HEALTH RISK PERCEPTION IN CANADA

Daniel Krewski, Ph.D., M.H.A. [1,2], Paul Slovic, Ph.D.[3],

Sheryl Bartlett, Ph.D.[1], James Flynn, Ph.D.[3], C.K. Mertz[3].

[1] Health Canada, Ottawa, Canada

[2] Carleton University, Ottawa, Canada

[3] Decision Research, Washington, U.S.A.

Correspondence: Daniel Krewski
Room 109
Environmental Health Centre
Tunney's Pasture
Ottawa, Ontario
K1A 0L2

Abstract

A national survey of 1500 Canadians was carried out to assess public perception of health risks. Questionnaire items focussed on ratings of perceived risk, sources of information on health risks and responsibility for risk management, attitude and opinions about risk, and risk taking and risk-avoiding behaviors in which the respondent has engaged. Respondents cited the news media as their most common source of information on health risks, but expressed most confidence in risk information provided by the medical profession. Respondents assigned risk management responsibility to many groups and organizations, but perceived medical doctors and Health and Welfare Canada as doing the best job of fulfilling their responsibilities. The Canadian public reported a high degree of perceived risk for many hazards, and were particularly sensitive to lifestyle risks such as cigarette smoking, street drugs, alcohol, AIDS and suntanning that are also of concern to health professionals. Other findings included a high degree of concern about health risks associated with industrial pollution and chemical products (with the exception of medicines), a widespread belief that a risk-free environment was an achievable goal, and sizable differences in perception of risk by gender, age, education and region.

I. Introduction

Public perception of risk is recognized as an important factor in risk management decision making (1,2). Vertinsky and Wehrung (3) argue that perceived risk can influence public policy, market processes, individual behaviour, evaluation of new risk evidence, as well as integrity and trust. Moreover researchers agree that public perception of risks often play an important role in influencing their response to risks and in particular health risks. Slovic et al. (4) suggest that an in-depth understanding of public perception of risk is essential for effective risk communication (5). Understanding the public's perception of risks is important in formulating risk communication strategies (6,7).

Descriptive studies of perceived risk are useful in obtaining information about public concerns. For example, a recent poll indicated that 97% of Canadians were either somewhat or very concerned about the possible effects of environmental pollution on human health and safety (8). The Department of National Health and Welfare subsequently sponsored a study of attitudes, perceptions and behaviour relating to ethical medicines in Canada (9). This study, conducted by Decima Research, involved telephone interviews with 1,000 subjects across Canada. Overall, prescription drugs were perceived to be safer and more effective than non-prescription drugs. Respondents were generally not willing to accept a high degree of risk of a serious side effect in exchange for therapeutic benefit. Other studies of the perceived risk of pharmaceutical

products in Canada and Sweden have been conducted recently by Slovic et al. (10,11).

Kraus et al. (12) conducted a unique study of the perception chemical risks in which the views of experts (members of the U.S. Society of Toxicology) were directly compared with those of the lay public. This pioneering investigation was designed to compare the views of these two groups on the relationship between dose and toxic response, the predictive value of animal and bacterial tests for human risk, general attitudes towards chemicals, and perspectives on reducing chemical risks. The results of this study provide a number of insights into how people perceive chemical risks.

Although the study by Kraus et al. (12) represents an important milestone in the analysis of perceived risk, the findings warrant confirmation in other study populations. To this end, the Department of National Health & Welfare[1] has conducted a survey of approximately 1500 respondents across Canada, and included a number of items similar to those used by Kraus et al. (12). The purpose of this article is to provide a detailed exposition of the results of this study. The results of a comparative survey of experts (members of the Canadian Society of Toxicology) will be reported separately.

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[1] After the study was conducted, the Department of National Health & Welfare was divided and the health component became the new Health Canada.

II. Method

Survey Content

The present survey was designed to assess many different aspects of health-risk perception. Accordingly, a variety of question formats was used including ratings of perceived risk, attitude and opinion questions, and questions about actual risk taking and risk-avoiding behaviors in which the respondent has engaged. The main components of the survey are outlined below.

Risk perception. Respondents were asked to indicate the degree of health risk they associated with each of 33 hazards. These 33 items covered a wide range of hazards including risks from technology (e.g., nuclear power, high-voltage power lines), lifestyle (e.g., AIDS, suntanning, cigarette smoking), pollution (e.g., waste incinerators, indoor air quality), common substances (e.g., bacteria in food, tap water), and crime and violent behavior. The array of items was selected to include many of the hazards that have recently been of concern to the public, the medical community, or government agencies.

Each of these items was rated in terms of the health risk posed "to the Canadian public as a whole." The possible responses were "almost no health risk," "slight health risk," "moderate health risk," and "high health risk." In addition, for ten of the items thought to pose risks to respondents and their families that might be quite different from the risks to the general public (e.g., street drugs), ratings were also obtained for "the health risk to you and your family."

Five additional items, representing medical devices or treatments, were rated on perceived health risk under the assumption that "you or some member of your family were considering using the following medical devices or treatments." These five items included breast implants, medical X-rays, contraceptives, contact lenses, and heart pacemakers.

Sources of information. Respondents were asked to indicate the amount of information about health risks that they received from various sources such as the news media, medical doctors, government agencies, and so on. They also were asked about the confidence they had in each of these sources.

Responsibility for health-risk protection. A diverse set of private individuals, private groups, and government agencies were rated according to the degree of responsibility they were perceived to hold for protecting people against health risks. These same individuals and groups were also rated according to how good a job each was doing in fulfilling their responsibilities for protecting people against health risks.

Attitudes and opinions. The middle segment of the survey contained approximately 40 items designed to elicit the respondents' attitudes and opinions to a variety of health-risk perception issues. These items were presented as statements with which the respondent was asked to agree or disagree.

The questions pertaining to perceptions of risk from chemicals and radiation were modeled after the extensive survey of intuitive

toxicology conducted by Kraus et al. (12). Items were designed to assess sensitivity to dose or amount of exposure as a determiner of risk, opinions about the value of animal tests as predictors of the effects of chemicals on humans, attitudes about the nature of chemical and radiation-induced cancer, and general attitudes about the benefits versus the risks from chemical technologies.

Worldviews. Over the past decade, evidence has been accumulating regarding the importance of general dispositions or "worldviews" in determining an individual's perceptions of risk (13, 14, 15). The survey contained a small number of statements designed to measure the following worldviews: fatalism, hierarchy, individualism, egalitarianism, and technological enthusiasm.

Personal and demographic characteristics. The final section of the survey elicited information pertaining to the personal background of the respondent. In addition to standard demographic information (gender, age, education, region of residence, occupation, and income), respondents were asked about their health status and health-related lifestyle (smoking, seat-belt use, exercise, voluntary risk taking, and occupational exposure to risk). They were also asked questions about their degree of political activism and their environmental activism (e.g., "Have you purchased a higher priced product because it was better for our health or environmentally friendly?").

Survey Design and Implementation

A representative sample of the Canadian adult population was interviewed by telephone. The interviewing was conducted in either English or French during the period between February 14 and February 24, 1992. A stratified random sampling procedure produced 2765 contacts from which 1506 completed interviews were obtained, for a response rate of 54.5%. Weighting of the data was performed to produce a final sample of 1500 individuals, matched to the 1992 Canadian population in terms of household size, community size, age, and gender. A survey of this type has an overall statistical reliability of ±2.6%, nineteen times out of twenty. The statistical reliability of the weighted proportions in various subpopulations ranged from 4.3% to 9.0% for the individual region and 3.5% for females and males, respectively.

Prior to the administration of the survey, the questionnaire was pretested with two focus groups, and with 30 telephone interviews. During administration of the survey, lists of items within questions (e.g., the various items in the perceived-risk question) were sequenced randomly, to balance possible order effects.

III. Results

Perception of Risk

Risk to the Canadian public. Based on the responses of the entire sample (N=1500), the perceived risk of thirty-three environmental hazards (Figure 1a) to the Canadian public as a whole

and of five medical devices and treatments to individuals and their families (Figure 6) ranged from high to low levels. Cigarette smoking elicited the greatest percentage of responses in the "high risk" category and bottled water and contact lenses the lowest percentage of high-risk responses. Ozone depletion and the related risk from suntanning stood out as quite high in perceived risk, testimony to the degree to which recent media coverage has effectively brought these problems to public attention. The same is true for silicone breast implants. The United States Food and Drugs Administration held hearings on breast implants in February 1992, and put a temporary moratorium on breast implants as did Canada. A substantial amount of media attention was directed towards this issue immediately before and during the time the survey was done. Stress also stands out as quite high in the hierarchy, close to street drugs and higher than crime and violence, AIDS, traffic accidents, and nuclear power risks. In contrast, other hazards that experts might see as relatively serious, such as bacterial contamination of food and indoor air quality, were rated rather low in risk to health.

Chemical risks from ozone, street drugs, chemical pollution, PCBs or Dioxin, pesticides, food additives, and alcohol were rated high in risk, but chemicals in the form of prescription drugs were rated relatively low in risk. Radiation hazards associated with industry (nuclear power and nuclear waste) were seen as more risky than radiation hazards associated with medicine (x-rays). The relatively low perceived risks associated with medical uses of

chemicals and radiation replicates earlier findings in Canada (11) and elsewhere (17) and may reflect the influence on risk perceptions of perceived benefit, familiarity, and trust in medical treatments and the medical establishment.

Perceived risks due to climate change were seen as moderate in magnitude, smaller than risks from ozone depletion. Nuclear waste was seen as a more serious risk than nuclear power (another replication of previous findings). Drinking alcoholic beverages during pregnancy was seen as more risky for the public as a whole than was drinking alcoholic beverages overall. If risk is equated with total morbidity and mortality, drinking alcohol must cause more harm than drinking alcohol during pregnancy (which is subsumed under the broader category of drinking alcohol). The higher perception of risk associated with alcohol and pregnancy may reflect the conjunction fallacy (18), whereby a combination of events sometimes seems more frequent or probable than the individual events themselves. This result may also indicate that perceived risk in this context reflects the probability of harm to the unborn child if its mother engages in the specified behavior (i.e., drinking alcohol if pregnant is perceived as more risky than drinking alcohol if not pregnant).

Risk to respondents and their families. Comparing the percentage of "high risk" responses when respondents were considering the health risk "to you and your family" with the percentage for the "Canadian public as a whole" for each of 10 items. In every instance, there were more high-risk judgments in

reference to the Canadian public for every item (Figure 2). For some items, such as street drugs and AIDS, the difference between personal and societal risk perception was quite large. Note that nuclear waste and nuclear power received more "high risk" evaluations than any other items when the reference was to personal or family risk. Most surveys have looked at either personal or societal risk perceptions. These results demonstrate that the reference group can be quite important, particularly when people are not personally exposed (or think they are not personally exposed) to certain hazards.

Subgroup analyses: Gender. Perceived risk for all thirty-eight health hazards was examined for subgroups of respondents differing according to gender, age, education, and region of residence. Sizable differences were observed as a function of each of these demographic variables. Women were more likely to rate a hazard as a "high risk" for every item but one—heart pacemakers (Figure 3). In many instances, the differences between men and women were quite large—up to 22.8%, for example, for suntanning. Other items exhibiting more than a 15% difference in percentage of high-risk responses were crime and violence, AIDS, motor vehicle accidents, stress, ozone depletion, malnutrition, nuclear power plants, drinking alcohol, chemical pollution, and waste incinerators. Items for which women had relatively less excess concern (when compared to men) included asbestos, nuclear waste, and genetically engineered bacteria.

Subgroup analyses: Age. Respondents of age 55 or more were more likely than respondents age 30 or less to rate a health risk as high (Figure 4). This tendency was particularly evident for street drugs, breast implants, crime and violence, suntanning, alcohol and pregnancy, asbestos, video display terminals, and cigarette smoking. The younger respondents displayed slightly higher perceived risk than did the older group for heart pacemakers and chemical pollution.

Subgroup analyses: Gender differences by age. In each of three age categories, women were more likely than men to rate a risk as high. However, the "gender gap" was not always uniform across age groups. Younger women were relatively more concerned about AIDS (compared to younger men). Middle-aged men were relatively less likely to see stress as a high risk and older women stand out in having relatively more concern about malnutrition than do older men.

The gender gap (greater tendency of women to judge a risk as high) increased with age for the following 14 hazards:

- Suntanning
- Motor vehicle accidents
- Ozone depletion
- Malnutrition
- Drinking alcohol
- Pesticides in food
- Food additives
- Food irradiation
- PCB's or dioxin
- Cigarette smoking
- Bacteria in food
- Food irradiation
- VDTs
- Genetically engineered bacteria
- Asbestos

The reverse held for 7 hazards. The gender gap decreased with age for:

- Crime
- Breast implants
- Nonprescription medicines
- AIDS
- Waste incinerators
- Street drugs
- Nuclear power

Subgroup analyses: Education. College-educated respondents were consistently less likely than respondents with high-school educations to rate a risk as "high" (Figure 5). People with less formal education were relatively more concerned about chemical pollution, street drugs, nuclear waste, AIDS, malnutrition, and high-voltage power lines. In general, these differences were smaller than the gender differences described earlier. The maximum difference in the "high-risk" response associated with education was 17.5%, for street drugs.

Subgroup analyses: Region of residence. Regional differences for the 10 items rated with respect to both individual and family risk were small in most instances, with one exception (Figure 6). Residents of Quebec were more likely to rate certain risks as high than were residents of other regions. This tendency was particularly marked for perceived individual and family risks from street drugs, nuclear waste, AIDS, alcohol and pregnancy, and nuclear power plants.

Out of the 38 hazard items, residents of Quebec produced the highest proportion of "high risk" responses for 29 of the items. Differences among the other regions were relatively small in

comparison with the differences between Quebec and the rest. Residents of Quebec were particularly high in perceived risk for street drugs, stress, chemical pollution, crime and violence, suntanning, nuclear waste, PCBs or dioxin, food additives, nuclear power plants, nonprescription medicines, malnutrition, and bacteria and molds in food. These results contrast somewhat with a survey conducted in Canada in February, 1989 (10). That survey assessed perceived risk and benefit from 33 hazards, more than half of which were various forms of prescription medicines. In that study, residents of Quebec were not particularly exceptional in their perceptions of risk but, instead, differed in their perceptions of benefit, which were consistently lower than benefit perceptions in four other regions (Atlantic, Ontario, Prairies, British Columbia). Residents of Quebec were, however, more concerned about the risks from prescription drugs than were other Canadians.

Two striking exceptions to the general pattern of regional differences occurs with perceptions of risk from breast implants and asbestos. Residents of Quebec exhibit considerably lower perceptions of risk for implants and moderately lower perceptions of risk from asbestos.

Sources of Information

The source of information about health issues and risks relied upon most heavily was the news media (Figure 7). Private industry and municipal government were relied upon least often. Differences among the remaining sources were relatively small. The degree of

confidence that respondents had in those information sources roughly paralleled degree of reliance on that source (Figure 8). However, medical doctors were trusted substantially more than other sources. Health and Welfare Canada and Environment Canada received high evaluations. Private industry received the lowest ratings on confidence. The news media, the most heavily relied upon source, was outranked on confidence by a number of the other sources.

Responsibility for Health Risk Protection

Medical doctors and Health and Welfare Canada were seen to be most responsible for protecting people against health risks (Figure 9). These two groups were also to be perceived to be doing the best job of fulfilling those responsibilities (Figure 10). Private industry was judged to be doing the poorest job in meeting this responsibility.

Attitudes and Opinions

The response distributions for the 34 attitude and opinion statements are presented in Tables I through X. These statements have been grouped by content category for easier interpretation.

Category 1 (Table I) includes general statements about the risks in one's local environment and in the global environment. At the local level, respondents were about evenly divided about whether there are serious environmental health problems where they lived (45% agreement; Question 1a). Only 39.6% agreed that their community was becoming a healthier place in which to live (Question

1b). There was almost a complete agreement (93.4%) with the statement that the land, air, and water are more contaminated now than ever before (Question 1c). In summary, almost everyone seems to believe that contamination has been increasing, and a high percentage of respondents express serious concern regarding the healthiness of their home environment. Considerable concern about the global environment was evident in the finding that 85.9% agreed that the greenhouse effect is a serious health threat (Question 1d).

Questions in Category 2 (Table II) examined general opinions and attitudes regarding the risks from exposure to chemicals. Only 43.0% agreed that the use of chemicals has improved our health more than it has harmed it (Question 2a). Respondents were split almost evenly on the question of whether most chemicals cause cancer (Question 2b). Significant concern regarding chemical risks is evident in the finding that 58.9% disagreed with the statement that "I don't worry much about chemicals because there are just too many other things in my life I have to deal with (Question 2c). Even more remarkable is the concern about chemicals indicated by the finding that 76.6% agreed that "I try hard to avoid contact with chemicals and chemical products in my daily life" (Question 2d).

Attitudes toward regulation of chemical hazards are indicated by responses to statements in Category 3 (Table III). The picture is mixed. Moderate confidence in the regulatory system is shown by the 54.6% of respondents who agreed that "Chemical risks are adequately regulated" (Question 3a). However there was 79%

disagreement with the statement in Question 3b that government regulation permits one the luxury of not having to worry about serious health problems and 85.3% disagreement with the statement that "Because chemicals provide many benefits . . . there should be less regulation . . . " (Question 3c). There was about equal agreement and disagreement with the statement that "A prescription drug that hasn't been formally tested but has been used for 20 years is safer than a new prescription drug that has been tested and approved for use under the present guidelines (Question 3d).

Categories 4, 5, and 6 were based upon statements from an earlier study (12) that examined the cognitive models, assumptions, and inference methods that comprise lay people's intuitive theories about the relationship between chemicals and health risks. The purpose of the present investigation into what has been termed "intuitive toxicology" is to provide a deeper understanding of perception of chemical risks that can serve as a starting point around which to structure discussion, education, and communication about health-risk assessment.

Questions were developed to address fundamental concepts within the science of toxicology, specifically

- Conceptions of carcinogenicity
- Conceptions of the relationship between chemical dose or amount of exposure and degree of risk
- Trust in the use of animal studies to determine the risk a chemical poses to humans.

Questions in Category 4 (Table IV) assessed the respondents' sensitivity to the relationship between the dose or amount of exposure to a chemical (or to radiation) and the degree of health risk. Previous studies have found that the public appears to have an "all-or-none" view that equates the mere fact of exposure to a carcinogen (regardless of degree of exposure) with a high probability of being harmed. This same tendency was observed strongly in the respondents to the present survey. For example, 61.7% agreed that "If a person is exposed to a chemical that can cause cancer, then that person will probably get cancer some day" (Question 4a). A similar question involving exposure to radiation elicited agreement for 64.9% of the respondents (Question 4b). Almost half of the respondents (49.6%) agreed with the statement that "Chemicals are either safe or dangerous. There is really no in between." Although the responses to questions 4a, 4b, and 4c suggest a lack of sensitivity to degree of dose or degree of exposure to chemicals and radiation, the responses to Question 4d illustrate that people also believe that repeated exposures increase risk. There was agreement by 88.3% that "The more often a person is exposed to a substance that can cause cancer, the more likely he or she is to get cancer" (Question 4d). In light of these concerns about any degree of exposure (single or repeated) to carcinogens, it is perhaps not surprising that 73.9% agreed with the statement that "If even a tiny amount of a substance that can cause cancer were found in my tap water, I wouldn't drink it" (Question 4e). On the final question in this series, Question 4f,

62.0% agreed that "No matter how low the level of exposure to radiation, it can still cause cancer." This "non-threshold" view is consistent with the assumption that guides risk assessment and regulatory policy regarding radiation exposure.

Kraus et al. (12) found a strong relationship between a person's sensitivity to level of exposure or dose and their general attitudes toward chemicals. Persons who lacked sensitivity to dose and thus believed any exposure to a toxic substance or carcinogen implied subsequent harm had less favorable attitudes toward chemicals. The same relationship held in the present study. For example, among persons who disagreed with Question 4a (exposure to a carcinogen implies cancer), 69% said they tried to avoid contact with chemicals (Question 2d). Among those who agreed with Question 4a, 82% said they tried to avoid chemicals. Similarly, expressed avoidance of chemicals in Question 2d jumped from 53.9% among those who disagreed with Question 4e (If even a tiny amount of a carcinogen were found in my tap water, I wouldn't drink it) to 81.4% among those who agreed they would not drink the water.

Category 5 (Table V) included two questions designed to gauge one's trust in the use of animal studies to determine a chemical's risk to humans. There was a moderate level of trust expressed in answers to the general statement in Question 5a: "The way an animal reacts to a chemical is a reliable predictor of how a human would react to it" (60.3% agreement). When an animal study was said to provide evidence that a chemical causes cancer in animals (Question 5b), confidence increased (82.3% agreed). The tendency

for studies that bring bad news about risk to be seen as more valid than other studies has been observed in a number of other surveys (see, e.g., 12).

Other questions pertaining to cancer are grouped in Category 6 (Table VI). Responses to Question 6a (68.5% disagreement vs. 25.6% agreement) indicates that most respondents do not share the view presented by Ames (19) that fruits and vegetables contain natural substances that are carcinogenic.

Questions 6b and 6c were designed to assess people's conceptions of the mechanism by which a carcinogen acts. In Question 6b, about 42.6% agreed with the notion that carcinogens turn normal cells into cancer cells through contact, much like the spread of a highly contagious disease. About 44.8% disagreed with this statement and 12.7% did not know or did not answer. In Question 6c, only 31.3% agreed that the body usually repairs damage caused by exposure to radiation (57.8% disagreed).

Willingness to entertain risk/benefit tradeoffs was examined in Category 7 (Table VII). Only 29.0% agreed that "Canadians should be prepared to *accept some risks* to their health in order to strengthen the economy" (Question 7a). However, if the benefit was a personal one involving drugs or medical devices, willingness to *accept some risk* rose to 52.9% (Question 7b).

Two questions about health risks and energy policies are included in Category 8 (Table VIII). On Question 8a, 45.0% agreed that Canada should rely more heavily upon nuclear power to meet future electricity needs, in light of health concerns associated

with burning coal and oil. In light of these same concerns, 95.0% agreed that Canada should place greater emphasis on energy conservation (Question 8b).

Seven miscellaneous questions are contained in Category 9 (Table 1X). Question 9a indicates that 56.1% agreed with the statement that natural chemicals are not as harmful as man-made chemicals, a view forcefully proposed by Rachel Carson in *Silent Spring* (20) but disputed by most toxicologists (12). Most respondents (57.8%) disagreed with the view that "Canadian society is becoming too concerned about small health risks" (Question 9b); 40.5% agreed with this statement. A note of optimism was evident in responses to Question 9c. Exercise and proper eating were believed by 90.1% to be able to offset health risks from pollution. In Question 9d, 58.9% agreed that lifestyle factors such as smoking and diet posed greater cancer risk than did chemicals in the environment; 38.8% disagreed with this view. In Question 9e, a majority of respondents (60.9%) agreed that " . . . a risk-free environment is an attainable goal in Canada" (38.1% disagreed). In Question 9f, 89.2% agreed with the statement "I pay close attention to warning labels on products that I use." The final miscellaneous question (9g) elicited 60.8% agreement with the statement: "Experts are able to make accurate estimates of health risks from chemicals in the environment."

Worldviews

Response distributions for questions pertaining to worldviews (also known as "cultural biases" or "orienting dispositions") are shown in Category 10 (Table X).

The worldview "fatalism" was assessed in questions 10a and 10b.[1] In Question 10a, there was about an even split between agreement and disagreement with the statement, "I have very little control over risks to my health" (49.1% agreement; 50.7% disagreement). On Question 10b, 32.5% agreed with the view that "there isn't much I can do" regarding harm from chemicals—"what will be, will be"; 65.9% disagreed).

Two questions about experts were designed to assess the worldview "adherence to hierarchical forms of social organization" (hierarchy). In Question 10c, 38.8% agreed with the hierarchical position: "Decisions about health risks should be left to the experts." The second question about hierarchy was 10d, which elicited 22.2% agreement with the statement, "People in positions of authority are not likely to abuse their power." The fact that a majority of respondents did not wish to leave decision making to the experts is interesting in light of the finding that medical doctors and organizations employing experts were judged to have a high degree of responsibility for protecting the public against health risks (Figure 9). What appears to be an inconsistency

[1] Studies of worldviews typically use four or more questions to measure each view. The present study included only one or two items representing each view, thus providing only a partial assessment.

between these two perspectives may be explained in light of the fact that experts and organizations were not always given high marks in fulfilling this responsibility (Figure 11, right-hand panel).

The view known as "individualism" was measured by Question 10e; 76.0% agreed with the individualist view: "In a fair system people with more ability should earn more." The worldview known as "egalitarianism" was measured in Question 10f: 81.1% agreed with the egalitarian view that "If people in this country were treated more equally we would have fewer problems."

The final view assessed here, "technological enthusiasm" (15) is reflected in responses to Question 10g: "A high-technology society is important for improving our health and social well-being" (71.2% agreement).

A number of previous studies have found that worldviews correlate significantly with perceptions of risk (see, e.g., Dake, 1991). Of the seven worldviews assessed in this study, two appeared related to perceived risk. Item 10a, expressing Fatalism, correlated positively with perceived risk from many of the hazard items. The highest correlations, ranging between .18 and .20, involved hazards from foods and/or bacteria (bacteria in foods, food irradiation, molds in food, genetically engineered bacteria in agriculture).

The second worldview that showed consistent relationships with perceived risk was item 10f, expressing Egalitarianism. Egalitarianism showed positive correlations, ranging between .12

and .15, with perceived risk from nuclear power, mercury fillings, malnutrition, chemical pollution, bacteria in food, tap water, alcohol, genetically engineered bacteria in agriculture, and food additives.

IV. Summary and Discussion

The present study represents one of the most comprehensive national surveys of health-risk perception conducted to date. The key findings were as follows.

1. The Canadian public reported a high degree of perceived risk for many hazards. Contrary to the view of many observers that the public is overconcerned about small risks and underconcerned about serious risks, the present study found that people are quite sensitive to individually chosen lifestyle risks that are judged serious by health and risk professionals (e.g., cigarette smoking, street drugs, alcohol, AIDS, suntanning). There was also a great deal of concern expressed regarding health risks associated with industrial pollution (e.g., ozone depletion, chemical pollution, nuclear waste) and risks from certain medical devices (e.g., breast implants).

2. Perceptions of risk between pairs of hazards tended to be positively correlated. That is, persons concerned about one hazard were more likely to be concerned about other hazards as well. Those unconcerned about one hazard were more likely to be unconcerned about others.

3. There was a high degree of concern about chemical products (except for medicines) and chemical pollution. There was almost complete agreement (93.4%) that the land, air, and water are more contaminated now than ever before. Fewer than half (43.0%) of the respondents agree that use of chemicals has improved health more than it has harmed health. Perhaps most dramatic was the finding that about 75% of the respondents said that they try hard to avoid contact with chemicals and chemical products. This response was linked to a widespread belief that even very small exposures to chemicals could be harmful and that chemicals found to produce cancer in animals were likely to produce cancer in humans.

4. There was a widespread belief that a risk-free environment is achievable in Canada and a definite unwillingness to accept some risks to one's health in order to aid the economy. A majority of respondents would, however, accept some risk in order to achieve the potential personal health benefits of medicines or medical devices.

5. There were sizable effects of gender, age, education, and region of residence that need to be better understood. Women generally rated health risks as higher than did men, and less educated persons had generally higher perceptions of risk than did people with more education. Residents of Quebec stood out from other respondents in their attitudes and perceptions.

Many studies have found women to be more concerned than men about risks from nuclear power and chemicals (14,15,13,4). The differences between men and women observed in the present study

appear to be larger than differences observed previously. The present results also indicate that gender differences exist even for perceptions of nonchemical and non-nuclear hazards (e.g., stress, crime, motor vehicle accidents). These results also demonstrate that the magnitude of gender differences in risk perception varies considerably across hazards. There have been relatively few studies attempting to explain the origin of gender differences in risk perception. The sizable differences observed in the present study call attention to the need for a better understanding of these differences.

The observed regional differences also need to be much better understood. Why, for example, do residents of Quebec perceive more risk from nuclear power and nuclear waste than do residents of Ontario when only one of the country's 22 reactors are located in Quebec and 20 are located in Ontario? Is this another example of the finding by Lindell and Earle (21) that persons closest to hazardous facilities are least concerned about them? Or do persons living in Quebec feel vulnerable to the reactors in Ontario? Why, also, do respondents from Quebec appear to perceive less risk from breast implants and asbestos than do persons living elsewhere?

6. There were numerous other specific findings of interest. For example:

   a. More persons were in favor of stepping up energy conservation in response to concerns about risks from burning fossil fuels than were in favor of increasing use of nuclear power.

b. A high percentage of Canadians believe that proper exercise and diet can help offset health risks from pollution.

c. A majority of respondents agreed that lifestyle factors such as smoking and diet posed greater cancer risk than do chemicals in the environment.

d. Although younger people were slightly more likely than older people to rate cigarette smoking as a high risk, a higher percentage of younger persons smoked.

e. Health and Welfare Canada was viewed relatively favorably as a useful and credible source of information about health risks and as an agency that was doing a good job in fulfilling its responsibility for protecting people against health risks.

f. Almost 90% of the respondents claimed to pay close attention to warning labels on products that they use.

g. Generalized attitudes, known as worldviews, were correlated with perceptions of risk. Specifically, a fatalistic view ("I feel I have little control over risks to my health") was endorsed by over half of the respondents and was associated with high perceptions of risk. An egalitarian view ("If people in this country were treated more equally we would have fewer problems") was endorsed by about 72% of the sample and was also associated with high perceptions of risk.

While these results are broadly similar to results from other studies in Canada and elsewhere, many of the findings are new and point to the need for more extensive studies of specific issues. Many of the hazards currently of concern to Canadians, such as ozone depletion, breast implants, suntanning, AIDS, and climate change, would not have been considered serious only a few years ago. Perceptions of risk are constantly in flux and surveys such as the present study, if repeated periodically, can track the ebb and flow of public opinion in light of new discoveries in the world of hazards, educational campaigns, and risk-management policies.

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Table I. Percentage Responses to Attitudes and Opinion Statements: Category 1 Local and Global Environmental Health Risks

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
1a. There are serious environmental health problems where I live	17.86	36.06	29.88	15.14	1.06
1b. I believe my community is becoming a healthier place in which to live	22.05	37.38	31.27	8.30	1.00
1c. The land, air and water around us are, in general, more contaminated now than ever before	1.86	4.25	20.78	72.58	0.53
1d. The greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health	2.32	8.03	35.92	49.93	3.78

Table II. Percentage Responses to Attitudes and Opinion Statements. Category 2 General Opinions About Health Risks from Chemicals

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
2a. Use of chemicals has improved our health more than it has harmed it	23.84	30.15	32.74	10.23	3.05
2b. Most chemicals cause cancer	13.35	32.67	29.88	18.53	5.58
2c. I don't worry much about chemicals because there are just too many other things in my life that I have to deal with	29.22	29.66	27.42	12.62	1.86
2d. I try hard to avoid contact with chemicals and chemical products in my daily life	5.71	16.80	39.58	37.05	0.86

Table III. Percentage Responses to Attitudes and Opinion Statements. Category 3 Attitudes Toward Regulation

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
3a. I believe chemical risks are adequately regulated	14.28	29.15	43.76	10.89	1.93
3b. When there is a really serious health problem, the government will regulate it. Until they alert me about a specific problem, I don't really have to worry	45.09	33.86	15.74	4.52	0.80
3c. Because chemicals provide many benefits to society, there should be less regulation than there currently is	51.53	31.81	11.42	3.78	1.46
3d. A prescription drug that hasn't been formally tested, but has been used for 20 years, is safer than a new prescription drug that has been tested and approved for use under the present guidelines	18.66	32.60	31.47	12.48	4.78

Table IV. Percentage Responses to Attitudes and Opinion Statements. Category 4 Perceived Relationship Between Level of Exposure and Health Risk

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
4a. If a person is exposed to a chemical that can cause cancer then that person will probably get cancer some day	6.71	26.95	38.71	22.97	2.66
4b. If a person is exposed to radiation, then that person will probably get cancer some day	7.30	25.17	39.38	25.50	2.66
4c. Chemicals are either safe or dangerous. There is really no in between	20.19	27.62	25.03	24.57	2.59
4d. The more often a person is exposed to a substance that can cause cancer the more likely he or she is to get cancer	3.65	6.51	34.93	53.39	1.53
4e. If even a tiny amount of a substance that can cause cancer were found in my tap water, I wouldn't drink it	4.52	19.65	27.89	46.02	1.93
4f. No matter how low the level of exposure to radiation, it can still cause cancer	7.30	25.30	41.30	20.72	5.36

Table V. Percentage Responses to Attitudes and Opinion Statements. Category 5 Trust in the Use of Animal Studies to Determine Human Health Risk

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
5a. The way that an animal reacts to a chemical is a reliable predictor of how a human would react to it	14.87	21.71	39.64	20.65	3.12
5b. If a scientific study produces evidence that a chemical causes cancer in animals, then we can be reasonably sure the chemical will cause cancer in humans	4.05	11.82	47.54	34.73	1.86

Table VI. Percentage Responses to Attitudes and Opinion Statements. Category 6 Other Questions Pertaining to Cancer

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
6a. Fruits and vegetables contain natural substances that can cause cancer	34.86	33.60	19.85	5.78	5.91
6b. A cancer-causing substance turns normal cells into cancer cells through contact, much like the spread of a highly contagious disease	18.33	26.43	30.35	12.22	12.68
6c. The body usually repairs the damage caused by exposure to radiation so that cancer does not occur	23.90	33.93	25.23	6.04	10.89

Table VII. Percentage Responses to Attitudes and Opinion Statements. Category 7 Willingness to Entertain Risk/Benefit Tradeoffs

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
7a. Canadians should be prepared to accept some risks to their health in order to strengthen the economy	43.29	26.63	18.99	9.96	1.13
7b. I am prepared to accept some risk in order to achieve the potential health benefit of drugs or medical devices	20.45	24.44	42.43	10.49	2.19

Table VIII. Percentage Responses to Attitudes and Opinion Statements. Category 8 Health Risks and Energy Policy

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
8a. In light of health concerns about acid rain, damage to the ozone layer and climate change associated with the burning of coal and oil, Canada should rely more heavily upon nuclear power to meet its future electricity needs	22.05	26.83	32.54	12.42	6.18
8b. In light of these same health concerns, Canada should place greater emphasis on energy conservation	0.86	2.99	31.34	63.61	1.20

Table IX. Percentage Responses to Attitudes and Opinion Statements. Category 9 Miscellaneous Questions

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
9a. Natural chemicals are not as harmful as man-made chemicals	14.06	24.10	33.00	23.11	5.71
9b. Canadian society is becoming too concerned about small health risks	23.11	34.66	27.82	12.68	1.73
9c. People can offset health risks from pollution by improving their individual lifestyle, such as exercising and eating properly	4.12	5.18	26.69	61.42	0.60
9d. The risk of getting cancer from lifestyle factors such as smoking and diet is much greater than the risk of cancer from chemicals in the environment	12.55	24.24	38.84	20.05	4.32
9e. I believe that a risk-free environment is an attainable goal in Canada	13.41	24.70	36.45	24.44	1.00
9f. I pay close attention to warning labels on products that I use	3.25	7.50	32.20	57.04	-
9g. Experts are able to make accurate estimates of health risks from chemicals in the environment	11.22	25.03	47.34	13.41	2.99

Table X. Percentage Responses to Attitudes and Opinion Statements. Category 10 Worldviews

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly	Don't Know/ No Opinion
10a. I feel that I have very little control over risks to my health (Fatalism)	21.65	29.02	30.68	18.39	0.27
10b. If something like a chemical is going to harm me it will, and there isn't much that I can do about it—what will be, will be (Fatalism)	39.64	26.29	21.85	10.69	1.53
10c. Decisions about health risks should be left to the experts (Hierarchy)	8.75	32.40	23.44	14.41	1.00
10d. People in positions of authority are not likely to abuse their power (Hierarchy)	36.7	33.2	19.1	10.0	1.0
10e. In a fair system, people with more ability should earn more (Individualism)	7.0	16.5	45.4	30.6	0.6
10f. If people in this country were treated more equally we would have fewer problems (Egalitarianism)	5.5	12.6	36.5	44.6	0.9
10g. A high technology society is important for improving our health and social well being (Technological Enthusiasm)	6.91	18.06	45.55	26.69	2.79

Figure 1a. Perceived Risk of Thirty-Three Environmental Hazards to the Canadian Public

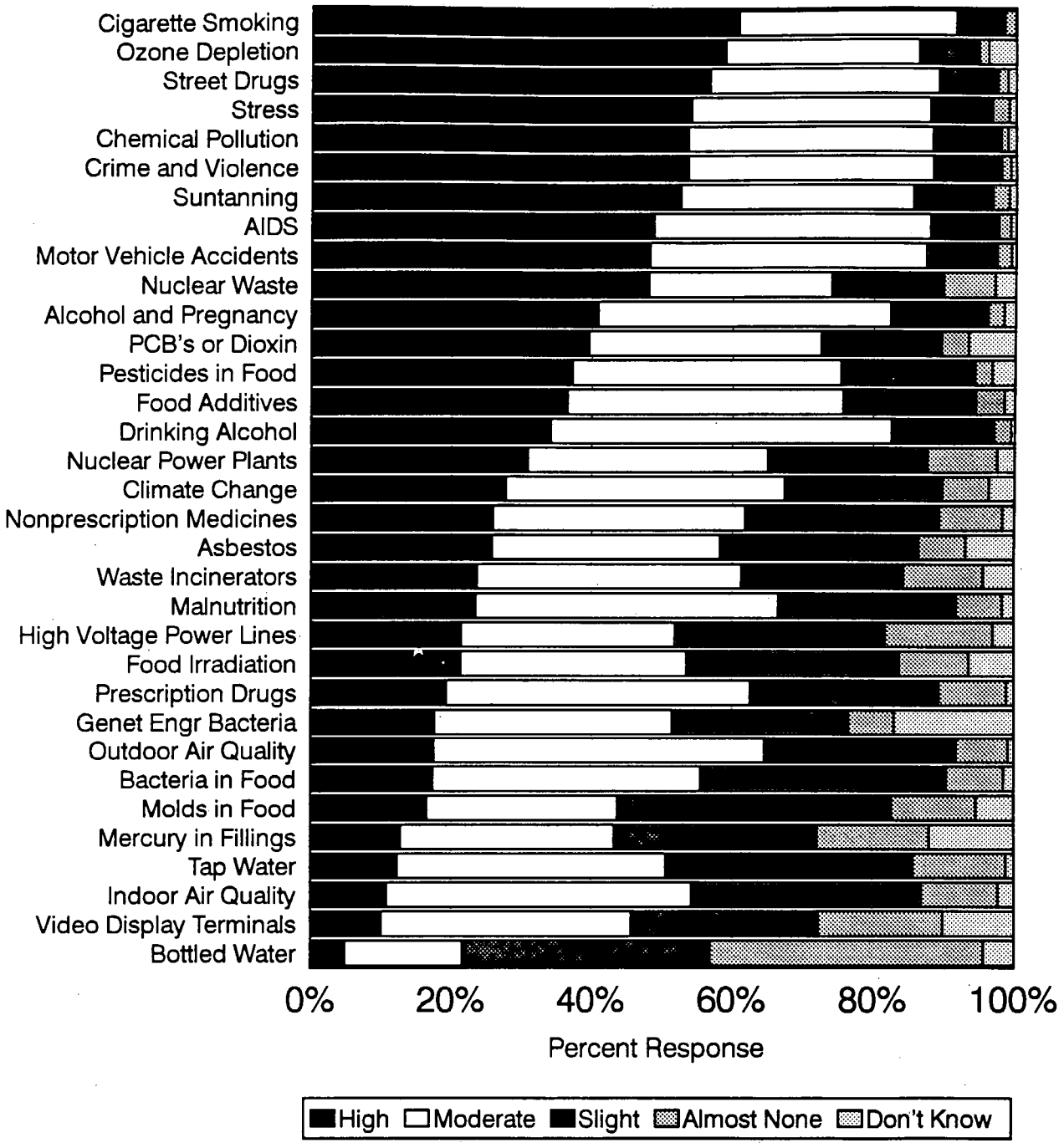

Figure 1b: Perceived Risk of Five Medical Devices and Treatments to Individuals

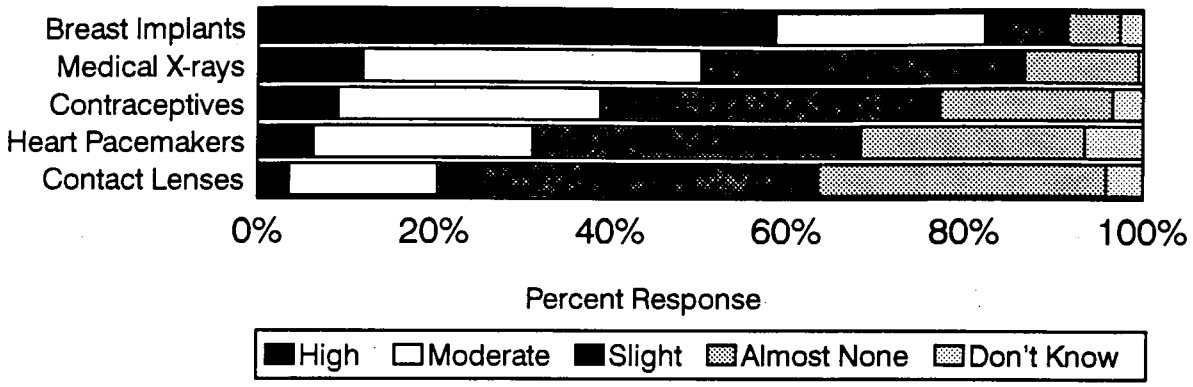

Figure 2. Perceived Health Risk to Individuals and to the Canadian Public for Selected Hazards

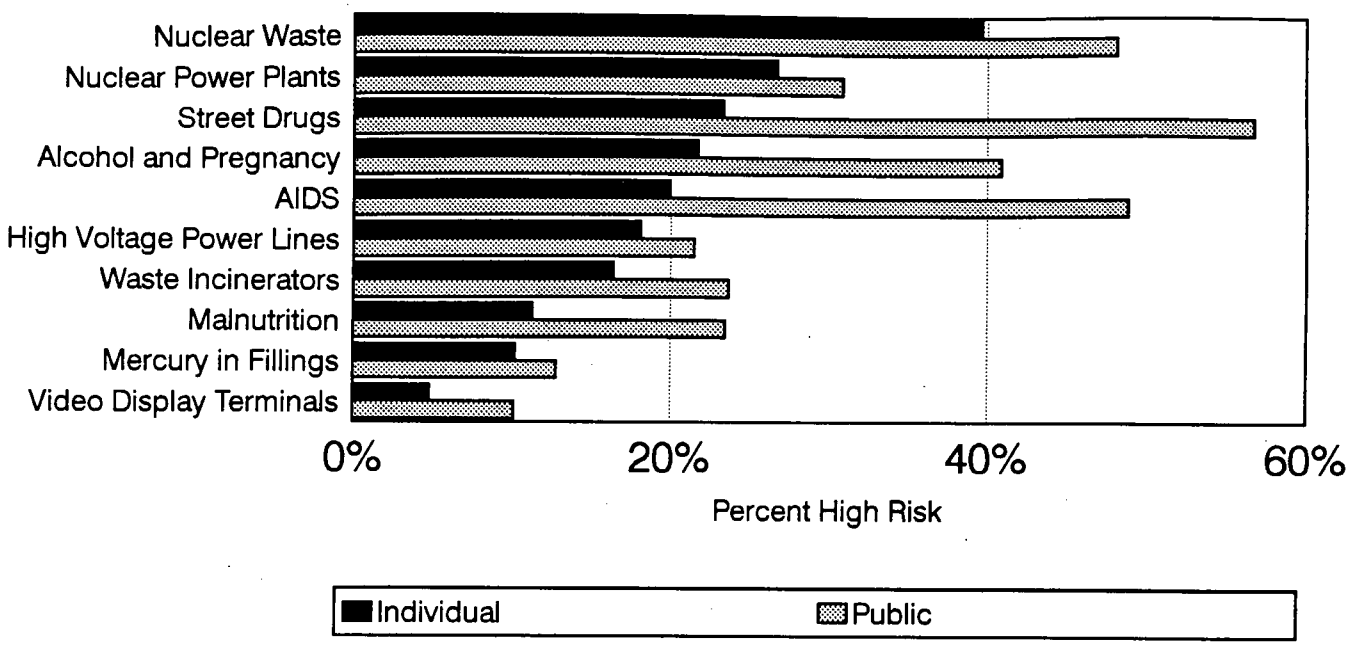

Figure 3. Perceived Health Risks to the Canadian Public by Gender

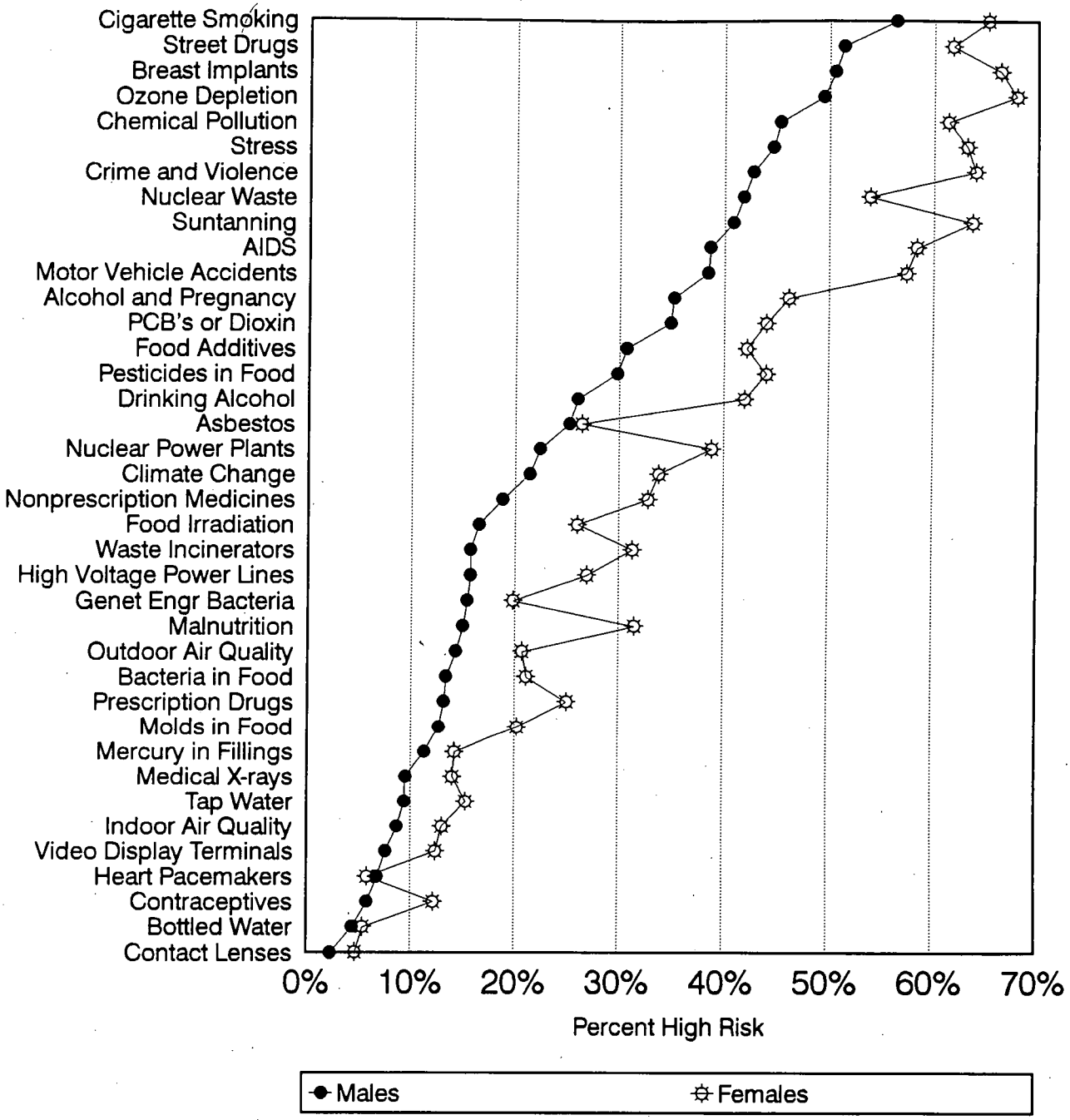

Figure 4. Perceived Health Risks to the Canadian Public by Age

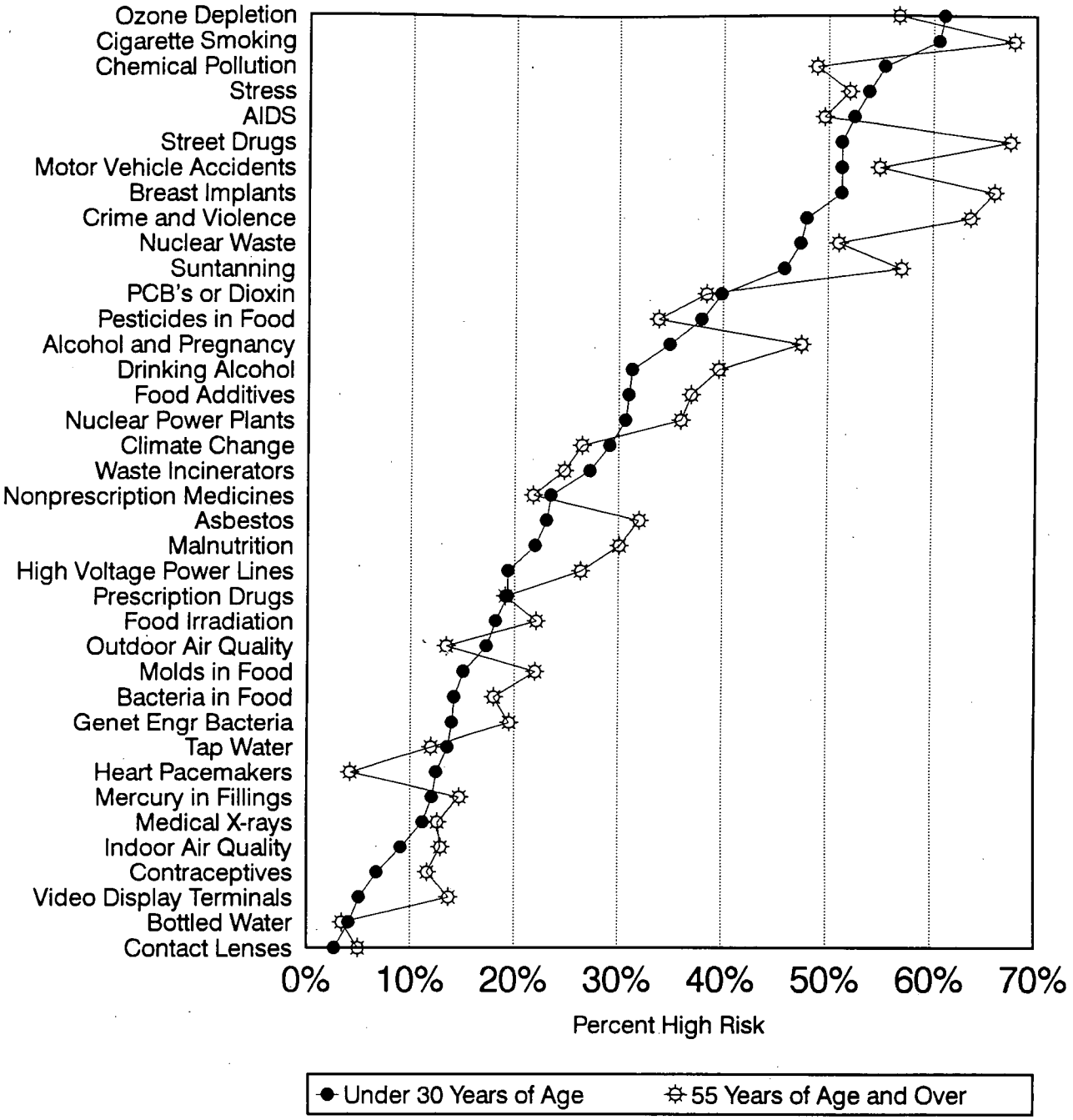

Figure 5. Perceived Health Risks to Canadian Public by Education

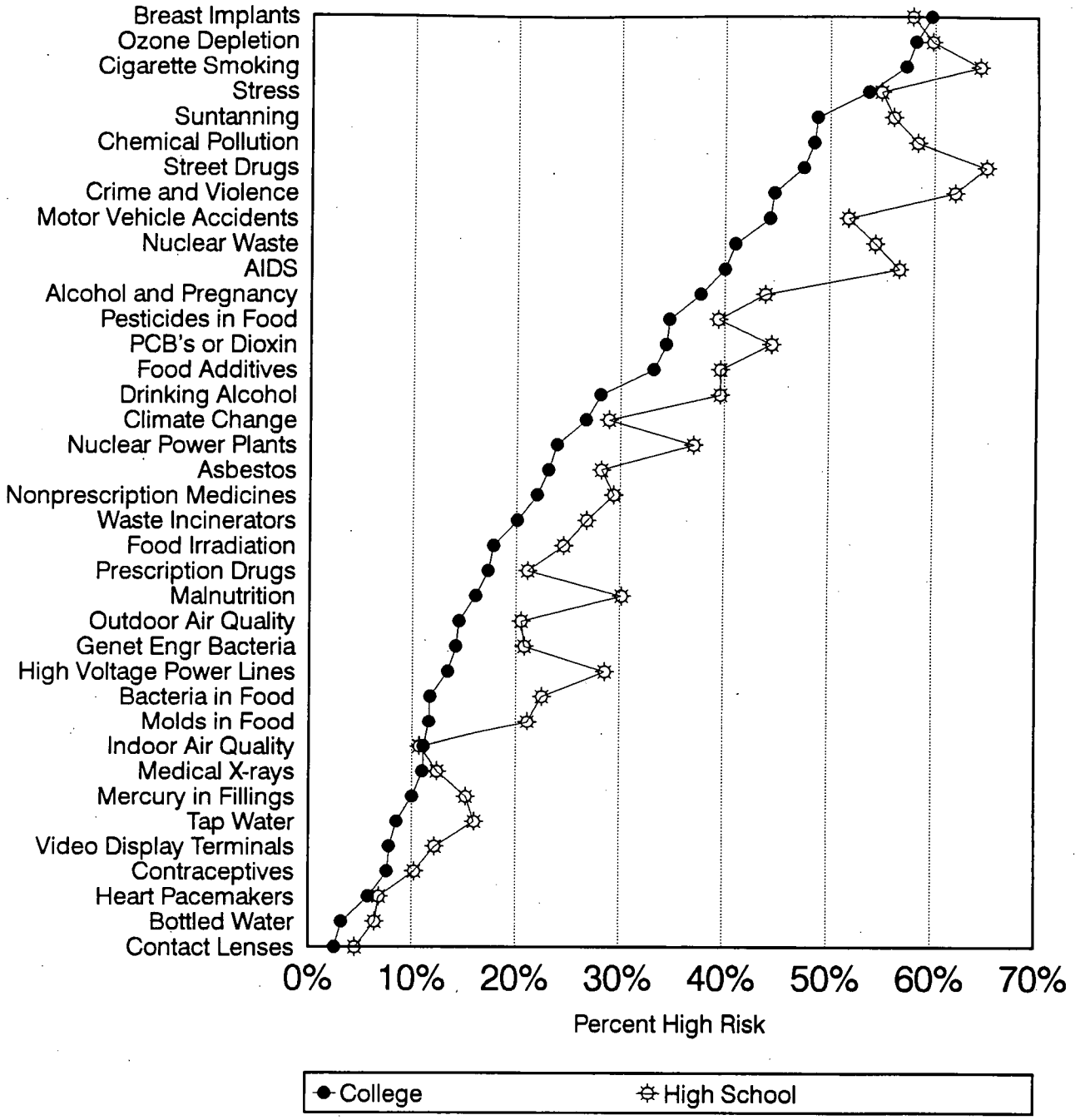

Figure 6. Perceived Health Risks By Region: Individual and Family Risks

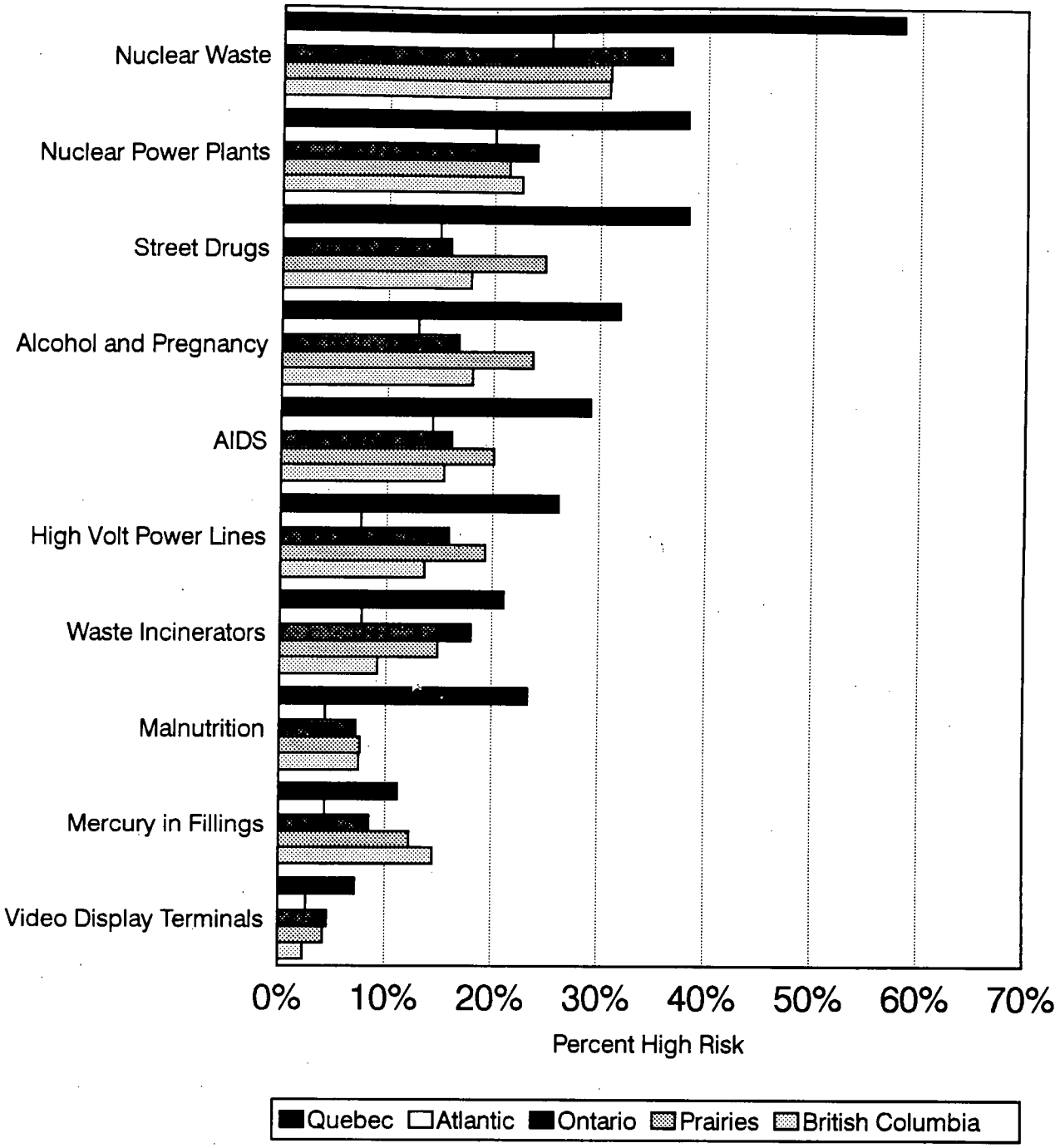

Figure 7. Sources of Information about Health Issues and Risks

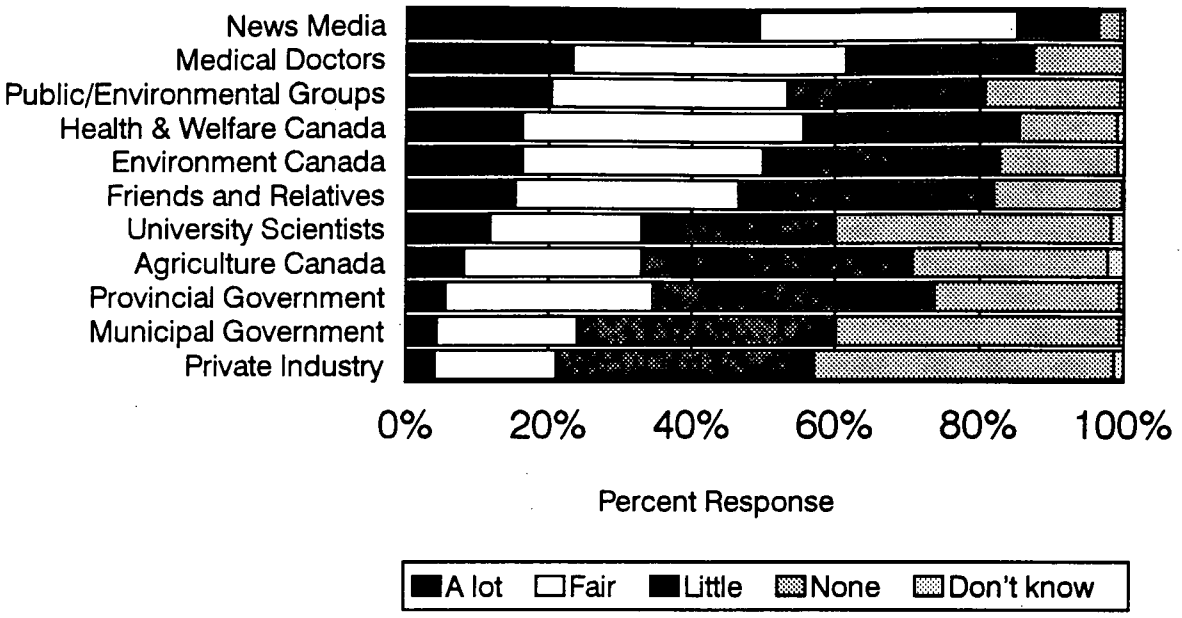

Figure 8. Confidence in Organization as Information Source

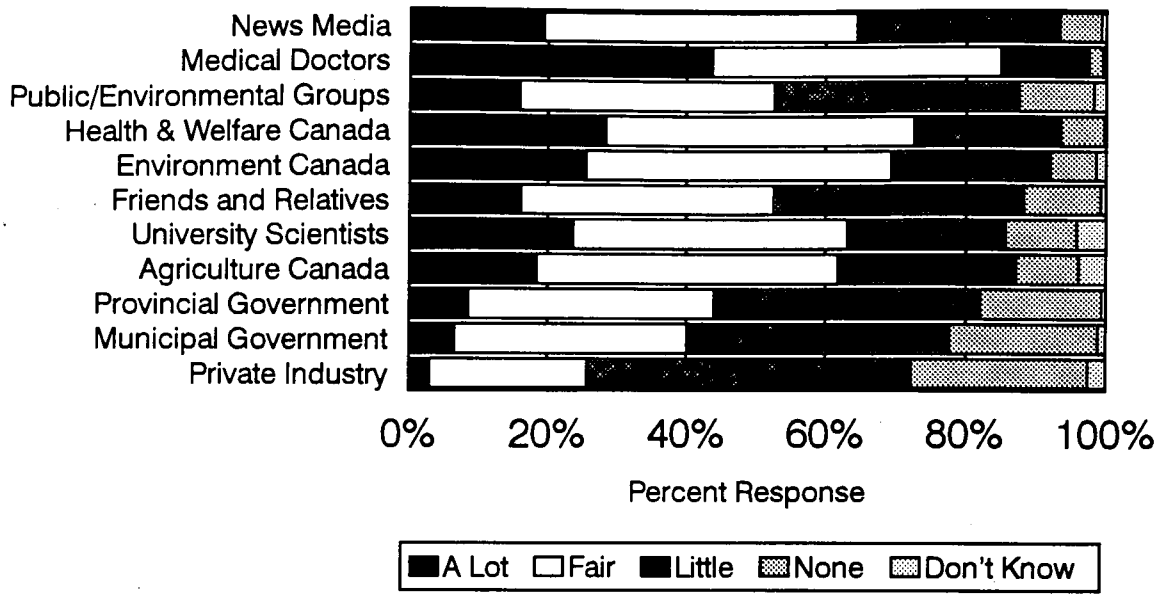

Figure 9. Perceived Degree of Responsibility for Protecting the Public Against Health Risks

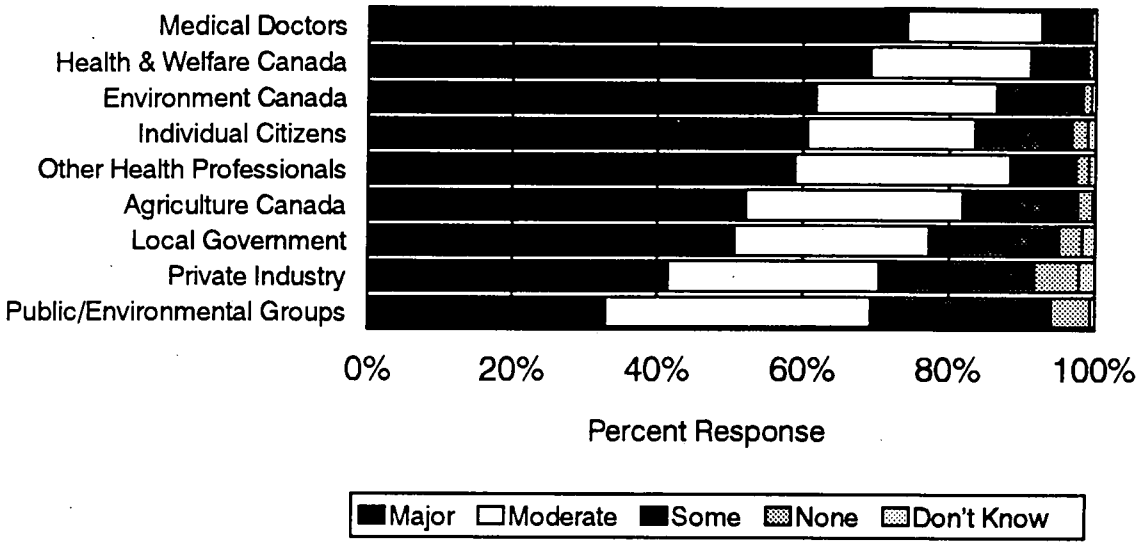

Figure 10. Perceived Fulfillment of Responsibility for Protecting the Public Against Health Risks