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Examining uncertainties in government risk communication: citizens' expectations

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With the shift towards more participative approaches to risk communication and risk management, policymakers are expected to be more transparent with the public concerning existing uncertainties about health risks, such as lack of data or contradictory evidence. There is, however, a debate among researchers as to whether this transparency about uncertainties is indeed welcomed by the public and if it is effective in promoting trust in risk regulatory institutions. The qualitative study on which this article is based aimed to clarify citizens' perceptions of diverse sources of uncertainty in government risk communication and their expectations with respect to discussing uncertainties. Forty-seven adults from two major Canadian cities took part in focus groups or individual interviews in which they voiced their expectations about *who* should be involved in risk communication, *why* uncertainties should be communicated, *what* sources of uncertainties were preferred, as well as *how* and *when* these should be discussed. Their discussions showed that they expected the government to include citizens in evaluating and managing uncertainties pertaining to risks under individual control and directly informing consumer choices about health risks. In contrast, they questioned the relevance of systematically exposing uncertainties relating to risks perceived as outside individual control, and associated with very low probability scenarios of possible threats. Globally, they appraised the desirability of discussing uncertainties in risk communication in relation to the perceived utility of the information for decision-making. These findings indicate that risk communicators and managers need to consider ways in which discussions of uncertainties can empower citizens.

Keywords: uncertainty; risk; risk communication; risk perception; qualitative analysis

Introduction

Health risks are increasingly becoming a component of public discourse. Complex global health risks such as climate change, genetically modified organisms (GMO), terrorism and pandemics (for example, SARS, H1N1 flu) have become important topics of concern and debate. Many sources of uncertainty are associated with these risks, either due to the lack of knowledge about their causes, consequences and probability, or due to ambiguity from conflicting data or divergent experts' interpretations of the data. In the information era, modern democratic societies are evolving as 'knowledge societies' (Mansell and Wehn 1998) and decision-makers are increasingly expected to adopt more transparent and participative approaches to risk communication and risk management (Pfeiffer 2006). This implies discussing openly with citizens the multiple sources of uncertainties in government risk communication. It has been suggested that this trend for open debate

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will improve risk communication, and encourage trust in risk regulatory institutions (Fischhoff *et al.* 1981, Wynne 2005, 2008, Palenchar and Heath 2007). However, the support for this view is largely based on argument by reason, and there is scant literature that provides empirical support (Johnson 2003). There is a need for more data to explore how citizens appraise the discussion of uncertainty in government risk communication. The study on which this article is based investigated the meaning people gave to the presence of diverse sources of uncertainty in risk communication and their expectations regarding the process of discussing uncertainties. More specifically, it employed a qualitative approach to explore public expectations about *who* should be involved in risk communication, *what* sources of uncertainty should be communicated and *why*, *when* and *how* these should be communicated.

Uncertainty and health risks

Defining uncertainty

Conceptualisations of uncertainty differ across scientific disciplines and fields of study (for a detailed review, see Walker *et al.* 2003, Bammer and Smithson 2008). In the context of risk, it has mostly been defined through a classification of *sources* of uncertainty, or type of questioning (see Smithson 1989, Klinke and Renn 2002, Walker *et al.* 2003, Brugnach *et al.* 2008). Three sources of uncertainty are often distinguished in the literature: ontological uncertainty, epistemic uncertainty and ambiguity (Klinke and Renn 2002, Van Asselt and Rotmans 2002). Ontological uncertainty refers to the inherent complexity of an issue or the chaotic relationships between the elements of a system (Van Asselt and Rotmans 2002). In contrast, epistemic uncertainty refers to the absence or lack of knowledge about an issue (Walker *et al*. 2003). Finally, ambiguity is present when a situation can be interpreted in multiple ways or when there are divergences or contested perspectives about its meaning (Brugnach *et al.* 2008).

There has been a growing interest in trying to understand how the perceived emotional costs possibly associated with uncertainty may explain avoidance of potentially relevant information (Osimani 2012). This line of research investigates how the utility of risk information influences the decision to process it. Information which is expected to be irrelevant for the decision at hand, in that it does not change the preferable option, is perceived as useless (this is called 'rational ignoring' by Berg and Hoffrage (2008), see also Delquié (2008)). Furthermore, if useless information comes with an attached emotional cost in terms of distress and anxiety, then its expected value can be negative (useless and emotionally detrimental information). This may explain why risk information, although genuinely informative in objective terms, may not always be welcome and provides an alternative account to approaches which insist on lay risk information gaps (Osimani 2012).

Evolving approaches to the discussion of uncertainty in risk communication

Models of communication are multiple and in constant transformation (Leiss 1996). The 'deficit model' is based on the assumption that there is an important gap in lay conceptions of uncertainty and risk, and in this model risk communication is treated as an exercise of persuasion (Frewer 2004). For this perspective, information thought to be too difficult for the public to grasp or susceptible to be misinterpreted, such as the intricacies of scientific risk assessment, is avoided or downplayed. Thus, simplified risk

information, stripped out of its intrinsic intricacies and dilemmas is transmitted to the public in order to prevent eliciting anxious and 'irrational' public reactions (Wynne 2006). Risk information is heavily 'popularised' for transmission to public audiences (Hilgartner 1990), based on the presupposition that the public would mistakenly construe scientific uncertainty as incompetence (Johnson and Slovic 1995, Frewer *et al.* 2003, Wynne 2008).

This approach to risk communication has however been criticised. In particular, some argue that the 'paternalistic' approach to providing public information stems from a misunderstanding of lay perceptions of uncertainty (Wynne 2006, 2008). In other words, risk communication fails to recognise that lay persons have unique and constructive manners of interpreting uncertainty relative to risks (Brashers *et al.* 2000, Powell *et al.* 2007). Indeed, research on risk perception has demonstrated that members of the lay public are not 'irrational' as such when they respond to risk in a different way than expected by public health recommendations or expert assessments. Rather, they evaluate risks based on other sets of criteria and values, in the context of their daily life (Alaszewski 2005). This insight underpins a more transactional approach to risk communication considering members of the audience as actively constructing the meaning of the message rather than passively decoding it (for example, Barnlund 1970, Bowers 1988, Russell and McClintock 1990).

Within this transactional approach, researchers have developed new models of risk communication which place greater emphasis on public consultation and participation in risk management. The strategic management of risk communications, also called 'strategic communication model' has been described as a 'purposeful process of skilful interaction with stakeholders supported by appropriate information' (Strategic Risk Communications Framework, PHAC 2006). Those using this model do not aim at persuasion but greater consultation with the public in order to better understand their preoccupations and take them into account in risk management (Frewer 2004, Macnaghten *et al*. 2005, Pfeiffer 2006).

For members of the public to truly be partners in risk communication and management, transparency about risk information seems essential (Renn 1992, Leiss 1996, Wiedemann and Schuetz 2000, Knapp *et al.* 2004, Palenchar and Heath 2007). A two-way dialogue approach implies including uncertainties, such as the lack of knowledge about certain aspects of risk or conflicting data in risk communication. This transition from a mechanistic and linear model of risk communication to a more participative and iterative approach has the potential to empower citizens in the process of decision-making about risk and uncertainty (Fischhoff 1995, Pidgeon 2008). However, transparency about uncertainties, gaps in knowledge and errors in past decisions could also create problems, such as a decrease in credibility and public confidence (Kasperson 2008). The empirical evidence on actual public reactions to uncertainty in risk communication is scarce and mixed.

Current evidence on citizens' reactions to uncertainties in risk communication

The public's ability to understand uncertainty in risk communication is the subject of debate (Johnson 2003, Beierle 2004). Some commentators recommend avoiding exposure to certain types of uncertainty such as contrasted experts' opinions on risk (Folker and Sandoe 2008). These recommendations are generally based on the belief that the lay public cannot understand uncertainty and will find it unacceptable (Frewer *et al.* 2003). A number of researchers have however tried to counter this perception by suggesting that individuals are familiar with uncertainty; they encounter uncertainties in their daily lives

and develop strategies to understand and cope with them (Wynne 1992, Frewer 2004, Berkes 2007, Morss *et al.* 2008). For example, results of a study by Frewer (2004) showed that individuals from the public wished to be informed about uncertainties in risk messages, including about the nature and the extent of divergences between different experts.

The effect of communicating uncertainty on mobilisation and health promotion is also a contested issue. Uncertainty relating to ambiguity has often been associated with a diminution in health behaviours such as screening and willingness to adopt preventative measures such as vaccines (Volk *et al.* 1999, Frosch *et al.* 2001, Han *et al.* 2007, Rubin *et al.* 2009). On the other hand, it has been argued that giving unrestricted access to honest and diversified information can encourage citizens' participation in risk management and promote more informed decision-making about environmental and health risks (Leighton *et al.* 2002, Beierle 2004, Palenchar and Heath 2007).

The communication of uncertainties has also been said to have an impact on trust in science and in institutions. Johnson and Slovic (1995) tested the effect on perceived trust and competence of messages including uncertainty as ranges of risk estimates. They found that presenting uncertainty seemed to signal honesty of the institutions, albeit reduced competence. In other experimental studies, mentioning uncertainty of divergence between experts or in the data has also been found to decrease credibility and trust in the source (Viscusi 1997, Smithson 1999). However, in several case studies, hiding uncertainties in risk communication has been shown to be detrimental to public trust in risk managers (for example, Wynne 1989). Several researchers have asserted that the lack of transparency on existing uncertainties about food risks such as bovine spongiform encephalopathy (BSE) fuelled many food security crises and harmed public trust (Powell and Leiss 1997, Frewer *et al.* 2002a, Miles and Frewer 2003, Lofstedt 2006).

A potential explanation for the variety of outcomes associated with the communication of uncertainty is that communicating different sources of uncertainty in various contexts could yield to different reactions. In a study, testing inclinations for different sources of uncertainty, Frewer and her colleagues (2002b) found that participants preferred uncertainty that served to inform public choices and decisions about food risks. In contrast, participants responded negatively to uncertainty related to government or institutional inaction about a food risk. It is therefore important to explore whether appraisals of the discussion of uncertainty in risk communication vary in function of the *sources of uncertainty* communicated and the *perceived utility* of the information provided for decision-making and risk management and we explore these issues in the remainder of this article.

Methods

Current study

The aim of the study on which this article is based was to explore how individuals appraised the discussion of uncertainties in governmental risk communication to help clarify the circumstances under which it was welcome or not. It was deemed important to allow individuals to express how they thought about uncertainty in risk communication relative to their personal experiences. A qualitative approach was chosen since it enabled us to examine how individuals assigned meaning to phenomena such as risk and uncertainty. The study was therefore based on a pre-theoretical notion of uncertainty, broadly construed around the participants' declarations. We focussed on governmental communication to promote discussion about social contextual factors. We encouraged participants

to reflect on factors influencing the desirability of risk information which discussed different sources of uncertainty. The analysis aimed to identify themes in citizens' view of how discussing uncertainties in government risk communication could lead to positive or negative cognitive and emotional appraisals. Ethics approval for the study was granted by the Social Sciences and Humanities Research Ethics Board of the University of Ottawa.

Participants

To access data on various perspectives and personal experiences regarding the discussion of uncertainties in risk communication, we recruited a sample of 47 participants whom we interviewed in nine focus groups (G1 to G9) and three individual interviews (I1 to I3). We recruited them through adverts in community outreach service. In the invitation to participate, participants were informed they would have the opportunity to 'share their perspectives on the nature and management of uncertainty in the context of risk'. All participants were recruited from the general adult population of Ottawa and Montreal, and could converse fluently in either French or English. Since the study was exploratory in nature and aimed at gathering numerous and varied perspectives on the topic of uncertainties in risk communication, we included a diversity of individuals, in keeping with the principle of maximum variation sampling in qualitative inquiry (Lincoln and Guba 1985). Participants varied in age from young adulthood, ages 18 to 29 (n = 20); middle adulthood, ages 30 to 54 (n = 14) and mature adulthood, ages 55 and up (n = 13). The sample was balanced between male (n = 23) and female (n = 24) participants. It was also culturally diverse, reflecting the reality of Canadian metropolitan areas. Most participants were Canadians (n = 27), but a portion of the sample (n = 6) identified with other cultural backgrounds such as Indian, Vietnamese and Egyptian. More than one quarter of the respondents (n = 14) were recent African immigrants from diverse countries such as Burundi, Congo and Rwanda. There was a wide distribution of socioeconomic status. A large proportion indicated that their highest level of education completed was high school diploma (34%), while some completed college (19%) and slightly under one-half completed undergraduate or graduate studies (43%) and 4% did not provide information about education level. In relationship to income levels, 38% indicated a total gross household income of less than $19,000 per year, 8% a yearly income between $20,000 and $39,000, 32% an income between $40,000 and $80,000, 4% indicated an income of more than $80,000 and 18% of respondents did not provide information about income level.

Interview questions

The interviews were semi-structured interviews and we shaped the discussion with a set of open-ended questions concerning uncertainty in the context of health risks in general. The open and semi-directed style of questioning allowed participants to discuss risk uncertainty relative to their own personal experience. In some cases, we used examples to help clarify questions, promote discussion or guide discussion towards more pertinent topics. All discussions had three phases, each of which addressed a broad concept. In the first phase, we asked participants to define the broad concept of uncertainty in their own words (for example, 'what is uncertainty for you?'). Subsequently, we asked participants to relate their notion of uncertainty to four major health risks: cancer, terrorism, global warming and food safety (for example, 'when thinking of uncertainty regarding terrorism what

comes to your mind?'). We chose risks that varied in terms of characteristics such as proximity, controllability, perceived impact and catastrophic potential. We used this wide spectrum of risks to stimulate discussion and encourage participants to think about different sources of uncertainty to verify to what extent their reactions depended on contextual factors. In the final phase of the interview, we returned the focus to uncertainty in general and respondents were asked to discuss their perceptions about the desirability of uncertainty disclosure. We used direct questions concerning the discussion of uncertainty in government risk communication (for example, 'do you think it is acceptable or desirable for the media and government agencies to disclose uncertainties regarding different risks?').

The same researcher (Marie-Pierre Markon) facilitated all discussions, which were conducted in either French or English. All participants signed a consent form and completed a brief demographic questionnaire before discussions were initiated. All interviews and focus groups were taped and lasted between 50 and 110 minutes.

Data analysis

We recorded and subsequently transcribed all discussions removing any identifying information from the verbatim transcripts. Names used for presenting the findings are pseudonyms to protect the identities of participants. We used *in vivo* software to facilitate the categorisation of data. We developed a coding scheme to identify themes and categories using both deductive and inductive reflection. We had anticipated some categories, for example, the role of perceived information utility in appraising the value of uncertainty (that is the 'expected outcome of discussing uncertainties'), but there were themes we had not anticipated which were evident in the transcripts. We conducted the analyses using constant comparison, which enabled us to identify themes through a process of iterative comparison of related data bits (Heath and Cowley 2004). We carried on coding until we achieved theoretical saturation and we were unable to identify any new codes when reading through the transcripts. During this process we were mindful of and adhered to the four principles of dependability, confirm ability, transferability, and credibility described by Lincoln and Guba (1985). Inter-rater reliability was tested for one-tenth of the data coded independently by two researchers. These independent coding efforts were subsequently compared and revealed a kappa of .80, signalling a very good level of inter-rater agreement. Back-translation was also performed on quotations in French used to illustrate the results.

Findings

We have examined the expectations which the participants in our interviews had in five inter-related areas: perceptions of government roles and interests, perceptions of citizens' responsibilities and aptitudes, expected outcomes from discussing uncertainties, sources of uncertainties and risks to be discussed, and preferred ways and timing for discussing uncertainties. These themes were not evident in each and every interview but they were evident in most.

Perceptions of government roles and interests

Many participants voiced their expectations, often unfulfilled, about government roles and interests in the context of risk communication. In general, they expressed a desire for

democratic and responsible governance, and conversely denounced intervening motives, such as political strategising, that tend to violate these ideals. Most respondents defended the idea that government transparency was a core value in Canadian democracy. As Myriam, a middle-aged woman said:

> We need people for whom it is their job to rummage and to snoop around and to be curious and inform the population, and to seek out the areas that tend to be hidden by other agencies. (Translation, G7)

Another pervasive idea was that government should educate and inform the public. Many participants seemed to identify the government as an educator in society, a needed resource to provide citizens with important information of which they might otherwise be ignorant. In some cases, respondents expressed this idea in reference to health risks that threatened citizens through consumerism. Adam, a young man, expressed this view in the following way:

> There's always crooks and nannies, but I think it's the government's role to educate us. For example, a company would not announce (facetiously) 'Hey, this product also has mercury!' So, it's the government's job. (Translation, G9)

In general, it seemed clear that most participants bestowed on the government the role of health promotion through informing and educating its citizens.

Yet another predominant role attributed by some respondents to the government was to make decisions based on appropriate risk analyses (that is play an arbiter role). This idea underscored an understanding of decision-making as a process of weighing risks and benefits, as exemplified by the following comment by Roger, a mature man:

> I call this calculated risk. You have evaluated the pros and the cons, you have evaluated the real danger and you take a decision. The moment you take your decision, yes there is a certain risk, but it's calculated. (Translation, G1)

Many participants argued that government had the legitimate authority to play these two identified roles. However, some respondents noted that many sources of influence impacted on government decisions. They suggested that government decisions involving risks were not always made in the best interest of the citizen. For instance, Juliet, an older woman noted how political games could taint her perception of government integrity:

> It's that it's only short term, selling the electorate on certain issues. There's no planning for the future of the electorate […] it's all polling. There's no encompassing type of thinking that considers the implications of certain decisions, the repercussions, the risks associated […] if they want something, they go for it. (Translation, G5)

Other respondents felt that economic factors overly influenced government decisions. For example, Maria, a young woman said:

> I think it's good to inform the public about certain risks, insofar as the pros and cons of certain things. However, I find that in many cases it depends who will profit, or who has invested most in such or such affair that will determine which side [the pro or the con] is most touted. (Translation, G7)

Several respondents explicitly discussed low levels of trust in government representatives. Most expressions about government trust were negative and expressed as frustration as Emma, a mature woman noted:

> We have to read everything, you look at the government, the people are supposed to be helping us, and they give us something, and we say, I can't trust you'. (G8)

In general, participants expressed a complicated, somewhat contradictory, relation of trust with the government. In some cases, people attributed legitimate authority to the government as an information provider, and entrusted the government to make decisions about risks. In other cases, participants felt that the information provided by government was not always trustworthy due to conflicting self-serving political interests. In this light, many citizens felt that they were responsible for informing themselves about risk and scrutinising information. As we discuss next, members of the public were also seen as an integral part of risk communication.

Perceptions of citizens' responsibilities and aptitudes

A significant number of participants reflected on their own responsibilities and aptitudes for dealing with uncertainties. Some expressed the view that citizens had a responsibility to inform themselves independently of popularly disseminated risk information. They also believed citizens should keep a watch on officials. For instance, Chantal said:

> So, I think there are folks in positions of authority to manage all this for us, but there are still some little things we can do […] we cannot simply trust that others are competent enough to fulfil their responsibility. (Translation, G4)

A few participants felt that non-governmental organisations (NGOs) and opposition parties had a responsibility to verify and balance the information about risk and stimulate public debates.

Most participants argued that onus of risk communication did not strictly lie with the government. They considered themselves as having a responsibility to understand the issues surrounding risks, especially concerning the issues upon which they might affect their ability to control risks. They particularly felt that they had a responsibility to find out about the risks associated with everyday activities such as eating food. These participants were drawing attention to the overall context of communication and the way it involved those receiving and using the information as well as those providing it. This fits in with the partnership approach of risk communication where members of the public are encouraged to play a more dynamic and constructive role (Fischhoff 1995, Pidgeon 2008).

A related issue concerned participants' capacity to understand risk uncertainty which elicited a lot of ambivalence. Many participants saw themselves as open to debates on risk issues. They thought they deserved more credit than they could get for their ability to process uncertainties and cope with them. They realised however that some problems were more complex than others, and struggled to see how they could resolve the uncertainty in these cases. As Paul, a mature man commented:

> Some decisions are more difficult to take and we will be increasingly confronted with them with less and less involvement of the population on real decisions because of the complexities […] it's unavoidable. (Translation, G4)

Another participant observed that a lot of risk issues '*are specialised, and it's not possible to read everything on them*' (translation, G4).The implication of these comments was that the nature and degree of involvement between partners in risk communication needed negotiation and reorganisation in a way that would be considered optimal by all those involved. As Fischhoff (1995, p. 142) has observed: '*At times, they* (members of the public) *have information to consider. At other times, they may just want a seat at the table*'.

A good number of participants struggled with finding their role in these complex risk issues and wished they could trust the government to protect their interests when they feel their ability to deal with some risk intricacies was limited. This is consistent with studies that have shown how institutional trust promotes heuristic processing of information about risks involving many unknowns and scientific intricacies (Trumbo and McComas, 2008). Tversky and Kahneman (1974) have shown how these heuristics or cognitive shortcuts can ease decision-making in the presence of uncertainty. Social trust therefore seems essential for dealing effectively with highly complex problems (Slovic 1993, Kasperson 2008). These results suggest that as sociologists, Beck (1992), Giddens (1990) and Luhmann (1979), have observed the more intricate a situation is, the more trust is needed to optimise social arrangements for dealing most appropriately and effectively with the problem.

Expected outcomes

Participants' expectations about outcomes consisted of two inter-related issues; risk awareness and risk management. Risk awareness involved individual conscientiousness and vigilance concerning health risks. Risk management was related to individual capacity to manage risks, for example, healthful consumer choices and preparedness.

A majority of respondents believed that discussing uncertainties would raise individual conscientiousness about health risks. As Maria said:

> Let's look at some issues, say medical issues or even, as we talk often about it, environmentalism. I think it's good to create some uncertainty about these issues in order to mobilise people, so that they become more conscientious and on the watch. (Translation, G7)

Some participants felt that matter-of-fact styles of risk management and risk communication encouraged complacency about health risks. As one participant said: '*It could have an adverse effect, thinking that OK we are doing well, so we don't have to think about it anymore, but we're not*' (G8). However, participants also reflected on the ways in which disclosing uncertainty about risk issues might serve to encourage more encompassing and critical styles of thinking about health risks. They generally thought that deliberating about uncertainties would help them become aware of new aspects of reality and ultimately lead to more enlightened and prudent decision-making. In a related manner, Paul expressed the idea that individual preparedness might result from uncertainty disclosure:

> It's a preventative measure, it allows people to be aware of what could happen, and if there are measures to be taken, they can already start taking them. (Translation, G4)

Such views accord with researchers' propositions that risk uncertainty communication can encourage public self-efficacy in dealing with risks (Fischhoff *et al.* 1981, Frewer *et al*. 2002b, Graham 2002).

Participants tended to see the raising awareness about risks as promoting autonomy in managing risks. In other words, raising awareness about risks promoted the public's ability to manage risks independently. Under these circumstances, discussing uncertainties seemed to be an accepted practice. Conversely, in situations where uncertainty was perceived as undermining individual autonomy relative to risk management, it was less acceptable.

Participants tended to discuss unacceptable uncertainty in contexts that evoked fear. In reference to the risk of terrorist attack, for instance, Eric, a former school principal, remarked:

> I'm sure that we'd be a very nervous population if we were aware of all the information that was available to the RCMP [Royal Canadian Mounted Police] and National Defence'. (Translation, G7)

In this quote, the systematic disclosure of uncertainties (for instance, probability of occurrence of all potential national threats) was not seen as helpful as it increased nervousness and did not facilitate autonomous risk management. When participants perceived the communication of uncertainty as useless and even detrimental for citizens, they found it less acceptable. Isabel expressed this point more firmly in reference to the United States' Five-level national alert system:

> You know for a while there was the red light, the yellow light, the blue light, and they did that so often that you couldn't care less at the end, so I don't see the purpose of that, and I think it's just propaganda, a lot of it. (G8)

These responses to uncertainty were based on the notion of information utility. Information was only useful if it enabled the autonomous management of risks. Uncertainties are not always welcomed in every context of risk communication. The logic that many respondents used in evaluating the desirability of communicating uncertainty seemed to hinge on a prediction of the resultant outcomes. Some respondents expressed a belief that government risk regulators had similar criteria on which to base decisions. For instance, Laura said:

> The whole question in the end is should they show uncertainty? I think they should, but I can understand that sometimes they don't want to show any because they think that the reaction will not be the right one. (Translation, G3)

Several participants observed that there are often challenges to discussing uncertainty in that it could both increase risk awareness but also could increase anxiety and stress. They generally agreed that information should not be withheld from the public only because it could increase fear, if this information could be useful to citizens, as exemplified in the following comment by Anita, a mature woman:

> We have the right to know. I know that it could or it probably will make people more anxious. So, if people are thinking the government shouldn't, in order not to scare us and make us feel badly all the time that's not a good enough reason. (G8)

A majority of respondents were able to critically discuss the communication of uncertainty. They considered the context of risk communication and the outcomes that discussing uncertainties might generate within this context. This indicated that they were continuously evaluating how the strategies and communications are perceived and whether it is achieving the outcomes desired by the stakeholders.

Sources of uncertainties and risks expected to be discussed

Most participants identified certain forms of uncertainty that they felt were useful to discuss in the context of risk communication. They valued discussion of risk uncertainty that informed consumer choices about health risks. Conversely, they felt that risk uncertainty communication was less desirable when it concerned risks that were outside of individual citizen control. Myriam made this distinction explicitly:

> Yes, when the consumer is directly involved, I think he does have a right to all or nearly all the information in order to aptly make a choice. But when it's an event like we mentioned, a bomb scare, and the chances of it happening are not very high, I don't think they should discuss it with the whole of the population, when it touches the whole and not directly the consumption of individuals. (Translation, G7)

Most participants did not feel it was acceptable if there was no discussion of the factual uncertainties about a product or a new technology (that is divergence in the data about the associated risk). They expected to be informed about potential side-effects and unknown long-term effects (such as epistemic uncertainty) of exposure to a given product. Some also expressed their wish to debate ethical ambiguities surrounding biochemical and social health risks such as unemployment, poverty or criminality. For instance, Georges, an elderly citizen actively involved in trade-union activity all his life expressed his frustration about the lack of attention given to uncertainties related to social health risks:

> If you want to talk to me about uncertainty, talk to me about uncertainty with respect to certain realities like the number of suicides in the elderly; talk to me about the fact that children spend all day at school without eating, and that they have not eaten the very morning before school; talk to me about the misery in our society, talk to me about poverty, talk to me about real things. (Translation, G6)

In general, participants felt all those ethical uncertainties directly concerned them and the members of their community, and could influence their choices and behaviours. This fits with recommendations that normative ambiguities should form part of risk communication and management (Bunting *et al*. 2007).

In contrast, some sources of uncertainty were less welcomed. Most participants thought that discussing all uncertainties related to very low-probability scenarios of potential threats on the country would be excessive. They felt that doing so would be to 'cry wolf' and would eventually disregard government messages. Many also believed it was justified if there was no discussion of sensitive information containing uncertainties related to national security, because such discussions would be better handled by government officials. To make this point, Eric explained:

> I was a school principal for a long time and yes, three to four times a year we had bomb scares, but I never ever, not once evacuated the school or informed people. I informed immediate staff and we circulated a little around the school, on guard and vigilant, but never, how I would say this…made people anxious over this. (Translation, G7)

Like a few other participants, he also questioned the necessity of informing citizens about uncertainties that can be effectively handled by the government, and thereby prevent potential ripple effects on public reactions, as outlined here:

> For example, if we knew there was a bacteria in the municipality's water, which the municipality believed would be under control in the short term, the question is should the presence of the bacteria be made aware to the media? If yes, then perhaps no one would want to drink the tap water. (Translation, G7)

However, many participants made it clear that when 'there were safety measures to be taken' to cope with the uncertainty, then they should be made public.

Finally, several individuals drew a distinction between '*real uncertainties*' worth discussing, and '*false uncertainties*' fabricated to '*better manipulate the public*' and justify extreme safety measures. According to them, publicly discussed uncertainties (for instance, about probabilities or divergence) should be based on facts and trustworthy information. As Louis declared: '*I think it's not fair to instil fear in the public on unreliable information*' (G8). In general, '*fabricated uncertainties*' or unfounded uncertainties were seen as a diversion to hide '*real uncertainties*'.

As Michaels and Monforton (2005) and Moore (2008) have argued, uncertainty can be deliberately manufactured as a way to manipulate others or to pursue ones interest without being identified anti-health or anti-environment. Proctor (1995) and Proctor and Schiebinger (2008) work showed how tobacco industries fostered doubt about the hazard of tobacco to protect their interests. Lofstedt (2006) has argued that it is important to differentiate between real uncertainties (when there is actually a lack of scientific data) and fabricated uncertainties (when it relates to a false debate).

Preferred ways and timing for discussing uncertainties

Several participants shared their thoughts on how they would prefer uncertainties to be communicated. Many comments related to discussing uncertainty from divergence over health hazards or risk management measures. Most participants thought the government should inform the public about both sides of the argument, but they also wished to be guided through the process of weighing pros and cons, risks and benefits. They expected the government to better explain '*why and how they came to a conclusion*' about the risk of a hazard, or about the efficiency of a protective measure (for instance, a vaccine). This way, citizens could then decide if they agree with the criteria used by the government to make their recommendations about the hazard.

An opinion shared by many participants was that presenting uncertainty about the probability of an adverse event (such as a potential natural disaster) should always be accompanied along with guidelines for preparing and responding effectively to the threat. For instance, Anita noted:

> If the risk is heightened maybe you should educate people how to deal with it, and yes maybe you are instilling fear, but if they're aware of it, and they're aware of how to handle it, then the reaction would maybe, I don't know, it would be more smooth, in dealing with the emergency. (G8)

This view supports researchers' proposition that protective measures should form part of the communication of latent threats to reduce the feeling of fear and helplessness (Ruiter *et al.* 2001).

Some participants also believed an all-hazard approach to preparedness could reach better results than discussing all possible scenarios of potential threats for the country. William explained: '*sometimes they gear to a certain situation; they should just be more general and say what to do, because it could apply to different situations*' (G8). Using

an all-hazard approach has indeed been considered as an effective measure to address many uncertainties requiring similar protective measures in other research (Lemyre *et al.* 2005).

Some participants emphasised the importance of timing in communicating uncertainties about risks. They felt more open to discuss uncertainties *before* the emergence of a crisis than in the middle of it. They felt uncertainties are often mentioned too late in risk communication, only after it was raised by organisations other than the government, undermining government credibility. Indeed, researchers have mentioned the importance to initiate a dialogue with the public about uncertainties in the early stages of problem framing to help validate the process (Stern and Fineberg 1996). Covello *et al.* (1988) also proposed that engaging the community early in risk and uncertainty communication and management testifies to an agency's sincerity and respect for the public. Participants generally expressed clear preferences for discussing uncertainties pre-emptively, accompanied with some guidance to ease their decision-making and preparedness. The themes and characteristics of citizen's expectations of the discussion of uncertainty in government communication are summarised in Table 1.

Discussion

Participants did not see sharing uncertainties in risk communication as being intrinsically right or wrong. Participants gave consideration to the context of risk communication and the expected utility of the information communicated. They had a coherent discourse and clear expectations about *who* should be involved in discussing uncertainties and what their roles and responsibilities should be; *why* uncertainties should be discussed or not; *what* should be discussed; and finally, *how* and *when* uncertainties should be communicated.

Who

Participants saw both the government and citizens as important actors with complementary roles in risk communication and management. While they thought that the government should educate the public about health risks, they also believed that individual citizens were responsible for keeping themselves informed. They expressed the idea that the government should include the public in dealing with uncertainties and taking political decisions concerning health risks.

Why

Participants felt that the most important purpose for discussing uncertainties in risk communication was to raise citizens' consciousness about risks and promote preparedness. They saw effective communication about sources of uncertainty as a way of improving people's ability to make informed choices about exposure to health hazards. They expected uncertainty to lead to action and not to be used for creating paralysing fear or a stalemate.

What

The participants indicated that the perceived relevance of the information for risk management was more important than the source of uncertainty or the type of hazard. Overall, the notion of information utility was central to understanding citizen's ways of appraising the presence of uncertainty in risk communication and what they expected from a risk

Table 1. Themes and characteristics of citizens' expectations of the discussion of uncertainty in government risk communication.

Themes	Characteristics
Perceptions of governmental roles and interests	–Desire for democratic and responsible governance –Integrity is required –Governmental transparency as a value in Canadian democracy –Government should educate and inform the public –Government as arbiter –Duty to make decisions based on appropriate risk analysis
Perceptions of citizen's responsibilities and aptitudes	–Citizens have the responsibility to inform themselves independently of popularly disseminated information –Citizens organisations (i.e. NGOs) are responsible to verify and balance the information about risk and stimulate public debates –Citizens are capable of understanding most risk uncertainties and cope with them, however: –There are limits to their ability to understand complex problems
Expected outcomes of discussing uncertainties	–Risk awareness (i.e. individual consciousness; vigilance; critical thinking) –Risk management (i.e. increased capacity to manage risks; preparedness; enlightened decision-making; autonomy)
Sources of uncertainties and risks expected to be discussed	–Uncertainties affecting consumer choices about risks –Uncertainties about potential side-effects and unknowns –Ethical ambiguities surrounding biochemical and social health risks –Uncertainties about risks within individuals' control –Actual or factual (*not fabricated*) uncertainties –*Question the relevance* of systematically discussing very low probability scenarios of potential threats –*Question the relevance* of discussing uncertainties that can be dealt with timely by the government and prevent potential ripple effects
Preferred ways and timing for discussing uncertainties	–Present ways to cope with the uncertainties –Provide guidelines to ease decision-making (i.e. inform about both sides of an argument *and* guide the public through the process of weighing pros and cons; risks and benefits) –Better explain how and why the agency came to a conclusion about a risk –Adopt all-hazard approach to preparedness –Discuss uncertainties pre-emptively (i.e. before the emergence of a crisis)

message. Their judgment on the presence of uncertainty in a risk message depended on whether it could promote autonomous management of risks and improve their decision-making.

How and when

Many participants wished the government could be more explicit about the criteria it uses to determine the risk caused by a hazard around which there is much uncertainty. Furthermore, uncertainty from the probability of an adverse event was perceived as

much more useful in risk communication when accompanied by specific guidelines for responding. Adopting an all-hazard approach was also seen as an effective way to tackle many uncertainties calling for similar protective measures. Finally, participants did not want to be engaged in discussing uncertainty and risk too late in the risk management process, when decisions have already been made.

Implications for the communication and management of risk uncertainties

Citizens' expectations about discussing uncertainties in risk communication should be considered by government agencies and other policymakers. Indeed, public reactions and behaviours are considerably influenced by people's understanding and appraisal of the uncertain situation (Fischhoff *et al.* 1982, Slovic 1999, Slovic *et al.* 2002, Lee and Lemyre 2009, Markon *et al.* 2011). Moving towards a more dialogue based approach to risk communication and management is the key for understanding the public's conception and acceptance of uncertainty in different situations. The emphasis of risk communication should not be only about providing information, but also about encouraging constructive debates and public engagement regarding the management of uncertainties. Participants were willing to play an active role in evaluating uncertainties and coping with them. However, they were less receptive to the communication of uncertainties when they were not convinced that it led to positive practical outcomes and gave them more control over their life. They appraised sources of uncertainty that were perceived as fabricated or amplified to serve governmental interests very negatively. Participants also expressed reservations about the discussion of very low probability scenarios of potential threats when they were not accompanied by clear guidelines for preparedness. It is therefore crucial for risk communicators to better specify the purpose of discussing uncertainties, and emphasise the ways in which such communication can empower the public. Indeed, there is a clear preference for discussing epistemic uncertainties or ambiguities that are assumed to promote individual autonomy in dealing with risks. Even sharing unknowns and dilemmas about global risks such as terrorism and climate change can be perceived as positive under the condition that it could promote risk efficacy at a more personal level.

Another way to promote this sense of efficacy in dealing with risk ambiguities is to better equip citizens to evaluate different options and analyse decisions. Fostering scientific citizenship means supporting laypeople to arrive at informed evaluations and decisions about uncertainty (Pidgeon and Gregory 2004, Pidgeon 2008). This implies including citizens in all steps of assessing and managing uncertainties. It is also in line with an *autonomy-supportive* approach (Deci and Ryan 1985) which means for authorities (such as public health agency) to provide the necessary information while encouraging citizens to use the information in tackling the problem in the way they chose. It is contrary to a *controlling* approach using seductive or coercive techniques to force citizens to behave in particular ways (Black and Deci 2000).

However, uncertainties are often discussed with the public when it is, in fact, too late and there is no more room for changes in policies about the management of a risk. In these cases, the public simply feels constrained to depend on the risk manager, which can lead to much frustration as expressed in these focus groups (see Meyer and Ward's discussion of the difference between trust and dependence, 2013). According to Covello *et al.* (1988), it is important that citizens don't feel they are at the mercy of the policymaker for managing uncertainties. When communicators encourage citizens to search for varied sources of information with differing biases and values and invite them early to participate

in debating uncertainties, this can make the community feel more empowered and thereby judge the source more credible and trustworthy (Covello *et al.* 1988). The failure to address existing uncertainties early enough in risk communication and management can harm the authority's credibility and undermine public trust (Covello *et al.* 1988, Stern and Fineberg 1996).

Finally, even though in some cases behavioural change measures can be part of strategic risk communication, it should be part of a strategy privileged by all stakeholders (internal and external) and should be modified or adapted if it does not reach the outcomes that matter most to them. Also, it should be recognised that when people do not adhere to health officials' recommendations on a specific risk issue it may not reflect a lack of information or understanding, but rather diverging values or a lack of trust.

Limitations and future studies

This study offers important insights about the circumstances under which citizens expect uncertainties to be communicated. The generalisability of these findings is limited, however, by the size and composition of the sample. Although the sample was fairly diverse with an equal proportion of male and female, and a range of cultural origins, age and socioeconomic status, it was not meant to be representative of the broader population of Canada. Furthermore, in the context of the qualitative approach, participants provided their subjective perceptions about the communication of uncertainties, but it is unclear to what extent they would react to an actual situation in a similar manner as what is suggested by their opinions. Thus, the findings should be considered heuristic in nature. Further representative surveys and experimental testing could complement and triangulate the current qualitative findings.

In order to promote further thinking about the research question, subsequent investigations might also include determining what elements of communication from authority incline the public to attribute good intentions to that authority, and more specifically, intention to promote individual autonomy. Another promising avenue of research would be to investigate the extent to which individual and cultural variables influence preferences about discussing of uncertainty. It would also be interesting, in future studies, to analyse in more depth the perception of uncertainty in the context of one particular health risk to derive even more specific implications for policies.

Conclusion

In this article, we have shown that citizens expect decision-makers to include them in the questioning and debating of risk assessment and management. Participants in our study displayed a remarkable degree of intuitive discernment about risk uncertainty. Indeed, they brought nuances on the nature of uncertainties they found useful to discuss and the circumstances that were optimal for doing so. When discussing uncertainty was perceived as promoting the public's ability to manage risks independently it was most welcomed; in contrast to when it was appraised as merely raising fear in the population. Specifically, the reasoning that respondents expressed in judging the desirability of communicating uncertainty pivoted on a prediction of the probable outcomes. This highlights the importance for policymakers of systematically demonstrating how discussing uncertainties serves to empower citizens in the context of different risks. Communicating uncertainties to the

public can still be challenging and involves many trade-offs, but in the long-term, it could also contribute to strengthen scientific citizenship and foster a more resilient society.

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