preparedness and risk communication in the context of public health and security. Although experts discriminate between chemical, biological, radiological, nuclear, and explosive (CNRNE) terrorist events, little is known about how the Canadian public represents these forms of terrorism. A stratified random sample of 1502 Canadians participated in a telephone survey on CBRNE terrorism. A word association technique was used to assess first words or images that came to mind while thinking about different types of terrorist scenarios. Content analysis of this data revealed a number of potential uncertainties and misconceptions regarding different types of terrorism scenarios. Despite most frequently providing agents in response questions surrounding chemical or biological terrorism, respondents frequently confounded agents of biological and chemical nature. Similarly, different aspects of nuclear events were not consistently distinguished. Most notably, however, a sizable proportion of respondents had difficulty providing word associations to the different types of terrorist events or only provided vague responses that closely mirrored the scenario in question. Finally, images regarding the potential impacts of scenarios were infrequent. Implications for risk communication and preparedness are discussed; in particular, the need to provide the public with more detailed information regarding the nature of different forms of CBRNE terrorism and how to best prepare for a potential event.

Key Words: chemical, biological, nuclear, radiological, and explosive terrorism; Canada; emergency preparedness.

INTRODUCTION

Terrorist events in the last decade such as the 1995 Sarin gas attacks in the Tokyo subway (Okumura *et al.* 1998) as well as the events of September 11, 2001,

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underscored the global threat of terrorism and highlighted the need for a rapid, effective response to such attacks (Centers for Disease Control and Prevention [CDC] 2000). While preparing a nation for a terrorist attack is a daunting challenge, the consequences of being unprepared could be devastating (CDC 2000). Crucial to enhance preparedness and response capabilities is the development of effective strategies for providing information to the general public and frontline professionals who would manage an attack. Thus, effective risk communication is critical, not only during a terrorist event, but in the development and availability of risk messages and education prepared long before an attack occurs (CDC 2000; Durodié and Wessely 2002). A growing literature offers best practices for risk communication (Covello *et al.* 2001; Frewer 2004), and response to the U.S. Anthrax incidents revealed the problems with unclear, over-general, and conflicting messages (Durodié and Wessely 2002).

Long before any event occurs, risk communicators should identify the risk communication goals (Arkin 1999; USDHHS 2002). This is important because the goal of any risk communication will affect not only what is said, but also how it is said (Arkin 1999; Bier 2001). In the context of terrorism preparedness and planning initiatives, what are the goals of risk communication messages to the public? Is the goal to reduce worry about a possible terrorist threat? Is it to motivate preparedness activities (*e.g.*, encouraging each household to assemble an emergency kit)? Is it to provide basic information about different types of terrorist attacks? Is it to provide information on what to do in the event of an attack? The risk communication message will surely be different depending on which of these goals (and certainly others) it is addressing. Effective risk communication also requires knowledge about what the intended audience already knows and feels (Bier 2001). In the context of terrorism communication, it is relevant, therefore, to ask what the Canadian public currently knows and thinks about terrorism. Lacking a thorough understanding of audience motivations, risk communication may suffer from limited understanding of the interests, fears, values, and priorities of the audience and may therefore fail to provide data that address these specific concerns and fears (Bier 2001). We acknowledge that audience characteristics, in addition to messenger and mode of delivery, are all crucial elements of risk communication (Bier 2001; Rothman and Kiviniemi 1999). However, we focus on one facet of audience characteristics that may have implications for communicating about terrorism. The aim of the current study was therefore to elucidate the nature of Canadians' representation of various terrorism scenarios.

Terrorism and Risk Communication

Early risk communication was guided by the "deficit model" approach to decision-making about science and technology. In this view, public disagreement with scientific experts or official positions on a variety of technological and scientific issues is seen as arising simply from public ignorance of scientific or technological facts (House of Lords Select Committee on Science and Technology 2000; Irwin and Wynne 1996). This view also holds that, if public ignorance is corrected with education, positive public attitude will follow. However the deficit model has met with strong opposition (Irwin and Wynne 1996), and the current view is one of regaining

the public's trust in regulators and governments (Rowe *et al.* 2005). In the United Kingdom, for example, the House of Lords Science and Technology Committee recommends greater openness and transparency in science policy-making, including greater public involvement in these decisions. Decision-making in the context of terrorism is no exception.

Despite the widespread belief that the public would panic following an attack, research suggests that its response is generally collectively adaptive and orderly (Glass and Schoch-Spana 2002). Hence, it is increasingly advocated that governments engage the public in terrorism preparedness and emergency plans (Durodié and Wessely 2002; Sorensen 2004). As Sorensen (2004, p. 231) cautioned, "If the public is not engaged as a partner, the best of information may not be taken seriously." This suggestion is in line with a public engagement position, which is increasingly promoted in democratic societies as a style of decision-making in the assessment and management of a variety of health and environmental risks (Rowe and Frewer 2000; Rowe *et al.* 2005).

In order to involve the public as partners, however, it is crucial to have some prior knowledge of its beliefs, attitudes, and expected behaviors in the context of terrorism. Accessing this information not only helps to highlight those areas in need of focus in public information campaigns, but also the similarities and differences between experts' and the public's representation of different forms of terrorism. In the event of a terrorist attack, effective risk messages will need to be specific, rather than general or vague (Durodié and Wessely 2002). Additionally, greater resources may need to be allocated to communicating about issues that are a source of public uncertainty, and these may prove to differ from those identified by experts. This suggests the need for investigations of public perceptions of specific types of terrorism, namely chemical, biological, radiological, nuclear, and explosive (CNRNE), in order to craft specific risk messages in these contexts. Thus far, studies of this nature have revealed several misconceptions regarding CBRNE terrorism.

Public Understanding of CBRNE Terrorism

The CDC instituted a program of focus-group research designed to develop and test messages about these specific terrorist threats with members of the general public (Becker 2004; Wray and Jupka 2004). In response to a hypothetical bioterrorism attack (plague), group discussions did not highlight the infectious nature of biological agents. This finding raises questions about the level of public preparedness for such an attack and suggests that there is a need for the provision of basic information about biological agents in risk messages (Wray and Jupka 2004). Focus group discussions also revealed unfamiliarity with chemical terrorism, and specifically, with VX, a toxic nerve agent that can cause seizures, unconsciousness, and death (Henderson *et al.* 2004). There was a pervading sense of fatalism regarding the survivability of a VX attack among participants, with many believing that survival following this type of attack was not possible and that the entire human population would be decimated (Henderson *et al.* 2004).

A third series of focus groups centered on a hypothetical scenario of an attack involving "radiation or nuclear materials" (Becker 2004, p. 200). As in group discussions on chemical terrorism, a sense of helplessness and fatalism was conveyed.

Indeed, it has long been reported that nuclear technology, radioactive waste, and the like are particularly apt to evoke public concern as their effects are deemed "unknown" and are "dreaded" by members of the public (Slovic 2001). Participants also displayed a notable lack of knowledge regarding the signs and symptoms of a radiological or nuclear event and expressed concern about how to detect exposure. Becker (2004) cautioned that emergency messages involving radiation or nuclear devices must anticipate and answer these kinds of health questions, as well as counter the fatalism that may be associated with these types of attacks.

Similar to findings observed in the focus groups held by the CDC, student nurses participating in a study of knowledge about CBRNE threats and their willingness to care for victims of these attacks revealed that they were fearful of being infected by victims of inhalation Anthrax and botulism (Young and Persell 2004), despite the fact that these agents are not transmitted human to human. In contrast, student nurses were less concerned about Smallpox, which is highly contagious. Additionally, students were concerned that they would be contaminated by victims of chemical or nuclear attacks, regardless of assurances that victims had been decontaminated (Young and Persell 2004). Taken with other misconceptions of CBRNE terrorism observed in the above studies, these findings raise important questions about public response and willingness (or ability) to follow emergency plans.

Study Objectives

In Canada, minimal research has explored public attitudes about terrorism. In an effort to address this gap, a national survey was conducted to assess Canadians' perceptions of CBRNE terrorism threat and preparedness (Lemyre *et al.* 2006, 2007, in press). Briefly stated, findings revealed that Canadians perceived the likelihood of CBRNE terrorist events as low, but recognized that the consequences would be serious should either type of attack occur. Also, terrorist bombings were thought to be the relatively most likely form of attack, whereas nuclear terrorism was perceived to have the most serious consequences (Lemyre *et al.* in press). In light of potential uncertainties or misconceptions among respondents about the nature of CBRNE terrorism threats, definitions were provided about each form of terrorism. For example, "terrorist bombings" were defined as "the use of common explosives such as dynamite." "Chemical terrorism" was defined as "the release of harmful chemicals or gases such as Sarin nerve gas or Mustard gas." "Biological terrorism" was defined as "the intentional spread of diseases such as Smallpox or Anthrax." "Radiological terrorism" was defined as "the use of dirty bombs to spread radioactive material," whereas "nuclear terrorism" was defined as "the use of nuclear bombs." This ensured that respondents had similar conceptualizations of the different types of scenarios while answering survey questions. Nevertheless, respondents' initial and unprompted representations of these can also be informative about topics that could be addressed in risk communication.

Prior to being given each definition, respondents were therefore asked to identify the first type of attack that came to mind while thinking about chemical, biological, radiological, and nuclear terrorism, as well as terrorist bombings. This approach was inspired by Slovic and his colleagues' use of word association techniques in their work on public risk perception (Benthin *et al.* 1995; Slovic *et al.* 1993). They

argued, "word association techniques encompass efficient ways of determining the contents and representational systems without requiring those contents to be expressed in the full discursive structure of human language" (Benthin *et al.* 1995, p. 144). Leiserowitz (2006, p. 48) also noted that, "free associations minimize the researcher bias potentially imposed in closed questionnaires; they are unfiltered, relatively context-free, and spontaneous, thus providing a unique means to access and assess subjective meanings." It was therefore assumed that a similar technique could be used to unveil Canadians' representation of CBRNE terrorism, perhaps helping to identify areas in which effective information and message-dissemination campaigns could be developed. Exploratory in nature, the current study presents descriptive findings of a content analysis performed on the resulting word associations.

METHODS

Participants

Respondents were from a stratified random sample of 1502 Canadians matched to 2001 Census data in terms of: (1) region (Atlantic, Quebec, Ontario, Prairies, Alberta, and British Columbia); (2) age group within region (18–34 years, 35–54 years, and ≥55 years); and (3) gender within region. Respondents were more than 18 years of age with a modal age category of 35 to 44 years. Men and women were nearly equally represented (49% and 51%, respectively), and most respondents (70%) had some or had completed community college or university. Each region was represented with approximately 8% of respondents from the Atlantic region, and 24.5, 37.5, 7, 9.5, and 13.5% from Quebec, Ontario, the Prairies, Alberta, and British Columbia, respectively.

Procedure

Data were collected through telephone interviews, which were administered in, 2004 in French (23%) or English (77%) as required, by a local survey consulting firm. Data were collected using Computer Assisted Telephone Interviewing (CATI), which improves the flow of survey administration. Households were identified by random digit dialing, with a maximum of five call backs. Upon contact, the household member whose birthday was closest to the day of the call was asked to be interviewed. Of the total 28,648 phone numbers dialed, 4,910 were not valid (*i.e.*, unavailable phone number, fax machine) and 8,284 were unanswered. Completed interviews represented 9.7% of the 15,454 valid answered calls. Remaining calls either 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%). (Quotas were preestablished on the basis of the aforementioned stratification approach for a sample of 1,500.)

Measures

A detailed description of the survey instrument and its administration is provided elsewhere (Lemyre *et al.* 2006, 2007, in press). Briefly, it was designed to explore

the opinions of respondents on a number of issues related to terrorism and terrorism preparedness. Respondents were asked to respond to statements about the likelihood, severity, and uncertainty of terrorist attacks in Canada, as well as their perceived coping ability and the impact of the events on their lives. They also responded to statements about the potential impact of terrorism on their communities, the extent to which a variety of organizations (*e.g.*, federal government, hospital, and health care providers) were prepared for a terrorist event, as well as their level of confidence in each organization or group. Finally, respondents were asked about their own preparation activities, whether they would comply with recommendations from government authorities regarding terrorism, as well as sources of information about terrorism. Data from these survey components are reported elsewhere (*e.g.*, Lemyre *et al.* 2006, 2007, in press).

For the purposes of the current study, open-ended questions assessed the first type of attack that respondents had in mind while thinking about chemical, biological, radiological, and nuclear terrorism, as well as terrorist bombings. More specifically, respondents were asked, "When you hear of chemical [biological; radiological; nuclear; terrorist bombings] terrorism, what specific type of attack first comes to mind?" This question always preceded a set of additional closed-ended questions regarding the type of terrorism in question. However, the presentation order of sets of questions regarding each type of terrorism was randomized in order to control for order effects.

Analysis

Consistent with analysis of qualitative open-ended questions, a grounded inductive method allowed categories of responses to emerge directly from the data (Pope *et al.* 2000). Initially, responses to all five questions were read and re-read to identify preliminary themes and categories. When more than one response was given to a question, only the first phrase or idea was coded in accordance with the survey question (*e.g.*, "ecosystem—might harm nature, human nature" coded as "ecosystem—might harm nature," "grenades, bomb scares" coded as "grenades"). Responses relevant to emerging categories were identified and examined using the method of constant comparison (Glaser and Strauss 1967), in which each response was compared with the rest of the data to establish analytical categories. Categories were added as necessary to reflect as many nuances of the data as possible (Pope *et al.* 2000). This method allowed an assessment of the similarities and differences between perceptions of CBRNE terrorism. One investigator (HE) coded all the data, while two independent raters coded a random sample of 10% of the responses to each question in order to establish inter-rater reliability. Acceptable Kappa's of 83, 94, 95, 91, and 88% were obtained for CBRNE terrorism and terrorist bombings, respectively. Differences in coding were resolved by discussion, and there was no disagreement subsequent to discussion.

In this exploratory analysis, we sought only to provide univariate frequencies of the data. However, we refer the interested reader to Lemyre *et al.* (2007) for a more detailed discussion about demographic differences in CBRNE terrorism perception across a variety of dimensions (*e.g.*, likelihood, severity or amount of uncertainty).

Table 1. Categories and respective frequencies of responses to the question "When you hear of chemical terrorism, what specific type of attack first comes to mind?"

Chemical terrorism categories	Frequencies (%)	Examples
Type of agent—general	18.5	chemical, poison, gas
Type of agent—specific	9.5	Sarin gas, Mustard gas
Pathways—by water	9.2	poisoning the water supply
Pathways—by air	3.9	air attack, air chemical
Pathways—general bomb	3	bombs, explosions
Pathways—chemical/gas bomb	2.7	chemical bombs, gas bombs
Pathways—by mail	0.8	powder in the mail, envelope
Pathways—by food	0.7	chemicals in food
Confound with other type of terrorism	16.4	Anthrax, atomic bombs
Attack images	4.3	chemical terrorism, war
Reference to prior event	3.3	Tokyo, WW2
Consequences of an attack	2.8	diseases, fear, bad
Other	1.6	blanket, oil, government
No response	5.9	
Don't know	17.3	
Total	100	

RESULTS

Summaries of responses to word association tasks for each type of terrorism are presented in Tables 1 through 5. For the sake of brevity, we limit our discussion of results to the comparison of findings across scenarios. We first note that a sizeable number of respondents had no response to questions about chemical, biological, and radiological terrorism. Specifically, the proportion of "no response" and "don't know" responses are outlined in Tables 1–5. As an example, almost 20% of respondents had no response to radiological terrorism, whereas 30% indicated they did not know. Such responses also emerged for nuclear terrorism and terrorist bombings, although at a lower rate. The other response categories that emerged are also presented in Tables 1 through 5. Perceptions of both chemical and biological terrorism most frequently included the type of agent that might be used in such attacks. Named agents could be *general* in that reference to them was made using broad descriptors. Examples included chemical agent, chemical product, or harmful gas in response to chemical terrorism (Table 1) and virus, germ, or bacteria in response to biological terrorism (Table 2). Other respondents named *specific* agents such as Sarin and Mustard gas in response to chemical terrorism, or Anthrax and Smallpox in response to biological terrorism. Despite being the most frequent response to chemical (28%) and biological (35%) terrorism, type of agent only emerged in 6.6% of responses to terrorist bombings (*e.g.*, C4, nuclear weapons and dynamite; Table 5). It failed to emerge at all in response to radiological and nuclear terrorism.

In contrast to chemical and biological terrorism, many of the responses to the other types of terrorism involved pathways of exposure or, more specifically, the way in which one could be exposed to the act of terrorism (*i.e.*, how might the attack be

Table 2. Categories and respective frequencies of responses to the question "When you hear of biological terrorism, what specific type of attack first comes to mind?"

Biological terrorism categories	Frequencies (%)	Examples
Type of agent—specific	19.6	Anthrax, plague, flu
Type of agent—general	15.8	viruses, germs, bacteria
Pathways—by water	6.5	bacteria in water supply
Pathways—by air	2.8	airborne virus or disease
Pathways—by food	2	diseases spread through food
Pathways—general bombs	1.7	bombing, explosives
Pathways—by mail	0.9	powder in the mail, letters
Pathways—biological bombs	0.9	bacterial bomb
Confound with other type of terrorism	9.6	gas, chemicals, gas attack
Consequences of an attack	8.8	diseases, harm to health
Attack images	6.5	germ war, biological terrorism
Reference to prior event	1.5	Tokyo, Hiroshima, Hussein
Other	1.9	body, garbage, genetics
No response	9	
Don't know	12.7	
Total	100	

carried out?). Some form of bombing was frequently mentioned, with responses conveyed either in general or very specific terms. General responses included "bomb," "bombing," or "blow up." These responses did not mention the agent that might be used in the bomb, nor did they name a potential target. On the other hand, specific responses identified a type of bomb (*e.g.*, car bomb) or the potential target of the attack (*e.g.*, large cities). Although references to bombings were made in response to terrorist bombings (Table 5), these were typically framed in specific terms. For example, references to car bombs and to suicide bombings represented 12.5% and 9.6% of responses, respectively. Other references were made to being attacked from the air, a specific example of which was "bombed by plane." In total, roughly 40% of responses referred to bombing of some kind (Table 5).

As with terrorist bombings, radiological and nuclear terrorism mostly elicited representations of specific bombs, rather than vague references to bombing (*e.g.*, blow up, bombs). Of the 14.5% of responses to radiological terrorism that referred to bombing (Table 3), only 3.4% were general. Specific bombing references included those involving radiological bombs (5.9%), nuclear bombs (4.7%), or other specific types of bombings (*e.g.*, car bomb, suicide bomb; 0.5%). For nuclear terrorism, 24% of respondents cited nuclear bomb, whereas 21% responded with the general "bomb," "explosion," or "bombing" (Table 4). Overall, almost half of the responses to nuclear terrorism (47%) were categorized as bombs, either general or specific.

Although pathway of exposure also emerged in response to chemical and biological terrorism, bombing was cited much less frequently compared to other forms of terrorism (<6%; Tables 1 and 2). Instead, pathways typically involved environmental exposure (*e.g.*, through poisoning of the air, food, or water supply). For both

Table 3. Categories and respective frequencies of responses to the question "When you hear of radiological terrorism, what specific type of attack first comes to mind?"

Attack—nuclear	12.5	attack on nuclear plant
Attack—radiological	9.5	radiation attack, rays
Attack—target	1.5	planes, subways
Attack—descriptors	1.2	scary, unforseen
Bombs—radiological	5.9	dirty bomb, radiation bomb
Bombs—nuclear	4.7	nuclear bomb, atom bomb
Bombs—general	3.4	blow up, bomb, bombing
Bombs—specific	0.5	car bomb, suicide bomb
Pathways	3.6	by air, drinking water, toxin
Confound chemical/biological terrorism	2.7	virus, germ, chemical attack
Consequences of an attack	2.3	could be killed, burning
Reference to prior event	1.8	3 Mile Island, WW2, Iran
Other	0.9	signals, television
No response	19.1	
Don't know	30.6	
Total	100	

chemical (9.2%) and biological (6.5%) terrorist acts, chemicals or bacteria injected into the water supply were the most common pathway of exposure that came to mind (Tables 1 and 2). This corresponds with findings of a quantitative analysis of Canadians' perceptions of CBRNE terrorism, wherein water contamination was ranked second as a specific type of terrorism about which Canadians had thought (Lemyre *et al.* 2006).

Table 4. Categories and respective frequencies of responses to the question "When you hear of nuclear terrorism, what specific type of attack first comes to mind?"

Bombs—nuclear	24.2	nuclear bomb, atom bomb
Bombs—general	21	blow up, bomb, bombing
Bombs—specific	1.7	car bomb, bomb in suitcase
Attack—nuclear	13.6	nuclear weapon, plant
Attack—radiological	5.3	radiation, dirty bomb
Attack—descriptors	2.5	sudden, violent
Attack—target	1.9	planes, populated area
Pathways	6.6	air strike, by poison, missile
Reference to prior event	4.5	Chernobyl, Hiroshima, 9/11
Consequences of an attack	3.1	fallout, fear, war
Confound chemical/biological terrorism	1.5	attack with bacteria, gas
Other	0.5	case, take posession
No response	6.2	
Don't know	7.3	
Total	100	

In prior research, it was revealed that Canadians perceived the likelihood of all types of terrorism as low, but distinguished CBRNE terrorist events by their consequences (Lemyre *et al.* 2007). Specifically, a nuclear terrorist event was perceived to have the most serious consequences, followed by radiological, biological, chemical, and explosive terrorist events. In the current analysis, consequences of the terrorist attack emerged as a response category. These were similar across types of terrorism and included responses such as diseases, fear, and destruction. However, the number of such responses remained low for all but biological terrorism (ranging from 2% for terrorist bombings to roughly 9% for biological terrorism).

A substantial number of responses to each form of terrorism could be categorized under the broad theme of "attack images." Such responses were subdivided in different ways, depending on the specific form of terrorism. For both chemical and biological terrorism (Table 1 and Table 2, respectively), responses involving attacks typically reflected vague images of terrorism. Examples include chemical, biological or germ warfare, chemical or biological terrorism, military infantry, weapons of mass destruction, and war. However, few responses were categorized as attack images for these categories of terrorism (5–6%). For both radiological and nuclear terrorism (Table 3 and Table 4, respectively), responses that involved attacks referred directly to either radiological or nuclear attacks, to potential targets of attack (*e.g.*, large cities, subways, planes, and chemical plants), or to descriptors of an attack (*e.g.*, unforeseen, sudden, and violent). References were quite frequently made to attacks in response to terrorist bombings, such that either possible targets of attack (12.6%; Table 5), a type of attack (other than bombing; 4.6%), or the descriptor of an attack (*e.g.*, dangerous, terrorist attack; 4.0%) were named.

It is noteworthy that responses to both radiological and nuclear terrorism included "radiological" and "nuclear" attacks. In the case of radiological terrorism

Table 5. Categories and respective frequencies of responses to the question "When you hear of terrorist bombings, what specific type of attack first comes to mind?"

Bombs—general	12.7	blow up, bomb, bombers
Bombs—car	12.5	bombing cars, car bomb
Bombs—suicide	9.6	suicide bombs, suicidal
Bombs—specific	7.3	dirty bomb, blow up bus
Attack—target	12.6	train, airport, public place
Attack—type	4.6	missile attack, biological
Attack—descriptors	4	dangerous, terrorist attack
Reference to prior event—9/11	7.1	9/11, towers, New York
Reference to prior event—other	2.5	Montreal bombing, Iraq
Pathways—by air	3.5	air raid, bomb by plane
Type of agent	6.6	Anthrax, C4, dynamite
Consequences of the attack	2	open war, fear, fire
Other	1.1	case, mines, sympathy
No response	8.4	
Don't know	5.5	
Total	100	

(Table 3), 12.5% of responses incorrectly referred to a nuclear attack of some kind, whereas 9.5% referred to a radiological attack. The latter included a radiological attack or target of some kind that did not involve a bomb or bombing. In the case of nuclear terrorism (Table 4), 13.6% of responses were categorized as "nuclear attack," whereas 5.3% of responses to nuclear terrorism incorrectly referred to some sort of radiological attack (*e.g.*, dirty bomb, radiation bomb, radioactive attack or simply "radiation").

As another example, confounding of chemical and biological terrorism also emerged, despite the fact that distinguishing these is common practice. For example, 16.4% of responses to chemical terrorism (Table 1) referred to aspects of biological terrorism (*e.g.*, germs, bacteria, and viruses), with almost 7% specifically naming Anthrax. Other references were made to aspects of nuclear or radiological terrorism (*e.g.*, nuclear bombs, dirty bombs, and nuclear warheads). Similarly, 9.6% of responses to biological terrorism referred to gas, chemicals, nuclear bombs, warheads, and power plants (Table 2).

DISCUSSION

Our data are among the first to describe the Canadian public's unprompted and initial representation of CBRNE terrorism and should be useful to those involved in terrorism planning and emergency response. In recent years, Canada has invested considerable funds to increase knowledge and preparedness for countering terrorism, for example, through its CBRNE Research and Technology Initiative (CRTI 2007). In a broader campaign aimed at improving emergency preparedness, efforts have also been put toward informing the public about preparing for certain types of CBRNE events (*e.g.*, bomb threats, chemical releases, nuclear emergencies, and suspicious packages) (Public Safety Canada 2007). Although basic facts regarding these scenarios are disseminated as part of this initiative, the high number of "no response" and "don't know" responses observed in the present study highlights a potential need to provide additional information about the nature of different types of CBRNE events. This may be of particular relevance to radiological terrorism since specific information on this scenario is lacking in this public campaign. It is acknowledged that don't know responses may have a different meaning than no response at all. In the latter, for example, respondents may know the answer, but prefer not to share it with interviewers. Alternatively, respondents may not understand the question.[1] However, we think it unlikely that respondents misunderstood the questions, particularly since majorities were able to give answers to all five questions. We suggest that the higher proportion of don't know responses for most questions implies a lack of knowledge about the various types of terrorism, and this corresponds with the wider literature on public understanding of terrorism (Becker 2004; Wray and Jupka 2004).

Because a sizable number of respondents appeared to confound chemical with biological agents, findings also suggest that the public may have only a vague

[1]We thank anonymous reviewers for these suggestions.

conception of the type of agent that might be used in a CBRNE terrorist event and it may not recognize a particular substance as part of a category. Uncertainties regarding the nature of various CBRNE agents could lead to confusion about appropriate courses of action in the face of an event. Although empirical evidence on this matter is lacking, participants of a series of consultations with individuals across Canada indicated that they would not know what to do in a terrorist emergency and felt that they would benefit from more information and education regarding CBRNE events (Gibson *et al.* 2007). Risk messages about CBRNE terrorism may thus need basic information (*e.g.*, infectious nature) about the type of agent that could be used in these attacks as well as appropriate courses of action. Crafted with simple wording, such messages could foster and enable public preparedness for specific CBRNE events. Indeed, a study by Rubin *et al.* (2005) on Londoners' reactions to the July 7 bombings of 2005 revealed that individuals who had gotten information from a government leaflet about how to prepare for terrorism were less likely to have the intention of avoiding public transit following the attacks. This study did not explicitly examine the impact of uncertainty about terrorism on response to an event; however, findings could be taken to suggest that individuals who are less informed about terrorism are more likely to be strongly affected by an attack. Of course, we recognize that other variables such as trust in government or institutions, awareness of information sources, and feelings of fear or vulnerability about terrorism may influence the public's ability or willingness to prepare for and follow recommendations subsequent to an event (McGough *et al.* 2005; Siegrist and Cvetkovich 2000; Wray and Jupka 2004).

In contrast to the specific type of agent that might be used in an attack, bombings were a salient theme in respondents' representations overall. This finding may relate to the relative frequency of terrorist bombings relative to other scenarios. For instance, a count of terrorist events in Canada from 1973 to 2003 revealed 2 airplane bombings, 4 letter bombs, and 170 bombs, firebombs, and arson (Leman-Langlois and Brodeur 2005). The relative frequency of these events along with the notoriously intensive worldwide media coverage of bombings such as the 1993 World Trade Center bombing, the 1995 Oklahoma City bombing, or the Madrid train bombings of 2004 likely contributed to the salience of such representations. Whether real or vicarious, experiences with bombings may facilitate the availability of such representations—that is, the ease with which they can be brought to mind (Folkes 1988; Lichtenstein *et al.* 1978).

Highlighting those pathways of exposure that most readily came to mind in response to various forms of terrorism helped to emphasize other pathways of which the public may potentially be less knowledgeable. In particular, findings suggest that the pathways of exposure of nuclear and radiological terrorism may be less well understood. Past research has suggested that public knowledge about the signs and symptoms of a nuclear or radiological event is limited (Becker 2004). Accordingly, representations of nuclear and radiological attacks both appeared vague, characterized by responses such as "nuclear" or "radioactive." Risk messages involving a radiological or nuclear device will need to include basic information about the nature of the device, the possible consequences of this type of attack, the signs and symptoms of nuclear or radiological exposure and what to do in response to either type of attack.

Moreover, clear distinctions between radiological and nuclear terrorism were not always evident in respondents' representations, suggesting that the public may lack knowledge of differences among these types of CBRNE terrorism. We acknowledge that nuclear and radiological terrorism are not uniformly distinguished from one another by risk managers and researchers (with references frequently made to CBR or to NBC terrorism in other nations), nor are they clearly differentiated in the aforementioned campaign targeting citizens' emergency preparedness. However, a notable difference between nuclear and radiological terrorism is that the latter is less apt to producing mass casualties than it is to creating disruption. Consequently, the issues that members of the public would have to face following such a scenario would likely differ in important ways. Putting more emphasis on such distinctions could thus help to better prepare the public for more specific features characterizing the impacts of each type of event.

Related to this matter, the consequences of an attack were not particularly salient features of Canadians' representations of CBRNE terrorism. In the event of such an attack, it will be critically important for emergency managers and frontline professionals to provide the public with information regarding the specific consequences of the agent used and possible coping behaviors that might mitigate these. Pre-event messages could be crafted accordingly in an effort to engage the public with preparedness initiatives (Becker 2004; Sorensen 2004). Providing this information before any attack would allow the public to have a better idea of what to expect and could thereby facilitate preparedness. Of course, the degree to which people retain this information and maintain the correct correspondence between specific agent and specific response is a question in need of further empirical scrutiny. For instance, questions might be raised about the potential of increasing anxiety more than knowledge by disseminating this information.

Despite being among the first comprehensive efforts to understand Canadians' representations of CBRNE terrorism, an important limitation to consider entails the low survey response rate (9.7% of all valid numbers dialed). This limitation is quite common in telephone surveys, particularly when these are long in duration as was the present case (Allen *et al.* 2003; Wilson *et al.* 1998). Questions may nevertheless be raised about the generalizability of findings to the overall Canadian population. Indeed, respondents of this sample tended to have a higher level of education and income than the national average. On the other hand, the sample was stratified to resemble the Canadian population in terms of region, as well as age and gender within region based on 2001 Census data. Also, no research of near magnitude had yet examined representations of CBRNE terrorism within the Canadian context at the time the survey took place, rendering this work a meaningful contribution.

CONCLUSION

The current analysis provides risk managers, risk communicators, frontline professionals, or others who play a vital role in terrorism planning and emergency response with a descriptive first look at how the Canadian public represents CBRNE terrorism. In doing so, it highlights potential areas in need of focus in public education initiatives. More specifically, findings raise concerns about the effectiveness of risk communication if the public's representation of CBRNE terrorism is not mapped

with the same typology used in a number of governmental initiatives. Future research could explore in more detail how members of the public perceive attacks and classify them, as well as how they organize the repertoire of possible responses. It might also be fruitful to conduct similar research utilizing experts as participants.

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