FINAL REPORT:

Health Risk Perception in Canada

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I. Introduction

Attitudes and perceptions about health risk have important effects upon individuals and society. At the individual level they give and deny peace of mind and determine whether or not appropriate protective actions will be taken. At the societal level, they drive the agendas of regulatory agencies and lead to policies that affect the safety, cost, and even the very existence of many products and technologies.

This report describes the results of a national survey in Canada designed to address the following objectives:

1. Describe precisely and quantitatively people's attitudes, perceptions, values, knowledge, and beliefs pertaining to environmental health issues.

2. Place perceptions of environmental health risks within a broader context of perceptions of risks from other domains (e.g., lifestyle risks, risks from sporting activities).

3. Permit comparisons of perceptions, attitudes, etc. to be made across people who differ with regard to important personal and demographic characteristics.

4. Provide baseline data that will allow perceptions to be monitored over time and related to unfolding news and events.

5. Provide insights into the kinds of information that the public needs and the best means of disseminating that information.

6. Enable governmental policy makers and agencies to act in ways that appropriately address public attitudes and concerns.

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 word association, 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.

Word associations. The study of associations has a long history in psychology, going back to Galton (1880), Wundt (1883), and Freud (1924). More recently, word associations have been found useful in revealing important aspects of the ways people perceive risks (see, e.g., Slovic et al., 1989; Slovic et al., 1991a, 1991b). The first question of the present survey simply asked respondents to indicate the first word or image that came to mind when they heard the word "chemicals." Next, they were asked to do the same thing for the word "risk." These two association tasks were given at the beginning of the interview so that they would not be influenced by the content of the other questions.

Risk perception. In the next segment of the interview, 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 content of these items included statements about:

- One's local environment ("There are serious environmental health problems where I live")
- The global environment ("The greenhouse effect is a serious problem . . . ")
- Perceptions of risks from chemicals and radiation
- Attitudes toward government regulation (e.g., "When there is a serious health risk, the government will regulate it. Until they alert me . . . , I don't really have to worry")
- Energy risks (e.g., "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")
- Risk/benefit tradeoffs (e.g., "Canadians should be prepared to accept some risks to their health in order to strengthen the economy").

The questions pertaining to perceptions of risk from chemicals and radiation were modeled after the extensive survey of intuitive toxicology conducted by Kraus, Malmfors, and Slovic (1992). 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 vs. 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 (Buss, Craik, & Dake, 1986; Dake, 1991; Jasper, 1990). The survey contained a small number of statements designed to measure the following worldviews:

- Fatalism (e.g., "If something like a chemical is going to harm me it will, and there isn't much I can do about it—what will be, will be")
- Hierarchy (e.g., "Decisions about health risks should be left to the experts")
- Individualism ("In a fair system, people with more ability should earn more")
- Egalitarianism ("If people in this country were treated more equally, we would have fewer problems")
- Technological Enthusiasm ("A high technology society is important for improving our health and social well being").

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 your health or environmentally friendly?").

Administration of the Survey

The survey was conducted by Goldfarb Consultants. 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.

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

Word Associations

Chemicals. Previous surveys using small samples (e.g., students at a university) have found that associations to the word "chemicals" are dominated by the concept of danger, with rather few associations of a positive nature (Slovic, in press). In the present survey, associations involving dangerousness and pollution were produced by about one-third of the respondents (518 persons out of 1506). Generally negative terms (e.g., "bad") accounted for another 29 responses. In contrast, distinctly positive terms—such as "useful" or beneficial"—were given only 10 times. However, names of chemical products (e.g., "cleansers", "medicines," "pesticides," "gasoline") were produced 580 times, about as often as were the clearly negative terms. In sum, although the ratio of clearly negative to clearly positive associations is remarkably high, there is also an awareness of many useful chemical products. A listing of the major categories of response to the word chemicals is given in Table 1.

Previous research has found that the affective quality of a person's word associations to a hazard is related to fundamental attitudes and perceptions regarding that hazard. For

Table 1. Associations to the Word "Chemicals"

Chemical Products (All)		**580**
Medicines, drugs	133	
Cleaning agents	127	
Fertilizers	75	
Pesticides	63	
Gasoline	31	
Dangerous		**333**
Dangerous	79	
Poisonous	75	
Toxic	43	
Pollution		**185**
Chemical Compounds		**129**
Acid/Burn		**56**
Chemistry and Related Apparatus		**55**
Chemical Companies and Manufacturing Plants		**54**
Negative Terms		**29**
Workplace		**11**
Useful		**10**
Drug Abuse/Illegal Drugs		**9**
Miscellaneous		**15**
Total		**1466**

example, Slovic et al. (1991b) found that persons whose first association to the stimulus phrase "underground nuclear waste repository" was affectively negative (e.g., dangerous) were much more likely to say they would vote against a repository than were persons whose associations were positive.

In the present study, the affective quality of a person's association to the stimulus word "chemicals" was compared to the perceptions, attitudes, and demographic status of that person. As expected, many statistically significant relationships were observed.

To conduct this analysis, the associations were first partitioned into two categories: those that were clearly negative (dangerous, pollution, negative terms; N = 561) and those that were not clearly negative (all the rest of the associations; N = 905). Many of the associations in the non-negative category may indeed have been negative (e.g., chemicals such as PCB's or dioxin or associations such as pesticides, acid, burn, Exxon, and drug abuse). However, because respondents did not provide ratings of their associations, the affective quality of responses in the non-negative category cannot be verified. Labeling all responses in this category as non-negative likely works to reduce the observed relationships between association category and other variables. Nevertheless, the differences in responses between people whose associations were negative and non-negative were often moderately large.

For example, persons with negative imagery were more likely to assign high risk-perception ratings to many hazards. The largest differences were:

- Chemical pollution (62.9% of those whose association to "chemicals" was negative responded "high risk" vs. 49.9% responding "high risk" among those whose association was non-negative)

- Tap water (60.6% moderate or high risk vs. 46.7%)
- Food additives (44.4% high risk vs. 33.4%)
- PCB's or dioxin (47.2% high risk vs. 34.9%).

Persons with negative and non-negative associations did not differ much on responses to questions about information sources or agents responsible for health protection. However, there were some substantial differences on the various attitude and opinion questions. For example, persons whose associations were clearly negative were more likely to agree that most chemicals cause cancer (58.8% agreement vs. 41.8% among those with non-negative associations). Persons with negative associations were also more likely to agree that:

- "If even a tiny amount of a cancer-causing substance were found in my tap water, I wouldn't drink it"
- "I try hard to avoid contact with chemicals and chemical products in my daily life."

Persons with negative associations were more likely to disagree with statements asserting that:

- "I don't worry much about chemicals because there are just too many other things in my life that I have to deal with"
- "In a fair system people with more ability should earn more."

Negative associations were given by 40.9% of the women respondents and by 33.5% of the men. Persons with less education and persons living in the Atlantic regions or in Quebec were more likely than others to produce associations to the word chemicals that were clearly negative.

Risk. Table 2 presents the major response categories to the stimulus word "risk." Associations with accidents and danger dominate the list, followed by associations involving illness and economic or financial matters. Positive associations involving adventure, challenge, or sport were rare (42 mentions) and were greatly outnumbered by the negative categories. Of interest were the categories that one might have expected to be frequent but were not. "War" or "weapons" were mentioned by only 7 respondents. "Crime" was mentioned only four times, "uncertainty" only twice, and a natural hazard only once ("storm").

Perception of Risk

Risk to the Canadian public. Figure 1 illustrates the perceived risk to the Canadian public as a whole based on the responses of the entire sample (N = 1500).[1] 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. 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.

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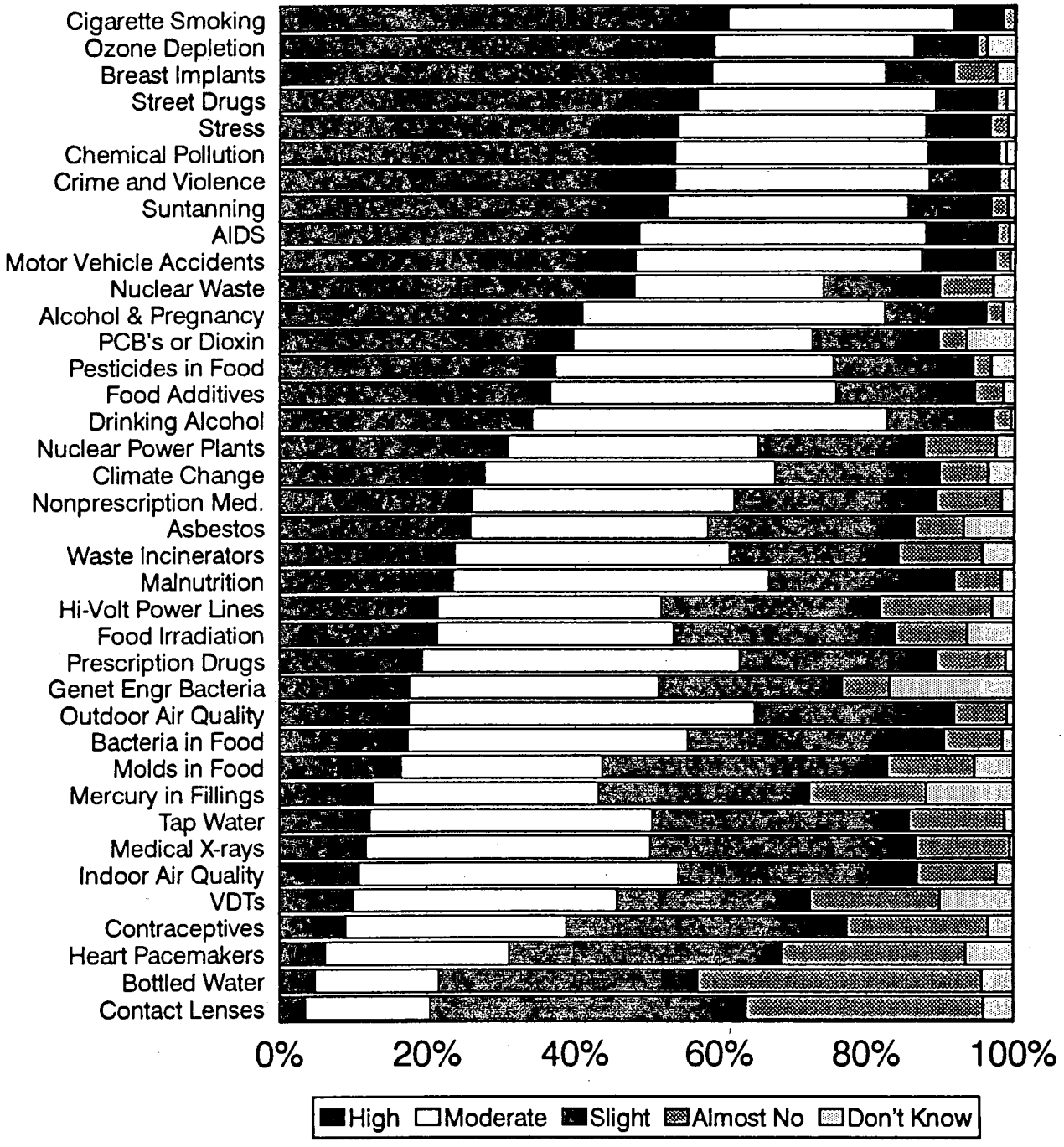
[1] Included in the figure are the five items for whom the rated risk pertained to an individual considering the use of a specific medical device or treatment. These items were breast implants, medical X-rays, contraceptives, contact lenses, and heart pacemakers.

Figure 1. Perceived Health Risk To Canadian Public

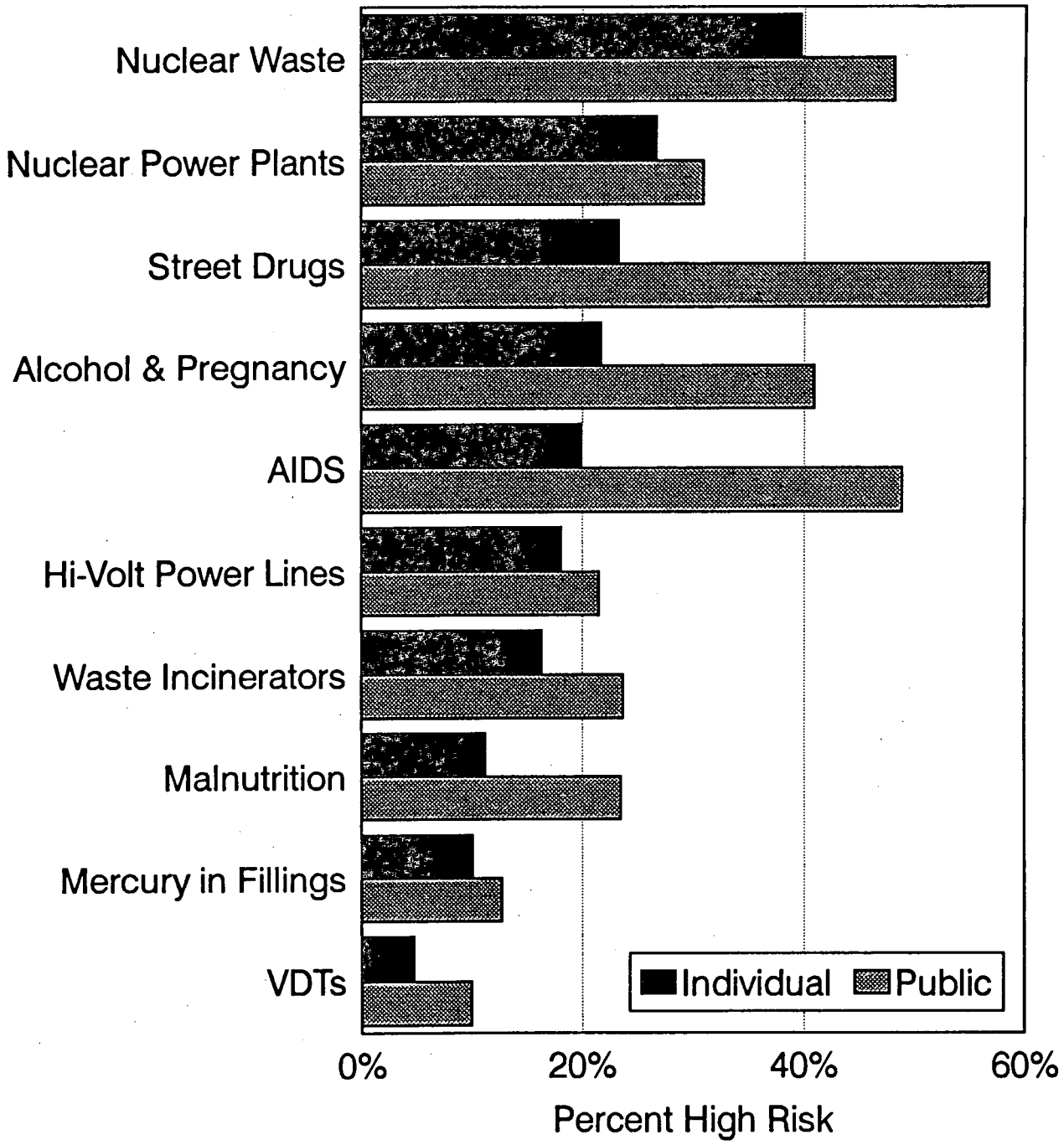


Chemical risks from ozone, street drugs, chemical pollution, PCBs or Dioxin, pesticides, food additives, and alcohol were rated high in risk, but chemicals in the form of prescription drugs were rated relatively low in risk. Radiation hazards associated with industry (nuclear power and nuclear waste) 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 (Slovic et al., 1989) and elsewhere (Slovic, 1990) 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 (Tversky & Kahneman, 1983), 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. Figure 2 compares the percentage of "high risk" responses when respondents were considering the health risk "to you and your family"

Figure 2. Public vs. Individual Perceived Health Risks



with the percentage for the "Canadian public as a whole" for each of 10 items. 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. This was true even in regions distant from nuclear power plants, such as British Columbia and the Prairie Provinces. In every instance, there were more high-risk judgments in reference to the Canadian public and for some items, such as street drugs and AIDS, the difference between personal and societal risk perception was quite large. 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 the Canadian public as a whole 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. Differences between men and women are shown in Figure 3. Women were more likely to rate a hazard as a "high risk" for every item but one—heart pacemakers. 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 (see Figure 4). Items for which women had relatively less excess concern (when compared to men) included asbestos, nuclear waste, and genetically engineered bacteria.

Figure 3. Perceived Health Risks to Canadian Public By Gender

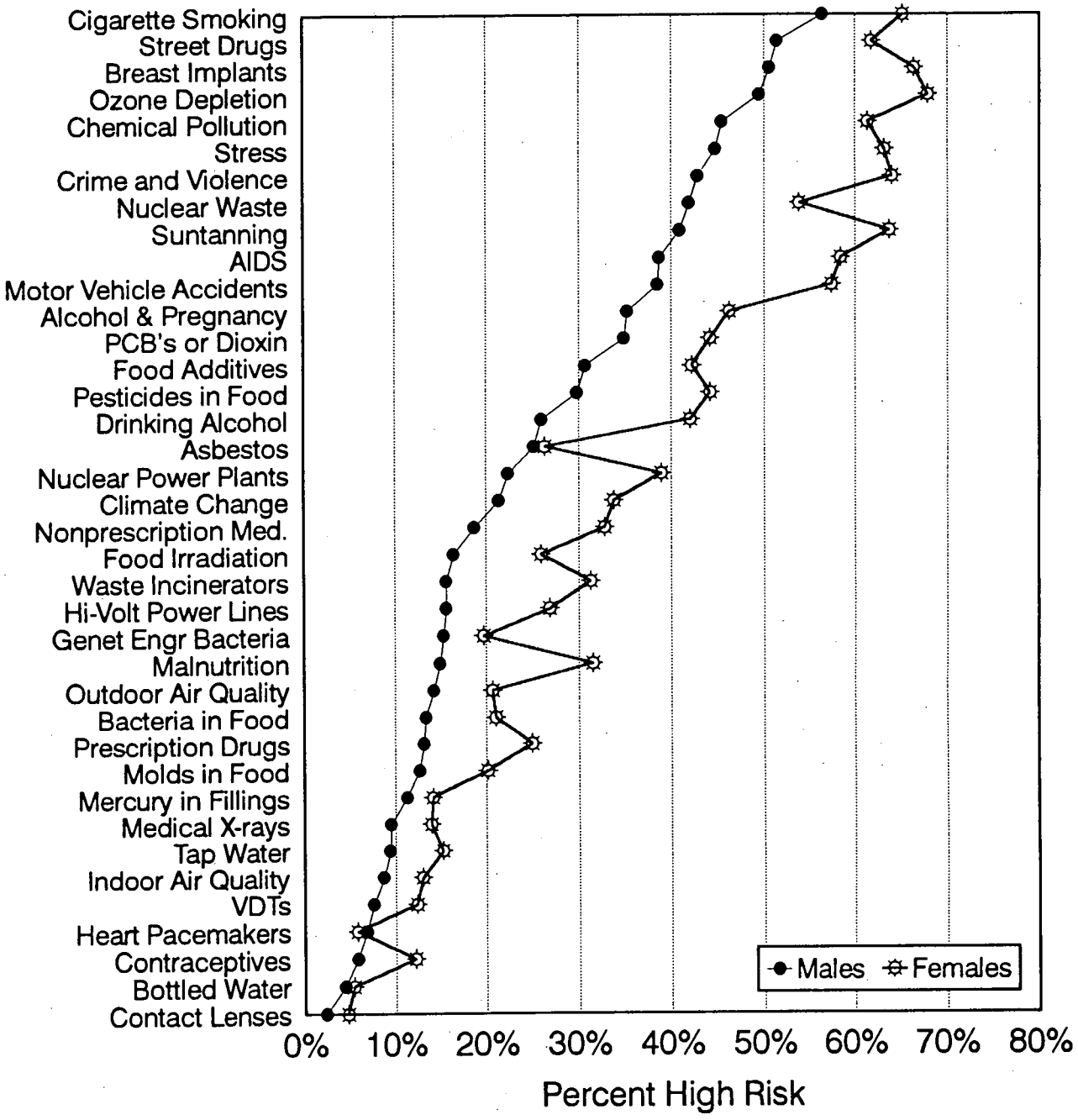
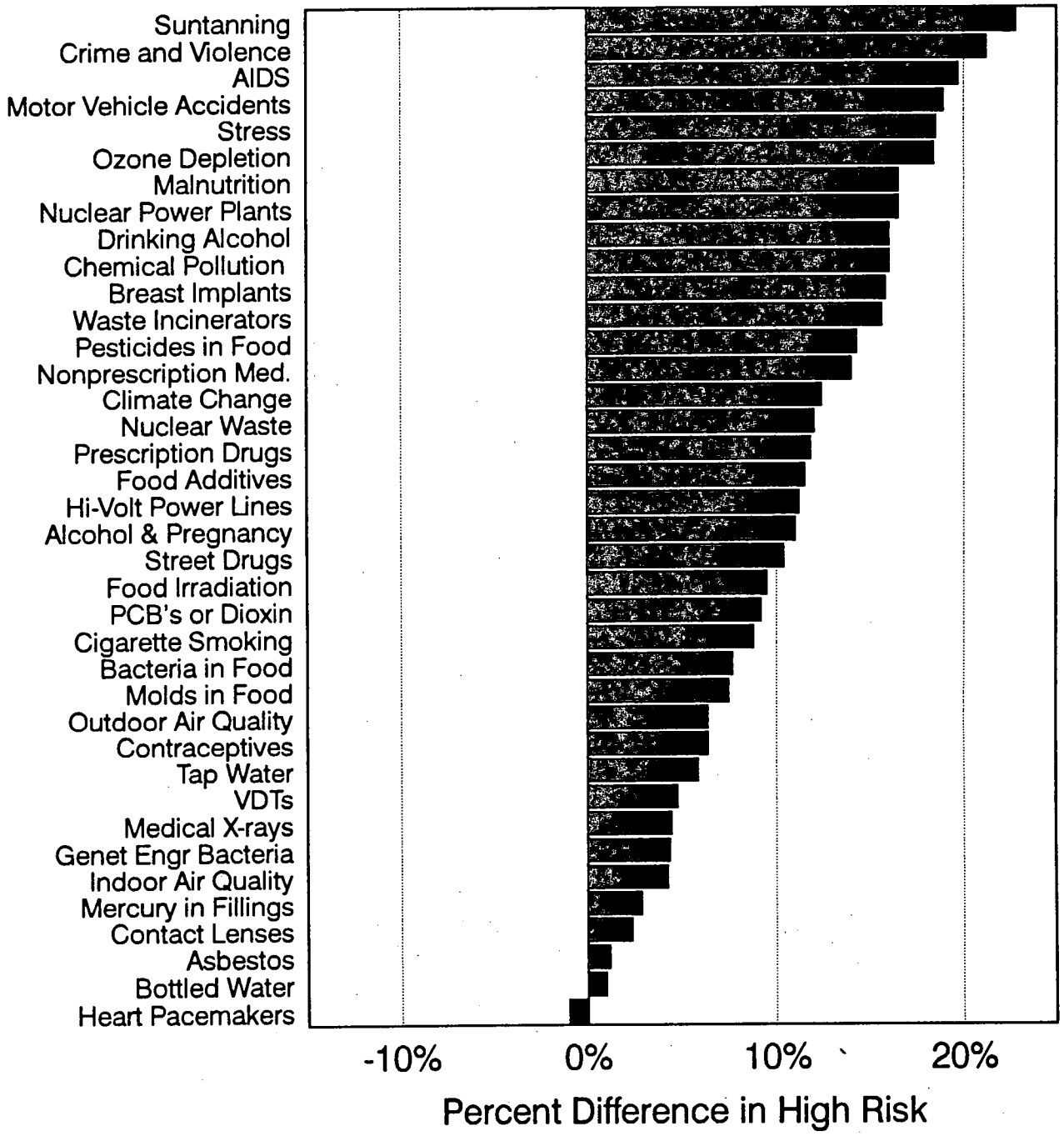


Figure 4. Perceived Health Risks to Canadian Public by Gender: Difference Between Males and Females



Note: Percent difference is percent female high risk response minus percent male high risk response.

Subgroup analyses: Age. Figures 5 and 6 portray the difference in high-risk responses between respondents age 30 or less and age 55 or more. In general, older persons were more likely to rate a health risk as high. This tendency was particularly evident for street drugs, crime and violence, breast implants, alcohol and pregnancy, suntanning, asbestos, video display terminals, drinking alcohol, and cigarette smoking. The younger respondents displayed slightly higher perceived risk than did the older group for heart pacemakers, pesticides, and various forms of chemical pollution (including ozone depletion and outdoor air quality). Younger persons were slightly less likely to rate AIDS as a high risk.

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, as Figure 7 indicates. Examination of Figure 7 shows that younger women are 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

Figure 5. Perceived Health Risks to Canadian Public by Age

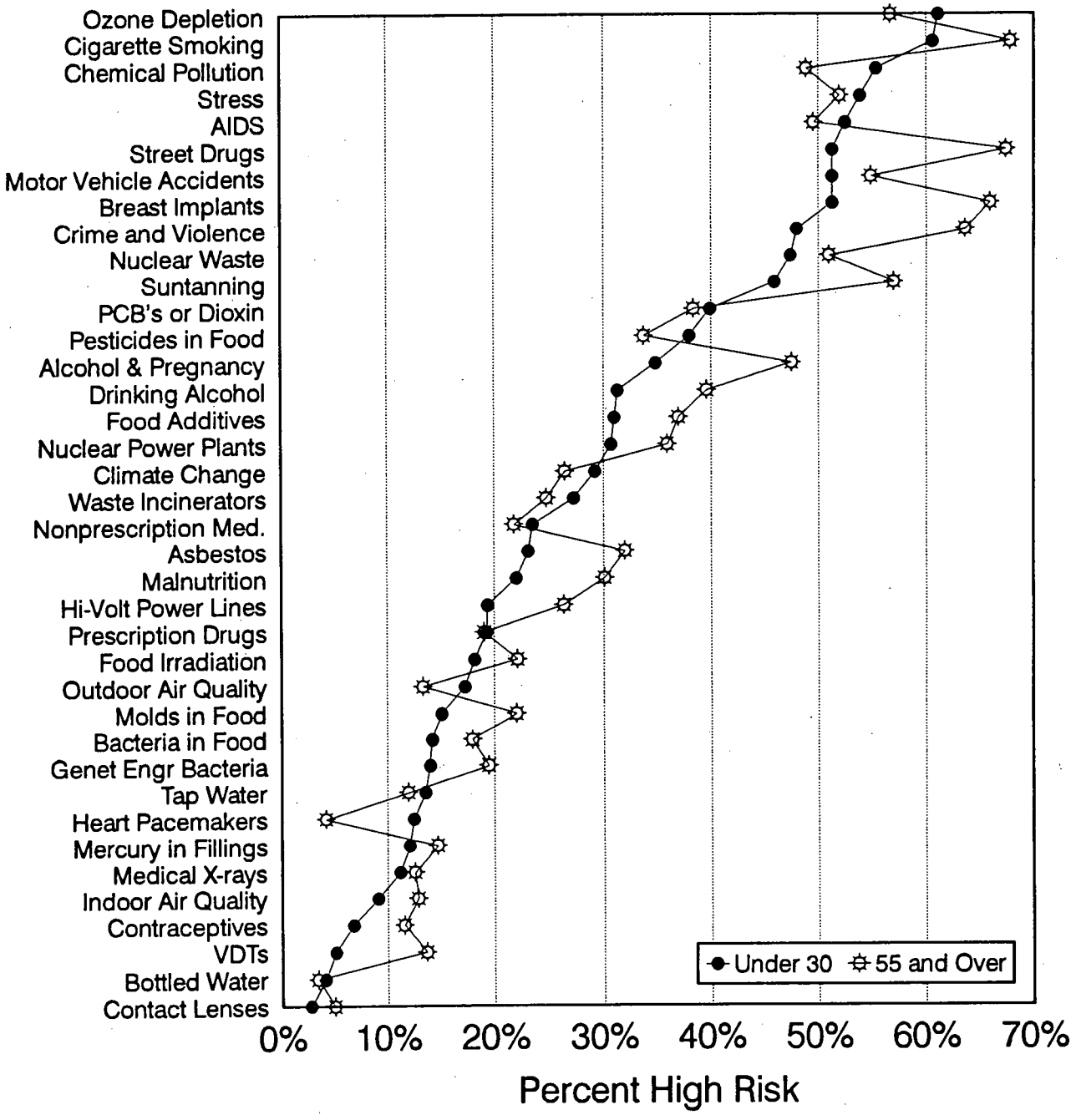
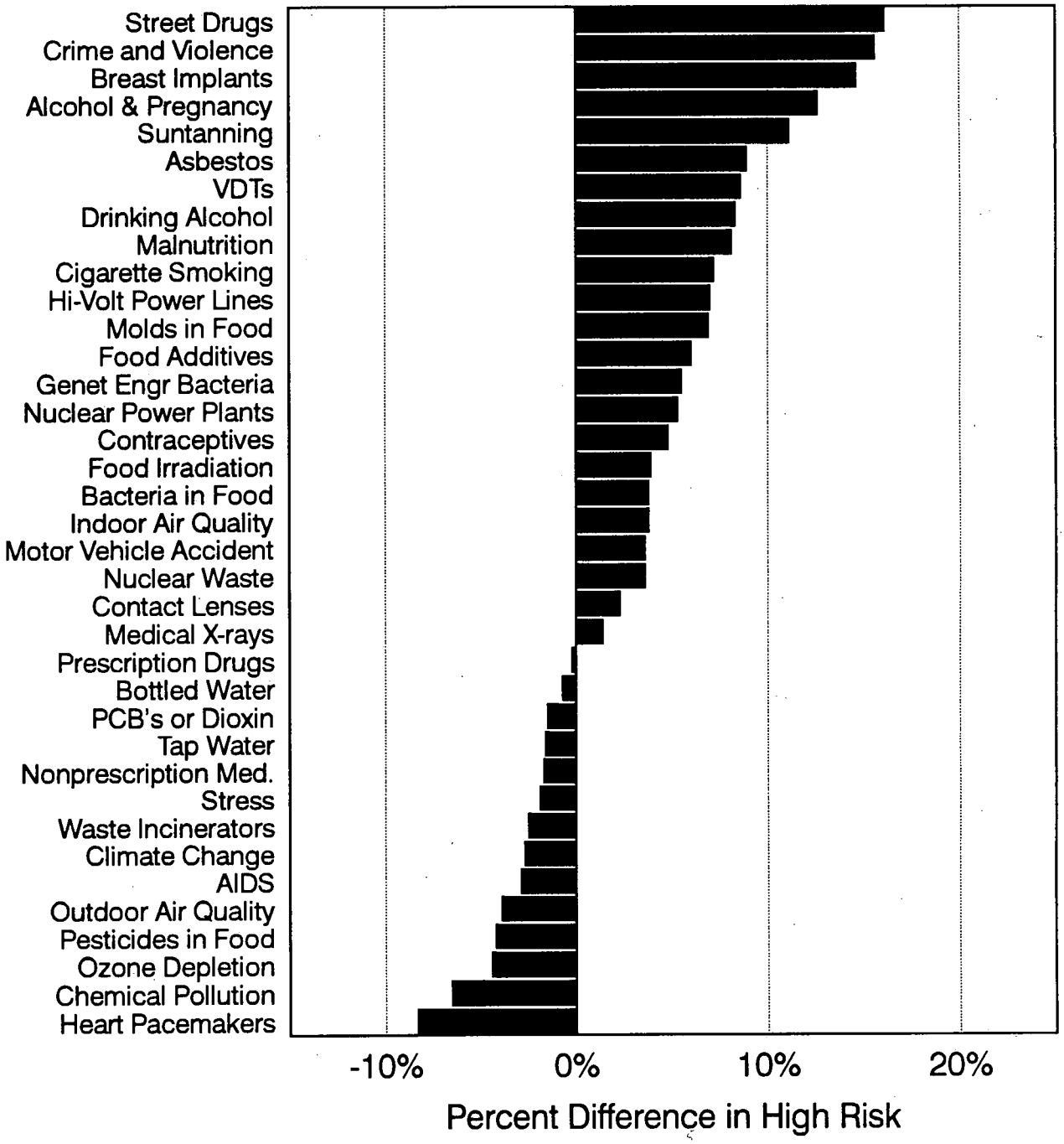
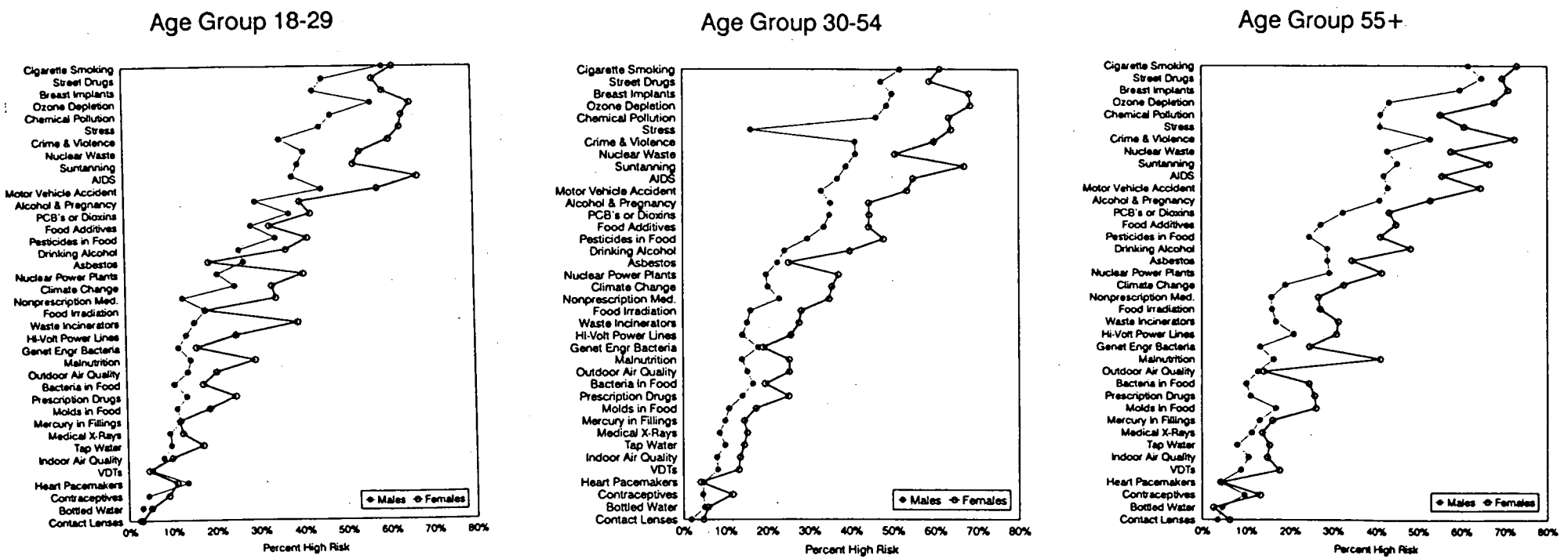


Figure 6. Perceived Health Risks to Canadian Public by Age: Difference Between 55+ and Under 30 Age Groups



Note: Percent difference is percent 55+ high risk response minus Under 30 high risk response.

Figure 7. Perceived Health Risk to Canadian Public by Gender and Age Group



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

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

Subgroup analyses: Education. College-educated respondents were consistently less likely than respondents with high-school or less education to rate a risk as "high" (see Figures 8 and 9). People with less formal education were relatively more concerned about street drugs, crime and violence, AIDS, high-voltage power lines, malnutrition, nuclear power and nuclear waste, and alcohol. 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 are shown in Figure 10 for the 10 items rated with respect to both individual and family risk. In most instances, regional differences were small, with one exception. 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.

Figure 11 presents the regional differences in perceived public risk across all 38 hazards. Residents of Quebec produced the highest proportion of "high risk" responses for 29 of the 38 hazard items. Differences among the other regions were relatively small in comparison with the differences between Quebec and the rest. As Figure 12 indicates, residents of Quebec were particularly high in perceived risk for non prescription medicines, nuclear waste, PCBs or dioxin, molds in food, malnutrition, chemical pollution, nuclear

Figure 8. Perceived Health Risks to Canadian Public by Education

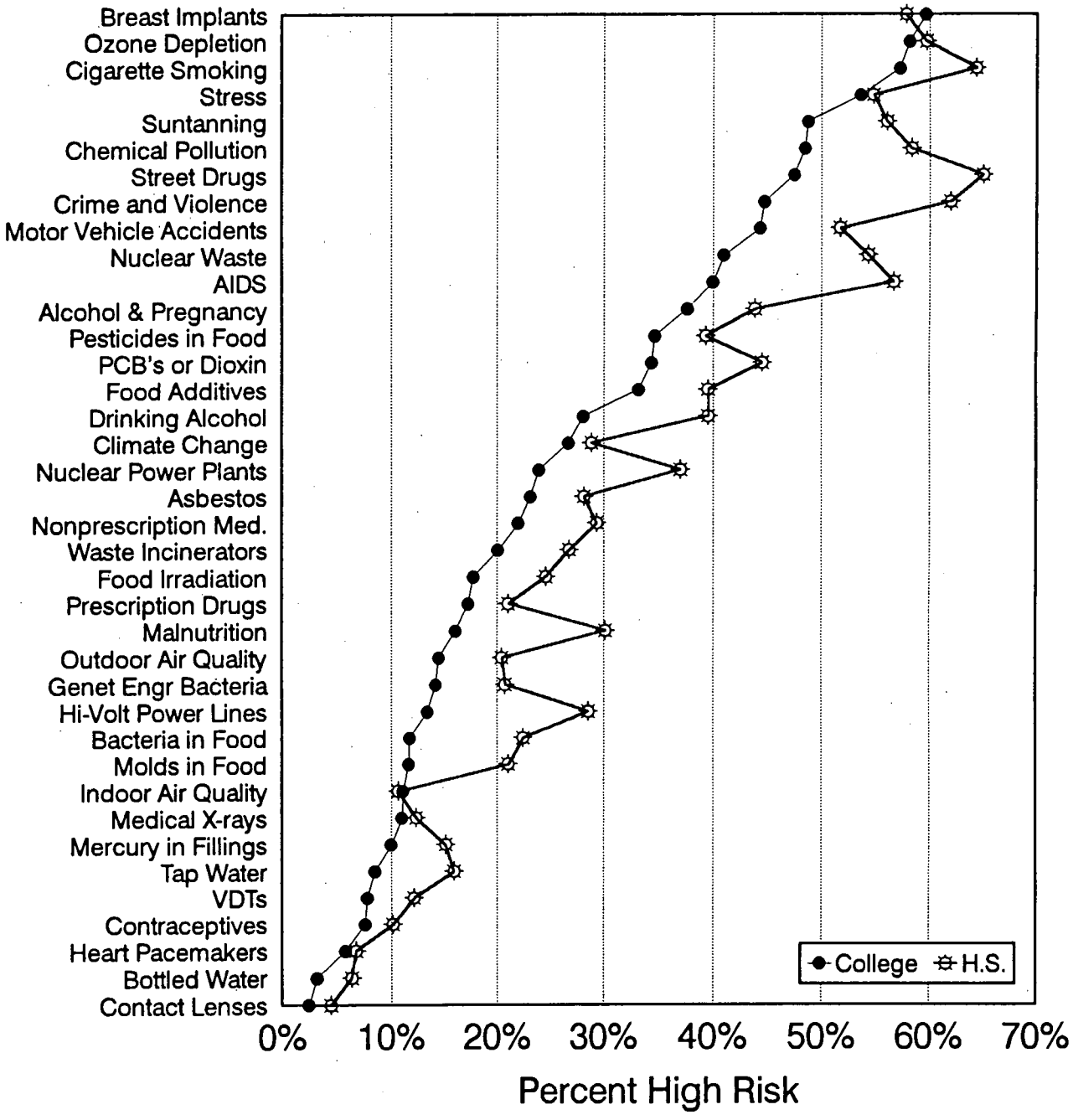
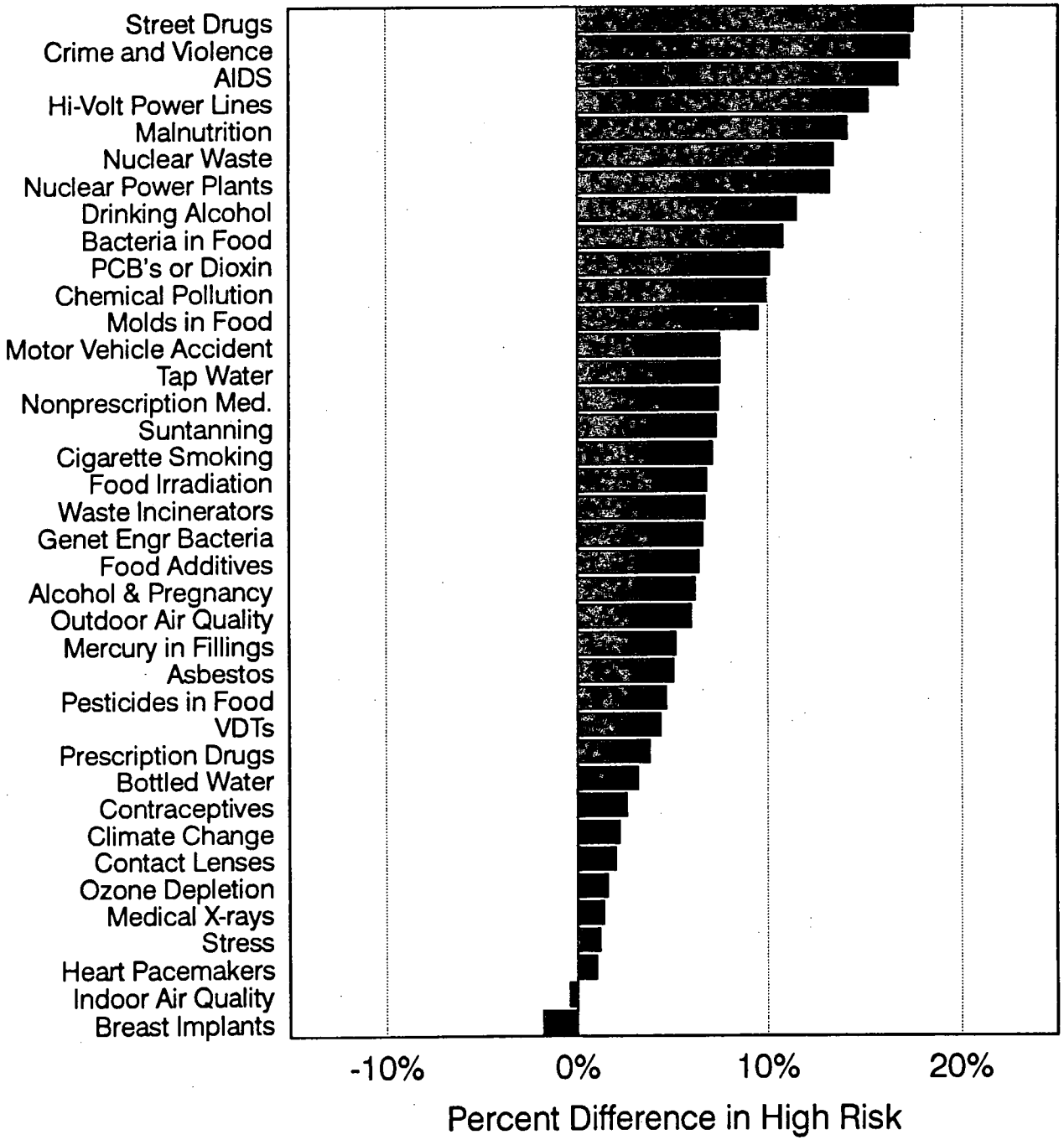


Figure 9. Perceived Health Risks to Canadian Public by Education: Difference Between High School and College Educated



Note: Percent difference is percent High School Educated high risk response minus percent College Educated high risk response.

Figure 10. Perceived Health Risks By Region: Individual and Family Risks

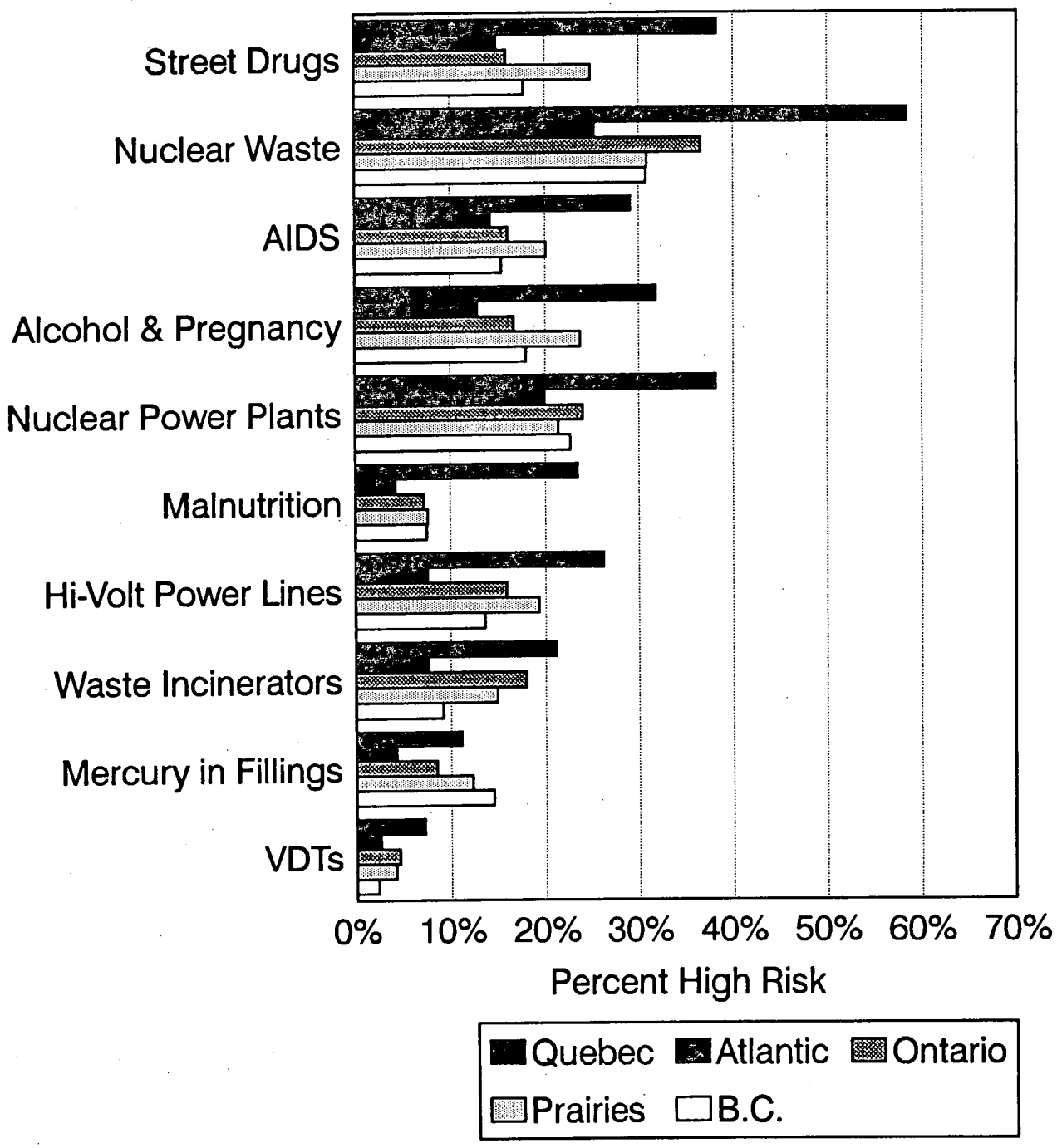


Figure 11. Perceived Health Risks by Region

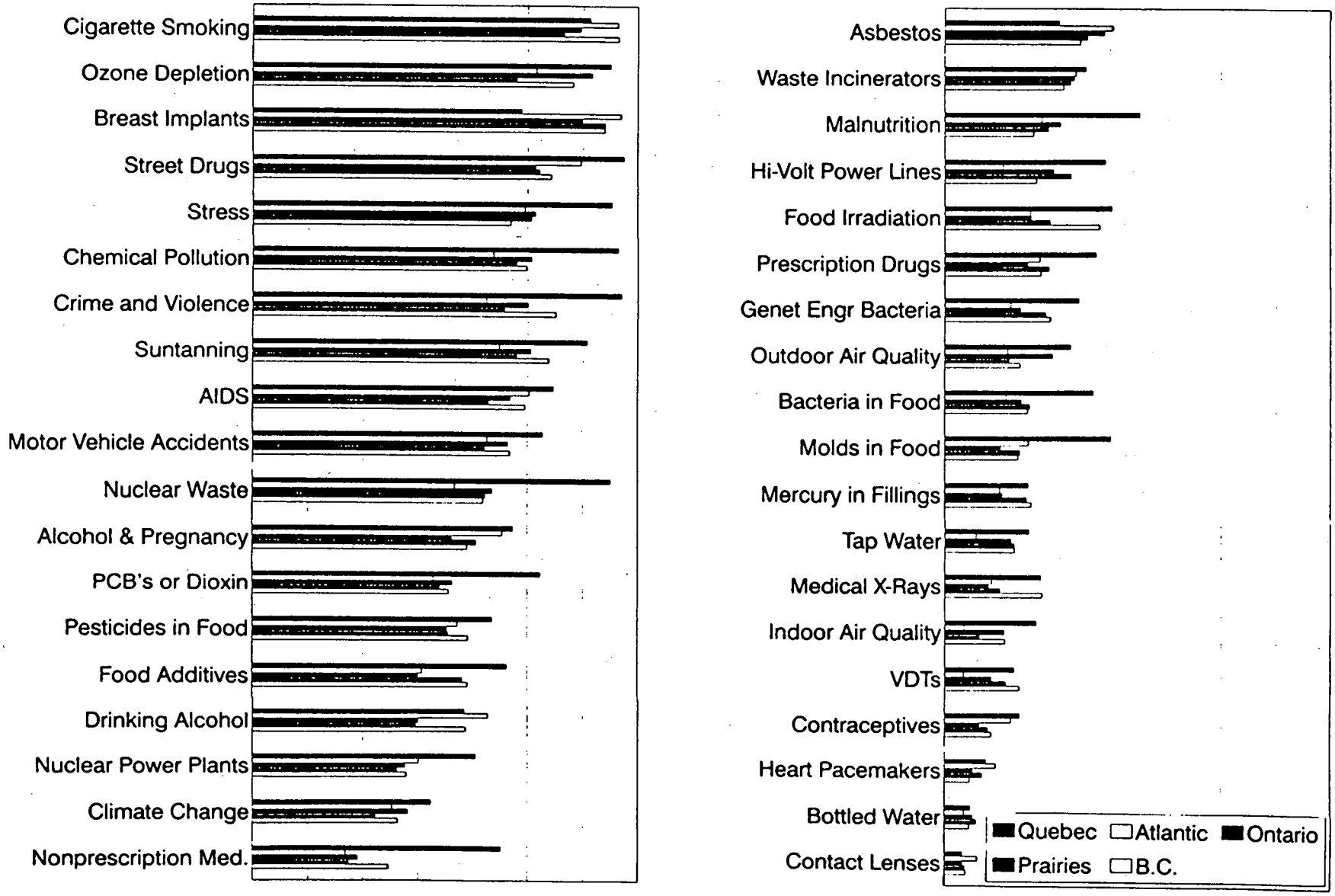
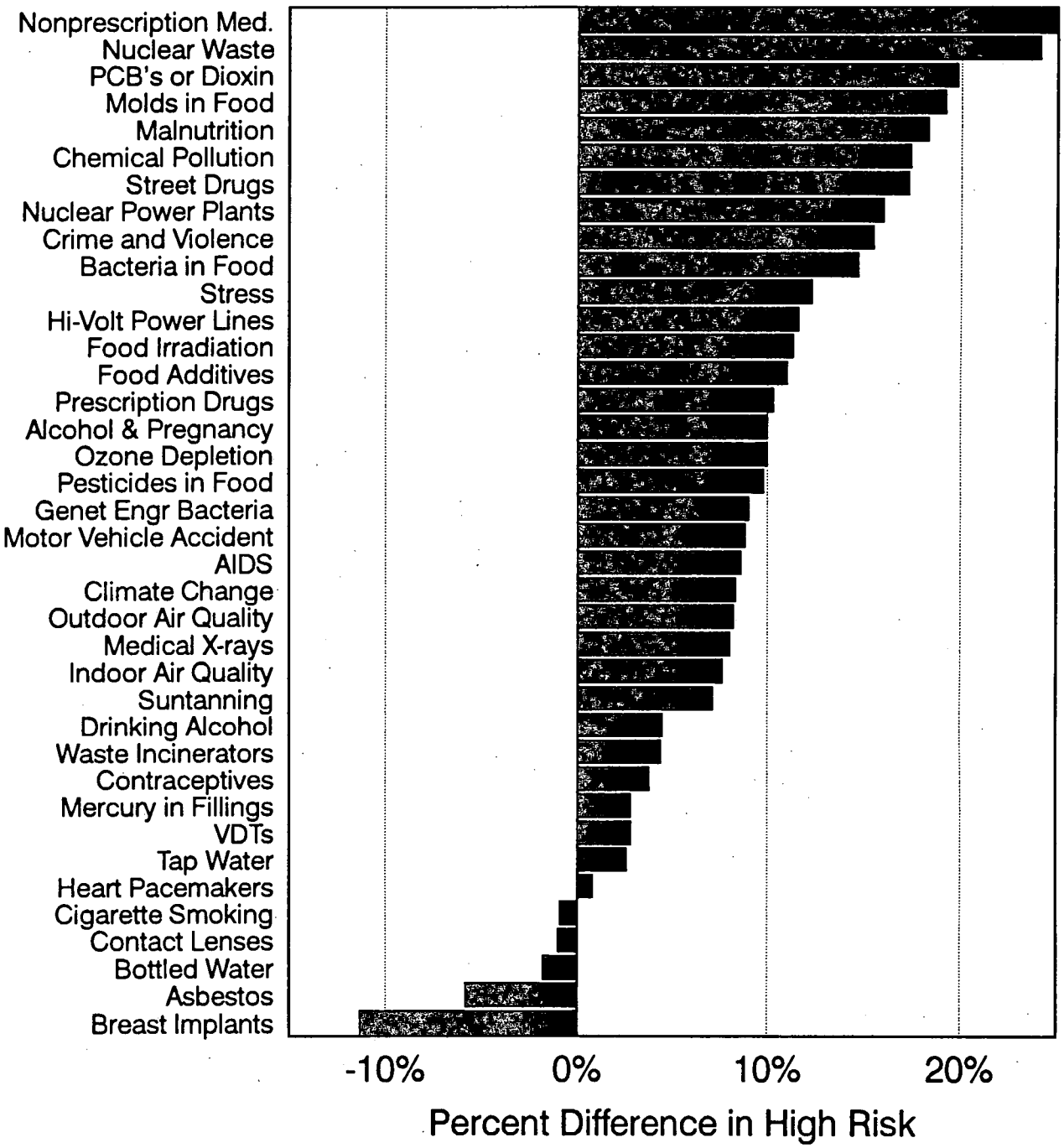


Figure 12. Difference Between Quebec and Other Provinces



Note: Percent difference is percent Quebec high risk response minus percent other provinces high risk response.

power plants, crime and violence, and bacteria in food.

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

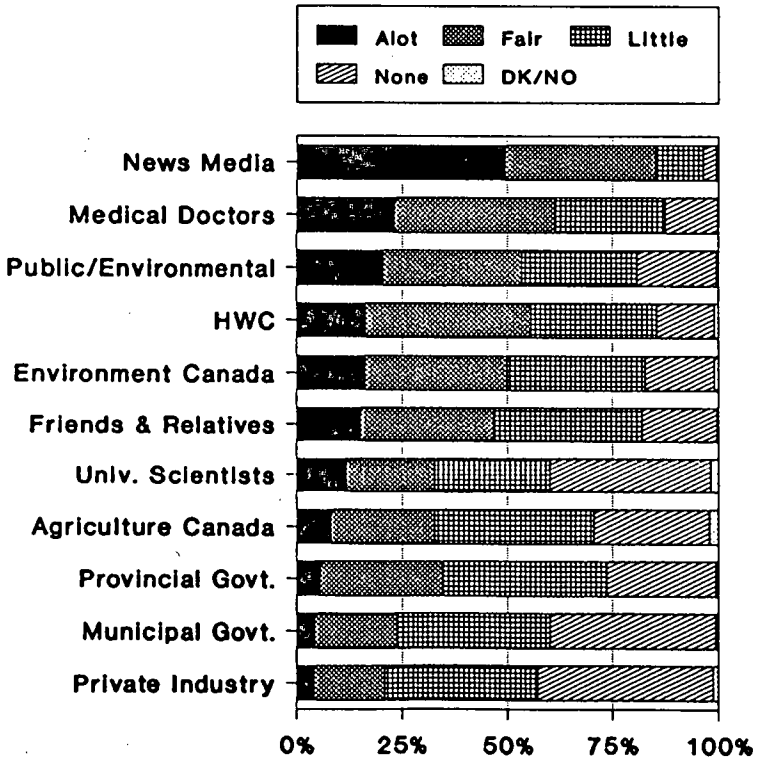
The left panel of Figure 13 presents the response distributions for the various sources of information about health issues and risks. The right panel of Figure 13 presents the responses regarding the confidence that respondents had in those information sources. The information source relied upon most heavily was the news media. Private industry and municipal government were relied upon least often. Differences among the remaining sources were relatively small. Degree of confidence in a source roughly paralleled degree of reliance on that source. 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

The perceived degree of responsibility that various individuals, private groups, and government agencies hold for protecting people against health risks is shown in the left panel of Figure 14. The right-hand panel of this figure indicates the evaluations of how good a job each of these agents is doing in meeting their responsibilities for health protection. Medical doctors and Health and Welfare Canada were seen to be most responsible for health-risk

Figure 13.

Sources of Information about Health Issues and Risks



Confidence in Organization as Information Source

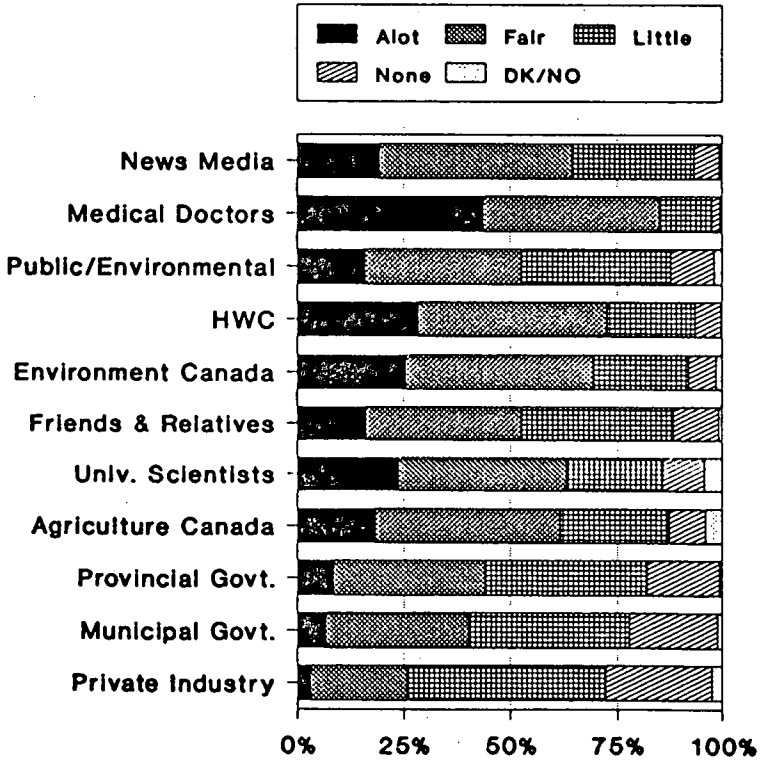
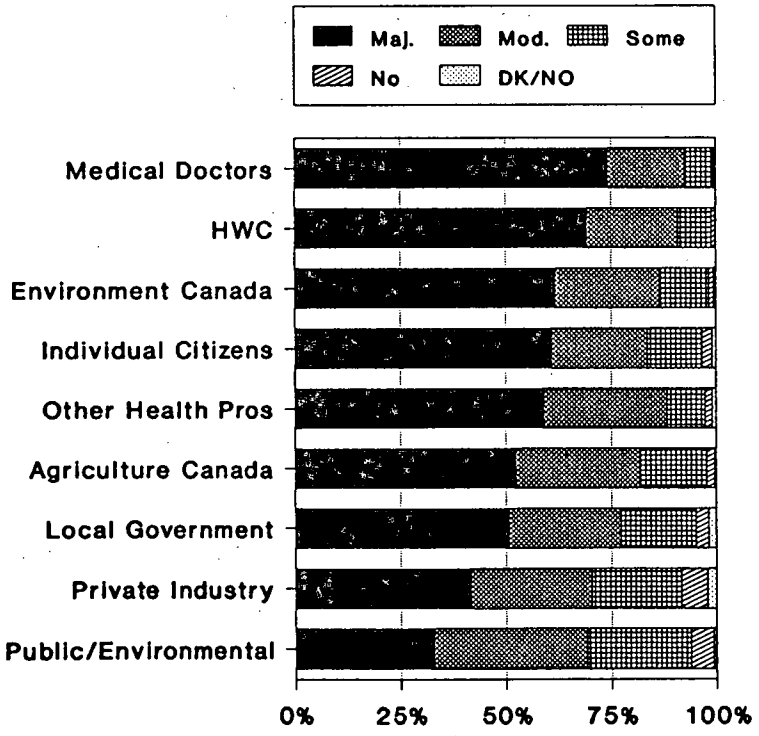
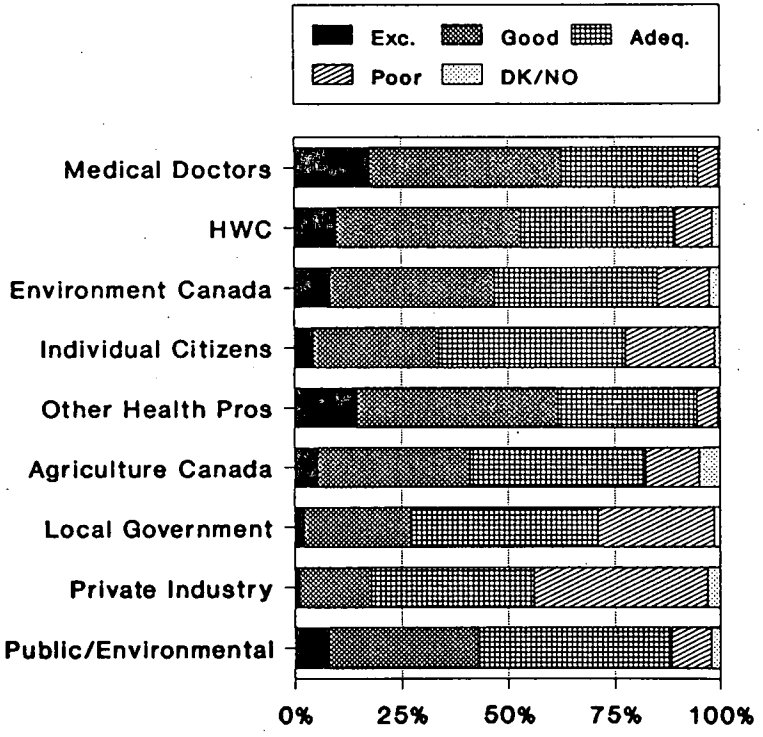


Figure 14.

Perceived Degree of Responsibility for Protecting the Public Against Health Risks



Perceived Fulfillment of Responsibility for Protecting the Public Against Health Risks



protection and also to be doing the best job of fulfilling those responsibilities. Private industry was judged to be doing the poorest job in meeting this responsibility.

There seemed to be a weak general tendency within individual respondents to either trust or distrust news sources and to believe that the diverse people and organizations were doing either a good or bad job in fulfilling their responsibilities for protecting people against health risks. For example the median intercorrelation between the confidence responses for pairs of the 11 items in Figure 13 was .26 and the median intercorrelation among "how good a job" responses for pairs among the 9 items in Figure 14 was .33. As one specific example, ratings of the job which private industry was doing in fulfilling its responsibilities correlated .21 with ratings of public interest groups. Ratings for Health and Welfare Canada and Environment Canada on the same question correlated .72.

Attitudes and Opinions

Tables 3-12 present the response distributions for the 34 attitude and opinion statements. These statements have been grouped by content category for easier interpretation.

Category 1 (Table 3) 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

Table 3. 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 (.20)	17.86	36.06	29.88	15.14	1.06
1b. I believe my community is becoming a healthier place in which to live (-.08)	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 (.13)	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 (.16)	2.32	8.03	35.92	49.93	3.78

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

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 4) 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

Table 4. 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 (-.28)	23.84	30.15	32.74	10.23	3.05
2b. Most chemicals cause cancer (.36)	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 (-.19)	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 (.26)	5.71	16.80	39.58	37.05	0.86

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

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 5). 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

Table 5. 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 (-.15)	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 (-.05)	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 (-.02)	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 (-.05)	18.66	32.60	31.47	12.48	4.78

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

"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 by Kraus, Malmfors, and Slovic (1992) that examined the cognitive models, assumptions, and inference

methods that comprise laypeople'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 6) 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

Table 6. 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 (.26)	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 (.26)	7.30	25.17	39.38	25.50	2.66
4c. Chemicals are either safe or dangerous. There is really no in between (.21)	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 (.05)	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 (.22)	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 (.19)	7.30	25.30	41.30	20.72	5.36

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

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. (1992) 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 7) 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

Table 7. 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 (.00)	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 (.17)	4.05	11.82	47.54	34.73	1.86

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

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., Kraus et al., 1992).

Other questions pertaining to cancer are grouped in Category 6 (Table 8). Responses to Question 6a (68.5% disagreement vs. 25.6% agreement) indicates that most respondents do not share the view presented by Ames (1983) 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

Table 8. 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 (.04)	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 (.07)	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 (-.14)	23.90	33.93	25.23	6.04	10.89

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

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 9). 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 10). 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

Table 9. 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 (.02)	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 (-.06)	20.45	24.44	42.43	10.49	2.19

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

Table 10. 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 (-.12)	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 (.10)	0.86	2.99	31.34	63.61	1.20

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

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 11). 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* (Carson, 1962) but disputed by most toxicologists (Kraus et al., 1992). 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 12).

Table 11. 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 (.01)	14.06	24.10	33.00	23.11	5.71
9b. Canadian society is becoming too concerned about small health risks (-.06)	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 (.06)	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 (-.13)	12.55	24.24	38.84	20.05	4.32
9e. I believe that a risk-free environment is an attainable goal in Canada (.12)	13.41	24.70	36.45	24.44	1.00
9f. I pay close attention to warning labels on products that I use (.16)	3.25	7.50	32.20	57.04	-
9g. Experts are able to make accurate estimates of health risks from chemicals in the environment (.06)	11.22	25.03	47.34	13.41	2.99

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

Table 12. 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) (.23)	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) (-.01)	39.64	26.29	21.85	10.69	1.53
10c. Decisions about health risks should be left to the experts (Hierarchy) (.05)	28.75	32.40	23.44	14.41	1.00
10d. People in positions of authority are not likely to abuse their power (Hierarchy) (.05)	36.7	33.2	19.1	10.0	1.0
10e. In a fair system, people with more ability should earn more (Individualism) (-.11)	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) (.19)	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) (-.01)	6.91	18.06	45.55	26.69	2.79

Note: Cell entries are percentages. Values in parentheses are correlations between responses to the statement and the risk-perception index. Correlations greater than .07 are significant at $p < .01$.

The worldview "fatalism" was assessed in questions 10a and 10b.[2] 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 14, left-hand panel). What appears to be an inconsistency 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 14, 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."

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[2] 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.

The final view assessed here, "technological enthusiasm" (Jasper, 1990), 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.

The Risk-Perception Index

There was a moderately strong tendency for people to be consistent across hazards in their perceptions of risk. Perceptions for every one of the 703 pairs among the 38 hazards studied here were positively correlated across respondents (the mean and median of the distribution of these correlations were both .25). Thus, for example, perceived risk to the public from nuclear power plants correlated .36 with perceived risk from chemical pollution. Perception of risk from nuclear power correlated almost as highly (.28) with perception of a very different type of risk—crime and violence.

A risk-perception index was created for each respondent by averaging his or her ratings across all of the hazard items. The mean ratings were distributed as shown in Table 13. Almost half (43.2%) of the respondents had a mean value greater than 3.0 (the "moderate risk" response).

Table 13. Mean Risk Perception Ratings (The Risk-Perception Index)

Index	Frequency	Percent
1.00 - 1.5	3	0.2
1.51 - 2.0	39	2.6
2.01 - 2.5	257	17.1
2.51 - 3.0	557	37.0
3.01 - 3.5	543	36.1
3.51 - 4.0	107	7.1
	1506	

Note: Cell entries are percentages. Responses averaged to create the index ranged from 1 (almost no risk) to 4 (high risk).

The risk-perception index values were correlated with responses to the attitude, opinion, and worldview questions presented in Tables 3-12. These correlations are shown in parentheses next to each question in Tables 3-12. We can see that the perception index was significantly correlated with general opinions about health risks from chemicals (Category 2, Table 4) and with sensitivity to the relationship between exposure and risk (Category 4, Table 6). In Category 2, for example, the perception index correlated .36 with the view that "most chemicals cause cancer" (Question 2b). In Category 4, there was a correlation of .26 between the index and the view that a person exposed to a chemical that can cause cancer

will probably get cancer some day (Question 4a). Worldviews pertaining to fatalism (Question 10a) and egalitarianism (Question 10f) also correlated moderately with the risk-perception index.

The risk-perception index also correlated strongly with gender ($r = .29$; women were higher on the index), education ($r = -.22$), and income ($r = -.20$). It also correlated significantly with the respondents' self-rated health status ($r = .14$). Persons with higher mean ratings for perceived risk rated their personal health as less good, in comparison with persons whose risk-perception ratings were lower.

Personal and Demographic Characteristics

Most of the questions in the survey asked for perceptions, evaluations, and attitudes about various health risk issues. The final section, however, asked questions about personal characteristics of the respondents including social, economic, and other behavioral information. Data from selected items are examined below and related to of the ratings of health and safety risk.

Smoking. One of the highest perceived health risks is smoking. Questions were asked about past smoking behavior ("Has there ever been a period in your life when you smoked cigarettes regularly?"), and current smoking behavior ("Do you smoke regularly now?").

Well over half the respondents (57.6%) said they had smoked cigarettes regularly at some period in their life. Males (62.6%) were more likely than females (52.8%) to answer "yes" to this question. The proportion of affirmative answers increases by age category. It was less than half for those under age 30 (49.7%), but more than ten percentage points higher for those ages 30-54 (59.9%) and over 55 years of age (60.9%). People with

educations of high school or less were more likely to have smoked regularly (64.5%) as compared to those who were college educated (49.6%). People who reported incomes under $35,000 were slightly more likely to answer "yes" to the smoking question (60.1%) as compared to those in the range of $35-49.9k (55.3%) or over $50k (57.8%).

Of those people who said they have smoked regularly at some time in their life, less than half (46.4%) said they smoke now. Table 14 shows the proportion who said "yes" to the two smoking questions. The table indicates that, although a slightly higher percentage of men than women are "ex-smokers," men still record a greater percentage of current smokers (28.9%) than women (24.7%). The decline from past smoking increases greatly with age. The two age categories under 55 show about the same percent of current smokers (32.0% and 31.0%) but for those over age 55 the abandonment of smoking has been extensive—only 15.1 percent report that they now smoke. Those of high school and less education are almost ten percentage points more likely to smoke now (31.0%) than are those with college education (21.4%).

Table 14. Percent of Respondents Who Answered "Yes" to Questions on Smoking (n = 864), by gender, age category, and educational status

	Total	Male	Female	Under 30	30-54	55+	H.S. Under	College
Ever Smoked	57.6	62.6	54.1	49.7	59.9	60.9	64.5	49.6
Smoke Now	26.7	28.9	24.7	32.0	31.0	15.1	31.0	21.4
Decline	30.9	33.7	29.4	17.7	28.9	45.8	33.5	28.2

How does personal experience with smoking, or lack of it, relate to perception of smoking as a health risk? To answer this question, we prepared a cross-tabulation, shown in

Table 15, that compares those who smoke now, those who once did smoke but quit, and those who have never smoked with their ratings of risk from smoking. Nonsmokers rate the risks of smoking higher than those who quit, and those who quit, in turn, rate the risks higher than those who currently smoke cigarettes. In all cases, however, a solid majority see smoking as a high-risk condition, even those who continue to smoke.

Table 15. Perception of Smoking as a Health Risk by Experience with Smoking Behavior (n = 1498)

	Smoke Now		Did Smoke and Quit		Never Smoked	
Smoking Risk Rating	n	%	n	%	n	%
Almost No Risk	7	1.7	8	1.9	9	1.5
Slight Risk	43	10.6	22	4.8	36	5.7
Moderate Risk	134	33.5	151	32.6	174	27.4
High Risk	217	54.2	281	60.7	416	65.4
TOTAL	401	100.0	462	100.0	635	100.0

$\chi^2 = 24.41$, DF = 9, P = .0037

Seat Belts. Another question asked if the respondent wears a seat belt when driving or riding in a motor vehicle. Over all, 95 percent said "yes" to this question. There were some differences between men (92.4%) and women (97.5%). Generally the reported use increased slightly with age: under 30, 93.0 percent; 30-54 years of age, 95.2 percent; and over age 55, 96.4 percent. Regionally, Quebec reported the highest seat belt use at 97.6 percent while the Prairies were the lowest at 91.8 percent. There were only slight differences by educational or income categories.

Exercise. A majority of the respondents reported that they exercised regularly (63.7%). Men were slightly more likely (66.4%) than women (61.2%) to report exercise behavior. The region reporting the highest proportion of respondents who exercise regularly was British Columbia (73.0%) while the Atlantic provinces reported the least (58.8%). More than two-thirds of those under 30 (67.1%) and those over age 55 (66.8%) reported regular exercise, while only 60.1 percent of those between ages 30-54 gave the same "yes" answer. College-educated people were more likely to report regular exercise (67.5%) than were those having a high school or less education (60.5%).

Voluntary risk. Less than a fifth (18.8%) of the respondents said they participate in an activity that other people consider risky. Regionally, the highest level of such reports is from British Columbia (27.1%) and the lowest from the Atlantic (13.4%) and Quebec (14.7%). Men (27.5%) are much more likely to report such behaviors than are women (10.6%). There is also a decline with age in such reports. Under 30 years of age, 31.7% reported voluntary risk behaviors, while the rate for ages 30-55 was 17.3 percent, and for those age 55 and older it was 10.1 percent. College-educated people reported such risky behavior (23.4%) more often than those with high school or less education (14.5%). Most of these voluntary risk activities were related to sports (skiing, parachuting, contact sports such as hockey or football, hunting, etc.). A small set had to do with volunteer community activities such as fire-fighting or militia service.

How do people who engage in voluntary risk behaviors rate other hazards as compared to those who do not undertake such voluntary risks? Table 16, below, shows a cross-tabulation for these two groups of people compared to ratings in the risk-perception index.

Table 16. Voluntary Risk Behavior by Risk-Perception Index Score

	Engage in Voluntary Risk Behavior:			
	Yes		No	
Risk-Perception Index Score	n	%	n	%
LOW (1.0-2.0)	13	4.7	33	2.7
MEDIUM (2.01-3.0)	178	63.3	643	52.8
HIGH (3.01-4.0)	90	32.0	541	44.5
Total	281	100.0	1217	100.0

These findings show that people who voluntarily engage in behaviors others think are risky generally rated risks lower than people who do not engage in such behaviors.

Health and safety risk from employment. Well over half (54.1%) of those respondents who said they were employed outside the home (n = 857) said their employment exposed them to health or safety risks. The Atlantic region had the lowest reported employment risk (43.5%) while British Columbia had the highest at 66.2 percent. Men were more likely (59.7%) than women (47.0%) to report exposure to occupational health or safety risks. For the two age categories under age 55, over 55 percent said they face health and safety risks, while only 42.1 percent of those over age 55 make this claim. Those with a high school or lower education reported such risks more often (57.7%) than those with college education (51.2%). The middle income group ($35-50k) reported health and safety risks at a rate 10 percentage points higher (63.2%) than those in a lower category (under $35k = 53.5%) and those in the higher category (over $50k = 51.7%).

It might be assumed that employment risks are both voluntary and imposed; voluntary in the sense that a person can quit a dangerous job, and imposed as part of complex social, psychological, and economic conditions. We wanted to examine whether or not job health safety risks were related to people's general assessment of risks. Table 17 shows a cross-tabulation of how people answered the question about job risks with the ratings of risk on the risk-perception index.

Table 17. Job Health Safety Risk by Risk-Perception Index Score

	Job Health Safety Risks			
	Yes		No	
Risk-Perception Index Score	n	%	n	%
LOW (1.0-2.0)	11	2.4	22	5.5
MEDIUM (2.01-3.0)	281	60.5	235	59.3
HIGH (3.01-4.0)	172	37.1	140	35.2
Total	464	100.0	397	100.0

Those who reported job health and safety risks and those who did not were quite similar in their ratings of the risks as indicated by the Risk-Perception Index. These results can be compared to those who reported voluntary risks, primarily from recreational activities. Those who engaged in voluntary risks tended to score lower on the risk-perception index than those who reported health and safety risks from their jobs.

Health-related employment. Over a fifth of the respondents (22.4%) said they worked in a health-related profession. Regionally, the highest proportion was in the Atlantic

(30.8%) while the Prairies recorded the smallest (17.5%) share. Women (32.1%) were more than twice as likely as men (14.8%) to work in the health professions. Interestingly, those over age 55 had the largest proportion of health profession workers, 32.2 percent. Neither educational nor income categories showed much variation with regard to employment in the health professions.

Self rating of personal health. Respondents were asked to rate their personal health on a four-point scale. For the country as a whole the results were: Excellent, 27.8 percent; Good, 52.5 percent; Fair, 26.8 percent; and Poor, 2.8 percent. Regionally, the Atlantic provinces reported the lowest proportion of "excellent" (20.7%) and the highest proportion (62.6%) of "good" ratings. Quebec (29.2%) and British Columbia (29.4%) reported the greatest proportion of "excellent" ratings. The Prairies, at 19.0 percent, recorded the highest "poor" rating score.

As might be expected, those over age 55 reported the lowest number of "excellent" ratings (20.3%), about ten percentage points below the two younger age groups. The 55 and older group also reported a much higher "poor" rating (25.5%), about 12 percentage points above the other two age groups.

College-educated people were more likely to rate their health as "excellent" (35.1%) than were those with high school or less education (21.6%). The "excellent" rating also increased with household income. Those under $35k were at 21.8 percent, those in the range of $35-50k were at 26.7 percent, and those over $50k increased another ten percentage points to 37.3 percent.

Rating of medical care. The same scale used for rating personal health was also used to rate the medical care available (Excellent, Good, Fair, Poor). A vast majority of

respondents (87.0%) rated the available health care as excellent (40.6%) or good (46.4%). The "excellent" rating was lowest in Quebec (27.7%) and highest in British Columbia (46.1%) and Ontario (47.4%). There was a steady increase in the proportion of "excellent" ratings by age category. For those under 30, the rating of "excellent" was made in 35.2 percent of the cases. Between 30-55 years of age this rating was 40.9 percent; and for over age 55 the rating was 44.2 percent. There were only slight differences by educational category. By income category, more than half (50.2%) of those with incomes over $50k rated medical care as excellent, while those under $50k were 15-18 points lower—about a third of those under $50k said medical care is "excellent."

In considering these two ratings, we were interested in knowing how personal health and available medical care ratings related to each other. These data are shown in Table 18, below.

Table 18. Personal Health Rating by Available Medical Care Rating (n = 1497)

	Personal Health	
Medical Care	Excellent/Good	Fair/Poor
Excellent/Good	1079	225
	72.1%	15.0%
Fair/Poor	124	69
	8.3%	4.6%

The personal health rating was positively correlated with evaluations of the available medical care. At the same time, medical care ratings were consistently higher than personal

health ratings. For example, while 80.4 percent of the respondents rated their own health as good or excellent, 87.1 percent rated the available medical care as good or excellent. Almost a fifth of the sample (19.6%) said their health was only fair or even poor. However, of these people, who presumably would most need current medical care, three quarters rated the care available to them as good or excellent.

Living with disabled or serious health problems. Over a tenth (11.4%) of the respondents reported that they have people living with them who are disabled or have serious health problems. The lowest proportion of such households is reported for Quebec (6.5%) and the highest for Ontario (15.1%). Those under age 55 reported this household condition for about 9.5 percent of the cases while those over age 55 recorded a "yes" answer for 15.3 percent of the households. The largest proportion of such conditions was reported for households under $35k annual income. The two income categories above that figure report 6.9 percent ($35-50k) and 7.6 percent ($50k and over).

Table 19 below shows how people with and without disabled persons or serious health problems in their households rated the available medical care.

Although the households with disabled or serious health problems would be expected to have more contact with the available medical care, at least in the area of the problems referred to, they did not record a significantly different rating of medical care than those households without such problems.

Additional demographic analyses. A snapshot of the relationships between various personal characteristics and risk perception was provided earlier (see, e.g., Figures 3-12). A broader view of the relationship between personal and demographic variables and health-risk

Table 19. Ratings of Available Medical Care by People Living in Households with Disabled or Serious Health Problems

Household with Disabled or Serious Health Problem		Rating of Available Medical Care				
		Excellent	Good	Fair	Poor	
Yes	n	65	81	17	8	171
	row %	38.0	47.4	9.9	4.7	
	col %	10.7	11.7	11.0	21.1	
No	n	544	613	137	30	1324
	row %	41.1	46.3	10.3	2.3	
	col %	89.3	88.3	89.0	78.9	
		609	694	154	38	

$\chi^2 = 3.89$; DF = 3; p = .2746

attitudes and perceptions was obtained by correlating responses to the survey questions with gender (men were coded as 1; women as 2), age, education, and income.

Looking first at correlations with the 38 questions about perceived risk to the Canadian public, gender differences were more important than the other demographic variables. Gender had the highest correlation with perceived risk for 24 of the 38 items. Education was highest for 8 (AIDS, street drugs, malnutrition, bacteria in food, tap water, genetically engineered bacteria, crime and violence, and food irradiation). Income was highest for 3 (mercury fillings, alcohol, bottled water) and age was highest for 3 (pacemakers, contact lenses, alcohol when pregnant). The correlations with gender were all

negative (women had higher perceived risk). When the highest correlations were with age, the correlation was negative for pacemakers and positive for contact lenses and for drinking alcohol when pregnant.

Based upon these results one might expect that responses to the attitude and worldview statements in Tables 3-12 would also correlate more highly with gender than with any of the other demographic variables. This was not the case. Education had the highest correlation for 24 of the 37 statements. Gender was highest for only 6 statements, age for 5, and income for 2.

Compared to persons with less education, those who were college educated

- had more favorable attitudes toward chemicals
- were less likely to see chemical risks as all-or-none matters
- were more likely to reject a fatalistic view of risk
- were more likely to disagree that decisions about health risks should be left to experts or the government
- were less likely to agree that Canadians should be prepared to accept some risks to their health in order to strengthen the economy.

Correlations with gender indicated that women were more likely than men to:

- pay close attention to warning labels
- try to avoid contact with chemicals and chemical products
- express negative attitudes toward chemicals and their safety.

Correlations with age indicated that older people were more likely than younger people to:

- disagree that these are serious environmental health problems in their community
- trust government and experts to take care of health risks
- express fatalist attitudes toward health risks
- try to avoid contact with chemicals and chemical products.

In general, persons with higher income

- had more favorable attitudes toward chemicals and less concern about chemical risks
- were less likely to see risk from chemicals as an all-or-none matter
- were less likely to trust government and experts to take care of health risks
- were less likely to agree that treating people more equally would lead to fewer problems.

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 aware of individually chosen lifestyle risks that are judged serious by health and risk professionals (e.g., cigarette smoking, street drugs, alcohol, AIDS, suntanning). However there was a tendency to see AIDS, drugs, and alcohol as posing much higher risk to society in general

than to oneself and one's family. 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). Perceptions of risk from nuclear power and nuclear waste were particularly high with respect to oneself and one's family and these concerns were not related to one's distance from nuclear power plants.

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 (see, e.g., Kraus et al., 1992, Slovic et al., 1989, 1991). 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 (1983) 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. Younger people were slightly less likely than older people to rate cigarette smoking as a high risk, and a higher percentage of younger persons smoked. Colleged-educated persons perceived higher risk from smoking and were less likely to smoke than were persons having less education.

   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 the broad outline of these results is 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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