

**HEALTH RISK PERCEPTION IN CANADA I : RATING HAZARDS,
SOURCES OF INFORMATION AND RESPONSIBILITY FOR HEALTH PROTECTION**

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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). Kraus et al. (8) 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. Although this investigation represents an important milestone in the analysis of perceived risk, the findings warrant confirmation in other study populations. The purpose of this article and a companion paper (9) is to report on the results of a national survey of risk perception in Canada, patterned after the study by Kraus et al. (8). This paper will focus on the ratings of perceived risk for specific health issues, sources of information on health risks and responsibility for RBK Mangement. The companion paper (9) reports on attitudes and opinions about risk. The results of a comparative survey of experts (members of the Canadian Society of Toxicology) will be reported separately (10).

II. Methods

Survey Content

The present survey was designed to assess many different aspects of health-risk perception. Respondents were asked to indicate the degree of health risk they associated with each of 33 hazards. 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 (breast implants, medical X-rays, contraceptives, contact lenses, and heart pacemakers), 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."

Respondents were asked to indicate the amount of information about health risks that they received from various sources and the degree of confidence they had in each source. Respondants were also asked about the degree of responsibility those same individuals or groups were perceived to hold for protecting people against health risks, and about how good a job each was doing in fulfilling their responsibilities for protecting people against health risks.

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. The survey contained a small number of statements designed to measure the following worldviews (11, 12, 13): fatalism, hierarchy, individualism, egalitarianism, and technological enthusiasm. Finally, the survey elicited information on demographic variables, health status and lifestyle, voluntary risk taking, occupational exposure to risk, and political and environmental activism. These will be reported on in the companion paper (9).

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 $\pm 2.6\%$, 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.

III. Results

Perception of Risk

Risk to the Canadian public. 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. Using the percentage of responses in the "high risk" category as an indicator of perceived risk, cigarette smoking was perceived as presenting the highest risk; bottled water and contact lenses were perceived as the lowest risk. Ozone depletion and the related risk from suntanning stood out as quite high in perceived risk, perhaps reflecting the degree to which recent media coverage has effectively brought this issue to the public's attention. A substantial amount of media attention was directed towards breast implants, also perceived to be a high risk, immediately before and during the time the survey was done. Stress was assigned a relatively high level of risk, 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 as lower risks to health by the Canadian public.

Chemical risks from ozone, street drugs, chemical pollution, PCBs or Dioxin, pesticides, food additives, and alcohol were rated high in risk, although as prescription drugs were perceived as

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 (14) and elsewhere (15) 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. The higher perception of risk associated with alcohol and pregnancy may reflect the conjunction fallacy (16), 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.

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 as 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.

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. Residents of Quebec expressed considerably lower perceptions of risk for implants and moderately lower perceptions of risk from asbestos.

In a previous survey conducted in Canada in February, 1989 (17), residents of Quebec were not particularly exceptional in their perceptions of risk. However, their perceptions of the benefits of prescription drugs were consistently lower than benefit perceptions in four other regions (Atlantic, Ontario, Prairies, British Columbia). However, they were more concerned about the risks from prescription drugs than were other Canadians and rated the benefits lower.

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.

IV. Summary and Discussion

The present study represents one of the most comprehensive national surveys of health-risk perception conducted in Canada to date. The main findings with respect to ratings of perceived risk,

sources of information on risk, and responsibility for health protection may be summarized 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 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 (4,11,12, 13). 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 (18) 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?

4. Other specific findings of interest:

- a. 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.
- b. 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.

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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References

1. Krewski D, Somers E, Birkwood PL. Risk perception in a decision making context. *Environmental Sciences and Health* 1987; C5: 175-209.
2. Painter A. *The Psychology of Risk and Government Regulation*. Ottawa: Report prepared for the Treasury Board of Canada Secretariat, 1992.
3. Vertinsky IB, Wehrung DA. *Risk Perception and Drug Safety Evaluation*. Ottawa: Health and Welfare Canada, 1990.
4. Slovic P, Fischhoff B, Lichtenstein S. Why study risk perception? *Risk Analysis* 1982; 2: 83-93.
5. National Research Council. *Improving Risk Communication*: National Academy Press, 1989, Washington, D.C.
6. Renn. Risk Perception and Risk Management: A Review; Part 2: Lessons for Risk Management. *Risk Abstracts*; 1990:1-9.
7. Morgan MG, Fischhoff B, Bostrom MG, Lave L, Atman CJ. *Environ. Sci. Technol.* 1992, 26: 2049-2060.
8. Kraus N, Malmfors T, Slovic P. Intuitive toxicology: expert and lay judgements of chemical risks. *Risk Analysis* 1992; 12: 215-232.
9. Krewski D, Slovic P, Bartlett S, Flynn J, Mertz CK, *Health Risk Perception in Canada II: Worldviews, attitudes and opinions*. *Canadian Journal of Public Health* 1994; submitted.
10. Slovic P, Malmfors T, Krewski D, Mertz CK, Neil N, Bartlett S. *Intuitive toxicology II: Expert and lay judgements of chemical risks in Canada*. *Risk Analysis* 1995, to appear.
11. Buss DM, Craik KH, Dake KM. Contemporary worldviews and perception of the technological system, in Covello VT, Menkes J, Mumpower J, Ed., *Risk evaluation and management*. New York: Plenum, 1986, pp. 93-130.
12. Dake K. Orienting dispositions in the perception of risk: An analysis of contemporary worldviews and cultural biases. *Journal of Cross-Cultural Psychology* 1991; 22: 61-82.
13. Jasper JM. *Nuclear politics: Energy and the state in the United States, Sweden, and France*. Princeton, NJ: Princeton University Press, 1990.
14. Slovic P, Kraus NN, Lappe H, Letzel H, Malmfors T. Risk perception of prescription drugs: report on a survey in Sweden. *Pharmaceutical Medicine* 1989; 4: 43-65.

15. Slovic P. Perception of risk from radiation, In W.K. Sinclair (Ed.), Proceedings of the Twenty-fifth Annual Meeting of the National Council on Radiation Protection and Measurements. Vol 11: Radiation protection today: The NCRP at sixty years. Bethesda, MD: NCRP, 1990; 73-97.
16. Tversky A, Kahneman D. Extensional vs. intuitive reasoning: The conjunction fallacy in probability judgement. Psychological Review 1983; 90: 293-315.
17. Slovic P, Kraus NN, Lappe H, Major M. Risk perception of prescription drugs: report of a survey in Canada. Can J Public Health 1991; 82: S15-S20.
18. Lindell M, Earle TC. How close is close enough: Public perceptions of the risks of industrial facilities. Risk Analysis 1983: 245-254.

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

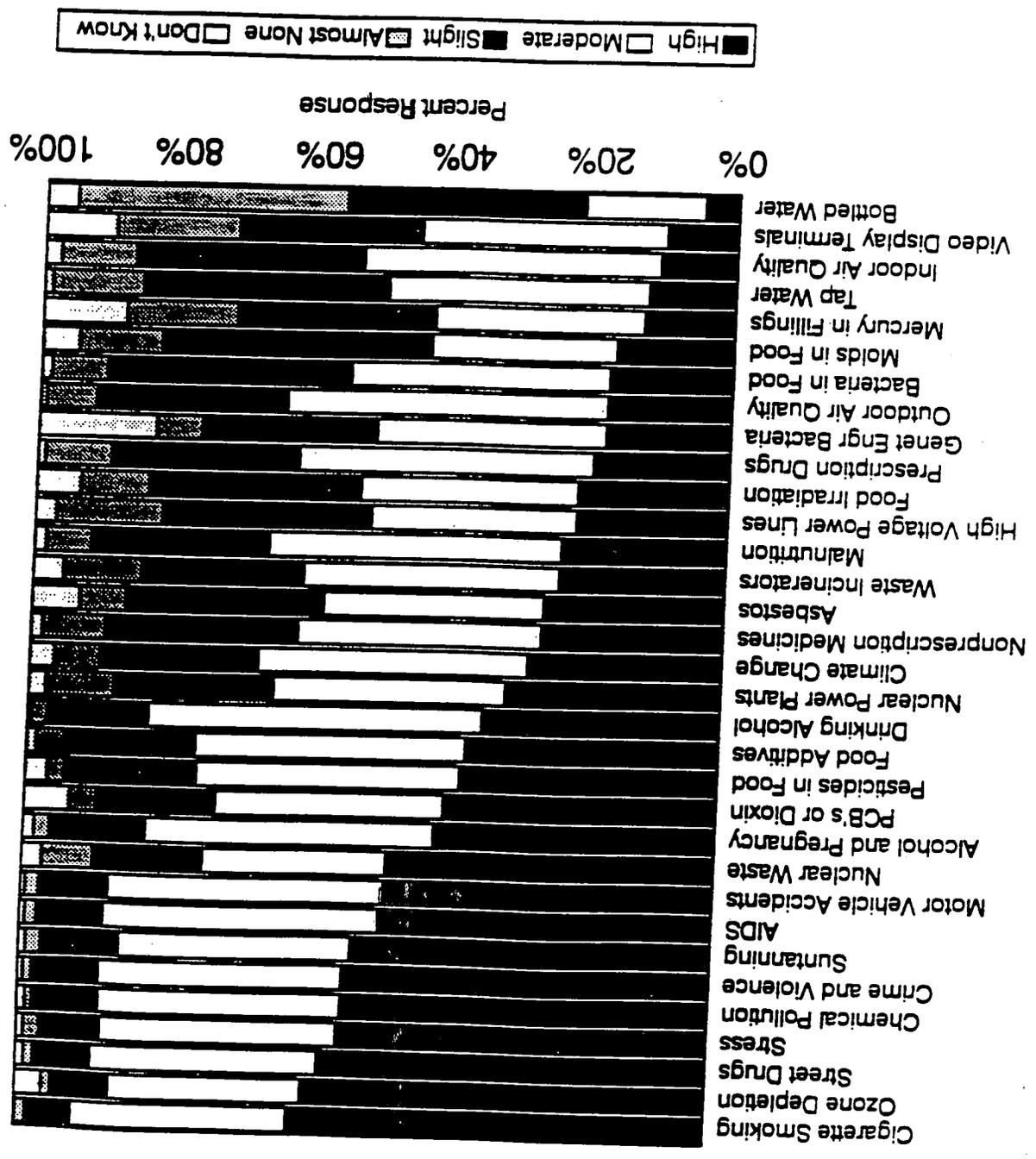


Figure 1b: Perceived Risk of Five Medical Devices and Treatments to Individuals

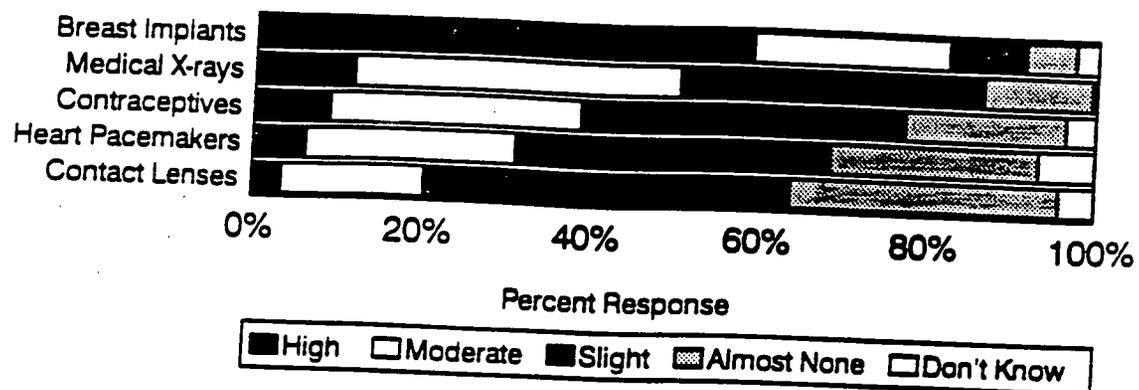


Figure 2. Perceived Health Risk to Individuals and to the Canadian Public for Selected Hazards

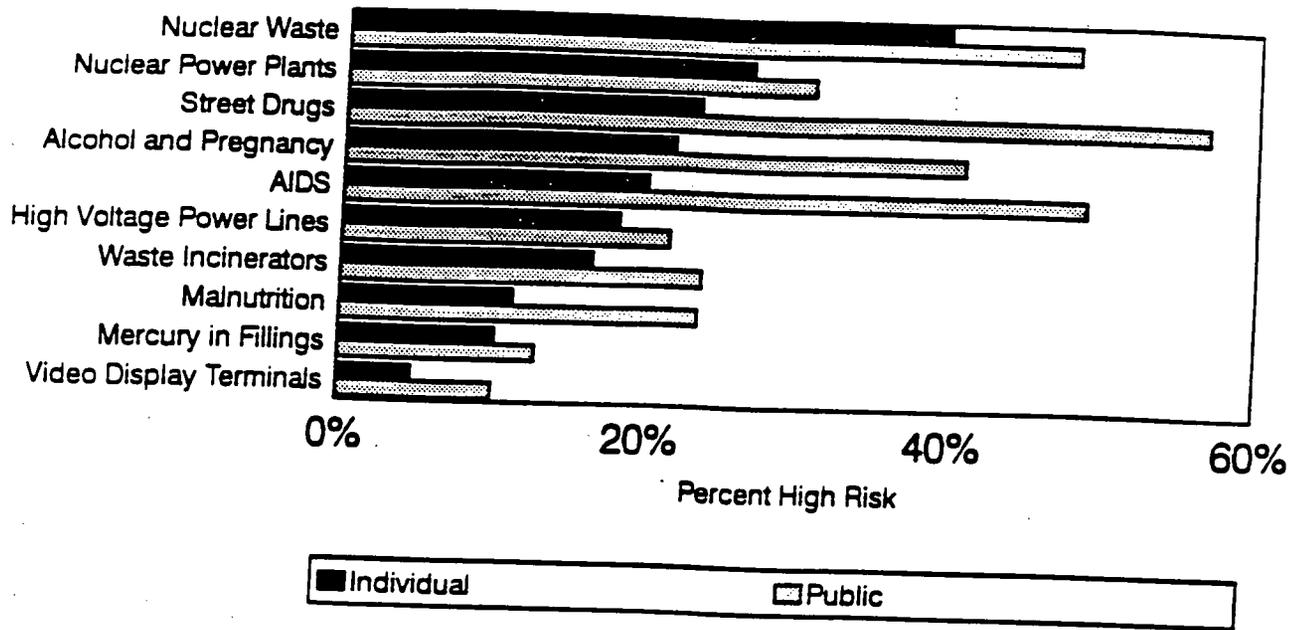


Figure 3. Perceived Health Risks to the Canadian Public by Gender

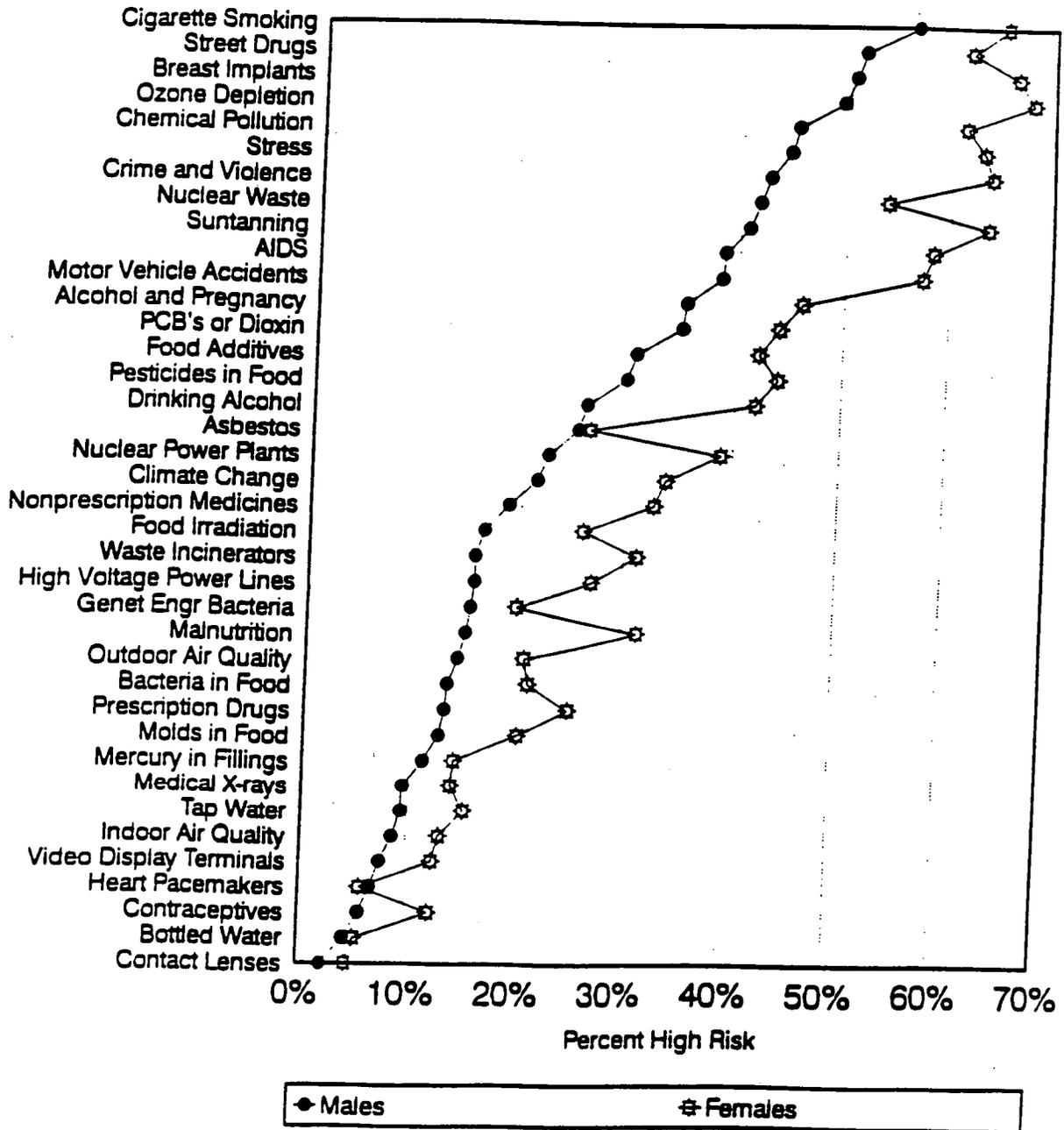


Figure 4. Perceived Health Risks to the Canadian Public by Age

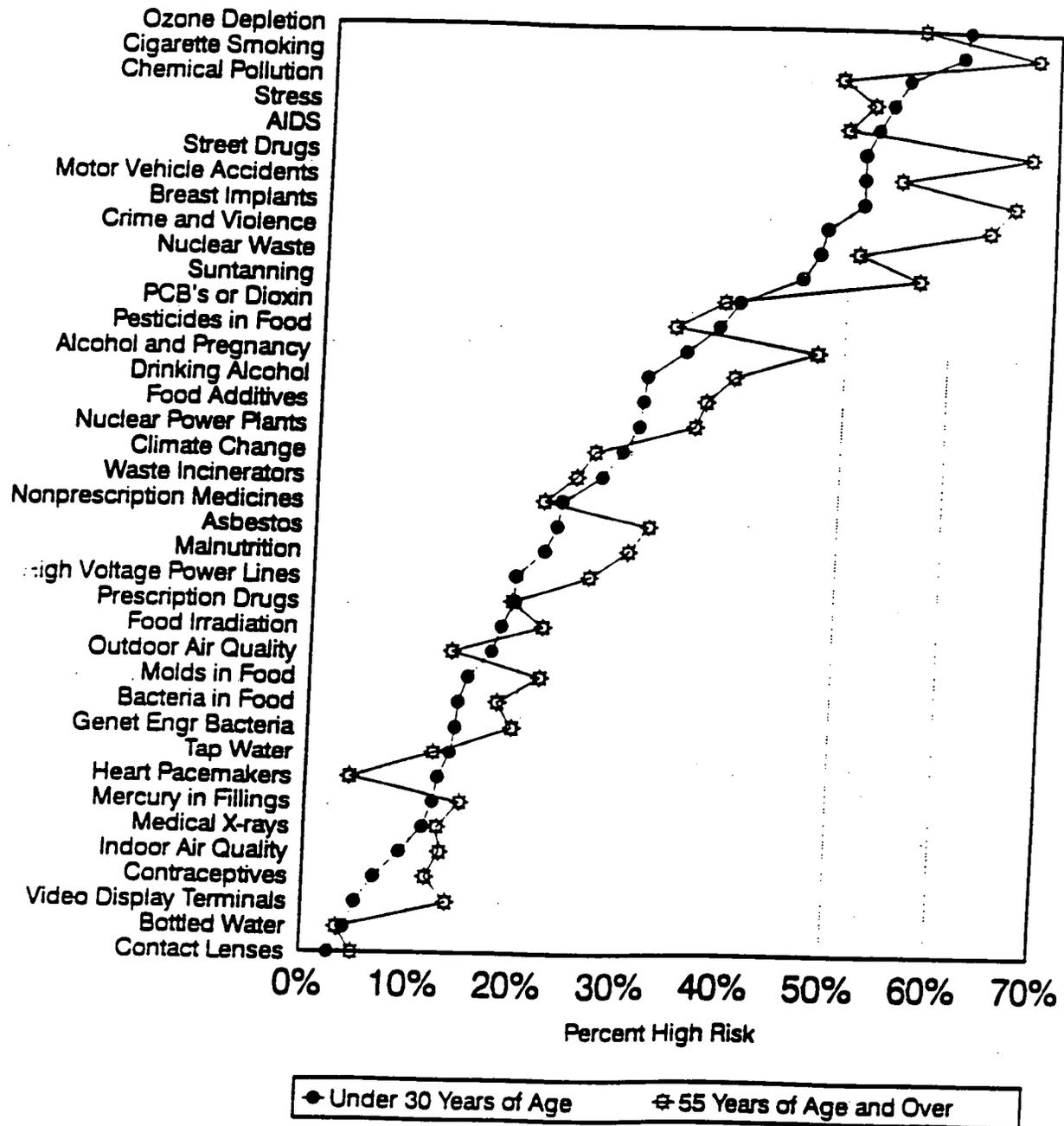


Figure 5. Perceived Health Risks to Canadian Public by Education

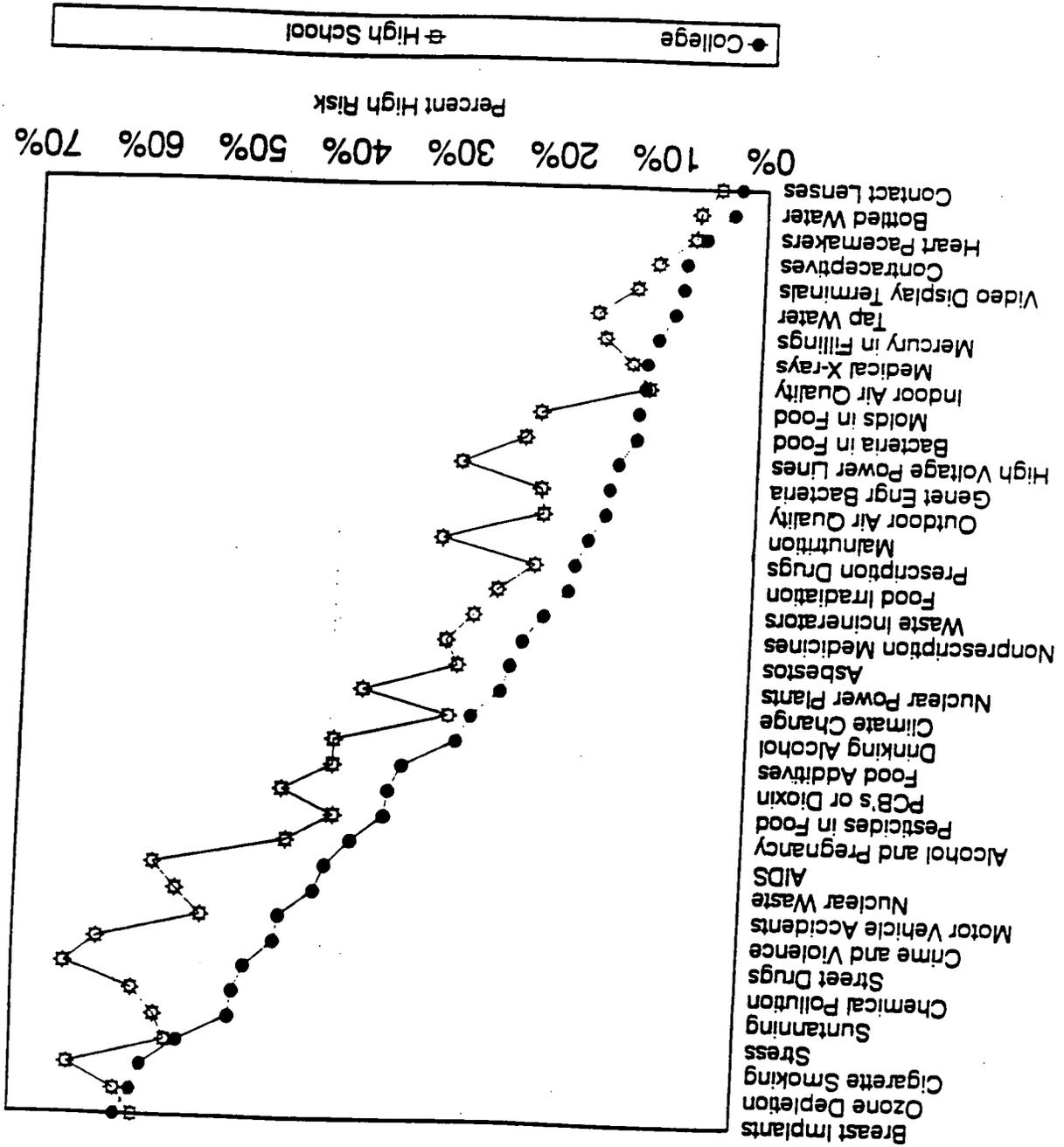


Figure 6. Perceived Health Risks By Region:
Individual and Family Risks

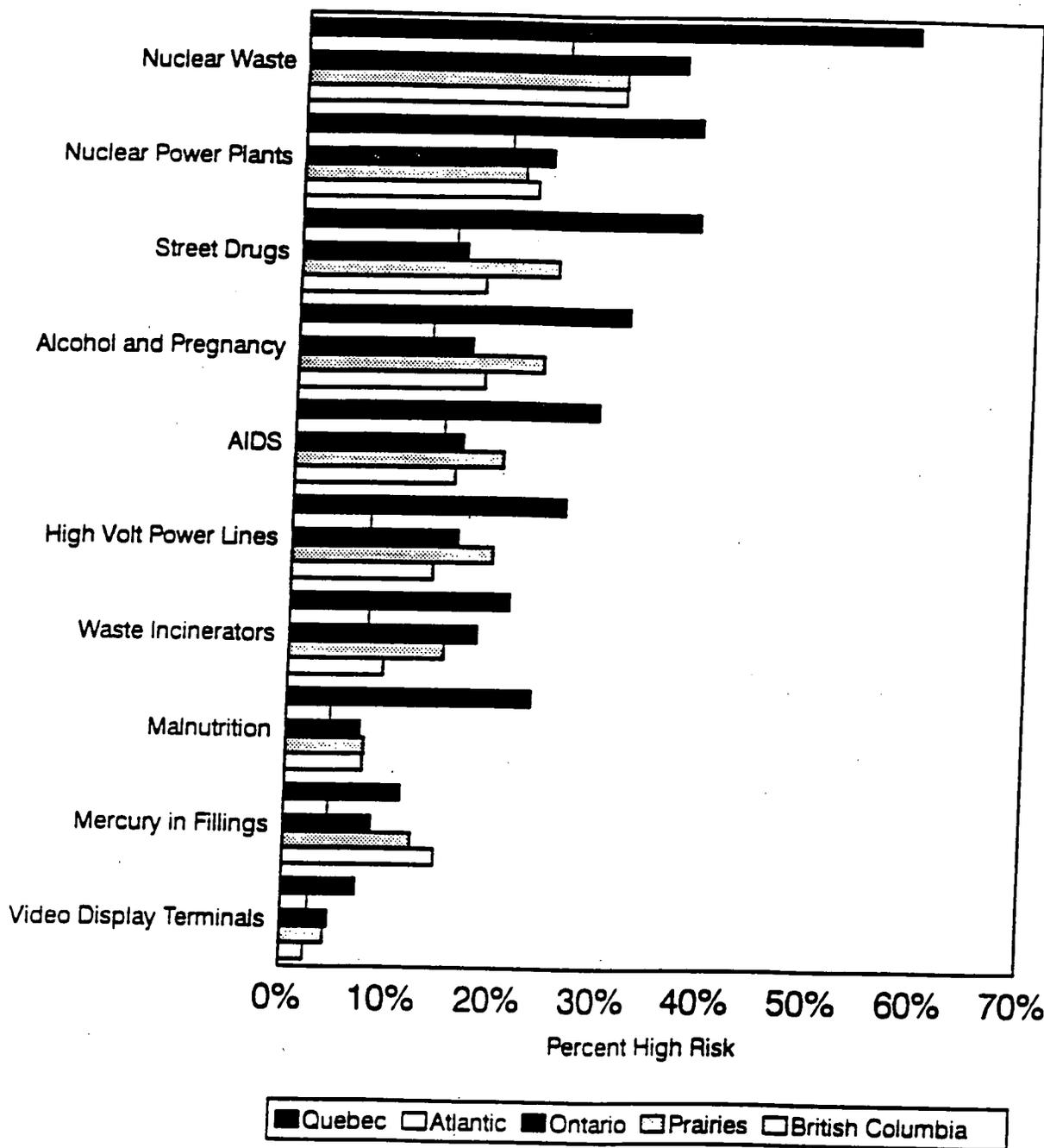


Figure 7. Sources of Information about Health Issues and Risks

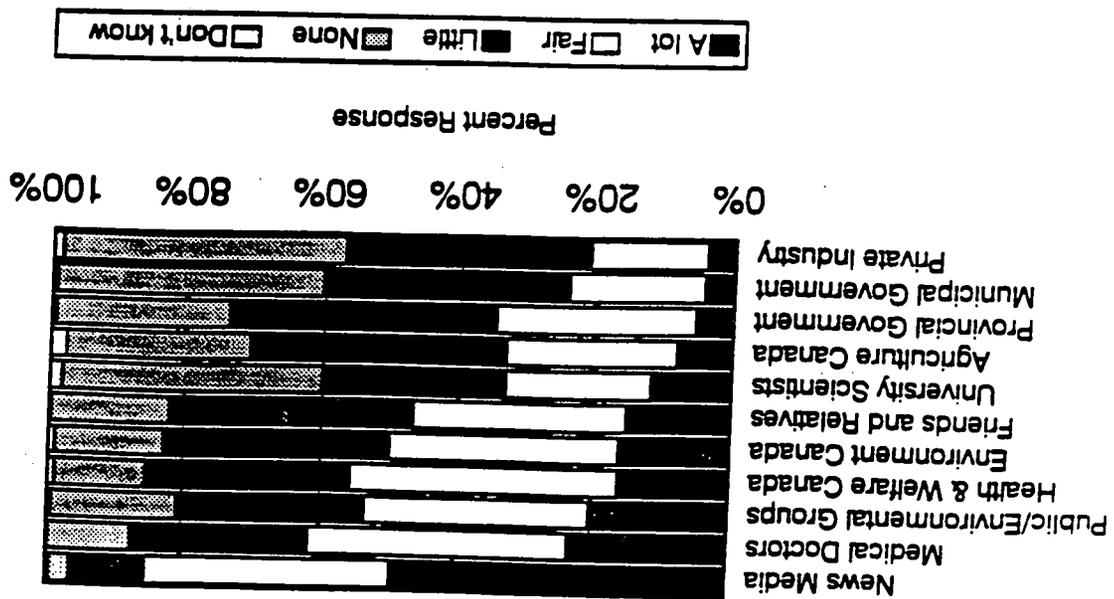


Figure 8. Confidence in Organization as Information Source

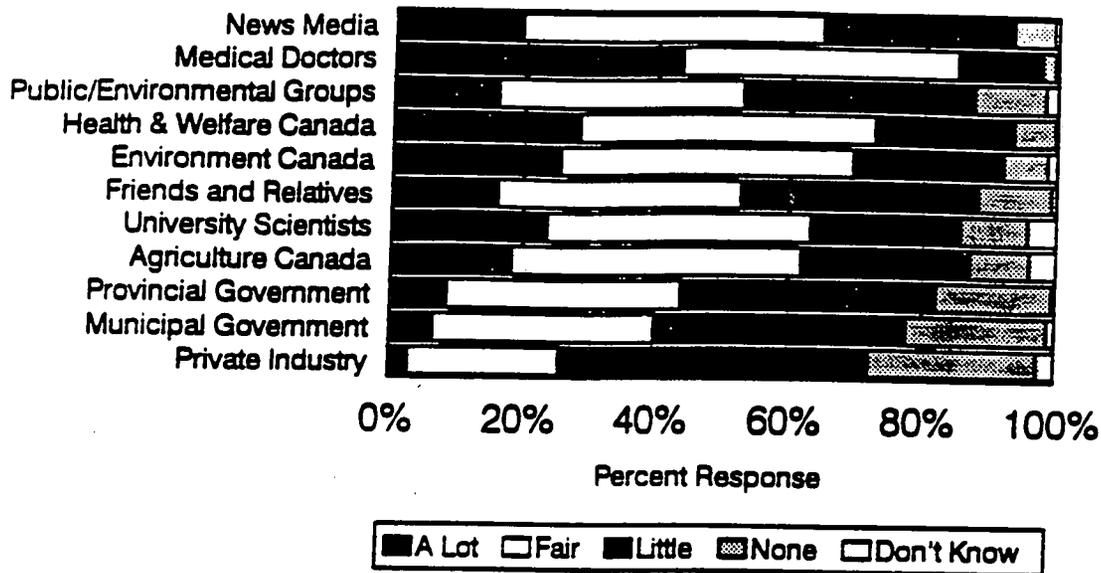


Figure 9. Perceived Degree of Responsibility for Protecting the Public Against Health Risks

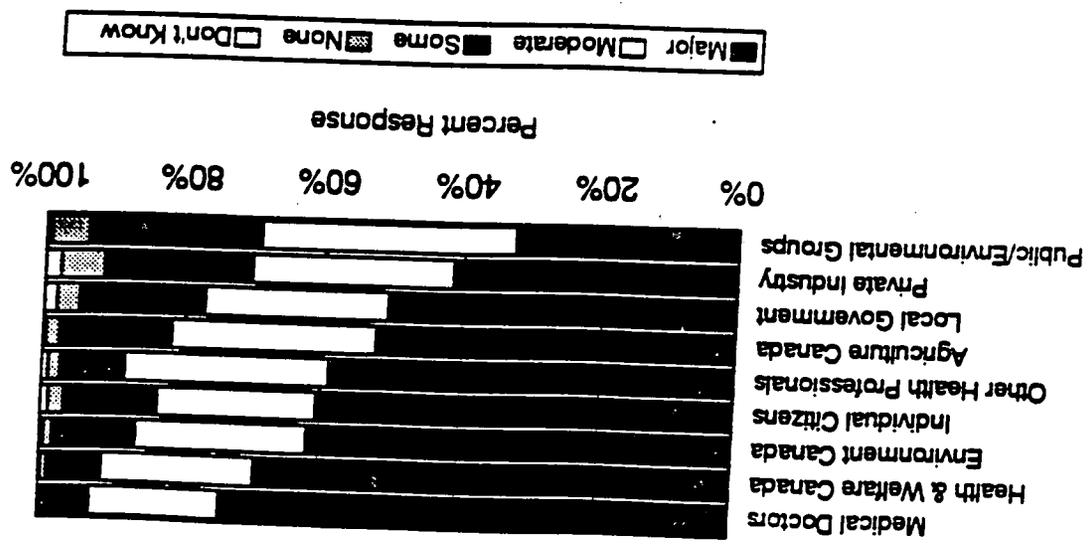


Figure 10. Perceived Fulfillment of Responsibility for Protecting the Public Against Health Risks

