

RESEARCH ARTICLES

Public Perception of Population Health Risks in Canada: Health Hazards and Sources of Information

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ABSTRACT

A national survey of health risk perception among 1,503 Canadians was conducted in 2004. The current survey follows-up a previous national survey conducted in 1992 and documents changes in risk perception since that time and investigates new risk issues not previously examined. This article presents a description of the ratings of perceived risk of thirty specific hazards to the Canadian population, sources of information about health issues and risk, and confidence in these information sources. Of the specific hazards considered, behavioral risks such as cigarette smoking, obesity, and unprotected sex were seen to present the greatest risk to the health of Canadians. Hazards related to the social environment (*e.g.*, homelessness, street crime, unemployment) were seen as posing moderately high health risks. Medical devices or therapies (*e.g.*, prescription drugs, vaccines, laser eye surgery) tended to rank the lowest in terms of health risk. Women, older respondents, and those with less education reported risks as being higher than men, younger respondents, and those with more education respectively. Large geographical differences in risk perception were also observed. Participants described receiving “a lot” of information from the news media, medical doctors, and the Internet but reported the greatest amount of confidence in medical doctors, university scientists/scientific journals, and health brochures/pamphlets.

Key Words: risk perception, determinants of health, health hazards, information sources.

INTRODUCTION

Public perception of risk is an important consideration in public health and risk management decision-making (Krewski *et al.* 1987; Krewski 1993; Slovic 1999). Public

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perceptions of risk can be influenced by a wide range of factors, including media coverage, whether or not the hazard in question evokes feelings of dread, whether the issue is well understood, involves a lot of uncertainty, is subject to personal control, or is familiar (Fischhoff *et al.* 1978). It is also correlated with personality type characteristics, referred to as worldviews (Slovic 1987; Dake 1991). Public perceptions of risk often differ from actuarial determinations of risk, and such differences are not easily eliminated by the pursuit of risk communication programs targeted at the public. In spite of differences in risk evaluation between the public and expert assessments of mortality and morbidity, decision-makers need to consider how the public views and values risk issues (Leiss 2001). Risk managers need to be sensitive to public concerns above and beyond toxicity, as such concerns emanate from real cognitive and affective sociopsychological processes. A better understanding of the factors shaping public perception of health issues and risks will help to determine how perception of risk should be addressed in managing health risk issues.

The first comprehensive national survey of health risk perception among Canadians was conducted in 1992 by Krewski *et al.* (1996a, b). Participants were asked to rate a number of hazards in terms of both personal risk and risk to the Canadian public; to identify their sources of information about health risks; and to state their agreement with attitude and opinion statements relating to a wide range of health risk issues. In the 1992 survey, Canadians perceived the risks associated with many hazards to be high, particularly behavioral and chemical risks. Perceptions of risk varied notably with age, gender, education, and geographical region. Worldviews (fatalism, hierarchy, individualism, egalitarianism, technological enthusiasm) also appeared to be correlated with perceived risk. Also, the majority of Canadians felt that a risk-free environment was an attainable goal.

More recently, findings from the survey were re-analyzed to gain further insight into the structure behind health risk perceptions. Inspired by previous work by Bouyer *et al.* (2001) and Sjöberg (2000), principal components analysis was used as an approach to examine the underlying component structure of health risk perceptions. It was believed that this approach would have the additional benefit of shedding light into which specific elements are integral to the way people perceive hazards. This re-analysis revealed a robust three-factor representation of health risks (Lemyre *et al.* 2006). Health risks appeared to fall into one of three clusters: environmental risks, therapeutic risks, and social risks. The environmental risks cluster included items relating to radiation, chemicals, or contaminants that are found within the global environment. Specific examples of such environmental risks were nuclear waste, nuclear power plants, PCPs or dioxin, chemical pollution in the environment, and waste incinerators. Therapeutic risks encompassed items with medical or therapeutic qualities such as contraceptives, contact lenses, and medical X-rays. Social risks spanned a number of lifestyle factors and items relating to societal problems. Examples of specific risks included in this cluster were motor vehicle accidents, drinking alcoholic beverages, crime and violence, cigarette smoking, and street drugs. Lee *et al.* (2005) also applied principle components analysis as a data reduction technique on findings pertaining to the various worldviews and beliefs held by Canadians about health risks. The analysis identified four underlying dimensions of beliefs related to health risk: cancer dread, trust in regulators, environmental concern, and personal agency (a sense of personal responsibility and/or control toward

one's health). Relationships between the belief components and environmental, therapeutic, and social health risk perceptions were examined. Environmental and therapeutic health risk perceptions were higher in respondents with high cancer dread and high environmental concern, but lower in respondents with high trust in regulators. Environmental health risk perceptions were lower in respondents with high personal agency. Social health risk perceptions were higher in respondents with high cancer dread and personal agency. These results demonstrated the role in risk evaluation not only of the toxicological properties of the hazard, but also of its sociobehavioral properties. The integration of the biophysical risk assessment and the sociopsychological properties of the hazard constitutes the basis of our risk evaluation and management framework (Krewski *et al.* 2002).

In March 2004, a follow-up survey of health risk perception among Canadians was conducted by members of our research team. The objectives of the present survey were to (1) to document changes in public perception of risk in Canada since 1992; (2) to investigate contemporary risk issues not included in previous surveys; and (3) to investigate psychosocial factors related to risk acceptability. This article focuses on a descriptive account of the ratings of perceived risk of thirty specific hazards in a representative sample of the Canadian population, of the sources of information about health issues and risk, and of Canadians' confidence in these information sources.

METHODS

Survey Content

The present survey was designed as a follow-up to the 1992 Canadian national risk perception survey (Slovic *et al.* 1995; Krewski *et al.* 1995a, b). Prior to its implementation, the study protocol was reviewed and approved by the Research Ethics Board of the University of Ottawa. The study questionnaire retained a number of items from the 1992 survey, and included a number of additional items in order to assess public perception of emerging health risks such as genetically modified foods, West Nile virus, laser eye surgery, and obesity. Retained items consisted of those with the highest factor loadings from our principal components analysis (Lemyre *et al.* 2006), as well as other items of particular topical or regulatory interest, such as suntanning, breast implants, and stress. The survey was also designed to account for the broad determinants of population health, including social and behavioural determinants, genetic and biological determinants, and environmental and occupational determinants, as well as health services and policies. The content-related validity of the survey was ensured via systematic evaluations of the survey questions by the research team. A pre-test with volunteers was also conducted to determine whether the questions were understood and to evaluate other formatting details. Adjustments were made to the final survey tool following the pre-test.

Respondents were asked to indicate his or her opinion about the health risks of thirty hazards to the Canadian public as a whole. Respondents were asked to provide their response based on a four point ordinal Likert scale: almost no health risk (1), slight health risk (2), moderate health risk (3), and high health risk (4). Respondents were also asked to indicate the amount of information about health risk issues

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they receive from nine different sources (no information (1), a little information (2), a fair amount of information (3), a lot of information (4)), as well as their level of confidence in each information source (no confidence (1), little confidence (2), a fair amount of confidence (3), and a lot of confidence (4)). Respondents could decline to respond (do not know/no opinion (0)), thus providing a fifth choice in each case. Demographic and health risk behavior information were also collected from each respondent.

The survey also contained questions to ascertain the degree to which five specific health hazards (motor vehicles, climate change, recreational physical activity, cellular phone, and terrorism) and five particular health outcomes (cancer, long-term disabilities, asthma, heart disease, and depression) were viewed to pose a risk both to the Canadian public and to their personal health, as well as associated levels of personal control, knowledge, worry, uncertainty and acceptability. Lastly, each respondent was asked to indicate their agreement with 25 different statements about a range of population health risk issues. Results from these survey components will be reported separately.

Survey Design and Implementation

A representative sample of 1,503 adult Canadians were interviewed by telephone between February 22, 2004 and March 25, 2004. Interviews were conducted in both official languages (English and French) and were approximately 30 minutes in length. Respondents were identified using a random digit dialing procedure, stratified by province, plus by age and gender within province according to the 2001 Canadian population. A maximum of five callbacks were made in attempt to reach potential respondents identified by this procedure. Upon first household contact, the resident whose birthday was closest to the current date was selected to complete the survey. A total of 26,223 numbers were dialed. Of these numbers, 5,604 were invalid and 4,944 were unanswered calls. Of the remaining numbers, refusals represented 44.4%, call-backs 5.4%, and ineligible due to strata quotas 4.2%.

The sample included a near equal proportion of males (48%) and females (52%). Respondents were categorized into three age groups: 18–34 years of age (representing 29% of participants), 35–54 years of age (41%), 55 years of age or older (30%). Thirty-three percent of participants obtained at most a high school education, and 67% had at least some college education. Seventy-eight percent of the interviews were conducted in English, and 22% were conducted in French. This distribution reflects the demographic profile of the Canadian population.

Statistical Analysis

Descriptive statistics were used to illustrate levels of risk perceived according to percent “high risk” response as well as mean response values (positive responses only). Chi-square tests were used to examine group differences in risk perceived for each hazard or information source according to the proportion of respondents perceiving risk as “high” (or “a lot” of information or confidence). *T*-tests were also used to examine group differences in risk perceived for each hazard or information source according to the mean response value. Design effects due to the stratified

sampling procedure were examined in the current survey and found to be close to 1 (ranging from 0.93–1.00), indicating that analysis of the data using simple random sample variance would result in conservative inferences.

RESULTS

Perception of Risk

Risk to the Canadian public

The perceived health risks to the Canadian public for the 30 hazards considered here are shown in Figure 1, with the hazards ranked according to the percentage of respondents indicating they considered it to be a “high health risk.” As in the 1992 survey, cigarette smoking was considered to be a “high health risk” by the greatest percentage of respondents. Obesity, unprotected sex, stress, and physical inactivity, respectively, received the next greatest percentage of “high health risk” responses. Percent high risk response and mean response values for perceptions of risk associated with cigarette smoking and stress both increased significantly from the 1992 survey ($p < 0.001$) (Table 1).

Natural health products received the lowest percentage of “high health risk” responses, followed by laser eye surgery, vaccines, medical X-rays, and tap water, respectively. Both medical X-rays and tap water were also ranked low in the 1992 survey, with the ratings for tap water demonstrating no significant difference between the two surveys, although concerns about medical X-rays declined significantly between 1992 and 2004 both in terms of percent high risk and mean score ($p < 0.001$).

As in the 1992 survey, chemicals in the form of air pollution and pesticides ranked relatively high in perceived health risk as compared to chemicals in the form of prescription drugs or natural health products. Industrial sources of radiation as represented by nuclear power plants, was seen again to rank higher in perceived health risk as compared to radiation for medical purposes, as characterized by medical X-rays. There was no significant difference in the rating of prescription drugs; however, a slight increase in the proportion of “high health risk” responses for nuclear power plants between the two surveys was observed ($p < 0.05$).

Risks related to the social environment including poverty, homelessness, family violence, street crime, and unemployment, measured here for the first time, were perceived as moderately high risks to Canadians. Emerging health issues such as genetically modified foods and West Nile virus were perceived as moderately low risks.

The perceived risk associated with suntanning and breast implants also declined significantly between 1992 and 2004 both in terms of percent high risk and mean score ($p < 0.001$). The mean response for drinking alcoholic beverages was also seen to decline from 1992 to 2004 ($p < 0.01$).

Gender differences. Differences in perceived high health risk to the Canadian public by gender are presented in Figure 2. As in the 1992 survey, women perceived the risk associated with every hazard to be higher than did men. The greatest gender difference (20.4%) in perceived risk in the present survey was observed for family violence.

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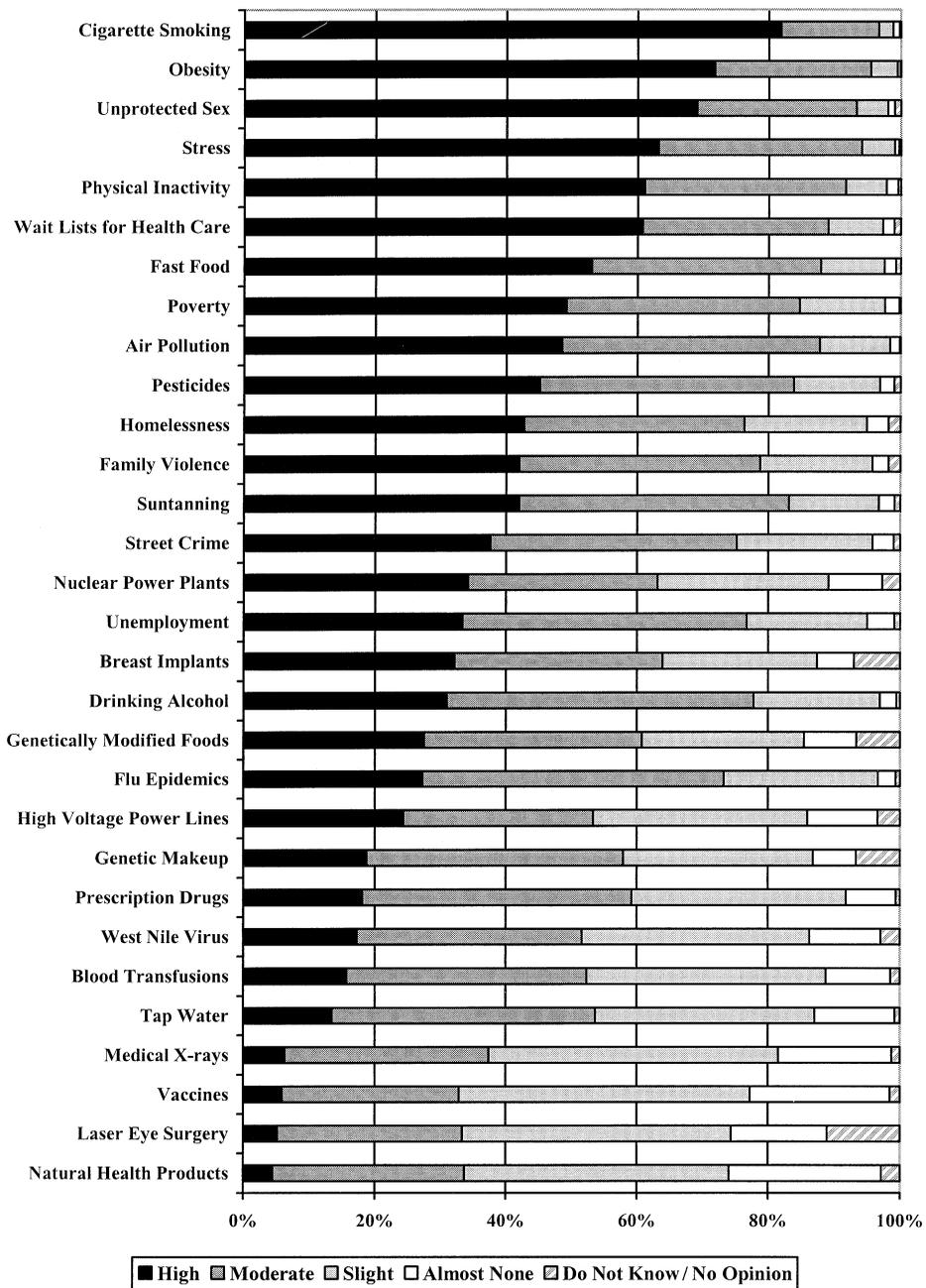


Figure 1. Perceived health risk of thirty hazards to the Canadian public.

Other hazards in which large differences between men and women were noted were sociobehavioral and included unprotected sex, suntanning, waiting lists for health care services, obesity, poverty, and stress. Actually, all gender differences were statistically significant ($p < 0.01$), with the exception of differences between women

Table 1. Percent high risk and mean ratings of perceived risk of selected hazards evaluated in 1992 and 2004.

Health risk to Canadian public	Percent high risk 1992	Percent high risk 2004	Mean 1992 (SD)	Mean 2004 (SD)
Tap water	13.0	13.4	2.53 (0.88)	2.55 (0.87)
High voltage power lines	21.4	24.4 (c)	2.61 (0.99)	2.69 (0.97) (f)
Air pollution	18.7	48.5 (a)	2.79 (0.82)	3.35 (0.73) (d)
Nuclear power plants	30.8	34.2 (c)	2.88 (0.98)	2.92 (0.97)
Prescription drugs	20.6	18.1	2.76 (0.89)	2.70 (0.85)
Cigarette smoking	60.6	81.8 (a)	3.52 (0.68)	3.78 (0.52) (d)
Drinking alcoholic beverages	34.2	30.9	3.16 (0.74)	3.07 (0.78) (e)
Suntanning	54.7	42.0 (a)	3.40 (0.77)	3.24 (0.78) (d)
Stress	56.7	63.2 (a)	3.46 (0.71)	3.57 (0.62) (d)
Breast implants	59.7	32.1 (a)	3.40 (0.89)	2.97 (0.92) (d)
Medical X-rays	12.2	6.3 (a)	2.53 (0.85)	2.27 (0.82) (d)
Sources of information about health issues and risk				
News media	50.5	35.1 (a)	3.34 (0.78)	3.10 (0.81) (d)
Industry	4.2	7.6 (a)	1.84 (0.86)	2.11 (0.87) (d)
Medical doctors	24.4	32.0 (a)	2.76 (0.95)	2.96 (0.89) (d)
Public interest or environmental groups	20.6	10.2 (a)	2.59 (1.00)	2.27 (0.89) (d)
University scientists	11.8	15.8 (b)	2.10 (1.03)	2.18 (1.07) (f)
Friends and relatives	15.1	19.4 (b)	2.44 (0.95)	2.64 (0.88) (d)
Confidence in organization as information source				
News media	19.2	15.7 (c)	2.78 (0.82)	2.73 (0.78)
Industry	3.2	6.8 (a)	2.03 (0.79)	2.23 (0.84) (d)
Medical doctors	43.2	51.8 (a)	3.26 (0.77)	3.38 (0.73) (d)
Public interest or environmental groups	17.0	12.5 (a)	2.61 (0.90)	2.52 (0.84) (e)
University scientists	25.3	41.6 (a)	2.82 (0.94)	3.14 (0.93) (d)
Friends and relatives	16.3	18.2	2.57 (0.90)	2.64 (0.86) (f)

a = Chi-square significant ($p < 0.001$), b = Chi-square significant ($p < 0.01$), c = Chi-square significant ($p < 0.05$), d = *t*-test significant ($p < 0.001$), e = *t*-test significant ($p < 0.01$), f = *t*-test significant ($p < 0.05$).

and men in percent “high health risk” in the present survey for laser eye surgery, medical X-rays, vaccines, natural health products, tap water, and blood transfusions. Evaluation of the mean scores by gender revealed similar results, with the mean score assigned by women exceeding that for men in all cases (results not shown here).

Age differences. Differences in perceived high health risk to the Canadian public by age group are presented in Figure 3. Participants 55 years of age or greater tended to be more likely to rate a health item as a “high health risk,” as compared to participants less than 35 years of age. Although this age difference was also noted in the 1992 survey, the magnitude of the differences tended to be greater in the present

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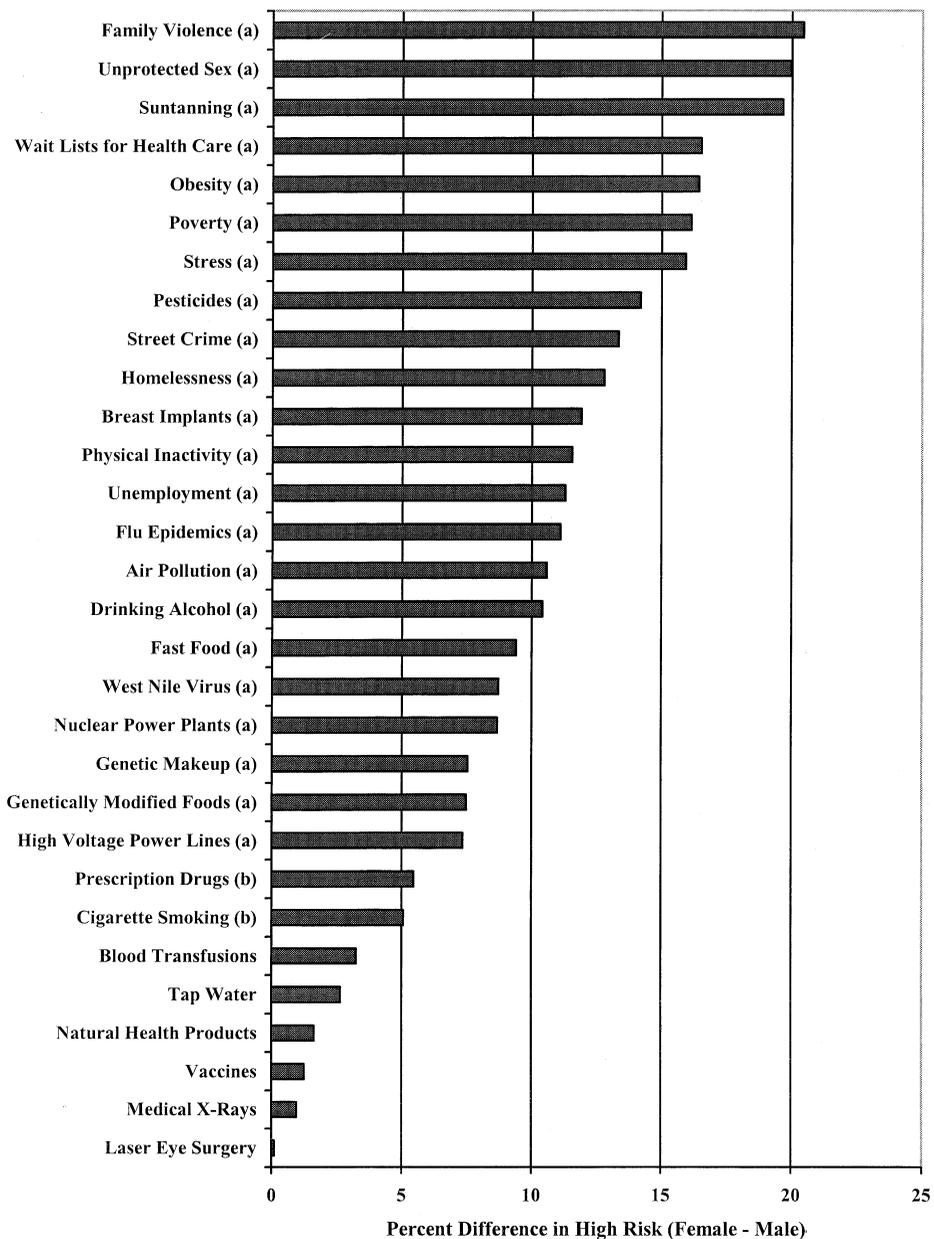


Figure 2. Perceived health risk to Canadian public by gender: Difference between females and males. a = Chi-square significant ($p < 0.001$), b = Chi-square significant ($p < 0.01$), c = Chi-square significant ($p < 0.05$).

survey. The greatest difference in perceived risk (20.7%) in the present survey by age group was observed for breast implants. Additional items where a considerable difference was observed between older and younger respondents included suntanning, pesticides, flu epidemics, and unemployment.

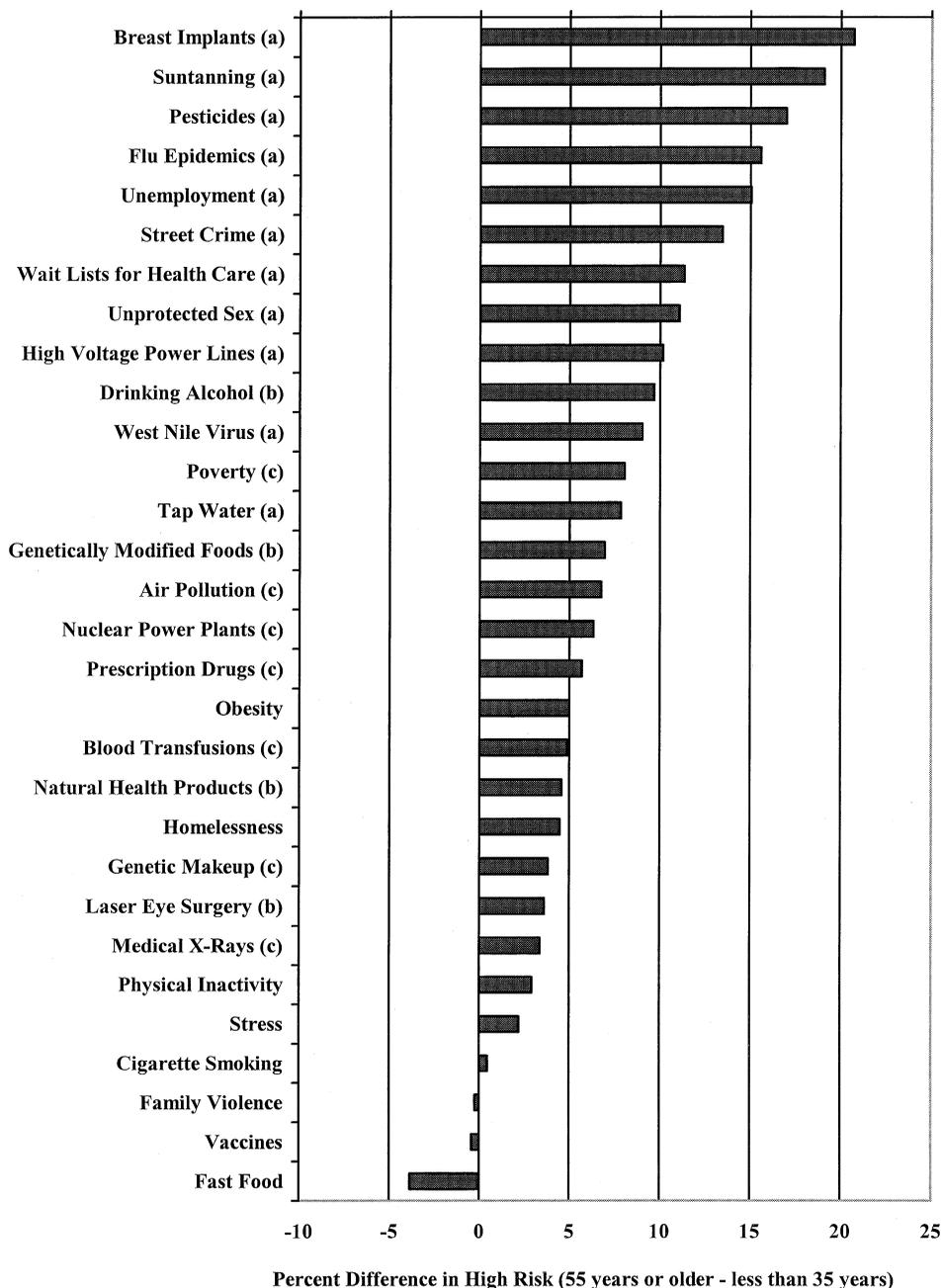


Figure 3. Perceived health risk to Canadian public by age: Difference between older and younger adults. a = Chi-square significant ($p < 0.001$), b = Chi-square significant ($p < 0.01$), c = Chi-square significant ($p < 0.05$).

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Similar results were observed upon evaluation of mean scores by age group (results not shown here). Participants in the older age group tended to have greater mean risk scores compared to the younger age group.

Education differences. Differences in perceived high health risk to the Canadian public by level of education are presented in Figure 4. In general, participants with a lower level of education were more likely to rate a health item as a “high health risk,” as compared to participants with a higher level of education. The greatest difference in perceived risk (19.8%) was observed for street crime. A notable exception was physical inactivity, where participants with some college education ranked physical inactivity significantly higher ($p < 0.001$) in risk than did participants with a high-school education.

Mean scores for the hazards considered here tended to be greater among participants with less education, reflecting the same pattern as the percentage “high health risk” (results not shown here).

Geographic differences. Figure 5 shows differences in perceived “high health risk” by geographic region in those cases where significant differences among regions were observed ($p < 0.05$). Due to large differences in risk perceived in the 1992 survey among respondents in Quebec compared to the other regions, we further examined risk perceptions accordingly. Respondents in Quebec were significantly more likely to rate a number of health items as a “high health risk,” as compared to respondents in other provinces combined. Participants from Quebec perceived nuclear power plants, family violence, air pollution, pesticides, flu epidemics, high voltage power lines, West Nile virus, poverty, medical X-rays, blood transfusions, and laser eye surgery as posing higher health risks ($p < 0.05$). Conversely, participants in Quebec rated fast food significantly lower in terms of “high health risk” than participants in other regions ($p < 0.001$). The magnitude of the differences in perceived risk in Quebec versus the other provinces tended to be smaller in the present survey than in the 1992 survey.

Sources of Information on Health Risks

Figure 6 summarizes amount of information on health risk issues obtained by the survey respondents from different sources. Participants reported receiving “a lot” of information most frequently from the news media, medical doctors, and the Internet. Participants received the least amount of information from industry, government, and public interest/environmental groups. This is similar to the 1992 survey, where participants also reported receiving the greatest amount of information from the news media and medical doctors, and the smallest amount of information from private industry. Although the ordering of information sources by the amount of information obtained from them was similar in the 1992 and 2004 surveys, the percent “a lot” and mean response values did change somewhat (Table 1). Significant increases in both percent “a lot” and mean response values between 1992 and 2004 were observed for medical doctors, friends and relatives, and industry ($p < 0.01$). Significant decreases in both percent “a lot” and mean response values were observed for the news media and public interest/environmental groups ($p < 0.001$).

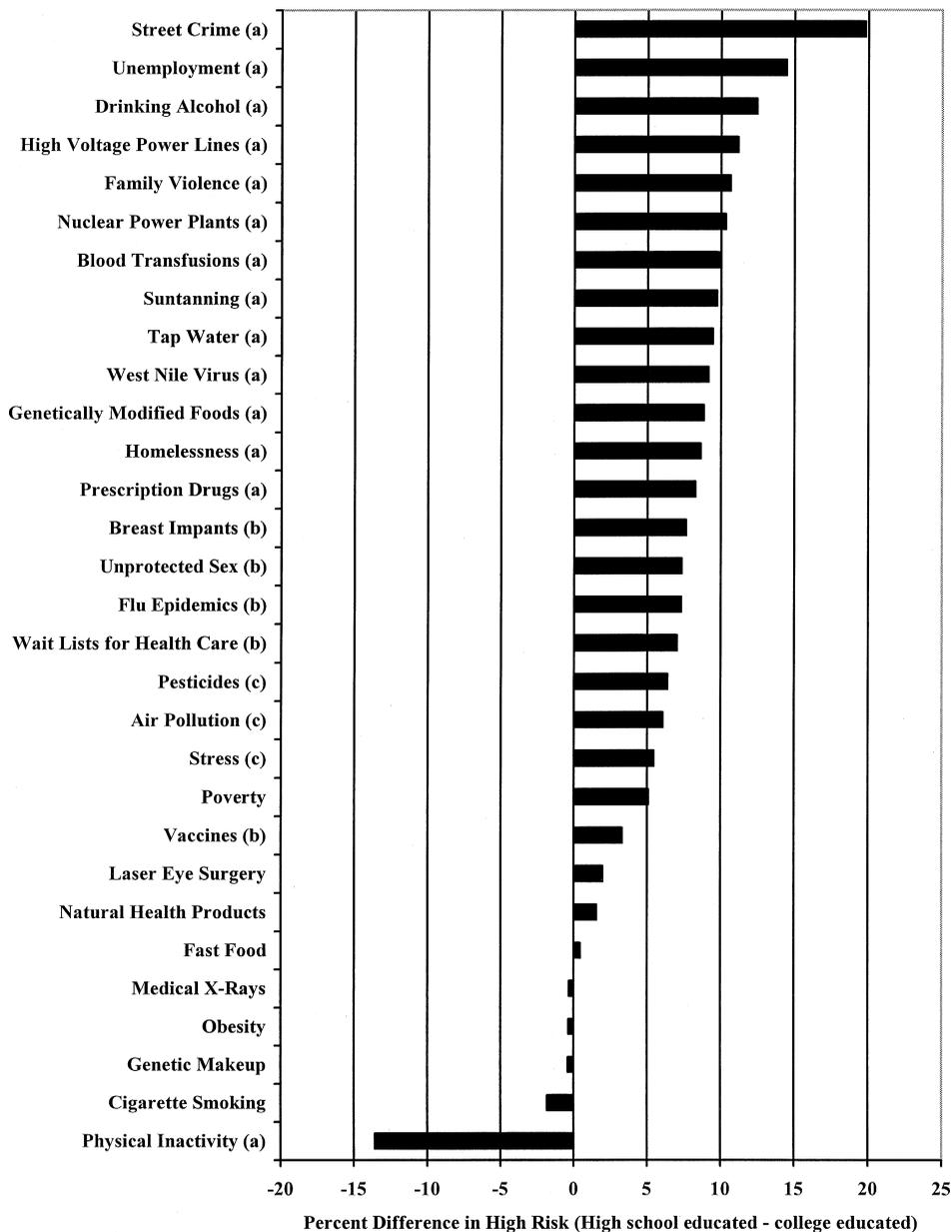


Figure 4. Perceived health risks to Canadian public by education: Difference between high school and college educated. a = Chi-square significant ($p < 0.001$), b = Chi-square significant ($p < 0.01$), c = Chi-square significant ($p < 0.05$).

Confidence in Information Sources

Figure 7 indicates the degree of confidence among the survey participants in the different sources of information on health issues and risks. Participants reported

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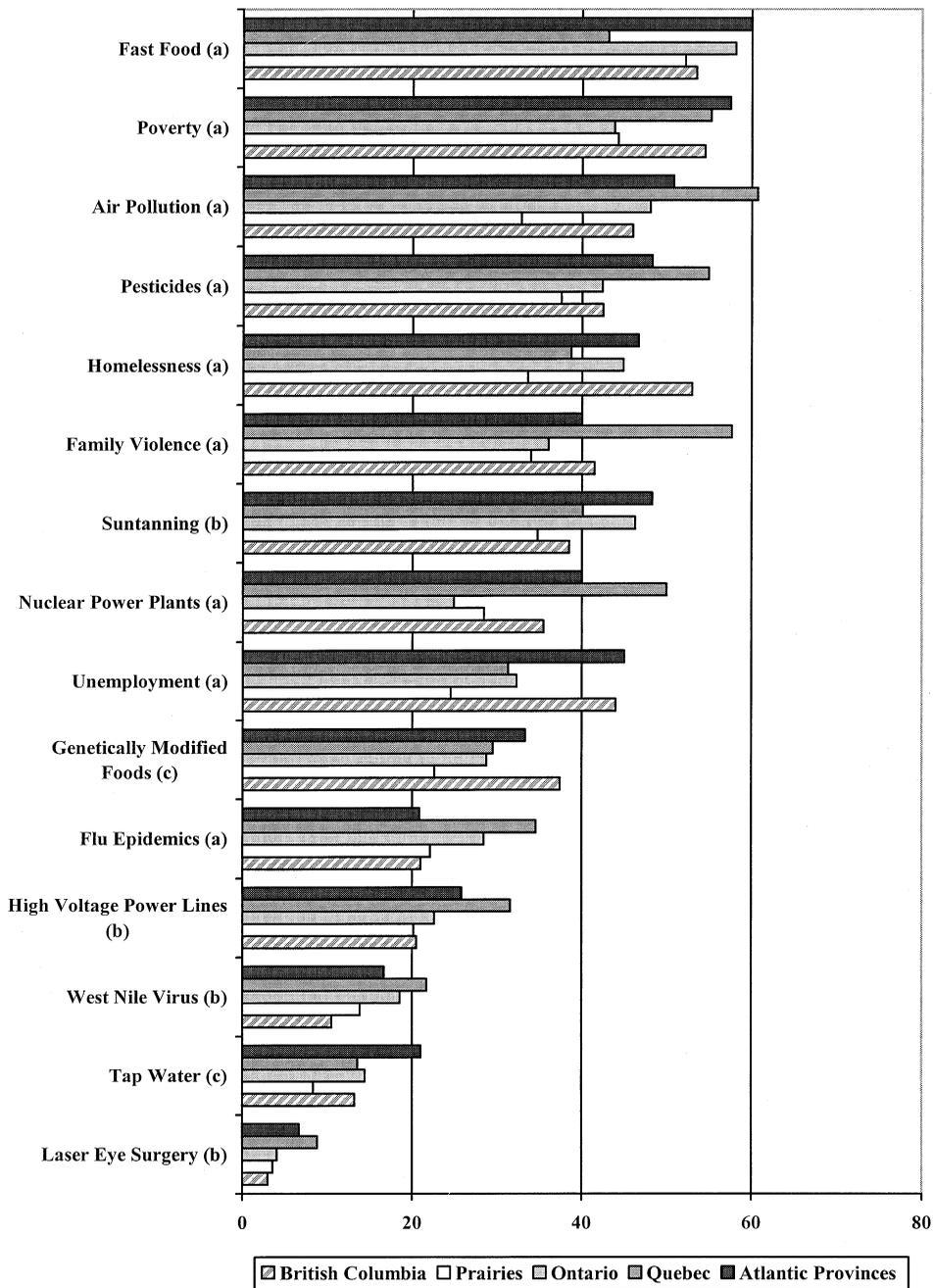


Figure 5. Perceived high health risk to Canadian public by region. a = Chi-square significant ($p < 0.001$), b = Chi-square significant ($p < 0.01$), c = Chi-square significant ($p < 0.05$).

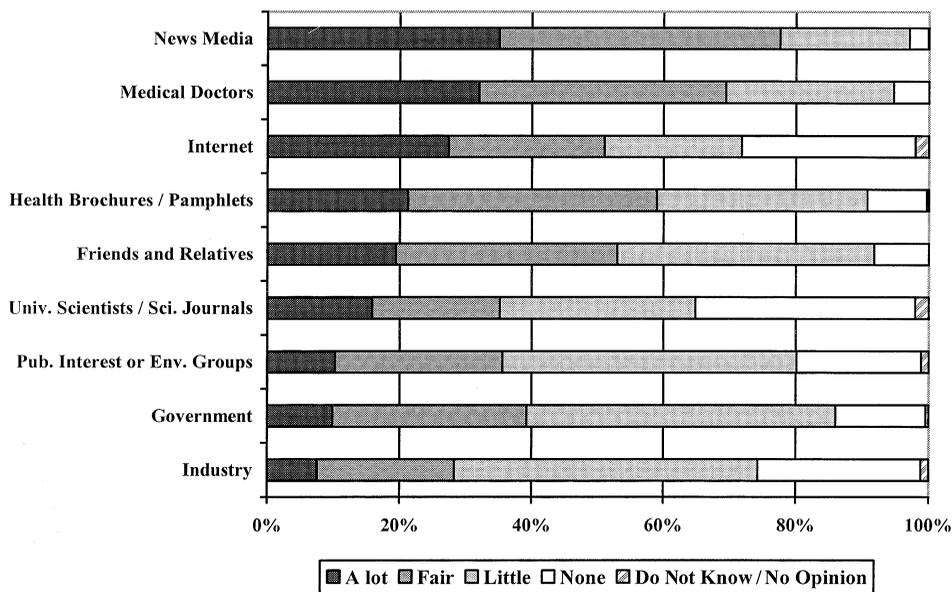


Figure 6. Sources of information about health issues and risks.

most frequently “a lot” of confidence in medical doctors, university scientists/scientific journals, and health brochures/pamphlets. Participants reported the least amount of confidence in industry and public interest/environmental groups. Although respondents indicated they received a lot of information from the news media, participants expressed low confidence in the news media as a source of

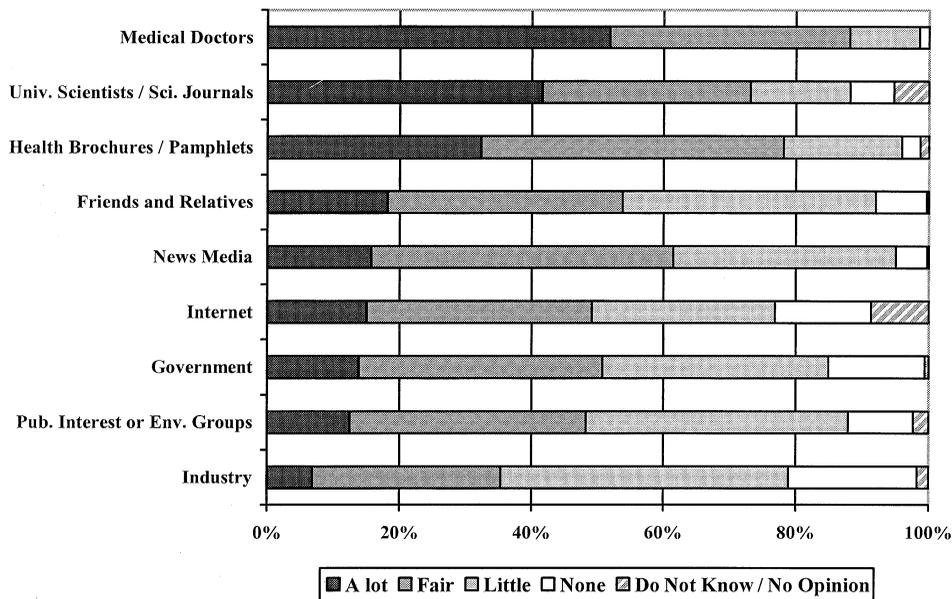


Figure 7. Confidence in organization as information source.

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information on health risks. Percent “a lot” responses and mean response values for confidence in the sources of information on health risks were seen to increase from 1992 to 2004 for university scientists, medical doctors, and industry (Table 1) ($p < 0.001$). A significant decline in confidence in public interest/environmental groups was noted since 1992 ($p < 0.01$).

SUMMARY AND DISCUSSION

The present large-scale national survey of public perception of health risks conducted in March 2004 serves both as a follow-up to our original 1992 survey, and presents unique information on the perception of a number of novel and emerging health risks. Survey respondents ranked many of the hazards considered in the present survey as presenting high health risks to the Canadian population. Behavioural and lifestyle factors were ranked among the highest of all risk issues considered. Of the 30 specific hazards considered, cigarette smoking was seen to present the greatest risk to the health of Canadians, as was the case in 1992. Health risks associated with obesity and physical inactivity, which have recently attracted considerable media attention due to increasing trends of obesity in North America, were also ranked as high health risks in this survey. In general, the tendency for lifestyle hazards to be perceived as high health risks may be due in part to this recent media coverage of lifestyle factors. Several authors have noted the tendency for people to recall the occurrence of events with high media profiles through a mechanism known as the availability heuristic (Tversky and Kahneman 1973, 1974; Combs and Slovic 1979). The danger of the availability heuristic lies in the fact that people may perceive high profile events as more likely even if it is not the case because memory, for instance, of these events is more readily accessible because of the media presentation. In the case of lifestyle hazards, however, Canadians' perceptions might be regarded as realistic given that smoking and obesity are important contributors to mortality in Canada (Makomaski Illing and Kaiserman 2000; Katzmarzyk and Ardern 2004). A question of importance might thus involve whether Canadians have actually made lifestyle changes in the context of their health risk perceptions. Of course, a thorough investigation of the relationship between health risk perceptions and health risk behavior was beyond the scope of this study. Yet, results from a companion project, which used group and individual interviews, do reveal that increasing the level of physical activity and reducing consumption of tobacco were respectively the second and third most frequent lifestyle changes participants reported making to deal with health risks (Dallaire *et al.* 2005). In light of this apparent link between the lifestyle factors Canadians identify as the highest risk issues and the health risk decisions they take, it would be worthwhile to examine whether the current findings on health risk perception translate into lifestyle changes in future research.

In contrast to hazards pertaining to individual lifestyle, hazards that were related to the social environment such as poverty, family violence, and unemployment were seen as posing moderately high health risks. These results suggest that the public may more clearly appreciate the role of social factors in health than academic research is traditionally putting forward. Recent models of population health have articulated and emphasized the role of social environment as a crucial determinant

of health (Mustard and Frank 1991; Evans *et al.* 1994). However, empirical research demonstrating the social gradient in health according to poverty, unemployment, and occupational status is still relatively new and marginal (Wilkinson 1996; Marmot and Wilkinson 1999; Orpana and Lemyre 2004). This may in part explain why social hazards were perceived as moderate rather than high in risk. Alternatively, this may have been the case because the pathways through which social hazards result in mortality are often less direct or obvious than they are for other hazards. This would be consistent with the contention that the amount of risk that one perceives to be associated with a hazard depends on the degree to which the hazard is understood and whether it results in immediate or delayed death (Slovic 1987).

Medical devices or therapies, which may be associated with significant health benefits, tended to rank the lowest in terms of health risk (Slovic 1987). Emerging hazards such as genetically modified foods and West Nile virus were perceived as moderate to low health risks. It is interesting to note the discrepancy between Canadians' health risk perceptions of genetically modified foods and those displayed by the British public (Frewer *et al.* 2002). In 2001, Canada along with the United States, Argentina, and China, was one of four countries responsible for the production of 99% of all genetically modified crops (Pan 2002). Research has shown that the degree to which members of the public support potentially hazardous technologies relates to their perceptions of economic benefits attached to the technologies or, similarly, to their level of economic dependence on the technologies (Hampton 1996; Sokolowska and Tyszka 1995; Williams *et al.* 1999). Thus, Canadians may perceive the risk of genetically modified foods as low because of the economic benefits that this industry entails within the country.

Of course, public perceptions of risk can change with the passage of time and the unfolding of new events, as manifested by the changes noted between our 1992 and 2004 surveys. For example, the substantial decrease in the perceived risk for breast implants may reflect the decline in media interest in the issue, which was intensely covered by the media at the time of the 1992 survey, as well as the impact of the changes in implant products and protocols.

As in the 1992 survey, women, older respondents, and those with less education tended to perceive risks as being higher than men, younger respondents, and those with more education, respectively. Gender differences in risk perception have been widely observed in previous studies (Slovic *et al.* 1995; Finucane *et al.* 2000; Dosman *et al.* 2001). However, the reasons for the differences in the views of men and women about health risk issues remain unclear. It has been suggested that biological differences or educational attainment may explain the gender-related differences in risk perception; however these hypotheses have not been substantiated (Slovic *et al.* 1995; Finucane *et al.* 2000; Dosman *et al.* 2001). Finucane *et al.* (2000) replicated the findings by Flynn *et al.* (1994) that white males in the United States tended to perceive the lowest degree of risk compared to nonwhite males or females of any race. These results appeared to be driven by a small proportion of white males (about 30%) who perceived risk as very low. It has therefore been suggested that gender-related differences in risk perception may likely reflect a complex array of sociopolitical factors (Finucane *et al.* 2000). White males have reported more individualistic and hierarchical worldviews, increased trust in technology, and less trust in government; white males may feel safer and receive more benefit from technology than other

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groups, and thus may tend to perceive hazards as lower risks to the population than other race and gender combinations (Finucane *et al.* 2000).

An alternate explanation for the gender gap in risk perception might be derived from research on psychological gender differences. For instance, a number of studies have demonstrated that women score higher on indices of worry (Robichaud *et al.* 2003) and psychological stress (Day and Livingstone 2003) than do men. In parallel, other research suggests that people perceive situations as more threatening when they are under acute stress because of the way they process information; not only do people pay more attention to threatening stimuli when they are under stress, they are also more likely over-predict negative outcomes (Mogg *et al.* 1990; Constans 2001). Taken together, these findings suggest that another explanation for gender differences in risk perception may be in gender differences in cognitive and affective processes.

The influence of age and education on risk perception has been less thoroughly studied. Dosman *et al.* (2001) have suggested that age-related differences in risk perception may be related to increased familiarity, increased exposure, or limited familiarity with the negative consequences of various hazards by younger individuals. Age, time period, or birth cohort effects may also be linked with perception-related sociopolitical opinions (Miller and Nakamura 1997; Harding and Jencks 2003). In this study, younger respondents tended to rate fast food as a higher health risk than older respondents. It is possible that this finding may reflect recent targeted health promotion strategies. The greater perception of risk by individuals with less education has been suggested to be related to a lesser understanding of the risks associated with various hazards, or a lesser degree of control toward the risks (Dosman *et al.* 2001). Further studies are needed to increase our understanding of the influence of gender, age, and education on risk perception.

Large regional differences in risk perception were observed in this survey. As in our previous 1992 survey, respondents from the province of Quebec reported a greater degree of perceived risk for certain hazards than respondents from other provinces, although the magnitude and extent of the differences observed in the present survey were smaller than in the 1992 survey. Regional differences in risk perception may be influenced by a number of factors, such as proximity to the hazard (Lindell and Earle 1983), sociopolitical climate, and the nature and type of information sources by region (Dosman *et al.* 2001). Of course, the disparity between respondents from Quebec and those from other provinces may have had its roots in a language-based difference in response scale use. Certainly, a greater proportion of respondents from Quebec completed the survey in French. Language-based risk perception differences have been reported in research conducted in Switzerland (Siegrist and Gutsher 2004), where French speakers displayed overestimation of flood risk compared to German speakers. Although this finding may be interpreted in terms of actual differences in perceived risk, it is possible that French speakers simply employed response anchors in a differential manner. A comparative psychometric analysis of French and English scales using Item Response Theory could help determine whether this was the case in future analyses (Knowles and Condon 2000).

In both surveys, participants reported receiving “a lot” of information from the news media and medical doctors. The current survey highlighted the increasingly

important role of the Internet as a source of information on health risks. However, confidence in this information source was relatively low compared to other sources such as medical doctors and university scientists. The findings from this national survey are similar to findings from a companion project that used group and individual interviews to ascertain health risk perceptions in Canadians (Dallaire *et al.* 2005). Among the main findings related to health risk information were the predominance of the news media as an information source followed by medical doctors, print materials and pamphlets, the Internet, and family members. Interview participants, however, tended to place the most trust in health risk information from personal or family experience, whereas other information sources, particularly industry, were less trusted.

Social psychological research has consistently demonstrated that the amount of confidence that people have in sources of information plays an important part in whether the information will be integrated with existing attitudes (Braunberger 1996; Mugny *et al.* 2000). Although confidence in the Internet as a source of information was low, its use as a source of information on health risks should not be discouraged in light of its increasing accessibility. Rather, future research should focus on identifying methods to increase the credibility of Internet-based risk communication programs. For instance, emphasizing the source of the information (such as governments or medical doctors) on the website may help to accomplish this.

Participants were selected using random digit dialing. This allows for access to over 96% of households in Canada (Statistics Canada, 2005). Potential limitations may include selection bias due to non-response or refusal to participate. In an attempt to reach respondents with caller ID, the number of the company conducting the survey was not blocked when calls were made. As no mechanism was in place to follow-up on the characteristics of non-respondents or refusals, it is difficult to assess selection bias in this study.

To conclude, the present results have been limited to a description of how hazards were rated in terms of health risk. This information will be of use to risk managers by aiding in the identification of priority risk issues of concern to Canadians. Our results on public perception of risk complement the work of risk analysts who strive to determine the actuarial risk associated with specific hazards. Understanding how Canadians form attitudes and opinions about risk can help in appreciating their concerns, and in designing effective risk communication programs.

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