

# Long-Range Transport of Information: Are Arctic Residents Getting the Message about Contaminants?

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**ABSTRACT.** Since contaminants were discovered in Arctic human populations well over two decades ago, northern residents have been receiving information about the nature of such contaminants in the environment and their possible effects on human and wildlife health. The information offered has evolved with attempts to improve its sensitivity and appropriateness and to assure northern peoples that traditional foods are still a healthy choice. A survey conducted in four Nunavut and Labrador communities to evaluate the degree to which residents had been exposed to and comprehended information regarding contaminants in country food found that the information has not been as broadly received as expected. In particular, women of childbearing age—a key population group—do not appear to have understood or to be able to recall messages previously disseminated. We argue the enormous effort put into communication on contaminants is not achieving the desired result: the statements and actions of Arctic people do not reflect the importance of the information passed on through communication programs. Characteristics of risk communication, as well as those of Arctic communities, may be influencing how information is received and interpreted. Much recent dissemination of information about country foods in the Canadian Arctic has emphasized the nutritional value of such foods. Should it become necessary to “nuance” this message in the future, regarding certain species that are being consumed or certain population groups with higher risk of contaminant exposure, it appears that more effective communication modes and messages will need to be developed.

**Key words:** environmental contaminants, health, country/traditional foods, risk, communication, comprehension, environmental health, evaluation, women of childbearing age

**RÉSUMÉ.** Depuis que des contaminants ont été découverts chez les populations humaines de l'Arctique il y a plus d'une vingtaine d'années de cela, les habitants du Nord ont reçu de l'information sur la nature de ces contaminants dans l'environnement et sur leurs effets possibles sur la santé de l'être humain et de la faune. Les renseignements publiés ont évolué, en ce sens qu'ils sont maintenant plus pertinents et adéquats. Ces renseignements visent aussi à assurer aux peuples du Nord que leur nourriture traditionnelle constitue toujours un choix sain. Grâce à un sondage réalisé dans quatre collectivités du Nunavut et du Labrador dans le but d'évaluer la mesure dans laquelle les habitants ont été en contact avec de l'information concernant les contaminants se trouvant dans la nourriture du terroir et la mesure dans laquelle ils avaient compris cette information, on a pu déterminer que l'information n'avait pas été reçue à aussi grande échelle qu'escompté. En particulier, les femmes en âge de procréer — un segment clé de la population — ne semblent pas avoir compris les messages diffusés ou ne se rappellent pas les avoir vus. On soutient que les efforts énormes qui sont consacrés à la communication sur les contaminants ne donnent pas les résultats voulus : les déclarations et les gestes des gens de l'Arctique ne reflètent pas l'importance de l'information transmise grâce aux programmes de communication. Les caractéristiques de la communication des risques de même que des collectivités de l'Arctique peuvent exercer une influence sur la manière dont l'information est reçue et interprétée. La dissémination plus récente d'information sur la nourriture du terroir de l'Arctique canadien a mis l'accent sur la valeur nutritive de cette nourriture. Advenant qu'il s'avère nécessaire de « nuancer » ce message à l'avenir, en ce qui a trait à certaines espèces qui sont consommées ou à certains segments de la population qui présentent plus de risques d'entrer en contact avec les contaminants, il semblerait que des modes de communication et des messages plus efficaces devront être mis en œuvre.

**Mots clés :** contaminants environnementaux, santé, nourriture traditionnelle, nourriture du terroir, risques, communication, compréhension, salubrité de l'environnement, évaluation, femmes en âge de procréer

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## INTRODUCTION

The processes that transport contaminants around the globe are becoming much more clearly understood: riverine, oceanic, and primarily atmospheric processes deposit significant amounts of contaminants from southern latitudes into the Arctic environment. Once there, the contaminants bioaccumulate and biomagnify in Arctic wildlife and humans (Van Oostdam et al., 2005). Over a decade of research on this issue in the Arctic has resulted in extensive scientific understanding and additional questions for research. There have been over 10 years of activity delivering information to northern residents on the nature of contaminants, their existence in traditional country foods, and the potential risks and benefits of country food consumption (Van Oostdam et al., 2003). In this paper we report on surveys conducted in four communities, two in Nunavut and two in Labrador, to evaluate the degree to which public information about contaminants has been received, absorbed, interpreted, and acted upon by residents.

We refer here to “contaminants” as a group of chemicals or substances, including persistent organic pollutants (POPs) such as dioxin, PCBs, organochlorine pesticides, and heavy metals. Most of these organic and metal compounds are produced or used in more southern latitudes in industrial processes, as agricultural or other pesticides, or in burning and disposal processes. Finding these contaminants in Arctic environments, wildlife, and humans proves the close interconnectedness of the previously assumed “pristine” Arctic to the rest of the world. We do not discuss radionuclides in this group of “contaminants,” as is sometimes done, because concern about radionuclide exposure via country food consumption has inspired little activity in the Canadian Arctic to date, probably because these substances occur at lower levels (compared to established health guidelines) than some heavy metals and organic contaminants.

In the Arctic, Inuit and other Aboriginal residents have a lifestyle and economy closely linked to the environment and its wildlife. Marine and land mammals, fish, wildfowl, and shellfish have provided food and the basis of many aspects of culture for millennia, and despite social and economic changes over the past few decades, these foods are still very important, both culturally and economically (Van Oostdam et al., 2003; Myers et al., 2004). The contamination of the Arctic environment and food sources has been a serious concern among northern residents (Usher et al., 1995; Poirier and Brooke, 2000; Furgal et al., 2005).

Since the discovery of contaminants in traditional foods and humans in Broughton Island (Qikiqtarjuaq), Nunavut, and Salluit, Nunavik (Arctic Quebec) (Dewailly et al., 1992; Kinloch et al., 1992) and the initiation of research into contaminants in the Arctic, northern communities have received over a decade of information about contaminants and their relation to country food consumption. Like the contaminants themselves, this information about their effects on wildlife and human health has essentially been

released by southern sources, in this case governments, scientists, and Aboriginal political organizations. In recent years, more effort has been put into including representatives of northern communities and Aboriginal organizations in developing research programs and in delivering related communications (Furgal et al., 2003a).

## INFORMATION EXPOSURE

Inuit communities in Canada’s North are typified by a “mixed” economy, in which some wage-paying work is available, and domestic production of food is also important to households. Unemployment is relatively high in the formal sector; some communities have more wage-work available than others. However, in all communities, production and sharing of traditional food are also very important, both for social and cultural reinforcement and for access to nutritious, affordable food (Freeman, 1988; Myers et al., 2005). Various food species are consumed, with some regional variation due to ecosystem differences and cultural preferences. In all regions, country foods make significant contributions to total intake of protein and other essential nutrients by males and females of all ages (Van Oostdam et al., 2005). While Baffin communities consume the largest amount of country foods (by weight) of all Canadian Inuit regions, Labrador communities consume the greatest variety of species from the land and sea (Kuhnlein et al., 2000). Residents of Inuit communities consume, on average, 194–440 g per day of country food, depending upon gender and age (Van Oostdam et al., 2003:12). Country food use varies according to community type, with lower consumption in communities closer to an urban centre than in those in more remote locations (Dewailly et al., 2001).

Communication about contaminants is complicated by several factors. Fundamentally, language capabilities (in English and in local Inuktitut dialects) vary among northern residents, among scientists and officials, and between the two groups. Information releases, especially in the past, were transmitted primarily in English — and in scientific terminology, which was lost on Inuktitut-speaking or non-scientific northern audiences. As well, traditional ecological knowledge (TEK) explains environmental processes and human-animal relations in its own way, while Western (or Southern) science speaks a different language. The language gap is widened by the lack of terminology that is meaningful to both groups. Powell and Leiss (1997:205) comment on the inaccuracy of terminology available in Inuktitut, and the resulting confusion between parasites, disease, garbage, and contaminants. The literal translations of some Inuktitut terms used in northern communities are: “the thing that makes you sick,” “the thing that’s harmful to the environment,” and “the things that are dirty.” The Baffin Regional Health Board (1996) glossary of terms highlights the difficulties in translating between English and Inuktitut. English definitions of “contaminants”

in the glossary include “a substance that makes something else less good than it was before”; “substances that may or may not be harmful to plants, animals, and humans, depending on the type and strength of the particular substance”; and “something poisonous that affects the air, land, water and the food of plants and animals including people.” The two Inuktitut terms given for “contaminant” translate literally into English as “something that can ruin or spoil” and “the product or consequence of something dangerous.” The difficulties impeding precise discussion about contaminants and health are sobering.

The problem is not simply the terminology: the science itself is uncertain and constantly improving, so that new compounds are often identified, and ever smaller amounts can be measured with increasingly precise equipment. As well, regional patterns of contaminant loads are different; western and eastern Arctic communities may be exposed to different contaminants, or different levels of contamination (Fisk et al., 2003). While some contaminants now appear to be decreasing in the Arctic environment, others, including new contaminants such as perfluorinated surfactants (PFOS) and polybrominated diphenyl ethers (PBDE), are increasing, and there is little understanding of what effects these new contaminants may have on health. Furthermore, some persistent organic pollutants (POPs) are likely to have “second-generation effects,” affecting the offspring of those animals and humans exposed to them. Thus, their long-term impact on human health may take longer (and be more difficult) to detect—never mind the difficulty of identifying current impacts of long-term, low-level (chronic) exposure. All of this is complicated by the perception that the information (like the contamination) is coming from primarily southern sources—governments, scientists, popular media, and “others”—sources that some Northerners do not trust, or worse, suspect of trying to undermine traditional Inuit food systems (O’Neil et al., 1997).

Over two decades ago, the first release of information about contaminant levels among Inuit in Broughton Island, Nunavut, and Northern Quebec was reported to have had significant impact. The new knowledge that Inuit women in those communities had surprisingly high levels of contaminants in their bodies, as detected in blood and breast milk samples, came as a shock. As a result, many people shifted away from consumption of traditional foods. This shift produced both economic difficulties, since people who were hunting and fishing less had to purchase more market foods, and a general increase in stress and anxiety among residents (Wheatley and Wheatley, 1981; Kinloch et al., 1992; Wheatley, 1993; Usher et al., 1995). The health impacts associated with these sudden changes were possibly more immediate and visible than any potential long-term effects of contaminants, since such shifts in diet have been associated with increased risk for heart disease, obesity, tooth decay, and diabetes.

In the early 1990s, the federal government, through the Arctic Environmental Strategy (AES) and the Northern

Contaminants Program (NCP), began to work with Aboriginal groups to design information programs for Northerners, in the hope that better information would support individuals’ decision making about healthy consumption of country foods. In the mid-1990s, information programs were re-oriented to tell people that country foods were still the most nutritious for them to eat, although ongoing research was needed to monitor the situation. In 2003, a press release by the Nunavik Regional Board of Health and Social Services (NRBHSS, 2003) advised pregnant women and those of child-bearing age to, when possible, limit consumption of certain foods with high organochlorine contaminant content, such as the fatty portions of long-lived marine species like seals and whales. But it noted that traditional foods also provide nutrients essential to a healthy diet, such as omega-3 fatty acids from fish, protein from low-fat caribou meat, and iron from seal meat and liver. It further noted that some elements from country foods (e.g., selenium from beluga mattak) may even protect against contaminants. Women were advised not to reduce their intake of these latter foods (NRBHSS, 2003).

The various techniques used to disseminate this information have included radio, TV, and newspaper stories; pamphlets and newspaper inserts; posters and videos; community meetings with research, government, and health personnel; and workshops for hunters and health representatives (Furgal et al., 2003a). Much of the NCP information has been text-based, whether in news reports, posters, pamphlets, fact sheets, or school curricula. Even health workers at the local and regional levels, according to informal discussions, still commonly use printed text, fax, or other indirect ways to distribute information amongst themselves and to the public, rather than delivering it face to face. Cost and logistical factors have limited participation in face-to-face workshops and meetings to a few hundred members of the public across the North. Thus, relying solely on these representatives to pass on all the information learned at meetings to their communities has proven ineffective (Mills and Loring, 2000; Furgal et al., 2003b).

Scientists, government, and health officials have been most involved in transmitting health information to Northerners, but wildlife and fishery departments have also been involved, especially initially, because of the focus on wildlife, contaminants, and country food (Furgal et al., 2003a). Thus hunters have often been the primary recipients of information. Community wildlife and health committees have been a key focus of information delivery, with representatives occasionally participating in workshops and meetings. Local, regional, and national Inuit organizations have helped to design and deliver information programs in their respective regions, and local and territorial contaminants committees established by the federal contaminants program represent both government and Inuit organizations. The media in both the north and south have also carried stories about contaminant levels and scientific research findings (Anonymous, 1988;

Schmidt, 2002; CBC News Online, 2002; World Wildlife Fund, 2002). Often, however, such stories are essentially speculative and sensationalist in tone: they neglect the scientific uncertainty and report extreme results about health and environmental effects before they are actually known from scientific studies.

Finally, Inuit have heard the contaminants issue discussed in the national and international media, as well as receiving information in their home communities. Although the latter information may have evolved from alarming, to reassuring, to nuanced, their overall impression may be one of contradictions and complexities. Political messages from Inuit leaders further complicate the picture, reinforcing the value of country food to constituents at home, while expounding the serious impact of contaminants on Inuit and wildlife at international meetings in order to advance policy agendas (Watt-Cloutier, 2003). With Inuit now connected to the global communication community, it is understandable that some may be confused or cynical about these seemingly “mixed messages.”

Effective communication, it has been shown, depends on clearly identifying the target audiences and their characteristics (Powell and Leiss, 1997; Furgal et al., 2005). In this cross-cultural context of communication between scientists, government representatives, southern and northern-based Aboriginal organizations, and northern Aboriginal residents, perception and interpretation of the risk of contaminants in country food are inevitably affected by a number of factors (see Powell and Leiss, 1997; Mulligan et al., 1998; Furgal et al., 2005; Table 1).

All of these factors influence how communications about contaminants in country food occur, and what kinds of information are considered worthwhile. Beyond the community characteristics themselves, the format, length, complexity and other aspects of communication style clearly affect the messages’ effectiveness for northern residents (Lampe et al., 2000). Further complicating communication are the inherent difficulties in communicating about risk, encountered in both northern and southern societies. Concepts of risk are difficult to grasp and sometimes to rationalize (Powell and Leiss, 1997). Personal experience, gender, age, socioeconomic status, and profession are all reported to influence perceptions of risk elsewhere (Vaughan, 1995; Slovic, 2000) and may be significant factors influencing individual perceptions in the North.

The NCP has funded extensive information programs over the past decade, delivered by researchers and by Aboriginal and local or regional health organizations. There is a pressing need to evaluate how well the communication programs have worked in northern communities (Usher et al., 1995; Furgal et al., 2005): do people understand what contaminants are, where they are, and what the implications are for country food consumption and health? Given the goal of the federal program, to help northern peoples make informed decisions, it is important to understand how well these programs have educated the public

about contaminants in country foods, their potential impacts on human health, and the nuances of healthy food choices, as well as what the current level of awareness of these issues is among key groups in the northern population. This evaluation project was funded under the NCP in two key regions — Nunavut and Labrador — that have previously been involved in contaminants research and have received information related to these topics in a variety of forms over a number of years.

## STUDY APPROACH

The study communities were chosen in consultation with territorial and regional contaminants committees, Aboriginal organizations, and of course, the communities themselves. We sought smaller, more traditional communities, as well as larger, more economically diverse communities in each region. Two Nunavut communities, Clyde River and Pond Inlet, and two Labrador communities, Makkovik and Nain, were suggested and agreed to participate in the survey, which was then conducted in 2002–03. Both Nunavut communities were among the six in the region that had received “contaminants tours” — a visiting team of trained personnel who put on workshops and visited schools and hunters and trappers’ organizations in 1999. During these tours, a panel presentation covered where contaminants come from, contaminants in the ecosystem and food chain, their relationship to human health, and ongoing NCP activities. Posters reflecting this information were sent to various organizations in the community (Mills and Loring, 2000). In the Labrador communities, annual reports and updates about contaminants work and recent results from the region had been disseminated through an open-house process by regionally based researchers, along with a front-line training workshop for representatives from communities along the Labrador north coast. In Nunavut, such a training workshop had been held in 1998 in Iqaluit, and representatives from communities throughout the region attended (Furgal et al., 2003b).

Survey questions were designed to reflect information known to have been disseminated through the NCP, as well as assessments of risk comprehension and behavioral change related to that information. The goal of the survey was to capture what people recognized, recalled, and knew about contaminants; how they had learned this information; what risks they perceived these contaminants to pose to wildlife and human health; and what precautions they thought had been or should be taken, either by themselves or by certain population groups, to minimize the risks of exposure to these substances.

The survey began with general questions on concerns about country and store foods and then led into the topic of contaminants. After responding to an open-ended question about the definition of the term “contaminant,” participants were read the definition provided under the NCP, and they were referred back to that definition for

TABLE 1. Some factors that may influence communication in Arctic communities.

*Views on environment and country food*

- The deep involvement of Inuit with the land; humans, land and wildlife are intertwined
- The importance of country food and the processes involved in producing, preparing and sharing it
- Benefits of country food for nutrition, cultural cohesion, affordability

*Language and communication patterns*

- Language gaps both between English and Inuktitut, and among Inuktitut speakers
- Language differences based on region, age, and personal experience
- Relatively high Inuktitut literacy and relatively low English literacy among some Inuit; the opposite among scientists and government officials
- Relationship-based focus within Inuit culture, versus an information-based bias within southern culture; simple transmission of “information” will not ensure it is taken up
- The lack of consistent Inuktitut terminology for scientific concepts; difficulties in translating terminology and concepts in both directions

*Knowledge systems*

- Different knowledge systems; Inuit knowledge is observation-based, using centuries of empirical experience and oral interpretation
- Tendency among Inuit to informal communication and “learning by observation”

*Characteristics of northern communities*

- Some skepticism and distrust of outside “informants”
- Web of informal communication networks
- Lack of access to specialized/expert scientific resources
- Frequent turnover and high workload of community-based staff interfere with uptake and continuity of contaminants information
- Increasing information sources and communication infrastructure
- People may “know” information, but still not act upon it, for a variety of reasons: disbelief/cognitive dissonance, lack of accessible or affordable alternatives, social/cultural pressure or values
- Socioeconomic status, age, and sex can affect communication patterns, risk comprehension, and local capacity to engage in scientific work or discussion

subsequent questions on the issue to ensure a standard use of the concept in responding to questions.

The survey was conducted in each community with randomly selected individuals from three “target groups”: hunters, elders, and women of child-bearing age (Babbie, 1990). These groups, identified by the NCP, have been the focus of many communication efforts in the past (Furgal et al., 2003a). Hunters have often been the target of information campaigns and sometimes also participants in research programs; elders are the most confirmed and longest-term consumers of country food in northern communities, as well as being, along with hunters, a primary source of information about country foods for their community; and women of child-bearing age (18–42 years old, as defined by the NCP) make many of the food decisions for their households and, along with developing fetuses, are perhaps the key concern for contaminant exposure. Using community lists and local assistants, we identified the total population of these three groups in the community and randomly sampled a target quota of 20% of each group (Table 2).

Community lists were obtained from hamlet or town councils or local research offices, and local community research assistants helped the research team to assign residents’ names to the three categories. Individuals were then randomly selected, contacted, and asked to participate in the survey. In Labrador, surveys were conducted either at individuals’ homes or in the local Inuit organization offices, while in Nunavut, we used a central meeting place in the community, such as a Learning Centre, and respondents came to complete the surveys at their convenience. After obtaining participants’ consent, we conducted surveys in the preferred language of each (English or

Inuktitut). In Labrador, surveys were conducted with an interpreter/translator, while in Nunavut, respondents filled out survey forms in their chosen language, with the aid of a local research assistant if desired. The survey used a variety of open-ended and multiple-choice questions and took approximately 25 minutes to complete.

Surveys were then coded with an anonymous alphanumeric code, and those completed in Inuktitut were translated into English on-site by the local interpreter/translator. All responses, qualitative and quantitative, were entered into spreadsheet format, and proportions of responses were compared by chi-square analysis. Yates’ correction was employed when sample sizes were small. We analyzed differences between demographic groups and regions in proportions of responses to questions, and these differences are the focus of this report. All statistical analyses were conducted with the Statistical Analyses System software (SAS Institute Inc., 1996), and statistical significance was set at  $p = 0.05$ . Where chi-square analysis was not possible because responses were not categorized in mutually exclusive groups, we report percentages of responses for descriptive purposes only. Caution is used in reporting some descriptive results in light of small sample sizes that would not otherwise meet the assumptions and requirements for chi-square analysis.

Just before our Nunavut survey work began, some alarmist stories were issued on radio and in newspapers (Schmidt, 2002; CBC News On-line, 2002; World Wildlife Fund, 2002) following release of the most recent Arctic Monitoring and Assessment Program results about contaminant levels in Arctic wildlife and humans. The Nunavut team of our study was interviewed on the way to the communities by Nunavut CBC (in English and Inuktitut

TABLE 2. Community characteristics and target demographic groups.<sup>1</sup>

	Community Population (2001)	Target Demographic Groups and Sample Sizes		
		Women of Child-bearing Age	Elders	Hunters
		Clyde River	785	25
Pond Inlet	1220	21	12	9
Makkovik	385	7	6	11
Nain	1160	26	16	17

<sup>1</sup> Population sources: Nunavut Bureau of Statistics, 2001; Government of Newfoundland and Labrador, n.d.

translation). Interestingly, no survey participants commented on these stories, or reflected them in any way. It appeared that local CBC radio and other media were not penetrating the public consciousness in this case, or that the stories were not deemed important enough to remember or to affect people's perspective at that time.

## RESULTS

### *Understanding of the Word "Contaminant"*

The participants in our survey reported relatively little previous involvement (12% of elders, 15% of women, and 38% of hunters) in workshops, focus groups, or meetings on the topic of environment or food. The majority of respondents said that they had heard about contaminants in their region (69%), with significantly more hunters (82%) reporting this awareness than elders (57%;  $p = 0.016$ ). Similarly important is the number of respondents who reported not having heard this information in their region (31%;  $n = 44$ ) (see Table 3).

According to the NCP, "contaminants" are substances found in places where they should not be, at levels harmful to wildlife and humans. Our survey retained the Inuktitut term for contaminants used in previous NCP information delivered to each region and recommended by local translators (e.g., Baffin Regional Health Board, 1996; L. Kojak, Labrador Inuit Association, pers. comm. 2004).

The concepts of chemical contaminants transmitted through NCP program activities were often not those reported by the survey respondents. Just over 40% of all respondents providing their explanations of the term included substances other than the chemical or natural compounds that would be included in the NCP definition, while 15% of respondents were unable to state what they thought a contaminant was. Women provided definitions related to the "NCP-defined concept" of the term more often than hunters (56.3% vs. 44.6%;  $p = 0.039$ ) or elders (15.8%;  $p < 0.0001$ ), and hunters provided the NCP-related definition more often than elders ( $p = 0.014$ ). Respondents often related the concept to rusted metals, garbage on the land, old batteries, old DEW Line or

TABLE 3. Have you ever heard of contaminants in your region? (% of total response, by demographic group and region)

Region	Elders		Hunters		Women	
	Yes	No	Yes	No	Yes	No
Baffin ( $n = 61$ )	79	21	71	29	53	47
Labrador ( $n = 79$ )	43	57	89	11	77	23

military sites, or garbage, like sealskins left on the beach. The interpretation of the concept by some respondents did include some relationship to air pollution, mercury, PCBs or nuclear waste. Many also related the word to food and health, reflecting "food-safe" information such as dented cans of food, or aged meat.

Sources of contaminants were commonly identified as development, the DEW Line, modern technology, air pollution, garbage, consumer goods, and motor vehicles. Noise, tourists, and scientists were also identified, though by fewer respondents. Elders in Nunavut, and elders and hunters in Labrador, were most likely to point to development on the land as a source of contamination. More Labrador respondents named specific sources, often close to the community, whereas Nunavut respondents were more likely to identify faraway sources. Contaminants were thought to get to Nunavut and Labrador predominantly via air currents, depositing with precipitation, and in Labrador, respondents also identified rivers and sea ice, perhaps reflecting the presence of major rivers there.

When presented with a choice of possible locations where contaminants are found in the Arctic, participants most frequently selected land and marine mammals. In Labrador, especially, fish and birds were also thought to contain contaminants. These patterns may reflect the nature of foods typically eaten in those communities. Among Nunavut respondents, few thought humans (women, children, or men) contained contaminants, though two specifically mentioned the Broughton Island findings in the 1980s; in Labrador, more respondents (predominantly elders and hunters) thought that contaminants could be found in humans.

Later in the survey, respondents were asked specifically whether there are contaminants in country foods (see Fig. 1). Responses tended towards "yes" (52% overall; 38–79% of each demographic group), but significant numbers responded "no" (23.6%) or "maybe" or "don't know" (23.6%). Respondents in Labrador showed much greater certainty, with relatively few (12%,  $n = 9$ ) answering "maybe" or "don't know," vs. 36% in Nunavut. Significantly fewer respondents in Nunavut than in Labrador said there were contaminants in country foods (46% versus 59%;  $p = 0.004$ ). Significantly more hunters in all communities reflected certainty that there are contaminants in country foods: 79% of hunters ( $n = 34$ ) versus 50% of elders ( $p = 0.026$ ) and 38% of women ( $p < 0.0001$ ). Strikingly, about 50% of elders and 62% of women replied "no" or "don't know" to this question.

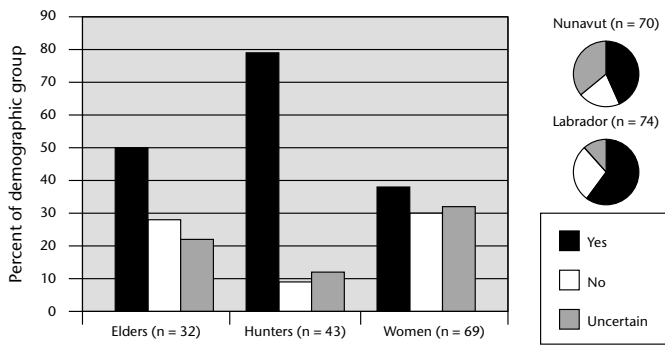


FIG. 1. Are there contaminants in country foods?

*Country Foods Consumption, Preferences, and Concerns*

Virtually all respondents reported that they ate caribou, and almost all ate seal except women in Makkovik, only 43% of whom reported eating seal. Elders in all communities were the most likely to eat a variety of foods, including polar bear, beluga, muktuk, char, other fish, seal, walrus, geese, and ducks. Nunavummiut (Inuit of Nunavut) were most likely to report eating marine mammals, with more elders and hunters reporting this than women. In Labrador, char, other fish, berries, mussels, geese, and ducks were more important, reflecting regional differences in diet. Women in both Nunavut and Labrador were less likely than elders and hunters to eat or have eaten marine mammal products or char.

When participants were asked if they thought they ate more or less country food than they did five years ago, 41% responded less, 21% more, and 38% had not changed the amount they ate. There were no significant differences between demographic groups or regions in these responses. Of those reporting less consumption of country foods, only 4% (n = 3) related this change to concern about contaminants, while 96% reported making the change for other reasons.

Many respondents listed various foods that they did not eat—mussels, polar bear, and beluga predominated slightly—but no clear pattern exists in the data. Taste and seasonality were the leading reasons why these foods were not consumed, but geography and access were important in Clyde River and Nain, and never having tried the food was a common answer in Nain. It is notable that safety and contamination were virtually never given as the reasons people did not eat, or had not eaten, some country foods.

Probed later about whether they had concerns about any country foods they do eat, the majority of respondents said “no” (61%: 60% in Nunavut, 62% in Labrador) (see Fig. 2). In general, more hunters than women reported concerns (55% vs. 30%;  $p = 0.007$ ). Those who did have concerns most commonly mentioned wildlife health, abnormalities, contaminants, and “other.” “Food safety,” another choice, is also interpreted to include abnormalities, spoilage, and other tangible conditions, according to respondents’ explanations.

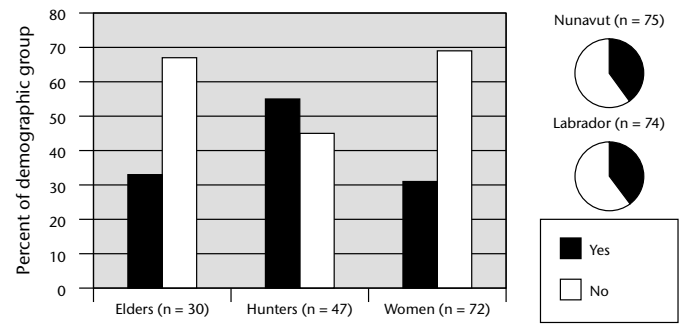


FIG. 2. Are you concerned about any country foods that you eat?

*Adjusting Consumption Because of Contaminants*

Answers to questions about whether some foods contain higher levels of contaminants than others indicated that people are relying on visible clues about contamination. Many replied, for example: “If we notice something wrong, we don’t eat it”; “When we kill animals and look at them, we know if they are bad to eat”; “Wildlife are not contaminated as long as they are not sick.” There was no significant difference between the regions on this question; overall, of the 143 who answered, 21% said there were no differences in contaminant levels between different foods, 40% said there were differences, and 39% were uncertain.

When asked which country foods had higher levels of contaminants in them, 45% of all respondents who answered yes to the previous question reported that marine mammal species had higher levels of contaminants, followed by terrestrial mammals (14%), fish (6%), birds (3%), shellfish (1.5%), and other species (11%).

In recent years, the main messages transmitted to Northerners have been that the benefits of the traditional diet outweigh the risks, but that because of uncertainty about health effects, research will continue on these issues, and furthermore, that some foods are better for specific groups of people, such as women of child-bearing age, than others (ITK, 2004). To populations (e.g., Nunavik and Baffin Island communities) at higher risk because of greater consumption of marine mammal species, the official message was modified in 2003, to the effect that some groups (women of child-bearing age) may need to pay more attention to contaminants and dietary information (NRBHSS, 2003; Van Oostdam et al., 2005). This possibility had been discussed among contaminants committees and in workshops for a few years before that. Our survey (conducted in 2002) attempted to find out whether this increasingly important nuance about contaminants information was already known to survey respondents. In fact, most people (74%) said they knew of no groups who should avoid certain county foods.

In open-ended answers about whether some groups should avoid some country foods, the most common response was “no one-country food is good for you”; some

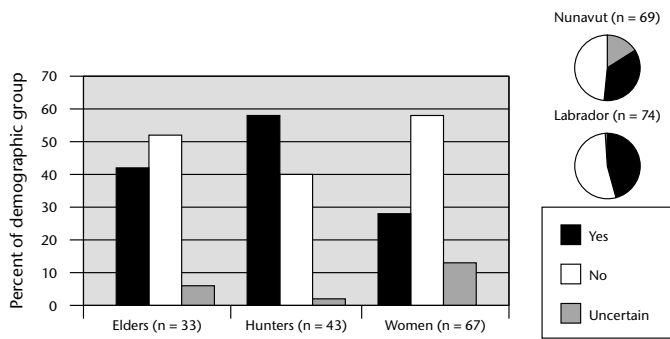


FIG. 3. Are there certain country foods that people should not eat?

suggested “people with food allergies”; a few suggested that “Greenpeace” should avoid it. No one reported that women of child-bearing age or children should avoid country foods.

Asked whether some specific country foods should not be eaten, more than 50% of all respondents reported “no”; however, significantly more hunters (58%) than women (28%) reported that there were some foods to avoid ( $p = 0.004$ ). Regional differences were evident, with a greater proportion of Nunavut residents being uncertain about this issue (16% vs. 1% in Labrador;  $p = 0.006$ ) (see Fig. 3). In the qualitative responses given to explain this question, it was clear that food quality education about dented cans or botulism in aged meat, for instance, had been internalized by people in both regions. Other answers related to seasonality and the toxicity of some foods. Foods to be avoided by some individuals or at certain times included polar bear liver, narwhal brain, shellfish, aged meat and old food, black bear and polar bear, and also “robins and budgies.” Reasons for avoiding these foods included, most commonly, diet and habitat or time of year, but usually no reasons were given.

The predominant attitude was that respondents themselves had not been exposed to contaminants (73%; range among demographic groups 69–78%). Sixteen percent ( $N = 25$ ) of respondents reported that they had been exposed to contaminants, and 9% were unsure. Among those who did report having been exposed, diet (44%), work (22%), general environment (22%), and other sources (11%) were given as the reasons for exposure.

Most people in Nunavut (65%) said they would never change their food habits because of concern about contaminants, while the majority of Labrador respondents said they would make changes (60%;  $p = 0.004$ ). These differences are reflected in individual community responses, with significantly more respondents in Clyde River and Pond Inlet reporting that they would not change than respondents in either Makkovik or Nain.

It was commonly commented that “country food is good for you.” However, among the respondents who said they would change, Nunavummiut included changing what or how much was eaten, cooking food more thoroughly if it

were contaminated, boiling water when needed, or getting checked out at the hospital. In Labrador, several respondents said they would promote clean-up programs or raise their concerns with officials.

### Summary of Results

The results of our survey show that many people had heard about the issue of contaminants in country food (69% overall; 64% in Nunavut and 72% in Labrador), but also that almost one-third had not. Of the demographic groups included in the survey, hunters were the most likely to report having been informed. Eighty-two percent of hunters, 66% of women, and 57% of elders replied that they had heard about contaminants.

Despite activities by the Northern Contaminants Program and other environment and health initiatives, including workshops and extensive media coverage on this issue, less than half (40%) of the participants could define the concept of contaminants in the way it has been discussed or intended by scientific and health communicators. Many survey respondents focused on concrete, visible objects such as garbage, old sealskins, and rusting barrels. Development on the land, air pollution, garbage, and motor vehicles were commonly identified as sources of contaminants, with Labradorimuit (Inuit of Labrador) showing greater certainty in this response than Nunavummiut. Noise, scientists, tourists, modern technology, and consumer goods were also identified as sources or pathways of contamination to the North.

Overall, more survey respondents indicated that contaminants are found in marine and land animals. Fewer reported they are found in birds and fish; fewer still, in the environment; and the smallest number, in humans. However, many elders and women said “no, there are no contaminants in country food” or that they did not know. Significantly more people in Labrador than in Nunavut recognized the reality that contaminants exist in food. Hunters were more likely than the other groups to respond that country foods contain contaminants, and that different foods could contain different levels of contaminants. In Labrador, there seemed to be greater recognition, mostly among elders and hunters, that humans could have contaminants in them. There was very little recognition that some demographic groups might have special dietary considerations regarding country food. Women, who bear children and choose foods for their families, should have the most information about contaminant levels in different country foods and the need to avoid certain foods. Ironically, they seem to have the least awareness of these concerns, while hunters showed greater awareness. The majority of respondents said they had not been exposed to contaminants, and those who said they had, most commonly identified diet as the source.

All respondents reported eating country food (caribou and seal predominantly), and though some foods are not eaten, this avoidance appears to be associated primarily with personal tastes, seasonality, and regional availability.



TABLE 4. Concerns about eating country foods (% of respondents who expressed concerns).

Concerns	Nunavut (n = 22)	Labrador (n = 22)
Quality	4	7
Wildlife health	30	7
Contaminants	17	29
Abnormalities	13	18
Safety	13	11
Other	17	29

Respondents showed a high degree of certainty about the consumption of country foods: most said they had no concerns about the country foods they ate, and that country food is good for you. Women and elders reported concerns less often than hunters. Among respondents who did report concerns, “contaminants” and “other” were most prominently mentioned, followed by “wildlife health,” “abnormalities,” and “safety” (Table 4). Food quality and safety were often explained in terms of spoilage, and it was apparent that people rely on visual clues such as spots or discolorations in meat, blubber, or organs to tell whether foods contain contaminants or are good to eat. Most Nunavummiut said that they would not change anything should they be exposed to contaminants, or as a result of concern about contaminants; the others said they might choose or cook foods differently. Most Labradorimut said they would change something about their personal behaviour or take local political action.

## DISCUSSION

These results may reflect the influence of the factors identified earlier as shaping communication: differing knowledge systems, language and communication patterns, characteristics of northern communities, and views on environment and country food. In terms of evaluating communication effectiveness, we can organize our discussion into three main themes: interpreting the problem, understanding and acting on perceived risk, and judging the effectiveness or impact of past communications.

### *“Interpreting” the Problem (Language/ Concepts)*

Johnson and Covello (1987:viii) explain that risk is socially constructed: societies selectively choose risks for their attention, because of their values, social institutions, nature, and idea of moral behaviour. Risks may be minimized or exaggerated according to the social, cultural, and moral acceptability of the underlying activities. An example is that Americans focus on cancer risks from industrial pollution, even though rates are falling and few cancers can be linked definitively to industrial pollution. Perceptions of risk can also be influenced by socioeconomic status, profession, gender, age, and personal experience (Vaughan, 1995; Slovic, 2000).

Obviously, we cannot assume that Inuit focus on the same risks in the same way as the rest of North American society. In determining what concerns them as a risk, people take into account many factors, such as catastrophic potential, familiarity, voluntariness, and dread—not just mortality rates. Lay people often have difficulty understanding and interpreting probabilistic information, especially when probabilities are small and risks are unfamiliar (Johnson and Covello, 1987). Further influences on risk assessment come from organizational affiliations, community dynamics, institutional context, ideology, and social interactions with family, friends, workers, and neighbours. In this light, it is easy to understand why the contaminants message “heard” by Inuit might be altered from the original: there is little clear evidence of catastrophic, imminent, or visible impact from contamination; it is, as yet, a prediction of scientists, unsubstantiated by peoples’ own observations (and then, interpretation through TEK). Social and cultural values, institutions, and dynamics (not to mention economic realities) reinforce country food harvesting and consumption—perhaps more strongly than contaminants messages undercut them—and so do official messages saying that, on balance, country food is the best.

Survey responses did reflect a general, if somewhat variable, public understanding of contaminants and their spread or presence in the Arctic. Indeed, many definitions of contaminants volunteered by survey participants describe items that are contaminants, in the sense that they are unnatural or outside intrusions upon the environment, and they may even fit the NCP definition of “substances in places they shouldn’t be” and perhaps also “levels harmful to humans and wildlife.” However, many participants’ definitions do not capture the essence of the chemical contamination that has been the focus of environment and human health research and communication, including activities under the NCP, to date. There is some reflection of NCP-type information about sources, pathways, and sinks for contaminants, but it seems that this information is not widely held or understood in any detail. The lack of accepted or broadly used terminology is apparent, but it is also clear that information programs and media may not be succeeding in truly “informing” and educating the public.

There appears to be a regional difference in terms of comprehension of the contaminants issue, as well as in assumptions about personal exposure. While Nunavummiut experienced the early “scares” described above, as well as a longer history of focused research activity on the health and environmental aspects of contamination, Labradorimut have more recently, and more purposefully, tried to balance benefits and risks in communications on these issues (Craig, 1999). Nunavummiut seem to have passed into a phase of minimizing the risk and the likelihood of their exposure, while Labradorimut appear to be acknowledging the risk and consciously acting to reduce it.

People in northern communities seem to be interpreting contaminants messages through the perspective of their

own experiences and observations. Regional experiences of environment and geography or food availability and customs appear to influence perceptions of where contaminants are found, with people focusing more on the foods and environmental processes they are familiar with. However, respondents rely on visible evidence, and in its absence, remain certain that they and their country foods are not affected, and that should food be contaminated, they will be able to avoid it.

While 42% of all respondents reported some concerns about the safety of eating country food, only 23% of those (less than 10% of all respondents) think that there are contaminants in people. There is little awareness or recall of different levels of contaminants in different species or regions, and certainly no awareness of the nuances regarding specific types of foods and consumers. Further, more than half the respondents said that if their country food were contaminated, they would not change their food habits, assuming that they could avoid any problems by visual checking, extra cooking, or hospital check-ups.

It appears that despite a decade of information programs delivered by scientists, governments, community-based officials, Aboriginal organizations, schools, and national and international media, Inuit may not have gained a clear understanding of what chemical contaminants are or the degree of their presence in the Arctic environment, biota, traditional foods, and humans—much less the implications of this information for northern consumers. However, among our survey participants, the Labradorimiut appear more receptive to messages about contaminants than the Nunavummiut.

Reflection of information or “understanding” must be very cautiously interpreted. While the survey reflects responses from participants, it does not divine the underlying causes or rationales for their answers. It may be that people did not receive information in the first place, did not understand it, resisted or ignored it, or forgot it. Thus, while the terms “understanding” or “comprehension” are used here, they raise many questions of their own.

#### *Understanding and Acting Upon Risk*

O’Neil et al. (1996:16) suggest that uncertainty about risk should not be construed as “an indication of ignorance or lack of knowledge.” Among Inuit, there is “a cultural rationality which recognizes that risk is best contained by remaining noncommittal and open to contingencies”: uncertainty indicates “wisdom and respect for the land.” Especially where information is contradictory, people adopt a “wait and see” attitude, which is reflected as more uncertainty. In the face of unclear information, or when leaders fail to respond, people may be unwilling to act. Also, when people have had little exposure to a certain problem or its impact, they tend to be more uncertain about it; in the absence of tangible risk, they remain uncertain.

Illustrating the value of country food to respondents, Nunavummiut were committed to pursuing country food

consumption, and to the idea that they could identify contaminated food and avoid it or cook the contaminants out, whereas Labradorimiut more commonly said they would change their habits should they need to, though most thought they had not been exposed. O’Neil et al. (1996) also found this attitude prevalent in northern Canada; Aboriginal people felt a high level of confidence in their ability to recognize plants or animals that were diseased or affected by contaminants, though they did perceive a higher danger of mercury in fish, possibly because of previous intensive media coverage on that particular topic.

It cannot be assumed that apparent resistance to the messages means ignorance; it might be that many Inuit have resisted the intellectual and behavioural “innovations” required by new knowledge about contaminants in Arctic biota and country food, namely, taking an active role rather than a passive one. In their study of peasant farmers’ uptake of new farming techniques, Lakshman et al. (1978) found that adoption of new techniques requires sufficient information, a favourable attitude, economic means to acquire the innovation, and physical availability of the innovation. For Canadian Inuit, achieving these prerequisites may be impossible. Sufficient and accessible information is debatable, given the uncertainties involved in the science, the unknown outcomes of current contaminant levels, and the difficulties in communicating across linguistic and cultural lines. Favourable attitudes are made unlikely by strong cultural, social, and economic pressure for continued country food use. Many people in Arctic communities lack the economic means to pay for alternative quality foods. And satisfactory imported foods that could substitute for country foods in tasty, nutritious ways may be unavailable, as well as unaffordable (Myers et al., 2004).

#### *The Effectiveness of Communication Programs*

Our results suggest that more than ten years of significant effort to inform the public have produced only a general awareness of contaminants in country foods. Recall of specific contaminants and comprehension of their real nature and implications are still vague among Nunavummiut, and only slightly less so among Labradorimiut. While about half the sample population (which included primary target groups for past information releases) had some familiarity with the concept of chemical contaminants, they have blended this idea with visible phenomena, so that chemical contaminants are conflated with garbage, parasites, and spoiled food.

Survey respondents in Labrador may have grasped more of the contaminants message than those in Nunavut, and there are significant differences between hunters and the other target groups in the survey in knowledge about the presence, levels, and variability of contaminants and their relationship to humans. However, some regional differences may reflect how much research assistants interacted with survey participants, so we must interpret

regional differences in levels of “uncertainty” with caution. Most importantly, these differences signal areas for future clarification.

If one interprets a lack of recall of basic contaminant messages as indicating a lack of awareness and understanding, it appears that to date, women and elders in northern communities have not “got the message” as well as hunters (this will be further analyzed and explored in future work). Hunters were also the most likely to have concerns about country foods, perhaps because in the past, scientific researchers and officials have targeted hunters when reporting to communities on contaminants in wildlife.

Knowing what to do with information is also problematic. Community representatives may not know how to use the information they receive or may lack the confidence to deal with such complicated issues in public information sessions (Mills and Loring, 2000). Several reported feeling inadequately prepared to relay information about contaminants to the community despite involvement in workshops and training sessions. Conversely, it may be that “cultural rationality” prevents people from acting on the information they have received: they know it is difficult or impossible to deal with, given the cultural and economic realities of country food in their communities. Stresses on food security in many communities mean that adaptations to diet, should they be required, might be difficult for some households and not even feasible for others. It may be more realistic to expect people to be receptive to information and understand it when they can take effective action; when a situation is beyond one’s control, these responses may be futile.

As well, the high turnover rate (Furgal et al., 2003b) of health officials, teachers, local wildlife and health committee representatives, and government personnel exacerbates the difficulty of developing local capacity, managing information and transmitting it regularly, and developing trust between researchers and community.

Added to this is an inherent tension in the science involved in this issue. Not only has science brought a variety of complex and sometimes conflicting messages to Inuit, but Inuit may resist western science when traditional knowledge may be more trusted. This attitude is illustrated in people’s statements that they can “see” if something is wrong with the meat; in other words, they know from traditional knowledge and long observation what is “good.” The invisibility of the contaminants presented by researchers and their long-term (maybe second-generation) effects, as well as the uncertain magnitude of their impacts, if any, must make the contaminants message quite suspect to some individuals (O’Neil, 1997; Poirier and Brooke, 2000).

Lack of trust in scientists or government, or perhaps even in political organizations, may hinder full two-way communication. Inuit have heard conflicting messages: contaminants are bad for them, but country food is the best food; they are being “poisoned” by southern pollution, but

are blessed by a strong, nutritious, culturally valued, country food tradition. These messages compound the cognitive dissonance Inuit can be expected to feel when the traditional food sources they have been taught to use, love, and respect since childhood—food that they feel identifies them as Inuit—is characterized as “bad” or “potentially harmful.”

From another perspective, the current state of knowledge among northern Inuit may reflect the dominance of the message given by Inuit organizations and others that “country food is still best.” This message, combined with traditional knowledge and community social values, may be the easiest, most logical, and most important one for people to accept.

Finally, and perhaps most importantly, Inuit face other issues, many of which seem more urgent than long-term chronic exposure to contaminants. Therefore, it may be that the non-specific nature of the contaminants message, combined with the barriers suggested above, has simply put it lower on the priority list. One community health committee member had very little familiarity with the contaminants issue; she and her committee were more focused on dealing with youth suicide.

Therefore, perhaps future communications on this issue need only focus on certain groups within the population, or times when change is strongly recommended to protect human health, rather than aiming for a high level of reception and comprehension in the general population on many aspects of this issue.

Risk communication practices are affected by various factors: the context or framing of an issue or risk; the pathways, materials, language, and partners in information releases; and their iteration and reiteration, complemented by evaluation (Furgal et al., 2005: Fig. 1). Disparate views, lack of trust, and local capacity to engage in information and discussion all challenge communication. According to the model developed by Powell and Leiss (1997), scientists (and government and health officials) are responsible for translating findings, explaining uncertainties, and building trust. The public’s role is to help frame the issue, identify specific concerns, and identify conditions to help the public build capacity to understand and participate.

Ideally, these processes are iterative, and the relationships developed through programs such as the NCP, which has invested significant resources in connecting communities with the research on these issues, have likely advanced the development of trust and capacity (i.e., the pathways for communication). Determining how best to transmit this increasingly complex and technical information has been challenging. The limited formal evaluation of these communication activities to date (e.g., Usher et al., 1995; Furgal et al., 2003a) indicates that greater emphasis has been placed on learning about the “who” of communication, with less attention to the “how” and “what.” The evidence presented here suggests that there is a great deal to learn about all aspects of the process, as well

as a significant need to think critically about modes and methods of engaging communities on these issues.

From our results, in the context of past communication activities, it is becoming apparent that while scientific understanding of contaminants is slowly improving, the lack of certainty about their definitive effects and the consequent information campaigns about the relative merits of the traditional diet, may be influencing Inuit reception, acceptance, and understanding of the information. Public perception of a terrible risk in the early days has been modified to balance the potential risks and merits of country food, with the value of country food still staunchly affirmed. Inuit appear to focus their concern first on wildlife health, then on human health—these concerns need to influence the design of future information campaigns. Factors affecting the efficacy of communications programs may include how information is framed; what pathways are used to send information; who the communicators are; what materials and tools, language, and terminology they use; and the reiteration and evaluation of information uptake.

## CONCLUSIONS

Our goal in this study was to evaluate community recall, awareness, and understanding of messages on contaminants previously released in these regions via various sources and pathways, including the Northern Contaminants Program. Conducting the survey proved a valuable way to engage community members face to face and exchange information on this and related topics. From the results it is clear that there are significant differences between regions and demographic groups in their recall and comprehension of many aspects of the contaminants issue: sources, pathways, sinks, impacts, and implications. Inuit respondents to our survey reflected limited understanding of the “chemical concept” of contaminants and its implications for country food consumption.

It appears that the level of awareness and recall is not proportional to the effort and delivery of information known to date. The Northern Contaminants Program, in its overall objective of supporting informed decision making by individuals, assumes that the information it transmits is important to northern Aboriginal peoples, and that they have taken up this information. Working under those assumptions and goals, we have evaluated aspects of individuals’ levels of “informedness.” Further research may be necessary to define why there has been uneven uptake of contaminants information, as well as how best to continue communications in the future—whether, when, and how to engage the public, and whom to target, regarding scientific findings and related health advice.

Earlier messages, which modified and nuanced concerns about contaminants in order to emphasize the benefits associated with a country food diet, have apparently had the desired effect, but perhaps at the expense of clear

public understanding of the overall issue and its details. Considering that new results from human health studies now suggest that there could be subtle but identifiable second-generation effects of contaminants, new communication programs will have to be carefully designed. It may not matter today that people do not use a government scientific program’s definition of contaminants, or that they “sort of” grasp the idea of contaminants. But it will matter in the future if new results show that people need to change their food habits in order to minimize exposure of sensitive individuals in the population, such as pregnant women and their developing fetuses.

The goals and targets of such communication strategies must be carefully thought out and planned. Although there is the obligation and responsibility to return results to communities engaged in research programs, there is also an ethical responsibility to communicate and educate in ways that are accessible and understandable to the population. One might argue that if current approaches to communication are potentially confusing because of scientific uncertainty and challenges to communicating on this topic, and if the benefits of country foods do outweigh the known risks, then perhaps we should ask: is there a need to undertake extensive communication activities about contaminants in the Arctic environment?

However, if people will need to alter food habits because of new information, then officials and Aboriginal organizations must learn to communicate effectively and ensure that efforts are evaluated and adapted so as to increase the chances that target populations will understand them accurately. In fact, the evaluation processes themselves need to be seen as further opportunities to engage the public and exchange information on these issues, as was experienced in this study.

It will be important to understand fully why people interpret the issue the way they do, how they perceive and understand risk, and what their current food behaviours indicate. We must ask how we can better understand the risk communication and information needs of individuals, and how we can make these issues more understandable for Inuit and other northern groups. Responding to the results given here will require an explicit decision about whether or not to heighten the issue once again. Does communication need to go on in the same manner, or are there better ways of informing and engaging the public on these issues than those previously used? Do we need to be selective about which scientific results are worth transmitting, and what public advice is needed? What kinds of messages are currently better understood and used than others? Different levels of complexity and different modes of appropriate communication may be required for different audiences.

In fact, it appears that the current contaminants issue may challenge the very way in which traditional knowledge systems understand phenomena (and in particular, food safety issues). The issue of chemical contaminants in the North focuses on long-term, chronic exposure and

potentially subtle effects, now reported to affect the next generation. Previously reported and understood “invisible” local food safety issues (e.g., vitaminosis, botulism, etc.) are more short-term, cause-effect, experiential phenomena. It is not surprising that the concept of invisible chemical contaminants—which may have exceptionally complex and subtle effects, and which are difficult to associate in a cause-effect manner with specific personal behaviours—challenges the understanding of scientists and traditional knowledge holders alike.

It appears that concerns about wildlife health are clear, but comprehension about contaminants is not, and neither the relationship of contaminants to food quality nor the vulnerability of women and children is directly acknowledged and accepted. This “disconnect” between concerns and knowledge could limit individuals’ ability to take part in discussion and action about contaminants in country food, whether within the household or at community level.

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