Safe Preparation and Storage of Aboriginal Traditional/Country Foods: A Review

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"The 2004 Justice Haines report on meat safety in Ontario noted that 'While science is an important element in developing food safety policy, it is not the only consideration. Social values, ethics, consumer demands, economic and political considerations will all impact these policy decisions' [1]. Health Canada and the Canadian Food Inspection Agency's Committee on Food Safety and Nutrition states, as one of its general principles, that 'While protection of public health is the primary objective, food policy recommendations will have regard, where appropriate, to economic and other legitimate factors' [2] . Thus, there is a growing recognition that constructs in addition to the biological domain can contribute to developing policy priorities, options, and implementations."

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[2] Health Canada (HC) Health Products and Food Branch. (2003). Terms of Reference for the HC/Canadian Food Inspection Agency (CFIA) Committee on Food Safety and Nutrition. Retrieved from, http://www.hc-sc.gc.ca/food-aliment/friia-raaii/iap-pia/e_terms.html new window

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Chapter 1: Introduction

Aboriginal populations in Canada have a diverse culture and live in a wide range of habitats. Traditionally, these populations obtained their foods by harvesting, hunting and fishing; foods obtained by these methods are referred to as traditional or country foods, in contrast to commercially available foods that are referred to as market foods. Although traditional foods still represent a large portion of the diet in some Aboriginal communities, they are increasingly replaced by market foods. Policymakers and health professionals have recognized the importance and the benefits of traditional foods for Aboriginal populations and efforts are made to encourage Aboriginals to increase the consumption of traditional foods.

It is expected that the preparation and storage methods of traditional foods differ markedly from those used for commercially available food. It is thus important to identify microbiological food safety issues associated with the preparation and storage of traditional/country foods at home, or for community events. The documentation of foodborne illnesses resulting from the consumption of traditional foods may or may not be accompanied with recommendations, or the implementation of measures aimed at reducing these illnesses in the relevant populations. Integrating food safety programs or risk reduction methods that were originally developed for non-Aboriginal populations may or may not be effective. Some adaptation of these programs may be required. The effectiveness of measures or programs aimed at reducing the number of foodborne illnesses should also be documented to assist in the development of future recommendations. The following review was undertaken to identify food safety issues associated with traditional/country foods and to assess the effectiveness of programs aimed at decreasing the number of food borne illnesses originating from these foods.

In this review, the introductory Chapter 1 presents goals and objectives. The research process used to develop this review is explained and a description of the Aboriginal populations of Canada including some statistics on population growth and location. The links between food and health in Aboriginal populations, notably food insecurity, nutrition and the health effects of market foods are briefly covered in Chapter 2. A definition of traditional food, and a description of traditional food preferences for the three Canadian Aboriginal groups, their preparation, storage and consumption methods are provided in Chapter 3. Information on food borne illnesses caused by the consumption of traditional foods is provided in terms of outbreaks and microbial agents posing the highest risks to Aboriginal populations in Chapter 4. Factors influencing the incidence of foodborne infections and intoxications from traditional foods are presented in Chapter 5. Chapter 6 describes programs to prevent foodborne illness from traditional foods while Chapter 7 examines the effectiveness of risk reduction methods such as food safety public education programming and the regulation of food safety in Canada noting the implications for Aboriginal populations. Successful initiatives not necessarily related to food safety *per se* are reported in Chapter 8 with inferences that could be applied to the development of new food safety programs for Aboriginals. The review ends with conclusion and a list of recommendations that are derived from this study, References are provided and presented by chapter. Lists of Tables and Appendices are also part of this report.

1.1 Goals and Objectives

Goals:

- To identify food safety issues associated with the preparation, storage and consumption of traditional foods by the Aboriginal population,
- To review the effectiveness of programs aimed at reducing the number of food borne illnesses originating from traditional food consumption.

Objectives:

- To review the scientific literature for reports on foodborne illnesses caused by the consumption of traditional foods in Canadian Aboriginal communities using electronic databases and Internet search engines,
- To identify preferences for traditional foods in the various Aboriginal populations of Canada,
- To review methods of traditional food preparation and storage,
- To define factors influencing the incidence of food borne infections and intoxications in Aboriginal communities,
- To determine any risk reduction methods relevant to traditional foods
- To evaluate successful initiatives in Aboriginal communities that could be useful for the implementation of food safety programs,
- To make conclusions from the literature review based upon research findings and scientific recommendations
- To make recommendations based upon analysis and identify gaps for further food safety research into traditional foods

1.2: *Research Process and Results*

Adherence to a protocol for a systematic review has been attempted as much as possible to reduce bias and to ensure reliability. The project consists of a literature review and a summary of results relevant to environmental health practice/policy.

The project started with an initial meeting of the seven member investigative team to clarify objectives and deliverables; an internal reporting schedule was developed. All members of the team have experience in researching the literature related to food safety.

The first phase of the project involved the production of a note file containing relevant literature using databases and keywords (Appendix A). The team members were assigned a series of databases and keywords. Manual searching was also included. The « Grey » literature included professional/government association documents. The search was conducted in both English and French.

The note files obtained from the team members were fused into a final reference file where duplications were removed (Appendix B1, Appendix B2). Each team member was then assigned a topic and used the reference file as the starting point for the review. In the original planning phase, the intention was to organize the sections of the review based on the Codex Alimentarius Commission risk assessment steps: hazard identification, hazard characterization, exposure assessment, and risk characterization. However, the team agreed that these themes were not adequate, or feasible for the present review.

The reference file was sorted based on title and abstract. Documents that failed to meet one of the inclusion criteria, or met one of the exclusion criteria, were omitted.

1. Inclusion criteria:
    - Topic: Related to foodborne illness, related to microbiological agents, and interventions to reduce illness/contamination.
    - Population: Aboriginal, Inuit, First Nations and Métis
    - Language: English and French
    - Settings: Traditional/country food preparation at home, food sharing and food service environments.
2. Exclusion criteria:
    - Illness caused by chemical contaminants
    - Chemical contamination of water
    - Health issues such as diabetes, obesity, nutrition unless related to some aspects of food safety
    - Large scale food preparation
    - Non traditional food preparation

Note: Studies in these exclusion categories may be included if a comparison/transfer can be applied to food safety issues (e.g. successful social change practices).

The documents chosen for the review were located, retrieved and assessed for relevance. To be judged as relevant for this review, a study had to:

- Describe Aboriginal communities in Canada,
- Describe issues judged useful to understand the context of this study,
- Describe Canadian Aboriginal traditional foods,
- Report on seroprevalence and outbreaks of foodborne illness associated with traditional foods, organisms involved and characteristics of these organisms,
- Define factors influencing the incidence of food borne infections and intoxications in Aboriginal communities,
- Report on the effectiveness of risk reduction methods in the context of traditional food preparation and storage,
- Report on the effectiveness of risk reduction methods not associated specifically with Aboriginal communities,
- Report on successful initiatives in Aboriginal communities that could be useful for the implementation of food safety programs.

This review provides a description of an intervention to reduce foodborne illness in Aboriginal populations and evaluates its effectiveness using a decrease in the number of foodborne illness outbreaks as evidence of a successful outcome. Due to the infrequent positive confirmation of food borne illness, evaluation of the described intervention may be based on observed improved food handling practices; improved food handling leads to a reduction in foodborne illness incidence.

All documents meeting the relevant criteria were retained for the data extraction phase of the review process. Relevant documents were then used to extract data for review.

A total of 761citations was obtained (Appendix B1) and the numbers retained for each of the topics of this review are presented in Table 1. Additionally, the number of papers dealing with each of the three Aboriginal groups: Inuit, First Nations and Métis were reported.

Very few published articles focussed on the Métis population were retrieved, in contrast to the relative overabundance of papers on Inuit. Papers on Aboriginal people living in urban centers and those living off reserves were also scarce. In a review of health research on Aboriginal populations in Canada, Young (2003) reported that the proportions of papers did not reflect the demographic composition of Aboriginal people with severe under-representation of Métis, urban Aboriginal people and First Nations people not living on reserves, and over-representation of the Inuit.

Table 1: Literature Search by Topic

Topic	Number of references
Demographics: jurisdiction, geographical areas	18
Non-food safety issues: food insecurity, nutrition, health	189
Statistics: health, growth, traditional vs. market foods	16
Traditional foods: description, preparation, storage	52
Hazard identification	220
Factors influencing the incidence of foodborne infections and intoxications	80
Effectiveness of risk reduction methods associated with traditional foods	21
Effectiveness of risk reduction methods not associated with traditional foods	36
Aboriginal food safety initiatives	27
Total number of papers on Inuit	78
Total number of papers on First Nations	42
Total number of papers on Cree	11
Total number of papers on Métis	23
Total number of references used for this review	264
Total number of references in the bibliography	761

Note: The number of references for each topic does not add up to the total number of references as some references may be used in more than one topic.

1. 3: Aboriginal Populations: Definition and Demographics

1.3.1. Defining the Aboriginal Peoples of Canada

According to Indian and Northern Affairs Canada (INAC) (2004), Aboriginal people are the descendants of the original inhabitants of North America. Three groups of Aboriginals, with their own unique heritage, culture and customs, are recognized under the Canadian Constitution: Indians (First Nations), Métis and Inuit.

While the term “Indian” is unpopular with many Aboriginal people and has gradually been replaced with the use of the term “First Nations”, the *Indian Act of Canada* (1985) continues to define Indians as a distinct group of Aboriginal people. There are three legal definitions applied to Indians in Canada: Status Indian, Non-Status Indian and Treaty Indian. Status Indians are registered, or are entitled to be registered, under the *Indian Act* which has several requirements for who may be classified as a Status Indian. Non-Status Indians are not entitled to be registered under the *Indian Act*, possibly because their ancestors were never registered, or because they lost their entitlement under previous provisions of the *Indian Act*. Treaty Indians are First Nations who signed a treaty with the Crown and are, therefore, entitled to certain benefits under the treaty which may include entitlement to reserve lands, hunting, trapping and fishing (Department of Justice Canada, 2008; INAC, 2004,). The First Nations live in 4 distinct areas of Canada: the Pacific coast and mountains; the Plains; the St. Lawrence Valley and the North-east Woodlands, a broad region encompassing the woods near the Atlantic/Maritimes to the treeline in the Arctic (First Nations People of Canada, 2009).

Another Aboriginal group, the Métis, are a diverse group, distinct from the Inuit, First Nations and non-Aboriginal people. They are not covered by the *Indian Act* and therefore, do not receive any Métis-specific benefits from the federal government. They are a mixture of First Nations and European ancestry with a unique culture derived from that mixed ancestry, which may include Scottish, French, Ojibway, and Cree (Department of Justice Canada, 2008; INAC, 2004).

The Inuit are also not specifically covered under the *Indian Act* but still receive certain benefits from the federal government. The Inuit live generally north of the 60th parallel in the Northwest Territories, Nunavut, northern Québec (Nunavik) and Labrador; only about 6% of Inuit live in southern Canada (Standing Senate Committee on Social Affairs, Science and Technology (SSC), 2002).

Aboriginal communities are located in urban, rural and remote locations across Canada. They include the First Nations or Indian Bands, generally located on lands called reserves; Inuit communities located in Nunavut, NWT, Northern Quebec (Nunavik) and Labrador; Métis communities and communities of Aboriginal people (including Métis, non-status Indians, Inuit and First Nations individuals) in cities or towns which are not part of reserves or traditional territories (Indian & Northern Affairs, Canada, 2009).

1.3.2. Demographics

The Aboriginal population in Canada is steadily increasing. In 2006, the number of Aboriginal people, encompassing the Inuit, Métis and First Nations, has surpassed one million and is increasing faster than the non-Aboriginal population. Aboriginals now account for 3.8% of the Canadian population, up from 3.3% in 2001, representing an increase of 46% between 1996 and 2006 compared to 8% for the non-Aboriginal population over the same time period. The fastest gain in population was among the people who identified themselves as Métis, with an increase of 91% since 1996. Comparatively, the First Nations have expanded by 29% and the Inuit by 26% (Statistics Canada, 2008).

Overall, First Nations account for 60% of the total Aboriginal population in Canada, followed by the Métis at 33% and the Inuit at 4% (Statistics Canada, 2008). There are over 600 First Nations communities across Canada, comprising over 50 nations or cultural groups and more than 50 languages (Statistics Canada, 2008). Only 5% of First Nations communities have more than 2,000 residents, and approximately 63% have fewer than 500. Inuit communities, most with fewer than 1,000 residents, share one common language, Inuktitut, but the dialects may change from one region to another. The Métis also have their own distinct language known as Michif, which is a mixture of French, English, Cree and Ojibway (Statistics Canada, 2008; SSC, 2002).

The Aboriginal population is distributed heavily between Ontario and the four western provinces; 8 of every 10 Aboriginal people live in one of these five provinces. A smaller population lives in Québec; less than 25,000 live in the other provinces and the three territories. Aboriginal people make up the majority of the territories' and Prairie provinces' population. The Aboriginal people living in Nunavut represent 85% of the territory's population, 50% of the Northwest Territories' population, and 25% of the Yukon. Aboriginals account for 15% of Manitoba's and Saskatchewan's population and 6% of Alberta's population (Statistics Canada, 2008).

Aboriginals comprise a substantial portion of the northern population of Canada. Statistics Canada reported there were 50,485 Inuit in Canada in 2006, with about one-fifth living outside of these regions, mostly outside the Arctic in urban areas of southern Canada (Statistics Canada, 2008). The Inuit lived mainly in Nunatsiavut, the region along the northern coast of Labrador (4%); Nunavik, primarily north of the 55th parallel in Quebec (19%), the territory of Nunavut (50%); and, in the Inuvialuit region of the northwestern part of the Northwest Territories (6%).In 2006, Statistics Canada reported that 87% of all Métis lived in the West and Ontario. An estimated 7% of the Métis lived in Quebec, 5% in Atlantic Canada and the remainder lived in one of the threee Territories. In 2006, 69% lived in urban areas. For the First Nations, Statistics Canada, reports that about 40% live on reserves (Statistics Canada, 2008). There are an estimated 698,025 people who identify as First Nations.

Many Aboriginal people are moving to more urban locations, with the urban Aboriginal population increasing by 55% between 1981 and 1991, compared to only an 11%

increase in the population of urban, non-Aboriginal residents. It has been estimated that this urban population of Aboriginal people will increase from 320,000 in 1991 to 457,000 in 2016, an increase of 43% in 25 years (SSC, 2002).

The Aboriginal population is not only growing at a rate two times as fast as the rest of the Canadian population, it also has a much younger population. A large percentage of the Aboriginal people belong to the groups most at risk for foodborne illness: infants, young children, pregnant women and the elderly. In 2006, the median age of Aboriginals was 26 years, compared with 40 years of age for the rest of Canada. Children and youths under the age of 24 represented 48% of the Aboriginal population in 2006 compared to 31% for the non-Aboriginal population. Approximately 9% and 10% were under the age of four and aged five to nine years, respectively. Although the number of Aboriginal seniors is small, it doubled between 1996 and 2006. The senior population of non-Aboriginal Canadian increased only by 24% over the same period (Statistics Canada, 2008).

Tables 1 provides details on the number and percentage of the Canadian population reporting Aboriginal identity while Table 2 gives a breakdown according to Aboriginal grouping for Northern Canada.

Table 2 Number and percentage of population reporting Aboriginal identity, Canada, provinces and territories, 2006

Provinces and territories	**Number**	**Percentage**
Canada	1,172,790	100
Newfoundland and Labrador	23,450	2
Prince Edward Island	1,730	0.1
Nova Scotia	24,175	2
New Brunswick	17, 655	2
Quebec	108,430	9
Ontario	242,495	21
Manitoba	175,395	15
Saskatchewan	141,890	12
Alberta	188,365	16
British Columbia	196,075	17
Yukon Territory	7,580	0.6
Northwest Territories	20,635	2
Nunavut	24,920	2

Source: Statistics Canada, Census of Population, 2006.

Table 3 Aboriginal Population of northern Canada

Location	First Nations	Inuit	Métis	Total (Aboriginal and non-Aboriginal)
Nunavut	100	24,640	130	29,325
Northwest Territories	12,640	4,165	3,585	41,055
Yukon	6,280	255	800	30,195
Nunavik	45	9,565	15	10,570
Nunatsiavut	0	2,160	35	2,410

Source: Adapted from Statistics Canada, Census of Population, 2006.

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Chapter 1

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Chapter 2: The Links Between Food & Health in Aboriginal Populations

While the First Nations, Inuit and Métis communities are exceptionally diverse culturally, linguistically, socially, economically, and environmentally, there is a remarkable similarity in the perception of health and wellbeing. Health as defined by the Aboriginal populations is holistic, a complex web, encompassing physical, mental, emotional and spiritual needs as well as spiritual, historical, sociological, cultural, economic and environmental factors (Adelson, 2000; Blanchet, Dewailly, Ayotte, Bruneau, Receveur & Holub, 2000; Waldram, Herring & Young, 2006). Aboriginal people believe that there are connections between the land/environment, animal well being and human health. If the land is not healthy, those eating traditional foods from the land and sea, also cannot be healthy. Safe food and environmental sustainability are often linked in the context of food security (Damman, Eide & Kuhnlein, 2008). Traditional foods are a key to Aboriginal cultural identity, health and survival, both historically and today (Adelson,2000; Power, 2008).

Many Aboriginal health issues are related, either directly or indirectly, to food. In this chapter, several food-related health issues are identified. Food insecurity is briefly described and the benefits of traditional food examined. Changes to the traditional native diet and the health impact of market foods upon Aboriginal populations are briefly discussed with the intent of providing an understanding of the links between health and food. Two additional food-health issues are infections/microbiological contamination and chemical contamination. The former is dealt with in Chapter 4 and the latter is not covered in this review since it has been extensively discussed elsewhere.

2.1. Food Insecurity

The issue of food insecurity is a complex problem and will be examined briefly since The concept and definition of food insecurity has evolved over time. Food insecurity exists when people do not have adequate access to affordable, high quality food (Food and Agriculture Organization of the United Nations [FAO], 2003). Cultural food security is a newer factor, defined by examining levels of traditional food knowledge, access to traditional food systems and the safety of traditional food (Power, 2008).

A Canadian Community Health Survey on nutrition status nation-wide was conducted in 2004 (Agriculture & Agri-Food Canada, 2006). 2.3 million Canadians were described as food insecure and food insecurity and hunger face 715, 616 Canadians, or 2.3% of the population. Poverty is a major factor in the incidence of food insecurity. Persons most vulnerable to food insecurity are those living in low-income households, including single-parent mothers, individuals with mental or physical disabilities, or chronic illness, and the Aboriginal population (Agriculture and Agri-Food Canada, 2006).

The food security of Canada's Aboriginal population is far below that of most Canadians, despite several initiatives to improve their access to safe and nutritious foods. There are several reasons for the high level of food insecurity in the Aboriginal population, including low incomes, high risk of chemical contaminants in traditional Aboriginal foods due to pollution, poor access to fresh, wholesome produce and other perishable foods due to inappropriate shipping and handling, and disruptions to food access caused by interruption in shipping or changes in migratory patterns of animals (Agriculture and Agri-Food Canada, 2006).

While 71% of the Inuit living in the Arctic were involved in harvesting country foods in 2000, perishable items such as milk and fresh vegetables must still be transported from the south. The long transportation process often results in food that is not fresh and is exorbitantly costly for commercial or 'market' foods. In the 2001 Aboriginal Peoples Survey, 33% of the adult Inuit in the Arctic said that they were dissatisfied with the freshness of perishable foods at their local store. This number increased to 45% for adult Inuit in the Inuvialuit and Labrador regions, while 32% of adult Inuit in Nunavut and 23% in Nunavik were dissatisfied with food freshness (Tait, 2007).

Several initiatives, which will be discussed in Chapter 8, have been initiated by the Canadian government to improve the food security of Canada's Aboriginal population.

2.2 Benefits of Traditional Food

Traditional food is culturally identified food from both plant and animal sources, harvested from the local environment, versus market food, which is commercial food transported from the south (Receveur, Boulay, & Kuhnlein, 1997). Practices regarding harvesting, preserving and preparing food reinforce indigenous culture and identity (Dewailly & Nieboer, 2005; Damman, Eide & Kuhnlein, 2008).

Most of the research studies of traditional food use are conducted in remote and rural areas, i.e. the North West Territories, Nunavut and British Columbia. The diet of the First Nations group has been more extensively studied. There are few data specifically related to diet of the Inuit and Métis populations, despite the fact that these populations have just as many risk factors for disease development as First Nations. Research with urban Aboriginal groups is sparse.

History shows that the traditional diet before European colonization was healthy, high in, proteins, fats and nutrients. Tribes moved to new hunting grounds if food became scarce and/or to permit the land to lay fallow periodically Native diets varied by seasonal availability, geographic location and preferences varied by Aboriginal grouping (Berkes & Farkas, 1978). All food was obtained from land and water. Plant foods (berries, leafy plants and roots) complemented the animal foods providing the major source of energy (Kuhnlein, 1992). Traditional diet practices maintained an active lifestyle and native cultural identity (Berkes & Farkas, 1978; Kuhnlein, 1992; Dewailly & Nieboer, 2005). Research of dietary patterns of Canadian Aboriginal communities demonstrates the high quality of foods from animal and plant species (Kuhnlein, Receveur, soueida & Egeland, 2004). Nutritional deficiency was avoided by eating all parts of the animal, e.g. vitamins A & D were supplied by animal liver, fish and marine mammal fat, animal products provided iron and zinc; raw meat, stomach contents of caribou, Plants and berries provided vitamin C (Blanchet, Dewailly, Ayotte, Bruneau, Receveur & Holub, 2000). Despite concerns over levels of environmental contaminants, traditional (country) foods are nutritionally and culturally important to the Aboriginal population of Canada.

Results from the EAGLE (***E***ffects on ***A***boriginals from the ***G***reat *L*akes ***E***nvironment) health survey conducted in 2001 indicated that traditional food consumption is related to age, gender and geographical regions (Boucher, Davies, Hanley, & Holden, 2001). In general, traditional foods represent a larger percentage of the diet the further north in latitude a community is located and while consumption by Arctic populations tends to be highest between September and November, and lowest between February and April, total community consumption varies from 6% to 40% depending on remoteness of location and proximity to a commercial centre. Consumption may also be related to community characteristics such as population size, road access and availability of affordable market foods, proximity to animal migration routes and prevalent hunting and fishing practices (Kuhnlein & Receveur, 2007).

A recent survey of food consumption of Yukon First Nations, Dene/Métis and Inuit, reported that daily dietary energy is supplied by 17%, 21% and 28% of traditional food sources, respectively (Kuhnlein & Receveur, 2007a). There is a declining level of participation in country food harvesting, decreasing from 90% to 74% for Inuit men aged 17 to 24 from 2001 to 2006 (Tait, 2007).

While traditional foods make up only 6 to 40% of the diet in many communities; these foods significantly contribute to the nutrient value of the total diet, particularly in iron, zinc and protein. Vitamin D, Vitamin E, and folic acid appear to be deficient when a diet consists solely of traditional food (Kuhnlein & Receveur, 2007a; Blanchet et al., 2000; Receveur et al. 1997). Market foods are typically low in several nutrients, including protein, iron, zinc, copper, magnesium and phosphorus. These foods contribute more fat, saturated fat and carbohydrate, particularly in the form of sucrose, to the overall diet (Kuhnlein et al., 2004). Calcium and Vitamin A intake appears to be deficient, regardless of food source but traditional foods remain extremely important for overall diet quality when market food is consumed as a major source of energy (Receveur et al. 1997).

2.3 Loss of Traditional Food Use

Aboriginal people in Canada are undergoing dietary change. They are using fewer species and lower overall quantities of local traditional foods and more imported market food (Kuhnlein & Chan, 2000). The change from self-reliant hunting, gathering and trapping in ‘the country’ to a sedentary village life (known as ‘sedentarisation’) has been associated with a marked decline in physical and mental health (Samson & Pretty, 2006). A lack of access to traditional foods causes a reliance on market foods. These dietary changes are threatening the knowledge required for maintenance of the traditional food system (Kuhnlein, Souida, & Receveur, 1996).

Reasons for an increased reliance on market foods include relocation into large urban centres, decreased access to land, fewer skills and less time available for harvesting due to employment, depletion of game, concern for environmental contaminants, costs of or restrictions on hunting and more readily available technology such as refrigeration and freezing (Trifinopoulos, Kuhnlein & Receveur, 1998; Doran, 2004). During the transition to a greater use of market foods, local knowledge and skills associated with collection and preparation of traditional foods are reduced and may be lost (Doran, 2004). It is important in terms of food safety that traditional preserving techniques are passed down to the next generation. People who have grown up eating traditional foods want to pass this knowledge to their children but often do not have the time to show traditional values or go out on the land to gather food for sustenance (British Columbia (BC) First Nations Head Start, 2003). It is a different economy with many working. There is often a lack of resource people in families and communities.

The British Columbia (BC) Head Start Program incorporates traditional foods into the menus at child care centres. Children learned how to traditionally smoke deer jerky (BC First Nations Head Start, 2003). Knowledge of the process and how to build the smoker is provided by a band elder; staff teach many precautionary steps to prevent foodborne illness.

Traditional foods are increasingly replaced by purchased (market) foods that often have low nutrient density. Twenty-four hour food recall studies in Arctic First Nations, Dene/Métis, and Inuit have shown that market foods provide a large portion of the energy in the diet of Aboriginals. Tea, sugar, white bread, biscuits, lard, crystal powdered drinks, instant coffee, evaporated milk, corn flakes, soft drinks such as Coca-Cola, butter and eggs are among the most frequently consumed Arctic market foods, in order by weight (Kuhnlein & Receveur, 2007).

There is no evidence that traditional foods are more likely to cause foodborne illness or intoxication, i.e. is riskier to consume than market foods. No studies describe foodborne illness from the consumption of market foods, thus, there is no evidence comparing foodborne illness from market foods to foodborne illness from traditional foods. Aboriginal people can suffer from foodborne illness and intoxication from market foods.

Although country foods remain an important source of nutrients for many Aboriginal communities, over the past 50 years, consumption of these traditional foods has decreased in many areas, with a coinciding increase in the intake of commercial (market) foods. Market foods such as fresh vegetables,fruits, dairy products are useful to supplement nutrients although market foods are costly and not always preferred foods, particularly for older natives (Kuhnlein, 1992; Dewailly & Nieboer, 2005; Dietitians of Canada, 2005). For many natives, market foods are increasingly providing empty calories. Although the effect of market food on the health of rural Indigenous Peoples remains controversial, a poor quality diet is associated with increasing obesity, diabetes and glucose intolerance (Dietitians of Canada, 2005).

2.4 Health Impact of a Switch to Market Foods

The decrease in traditional food use, food insecurity, difficulties in preserving and transferring knowledge of traditional hunting, preserving and preparation techniques in addition to a lack of knowledge and skill in combining traditional and market foods has major consequences for health. The increase in market food consumption is linked to declining health status of Indigenous Canadians. A diet of processed foods high in sugar and salt increases the incidence of obesity, diabetes and cardiovascular disease in the Aboriginal population. Aboriginal people have very high rates of obesity that have been linked to associated problems with chronic diseases and cardiovascular disease. In Canada, excessive pediatric obesity has been reported in the Sandy Lake Oji-Cree, James Bay Cree and the Kahnawake Mohawk communities (Gittelsohn, Wolever, Harris, Harris-Giraldo, Hanley & Zinman, 1997). Diabetes in the adult First Nations and Inuit population is three to five times higher than in other Canadians. The incidence of infant of iron deficiency anemia are higher and rates of overweight and obesity are at least twice as high. There is evidence of poor intakes of key nutrients required for good health including iron, calcium, folate and vitamins A and D (Doran, 2004; Kuhnlein et al., 2004). Cardiovascular disease occurs two to three times more frequently among First Nations people when compared to the general Canadian population. This is due to the higher occurrence of risk factors for cardiovascular disease in First Nations communities such as high blood pressure, diabetes, obesity and smoking (Dietitians of Canada, 2005).

Researchers believe that the traditional Aboriginal diet, combined with the active lifestyle needed to hunt and forage, is protective for chronic disease (Damman, Eide & Kuhnlein, 2008). The health effects of this transition on the nutrition of the Aboriginal population are not fully known, however, a poor quality diet has long been associated with increasing obesity, diabetes and glucose intolerance in many North American Indigenous populations (Kuhnlein et al., 2004). Alaskan Natives who had impaired glucose tolerance or Type II diabetes were significantly more overweight and reported a higher consumption of non-traditional foods than others (Gittelsohn, et al., 1997). Research has demonstrated that Canadian Aboriginals behave in a similar pattern; the reduction of traditional food consumption appears to play a key role in the increased incidence of diabetes in this population. In 1992, the Sandy Lake Health and Diabetes Project was initiated in Sandy Lake, Ontario, the location of a remote Ojibwa-Cree community. The age-standardized rate of Type II diabetes was 26.1% in this community, the highest reported in a Canadian population and the third highest reported worldwide. The diet in this population was typical of North America, high in saturated fat, cholesterol and simple sugars, and high in glycemic index, although it was lower in dietary fibre than is typical (Gittelsohn et al., 1997).

Type II diabetes is characterized by insulin resistance, relative insulin deficiency and hyperglycemia, while Type I is an autoimmune disease characterized by destruction of insulin-producing beta cells. Approximately 90% of people with diabetes have Type II which typically has a later onset than Type I. Incidence of Aboriginal children as young as 5 and 8 years of age, diagnosed with Type II diabetes is increasing (Health Canada, 2005). High consumption of saturated fats and simple sugars and low consumption of fibre, coupled with a decrease in physical activity all appear to be linked to the high incidence of diabetes, obesity and other chronic diseases in this population (Gittelsohn et al. 1997).

In 1996-1997, 17% of Yukon and 30% of Inuit women were obese compared to 12% of the Canadian female population. Similar data for Yukon men (10%) were slightly lower than the all-Canadian male population at 11%; however, Inuit men were at 18% (Kuhnlein et al., 2004). The Aboriginal Peoples Survey conducted in 1991 provided data on the incidence of diabetes among all Canadian Aboriginal people (Health Canada, 2005). According to this survey, the highest incidence of diabetes was among the First Nations people, with a rate of 6.4% (Health Canada, 2005). A higher rate occurred in those living on-reserve (8.5%) versus off-reserve (5.5%), possibly because of a greater access to market foods. The prevalence in the Métis population was 5.5%, which, while lower than that of the First Nations, was still considerably higher than the national rate at that time (3.1%) (Health Canada,2005). Inuit people appear to be the only exception, showing a diabetes incidence of 1.9% at the time of this survey. A more recent survey conducted in 1999 showed obesity prevalence in the Inuit people was 20% , much higher than the incidence found in 1991. This 1999 survey indicated that of the Labrador Inuit studied, 36% of women and 26% of men were overweight, indicating that risk factors for diabetes such as poor nutrition, a lack of physical activity and obesity exist in this population (Health Canada, 2005).

It is expected that these figures significantly underestimate the prevalence of obesity and diabetes in Canada’s Aboriginal people today. Existing data are often the result of self-reported national surveys which can lead to errors and discrepancies. While much of the health research to date has been focused on the incidence of diabetes and obesity in Aboriginal populations, there are several more chronic conditions and diseases that are highly prevalent in these populations, including cardiovascular disease (CVD) and respiratory illnesses such as chronic bronchitis and asthma (Health Canada, 2005).

There are additional health issues influenced directly or indirectly by the food system, dietary intake and nutrient availability. One study that screened for anemia identified a prevalence rate of 31.9% among children living in the Quebec Cree communities of James Bay (Willows, Morel & Gray-Donald, 2000). A study in northwestern Ontario showed that children 6 to 24 months were at greatest risk of anemia with prevalences of 52 to 80% (Whalen, Caulfield & Harris, 1997). A change from traditional eating and breastfeeding patterns has been implicated as a contributing factor in the development of anemia (Whalen et al., 1997). The change from self-reliant hunting, gathering and trapping in ‘the country’ to sedentary village life has been associated with a marked decline in physical and mental health (Samson & Pretty, 2006). The change to less traditional foods is also mentioned as a cause of increased dental caries and tooth loss in First Nations associated strongly with diets high in sugars, refined foods, saturated fats and low fibre (Kuhnlein & Receveur, 2007; Kuhnlein et al, 1996).

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Chapter 2

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Chapter 3: Traditional (Country) Food

3.1. Introduction

From time immemorial, the land has fed the Aboriginal people. They knew which plants to harvest for medicine, which ones would nourish them through the winter, where to find the best root plants, and where to pick the best berries. Indigenous people have always lived their lives around the food cycles of the seasons. Until very recently, many of the Aboriginal people followed the migration of the animals, and moved across the land and along its waterways depending on the season. It is only in the last fifty years that most people have come to settle in more permanent communities. However, the traditional lifestyle based upon traditional pursuits continues to be important. Hunting, fishing and trapping continue as important activities for native Canadians, providing a livelihood and food from the land, water and air.

The vast differences of the climate across Canada, the ecology, vegetation, fauna and landforms define survival and the foods that are available to indigenous people in Canada. Adaptability is the essential component for survival in these demanding environments, determining what is eaten by what is available. Similarly food preparation and storage methods are traditionally determined by where natives lived. The Aboriginals have learned to use the available resources to provide food and other necessities. The native people have learned to adapt to the environment and use what it provides for survival.

By definition, traditional food is food that is both plant and animal and is harvested from the local environment and culturally accepted, as opposed to market food that is commercial and shipped from the South (Kuhnlein &Receveur, 1996; Receveur, Boulay & Kuhnlein, 1997). Traditional food sources are unique and almost always culturally and geographically specific (Kuhnlein, Receveur, Soueida & Egeland, 2004). Dependable access to market foods, i.e. fresh fruits and vegetables is only recently available to the remote and rural native communities via the Government of Canada Food Mail program. Traditional foods provide all necessary nutrients. Depending on where they live, the season and the availability of plants, fish and wildlife, the kinds of traditional foods that people eat vary. The healthiest diet for Aboriginals is still one that includes traditional food (Kuhnlein et al., 2004).

There have been changes over the years to what is considered a traditional diet:
1. Foods eaten pre-contact with Europeans, food that is grown, gathered, fished, hunted or trapped
2. Foods introduced by Europeans and adapted for traditional diet e.g. bannock, meat pies
3. Market or store-bought foods.

This chapter will concentrate upon harvested foods that make up the traditional diet and known food preparation methods, arranged by the major Aboriginal groups. Next, food storage and preparation methods are presented, followed by a discussion of the food safety issues with traditional food preparation, storage and food sharing. Finally, a brief discussion of foods introduced by Europeans and adapted by the natives and market foods is included.

3.2 Traditional Aboriginal foods

The cultural differences, linked to distinct geographical locations and regional growing seasons, determined how these various peoples lived, what they ate and how they cooked. Sources of traditional foods include large game such as deer, buffalo, wild sheep and goat, antelope, moose, caribou and bear; small game such as beaver, rabbit, squirrel, skunk, muskrat and raccoon, wild birds such as ptarmigan, ducks and geese; many varieties of fish; reptiles such as snakes, lizards and turtles, insects and eggs from a variety of species. For natives living near the sea, polar bear and seals (e.g. ringed and harp), whales (e.g. beluga, narwhal and bowhead), and/or walrus are part of the diet. Plant foods where available are enjoyed and provide additional vitamins. For communities where green plant foods are unavailable, parts of animals such as caribou, whale and seal are sources of vitamins.

More than 250 species of plants and animals are part of the rich framework of traditional food systems of the First Nations, Métis and Inuit in Canada. According to Batal, Gray-Donald, Kuhnlein, & Reveveur, (2005), reliance on traditional food is still high in eight Denedeh (western portion of the Northwest Territories), and 10 Yukon communities. Seventeen different land animal species, three species of birds and two species of plants were consumed in the Denendeh communities. Twenty different land animal species, one species of bird and seven species of plants were consumed in the Yukon communities. Large land mammals were most commonly consumed, with moose the number one traditional food item.

Several authors have surveyed Native communities for traditional food items. The most frequently mentioned traditional food items are caribou, moose, salmon, whitefish, grayling, trout, coney, scoter duck, cisco, walleye, spruce hen, pike, ptarmigan, Arctic char, Canada goose, muskox, eider duck, crowberry, beluga muktuk, ringed seal, narwhal muktuk, partridge, and cloudberry (Van Oostdam, Donaldson, Feeley, Tremblay, Arnold, Ayotte et al., 2003). Among Inuit from the Baffin region, favourite foods include: caribou (especially the meat, fat, stomach and stomach contents), seal (especially the meat, liver and heart), muktuk from beluga and narwhal, Arctic char and walrus meat (Van Oostdam et al., 2003). Among Dene/Métis participants, caribou, moose, whitefish and rabbit were the most liked traditional foods. Within the Yukon First Nations group, caribou, moose, rabbit and salmon are among the favourites (Lambden, Receveur, & Kuhnlein, 2007).

Regional differences in the use of traditional foods reflect the diversity of ecosystems and cultural preferences across Canada. Traditional foods vary between communities depending on the availability of natural resources, climatic conditions and seasonal changes. Traditional foods are also associated with technological skills that form the identity of the ethnic group (Van Oostdam, Gilman, Dewailly, Usher. Wheatley & Kuhnlein et al., 1999). Hunting patterns have been examined particularly in northern communities by the Canadian government mainly to assess Aboriginal land claims and the impact of development projects. Thus, knowledge of Native diets is not comprehensive. Additionally, cultural traditions and taste preferences have an impact upon traditional/country food choices. Taste preference for traditional food has been documented for Aboriginal people (Willows, 2005).

In 2001, Statistics Canada reported that country food represented about half of the meat or fish eaten in 78% of Inuit households in Nunavik; 73% in Nunavut; 70% in the Inuvialuit region and 56% of Inuit households in Labrador. Of Inuit men, aged 45-54, 90% were involved in country food harvesting such as caribou, whales, seals, arctic char and berries (Statistics Canada, 2008). Aboriginal men typically consume more traditional food than women and not surprisingly, more country food appears to be harvested and consumed by the older generations. Younger generations tend to prefer commercial, market foods, even when traditional food is freely available (Kuhnlein & Receveur, 2007).

The results of a survey of five traditional foods most often consumed by Inuit, Dene and Métis and Yukon First Nations communities are presented in Table 4.

Table 4: Annual Average Days of Consumption for the Traditional Foods most often Consumed in Certain Aboriginal Geographical Areas.

Aboriginal Group	Region	Food Item and Yearly Average of Days per Week				
First Nations	Yukon	Moose 1.6	Caribou 0.7	Salmon 0.6	Grayling 0.4	Trout 0.1
Dene/Métis	Gwich'in	Caribou 3.2	Whitefish 1.3	Coney 0.5	Moose 0.3	Scoter 0.2
	Sahtu	Caribou 2.5	Moose 1.0	Trout 0.8	Whitefish 0.7	Cisco 0.3
	Dogrib	Caribou 3.9	Whitefish 1.2	Trout 0.2	Moose 0.2	Walleye 0.2
	Deh-cho	Moose 2.7	Whitefish 0.9	Caribou 0.8	Spruce hen 0.4	Pike 0.3
	South Slave	Moose 2.2	Caribou 1.9	Whitefish 1.8	Trout 0.4	Ptarmigan 0.2
Inuit	Inuvialuit	Caribou 1.8	Char 0.5	Goose 0.2	Whitefish 0.2	Muskox 0.1
	Kitikmeot	Caribou 1.2	Char 0.9	Muskox 0.3	Trout 0.3	Eider Duck 0.2
	Kivalliq	Caribou 1.9	Char 0.4	Crowberry 0.2	Beluga muktuk 0.2	Trout 0.1
	Baffin	Caribou 1.3	Seal 1.0	Char 0.9	Narwal muktuk 0.9	Beluga muktuk 0.1
	Labrador	Caribou 1.3	Trout 0.5	Partridge 0.3	Cloudberry 0.3	Char 0.2

Source: Van Oostdam, J. et al. (2003). Human Health – Canadian Arctic Contaminants Assessment Report II. Retrieved from, http://www.ainc-inac.gc.ca/nth/ct/ncp/pubs/helt/hea-eng.asp

Other researchers have conducted surveys of food consumption patterns and traditional food systems in Dene, Métis and Yukon First Nations communities in northern Canada (Kuhnlein, Appavoo, Morrison, Soueida & Peirrot, 1994; Receveur et al., 1997). Some examples are included in the Appendices E and F (Nuxalk, Gwich'in) to show the variation in species and preparation methods.

The map which follows shows the geographic diversity of the Canadian Aboriginal people and their foods in relation to provincial/territorial boundaries and the treeline in Canada. In the discussion of traditional foods that follows, the map will assist in locating the area of Canada where the various foods are available in relation to the treeline and aid in understanding some of the features that present challenges to subsistence lifestyle. It is important to note how much of the area where Aboriginal groups live is in the Arctic and sub Arctic areas.

Source: Teachers Maps Resources. (2008). *The treeline in Canada*. Yellowknife, NWT: Government of Northwest Territories, Culture, Education and Employment. Retrieved from http://www.ece.gov.nt.ca/Divisions/kindergarten_g12/Circum%20Polar%20World%20Web%20Copy/CP%20MAPS/C2-Map%20Page%2017%20The%20Treeline%20in%20Canada.pdf

3.2.1. First Nations Traditional foods

The First Nations grouping is varied geographically across Canada. Communities are located on the Pacific coast and mountains, the Plains, St. Lawrence Valley and the North-East Woodlands, a broad region encompassing the woods near the Atlantic/Maritimes to the treeline in the Arctic. Thus, foods vary based upon availability in the ecosystem and by season. Northern First Nations people rely less upon agriculture and more on hunting, trapping and fishing. Those who live in temperate zones, such as the Plains and Great Lakes regions farm corn, beans and squash.

Wein and Freeman (1995) surveyed traditional food species consumed by three Yukon First Nations in the Subarctic terrestrial ecosystem. A wide range of households used traditional foods. Moose, caribou, salmon (Chinook, sockeye and coho) and berries are the most frequently consumed species of traditional foods. Many households (50/121) also reported reported using hare, ground squirrel, beaver, ducks, grouse, whitefish, lake trout, Arctic grayling, low bush cranberries, crowberries, blueberries, and Labrador tea (Wein & Freeman, 1995).

Frequency of consumption of traditional foods is strongly related to their availability in the geographic region. Moose are widely distributed throughout the Yukon except for the southern part of the Yukon. For Old Crow residents, caribou is a dietary staple because of the twice yearly migration of caribou through Gwich'in land (Wein & Freeman, 1995).

Changes in the availability of wildlife and changes resulting from development of the North have had an impact upon Aboriginal eating habits. Many Aboriginals commented that hare, lynx, porcupine, ground squirrel and ptarmigan have been scarce in recent years, and that they would consume these foods more often if they were available (Wein & Freeman, 1995). The creation of Kluane Park restricted access of Champagne-Aishihik people to sheep, goats and marmots. Muskrat and beaver are infrequently consumed. Ground squirrels, marmots, and goats are absent in the northern Yukon where the elevation is lower. Swan and wild bird eggs are rarely consumed because of harvesting restrictions. Ducks and geese are consumed more often in Old Crow due to the proximity to Crow Flats, a waterfowl nesting area (Wein & Freeman, 1995).

Lake trout, whitefish, and Chinook salmon are caught in Teslin Lake. Chinook and chum salmon also migrate up the Yukon and Porcupine Rivers to Old Crow. Sockeye salmon migrate up the Alsek River in the Haines Junction region. The eggs of whitefish, salmon and sometimes burbot, fish livers and the stomach and intestinal lining (fish guts) are consumed; salmon eggs are considered a special delicacy. The Pacific Ocean is the source of eulachon and halibut. The Teslin area has the greatest variety and quantity of berries. In contrast, the northern Yukon supports only a few species, primarily low bush cranberries, blueberries, and cloudberries. Wild greens, such as Labrador tea, arctic dock, and wild onions are consumed in Old Crow, but rarely in the southern Yukon (Wein & Freeman, 1995).

In the Subarctic terrestrial ecosystem of the James Bay Cree of Quebec, there is very little hunting in summer. Fish are available year round, particularly lake trout, pike, whitefish, speckled trout, suckers, burbot and walleye although less fish are harvested in summer. Natives eat less pike because of the mercury contained and burbot and walleye are not very popular. Certain parts of the fish are preferred, e.g. eggs of the lake trout and sucker, viscera of whitefish in spring and summer taste good. Caribou and geese are hunted although migration patterns of these animals have changed because of the Hydro Quebec dams making the food less available. The liver, heart, kidney and fresh blood of the caribou are considered delicacies, although liver and kidney may be contaminated with cadmium. Moose and bear are popular. Fur animals such as mink, weasel, marten and red fox are not usually used as food. Porcupine and beaver are preferred and sometimes rabbit. Rock ptarmigan, osprey, snowy owl, spruce grouse and ducks are also hunted. Common eider is not popular but mallard and black duck are preferred. Birds represent a small percentage of traditional foods eaten by the First Nations Cree in James Bay. Plants include blueberries, wild strawberries, raspberries, cloud berries, currants and goose berries (DeLormier, Kuhnlein & Penn, 1993).

The Canada goose is a highly valued traditional food source for the Eastern James Bay Cree. It is the most frequently consumed traditional food species by Cree women. Sharing of Canada goose is extensive and functions to maintain family and social ties. Spring Canada goose is preferred over fall Canada goose and parts such as intestine, liver and fat are more likely consumed in spring. A decreased consumption of some Canada goose parts, such as lung, liver and goose fat, was observed, particularly among members of the younger generation (Belinsky & Kuhnlein, 2000).

More data was gathered about traditional food consumption in a recent survey of Quebec Cree in the Oujé-Bougoumou Cree population. Walleye, northern pike, lake sturgeon and white sucker fish are reported as commonly consumed species. In this area, the most commonly consumed wildfowl species are, in decreasing order, goose, partridge and willow ptarmigan. The most commonly reported game meats in this area, in decreasing order were moose, rabbit, American beaver, caribou and bear. Fish is consumed mainly during spring, summer and fall. Wildfowl is consumed in all seasons with goose the most common especially in summer. Game is mainly consumed in fall and winter. This study also reported that fish eggs are not often consumed but the fish skin of brook trout, lake trout, white sucker, lakefish, and northern pike are commonly consumed. About 20% of those eating goose reported eating the goose liver but liver from other wildfowl species is infrequently eaten. About 5% of those eating goose reported eating goose eggs. The game species of which the liver is frequently consumed are, in decreasing order, American beaver (34%), rabbit (22%) and moose (22%). Kidneys are also frequently consumed in moose (51%), rabbit (33%) and beaver (31%) (Dewailly & Niebour, 2005).

The dietary patterns of school children are described in a study conducted in Kahnawake, (Mohawk) territory of 7000 residents near Montreal, the Mixedwood Plains terrestrial ecosystem. It is one of three communities that comprise the Mohawk Nation in Quebec.This report provides anexample of how the traditional diet is influenced by contact with Europeans through use of flour and sugar. Traditional foods such as corn bread, corn soup and typical Kahnawake foods of current times such as “la sauce” (ground beef cooked with flour and water) or “meat pie” (pastry filled with ground pork and mashed potatoes) were represented in 29 of 164 dietary recalls (17.7%). Corn bread is noted as a frequently consumed food. Squash, another traditional food was not mentioned in the 24 hour recalls (Trifinopoulos, Kuhnlein & Receveur, 1998).

The EAGLE project Eating Patterns Survey, conducted in 2001 was designed to study the effects of changes in the environment on the eating habits of First Nations people of the Great Lakes basin (Mixedwood Plains terrestrial ecosystem). The three most frequently consumed species of fish are pickerel, whitefish and lake trout. Bass is also popular in the southwest and southeast regions of Ontario. Other species fished include: sunfish (bluegill), perch, catfish, splake trout, lake trout, speckle trout, rainbow trout, northern pike, smelt, sturgeon, chinook, cisco, red sucker, bullhead, muskie and ling (burbot). Moose and deer are the most frequently consumed species of wild game. Smaller wild game such as duck, rabbit and partridge are eaten less frequently. Other species of wild game consumed include: muskrat, rabbit, goose, pheasant, beaver, frogs legs, turtle, groundhog, bear and wild turkey. Fish and wild game consumption appear to be significantly higher in the Lake Superior region but the significance of this information is limited by the small sample size (Boswell-Purdy, Clark, & Paradis, 2001).

A 1991 study of Cree and Chipewyan Indians, and Métis of Cree and Chipewyan descent, conducted near Wood Buffalo National Park on the border of Alberta and the Northwest Territories revealed that frequent consumption of country foods resulted in better quality diets with respect to some nutrients (Wein, Henderson Sabry, & Evers, 1991). Thirty traditional food species are reported with moose and caribou consumed most often (Wein, 1994). Bison is also an important food in some households. Some individuals surveyed had home gardens for fresh vegetables in late summer and early fall. Traditional foods such as moose meat, deer meat, baked salmon, dried salmon, canned salmon, oilcan oil, seaweed, dried berries and root vegetables are consumed in many BC First Nations communities (British Columbia First Nations Head Start, 2003). Country foods are preserved by freezer storage, cold weather storage and some drying and smoking of meat and fish in the Wood Buffalo National Park on the Alberta-Northwest Territories border (Wein et al., 1991).

The final report from the First Annual Interior of BC Indigenous Food Sovereignty conference touched on the traditional food consumption of the Ktunaxa, Nlaka’pamux, Secwepemc, St’at’imc, Syilx, and Ts’ilqotin nations (Prairies terrestrial ecosystem). Roots, berries and animal species including fish, deer, moose, and elk are consumed in this population. Cooking of foods in dug-out pits is described and is reported to enhance the taste and nutrient value of meats through the transfer of nutrients from the wild greens used to layer the pits. Some indigestible carbohydrates present in indigenous root vegetables require pit cooking methods to convert the carbohydrates into a more digestible form (Morrison, 2006).

For First Nations people of British Columbia, a highly renowned marine fat is rendered from the small smelt-like fish called ooligan. Ooligan grease is used as a condiment for many different foods such as dried salmon, potatoes, wild berries, roots and vegetables. It is also used as an ingredient in soups, stews and breads. Breads can be fried in ooligan grease. It is used as a preserving agent for dried foods, protecting them against oxidation and pests (Kuhnlein, Yeboah, Sedgemore, Sedgemore, & Chan, 1996). Fermented salmon roe (stink eggs or gink) is a delicacy for West Coast BC First Nations people. Salmon heads, beaver tails and seal flippers are some of the traditional food items that are similarly fermented (Dawar, Moody, Martin, Fung, Isaac-Renton, & Patrick, 2002).

First Nations people from the Nuxalk Nation of Bella Coola, British Columbia live on a reserve at the mouth of the Bella Coola River. This is part of the Pacific maritime terrestrial ecosystem. Dietary studies were conducted by the Centre for Indigenous Peoples' Nutrition and Environment (CINE), McGill University, for the Global Health Initiative (CINE, 2008). Sixty-seven different foods are identified and divided into fish and seafood, game, wild berries, greens, roots and other plants (Appendix E). Most of the foods eaten by the Nuxalk are harvested locally. Food preparation methods range from eating fresh, boiling, frying after coating with flour.

3.2.2. Métis, Dene/ Métis Preferred Traditional Foods

The Métis are a distinct Aboriginal group originating from a mixed heritage of European and First Nations. There is not much documentation or research specific to the Métis. This is the group that has adapted French-Canadian foods such as "tourtiere" (a pork-based meat pie), "boulettes" (meatballs) and Aboriginal foods such as pemmican or wild rice (Young, P., Paquin, T., Dorion, L., & Préfontaine, D.R., 2003). Although a third of the Métis population follows a traditional lifestyle, maintenance of a traditional diet is difficult since many Métis live in urban areas (69% according to Statistics Canada, 2008). Common methods of food preparation seem to be either boiling or frying. According to information from the Métis Museum, meals tended to include a high percentage of wild meat and fish mixed with garden vegetables, particularly potatoes. Marrow fat or "graisse de moelle" is used rather than oil or butter with market foods such as sugar, raisins, flour, rice, butter, syrup, bacon and canned meats added if available and affordable. Bannock and pemmican remain popular foods (Young et al., 2003).

Studies of the diet of the Sahtu Dene/ Métis living in Fort Good Hope and Colville Lake in the Western Canadian Arctic, revealed that the most frequently consumed traditional foods were moose, black scoter (duck), barren land caribou, rabbit, whitefish and mallard in Fort Good Hope. In Colville Lake the most frequently consumed traditional foods are barren land caribou, whitefish, trout, black scoter, moose and muskrat. Many different parts of the animal or fish are used for food. More than half the households in Fort Good Hope used beaver, barren land caribou, moose, rabbit, scoter, ptarmigan, Canada goose, cisco, inconnu, burbot, whitefish, blueberry, gooseberry and cranberry. In Colville Lake, the foods are barren land caribou, rabbit, scoter, beaver, ptarmigan, Canada goose, merganser, burbot, trout and whitefish (Kuhnlein et al., 1994).

An intensive dietary survey conducted with Dene, Métis and Yukon First Nation communities in northern Canada reported that moose, caribou, whitefish, spruce hen and jackfish are the most frequently consumed in the Deh Cho area (Receveur et al., 1997).

The Northwest Territories, Traditional Food fact sheet series describe the food, parts and some preparation methods of Dene/Métis food (Table 5) (Northwest Territories, Health and Social Services, 2002).

Table 5: Traditional Foods and Preparation Methods: Dene/Métis

Food	Parts consumed	Preparation
Caribou	Meat, blood, liver, intestine, bone marrow, stomach contents, fat and kidney	Not obtained/Unknown
Moose	Meat, fat, kidneys, bone marrow, intestines, liver and blood	Not obtained/Unknown
Muskrat	Meat	The meat is fried, baked, roasted or smoked. Muskrat tail is smoked to singe off the outer skin and the tender meat inside is consumed.
Beaver	Meat, liver, tail and feet	The tails are singed or smoked under dry willows.
Rabbit	Meat	The meat is baked, boiled or cooked in a stew.
Fish (walleye/pickerel, cisco/tullibee, loche/burbot, pike/jackfish, whitefish, lake trout, inconnu, grayling, suckers, coni	Meat, head, liver, eggs	Fish eggs are eaten lightly fried or added to bannock.
Birds (goose, duck, ptarmigan, grouse)	Meat	Not obtained/Unknown
Wild greens (dock, fireweed, dandelion green and lamb's quarters)		Cooked as a vegetable or added to soup.

Source: Northwest Territories, Health and Social Services. (2002). *Traditional Food Fact sheet series.* Retrieved from, http://www.hlthss.gov.nt.ca/pdf/reports/healthy_eating_and_active_living/2002/english/nwt_traditional_food_fact_sheets/nwt_traditional_food_fact_sheet_series.pdf

Gwich'in
The Gwich'in are Dene people residing in the northern Northwest Territories. Extensive dietary studies were conducted in 1994 by the Centre for Indigenous Peoples' Nutrition and Environment (CINE), McGill University for the Global Health Initiative. Detailed information about the forty-two different foods identified and divided into land mammals, fish, seafood and sea mammals, birds and plants and berries categories plus food preparation methods is presented in the Appendix F (CINE, 2007).

3.2.3. Inuit Preferred Traditional Foods

Considerable research has been conducted examining the Inuit dietary practices and preferences. The **Baffin Region of Nunavut** is the most traditional of Canadian Inuit Regions and is home to Inuit. Studies have shown that traditional food has a central role in the life of Inuit people. Fish, seals, whales and other sea mammals provide food. The flesh is eaten cooked, dried or frozen. Polar bear, fox, hare, Arctic seabirds, caribou and walrus are also dependable foods. The animals provide dog food, clothing and materials to make boats, tents and harpoon lines. Blubber is rendered to provide fuel and light. Here is a summary of the literature on traditional foods of the Inuit.

As part of the evaluation of the Food Mail Program, the Department of Indian Affairs and Northern Development supported nutrition surveys (1992 to 1997) in two Inuit communities (Repulse Bay and Pond Inlet). The most important country foods are caribou, fresh, frozen or aged followed by Arctic char and muktuk. There is a higher consumption of muktuk and seal in Pond Inlet than in Repulse Bay. Seal and polar bear are eaten. In addition, aged meats or fats such as seal, walrus, muktuk and Arctic char and small amounts of rabbit, dried caribou, ptarmigan and other species of fish (trout, halibut, whitefish) are consumed. Caribou and seal liver are consumed infrequently (Lawn & Harvey, 2001).

Results of a study on food utilization by Baffin Inuit children and adolescents indicated that they relied more on marine mammals than land mammals or fish. The marine mammals consumed were beluga, seal, narwhal, walrus (flesh and parts including blubber, oil, broth, eyes, liver) and mattak/muktuk (skin and underlying fat of narwhal and beluga). Arctic hare, caribou (flesh and parts including fat, liver, and stomach) and polar bear are the land mammals consumed. Arctic char (flesh and parts including head, skin), sculpin, contents of clams, mollusks are consumed as well as ptarmigan, scoter, fowl eggs, berries and kelp fish (Berti, Hamilton, Receveur, & Kuhnlein, 1999).

In a paper on climate change affecting the **Inuvialuit** people of the small community of Sachs Harbour in Canada's western Arctic, the annual harvesting cycle is described. In March and April, people ice fish on inland lakes for lake trout and Arctic char. In May, fishing activity decreases as the snow goose hunting season approaches. The entire community is involved in goose hunting, plucking, cleaning and drying geese (Berkes &

Jolly, 2001).The goose hunt finishes by mid-June and people return to the lakes for ice-fishing. They will also fish for Arctic cod on sea ice and begin hunting seals. In June and July, people hunt mainly for ringed seals and some bearded seals off the ice floes and from boats in open water. From July through early September, people set gillnets for char, Arctic cod and some cisco. There is some rod-and-reel fishing in lakes. In September, people return to musk-ox and caribou hunting. The peak of the musk-ox hunt is in November. The population of muskox has increased since the 1950s. In some years, the musk-ox hunt is a commercial harvest that employs almost the entire community, plus some outsiders. (Berkes & Jolly, 2001).

There are 20 species of marine and land mammals, fish and birds harvested throughout the year. The main species is musk-ox; others include the snow goose, the ringed seal and various fish species. Caribou, Arctic foxes, wolves, polar bears and ringed seals are also hunted in winter. Small game includes ptarmigan and Arctic hare (Berkes & Jolly, 2001).

Duhaime, Chabot, & Gaudreault (2002) used the data from the 1992 Québec Health Survey of Inuit in **Nunavik** to examine dietary patterns. The most frequently consumed country foods are caribou, birds, fish (Arctic char and salmon), marine mammals and berries. According to a study by Blanchet, Dewailly, Ayotte, Bruneau, Receveur, & Holub (2000), the most popular traditional food consumed by Inuit women in Nunavik is caribou, followed by red char, Canada goose, willow ptarmigan, white whale skin, lake trout, ouananiche, white whale meat, brook trout, lake whitefish, ringed seal meat, fourhorn sculpin, arctic cod, white whale fat, ringed seal fat, Atlantic salmon, ringed seal liver and the common loon (Table 5).

The communities of Inukjuak and Puvirnituq are located on the east coast of Hudson Bay in Nunavik (northern Québec). Walrus are a significant proportion of the marine mammal species that are traditionally hunted for subsistence. The meat is frequently consumed raw or fermented *(igunaq)* (Proulx, MacLean, Gyorkos, Leclair, Richter, Serhir et al., 2002).

The Ministry of Health & Social Services of the Northwest Territories provides the Traditional Food fact sheet series describing the food item, parts and some preparation methods of the Inuit (Northwest Territories, Health and Social Services, 2002).

Table 6: Traditional Foods of the Inuit.

Food	Parts consumed	Preparation
Caribou	Meat, blood, liver, intestine, bone marrow, stomach contents, fat	The meat is eaten raw, frozen, aged, cooked or dried.
Seal	Almost all parts: meat, intestines, liver, blubber, flippers, brain and eyes	Seal meat is eaten raw, frozen, boiled, dried and aged (fermented). Seal fat can be used as a dip with seaweed, fish or meats such as dried caribou.
Walrus	Meat, blubber, skin and flippers	Traditional fermentation methods are used for walrus. Walrus parts are buried under gravel in a cool place, air is allowed to flow through and the parts age. Walrus meat, blubber and skin are eaten aged, raw or boiled.
Narwhal	Fresh skin (maktaaq or muktuk), meat	The meat is eaten dried. The skin and blubber are eaten raw, aged, cooked or boiled in soup and stew. Dried narwhal meat can be dipped in seal fat.
Beluga	Skin (maktaaq or muktuk), meat, blubber	The skin, meat and blubber are eaten raw, aged, dried, cooked or boiled in soups or stews. The ageing of skin, meat and blubber develops a desirable flavour. The cartilage near the flipper is consumed.
Polar Bear	Meat, fat	The meat is usually baked or boiled in a soup or stew. It is never eaten raw.

Table 6 (Continued): ***Traditional Foods of the Inuit.***

Food	Parts consumed	Preparation
Arctic hare	Meat	The meat is baked, boiled or cooked in a stew.
Muskox	Meat	The meat is ground and cooked to make burgers or sausage.
Ground Squirrel	Meat	The meat is usually eaten baked, boiled or in a stew. To boil, the carcass is cut in half and boiled until the meat separates from the bones.
Bear	Meat	The meat is baked or boiled but is never eaten raw.
Arctic Char	Meat, skin, eggs	It is eaten raw, frozen, dried, aged or cooked.
Fish (trout, whitefish, suckers, grayling, loche/burbot, cisco, pickerel, cod, herring, pike, haddock, inconnu, coni and sculpin) Seafood (scallops, sea cucumbers, mussels, clams, crabs, imported shrimp from Greenland)	Meat, eggs, liver, stomach and bones	Fish eggs are eaten fresh. The meat is eaten raw, frozen, boiled, roasted and dried. Scallops are boiled or fried. Sea cucumbers are eaten raw or boiled. Mussels, clams and xrabs are eaten raw, fried or boiled.
Goose	Meat	The meat is boiled or roasted.
Duck	Meat, liver, gizzard, heart, eggs	The meat is eaten raw, cooked or dried.
Ptarmigan	Meat	The meat is baked, boiled or fried.

Table 6 (Continued): ***Traditional Foods of the Inuit.***

Food	Parts consumed	Preparation
Wild plant greens (willows, mountain sorrel, netted willow and fireweed)		Greens are eaten raw, cooked as a vegetable or added to soups. Fireweed leaves are often eaten raw with seal blubber or cooked and eaten like spinach. Firewood flowers are eaten raw. Seabeach sandwort is added to boiling seal meat because of its high salt content. Plants such as the Vetch family have edible roots that are eaten raw or cooked.
Seaweed		Seaweed is usually eaten raw or boiled. It can be added to salads. It is also boiled with seal meat to give a salty taste to the broth. It can be dried to preserve it for later use.
Berries (blueberries, cranberries, blackberries, soapberries, raspberries, gooseberries, strawberries, cloudberries and crowberries)		Raw, frozen, preserved or cooked, for example with fish eggs or seal blubber or oil. Crowberries or cloudberries mixed with seal oil and chewed caribou tallow have the consistency of whipped cream.

Source: Northwest Territories, Health and Social Services. (2002). *Traditional Food Fact sheet series.* Retrieved from, http://www.hlthss.gov.nt.ca/pdf/reports/healthy_eating_and_active_living/2002/english/nwt_traditional_food_fact_sheets/nwt_traditional_food_fact_sheet_series.pdf

The extent of use of traditional foods of Belcher Island Inuit of southeast Hudson's Bay is documented in a 1996 study. Among the sea mammals, ringed seal is consumed most often, followed by beluga whale, bearded seal and walrus. Of the land mammals, reindeer is consumed most often followed by a much lower percentage of arctic hare, polar bear, caribou and arctic fox. Blue mussels are the most frequently consumed seafood followed closely by arctic char, sea urchin, sea cucumber, lake herring (whitefish), seaweed, tom cod and sculpin. Among the birds and eggs, Hudson Bay eider duck is consumed most often, followed by Canada goose, snow goose, red-breasted merganser, rock ptarmigan and wild bird eggs. Blueberries, crowberries, bog cranberries, cloudberries and red bearberries are the most frequently consumed berries (Wein, Freeman, & Makus, 1996).

Many parts of each species are used as food and prepared in various ways, such as raw-fresh, raw-frozen, cooked, dried or aged. With ringed seals, in addition to consuming the meat raw, frozen or fresh, cooked or dried, blubber is consumed fresh or aged. The liver, dried intestine, cooked intestine, brain, raw heart, cooked heart, eyes, kidney, tongue and moustache are also consumed (Wein, Freeman, & Makus, 1996).

Dry, cooked and raw meat of the beluga whale is consumed in addition to cooked or dried intestine, aged, raw or cooked flippers, tongue, heart and moustache. Walrus meat, raw skin and fat, aged skin and fat, raw or aged flippers and stomach contents are consumed. Reindeer and caribou meat, cooked, dried or raw is consumed as well as raw or dried fat, tongue, the cooked head, stomach contents and heart (Wein, Freeman, & Makus, 1996).

The cooked meat, raw and boiled gizzards, wings and feet of Canada and snow goose are eaten. Eider duck meat is consumed cooked or raw. The gizzard, liver and heart are also eaten. Cooked and raw meat from rock ptarmigan and the raw intestines are consumed.

Fish is eaten raw, boiled or cooked. The liver of the tom cod is eaten as are the raw or frozen eggs of the lake herring (whitefish). Sea urchins and sea cucumbers are eaten raw. Sculpins are roasted on the fire, boiled or consumed raw. Clams are eaten raw or boiled.

Most berries are eaten raw. Cranberries are eaten raw or frozen or cooked and crowberries are eaten with canned sardines and vegetable oil.

The most preferred foods of adults are dried fish, dried reindeer meat, goose, and beluga muktuk (skin with attached fat). The preferred foods of young people are goose, beluga muktuk, blueberries, and certain market foods (canned fruit and apples). A higher proportion of young people, compared to adults, had not tasted foods such as capelin, hare, starfish, fox, and polar bear (Wein, Freeman, & Makus, 1996).

The Belcher Island Inuit traditionally consume sea species. Reindeer are introduced to the Belcher Islands hence it is a relatively new food with which they have limited experience (Wein, Freeman, & Makus, 1996). They may have heard about tapeworm-infected reindeer liver and are cautious about eating this organ. This may explain the infrequent use of reindeer liver and kidney. The liver taboo, however, extends to all animals with four legs, including beef.

Freeman's unpublished field notes (as cited in Wein, Freeman, & Makus, 1996, p. 261) state that Inuit beliefs may account for the low consumption of species such as polar bear, arctic fox and arctic hare. Skinned polar bear is said to resemble a human in shape. Meats such as bear, fox, and hare have a strong odour and do not have much blood, in contrast to seals which have a large quantity of very dark blood. Fox is despised as food because the animal is a scavenger. Foxes are good when they are fat but they must be well cooked, as must all animals having little blood. If foxes or bears are lean, they are not eaten; there is too much odour. Some Inuit believe that the hare carcass must be cut across the long axis; sickness will result if it is cut longitudinally.

3.3 Traditional Food Preparation & Storage

There is limited documentation and research into food preparation and storage techniques, except for the information collected in community studies conducted for nutrient analysis. Cooking methods include open fire roasting, boiling, frying, smoking and fermentation. Food storage methods encompass caching both above and below ground, freezing, home canning and drying by air and in the sun.

Food preparation and storage techniques vary according to local ecosystems and community preferences. The traditional knowledge of the three Aboriginal groups describes a variety of methods, with very little wasting of scarce food sources. Fuel is scarce in northerly regions and has to be imported or else the native people learn to use what is available like rendered blubber, not only a taste preference, but an affordable choice that dictates different food preparation methods. Food is spiced to taste and according to what is seasonally available. Dried traditional food is an important part of the diet and indicates a continued reliance on this form of food preservation (Batal et al., 2005; Wainwright, 1993; Arnaq et al., n.d.). The most common dried foods are fish and sea mammals, particularly salmon and seal meat. Other preservation methods described include salting/brining, pickling of fish and sea mammals using rock salt layered with food in barrels. Cooking methods include open fire roasting, boiling, baking, frying and smoking. Canning or jarring is used, especially for salmon and to preserve vegetables (Northwest Territories, Health & Social Services, 2002; Centres for Indigenous Peoples' Nutrition & Environment Global Health Initiative, 2007 & 2008). Fish are usually split and filleted with the skin left on. The fish is placed in a brine solution of various compositions for several days after which the fish are hung by the tail to dry. The drying time depends upon the thickness of the fish and the weather. Rain can interfere with the process. When dry, some fish are smoked and stacked in the food cache (Wainwright, 1993).

All three Aboriginal groups enjoy some raw meats/organs, mostly due to local acquired taste preferences (Centres for Indigenous Peoples' Nutrition and Environment Global Health Initiative, 2008 and 2007: Northwest Territories, Health and Social Services, 2002). Detailed information on the risks and benefits of the consumption of organ meat is lacking (Batal et al., 2005).

3.3.1First Nations (Cree) Traditional Food Preparation

Food preparation techniques among the Cree (First Nations) in James Bay Quebec vary depending on the animal species used. Fish is fried, smoked, or boiled to obtain a broth; the eggs are boiled. Goose is cooked suspended over an open fire, boiled or roasted. Caribou, bear and moose are stewed and caribou stomach once cleaned can be fried in oil and seasoned. Caribou bones that are boiled for an hour can be supplemented for milk. Fire roasting is described as a traditional and preferred food preparation method, used for porcupine and Canada goose among the Quebec Cree, although these foods are also boiled or oven-roasted (Belinsky & Kuhnlein, 2000). Food preparation methods identified from the Nuxalk Nation (First Nation) in British Columbia range from eating fresh, boiling to frying after coating with flour. The European influence is apparent with descriptions of dipping meats in flour and frying or making batters and deep frying (Centres for Indigenous Peoples' Nutrition and Environment Global Health Initiative, Nuxalk, 2008, Appendix E). In the Global Health Case Study of the Gwich'in Nation in the Northwest Territories, Some items have "cooked" listed under preparation. No particular cooking method is described by the interviewee; therefore, it could imply any of the following: baked, boiled, fried or roasted (Receveur, Kuhnlein, Mills, Carpenter and community researchers, 2009).

3.3.2. Métis Traditional Food Preparation

There are varied Métis food preparation and storage methods reported. Meats and berries are dried and smoked for later use. Drying and smoking of meat and fish is done outdoors in the sun and wind using racks over low fires. Meat, berries and fruits are also canned in the autumn. Corn from vegetable gardening is dried and ground for easy storage. Freezing and caching fish, wild game and meat are common storage methods (Young et al., 2003). A food cache can be above ground in an enclosed storage shed to keep food away from scavenging animals or sometimes, buried under rocks (Wainright, 1993).

3.3.3. Inuit Traditional Food Preparation

Much of the research about food preparation and storage has been conducted in Inuit communities. In a preliminary report, methods of food preparation and preservation conducted in Native Alaskan villages are described. By visiting, five different villages, the processing of silver salmon, primarily by smoking, was observed. Most fish were caught by net and although processes used for smoking fish in the villages had some commonalities, the processes were different. Brine, size and shape of fish pieces, dried and smoked were similar but the difference in processes included drying time, brine concentration and brining time, the use of a first stage hot smoke and procedures used to store the fish after it was smoked and/or dried.The authors commented that in order to develop a recommended process to meet the requirements of all areas, more research was needed. This study demonstrated great variety in degree of dryness and the amount of salt in the fish. However, microbiological analysis was inconclusive because of the difficulties with sample handling. Several recommendations were given for further research, among them to investigate the concept of a community or shared food processing establishment and the need for improved documentation of improper processing or spoilage before processing (Zottala & Zoltai, 1981; Wainwright, 1993).

3.3.3.1 Igunaq

Igunaq is aged or fermented meat produced by placing meat and fat tissues into skin (hide) bags which are sewn shut. The raw meat is cached at certain times of the year, in a particular place and aged for a pre-determined length of time. Traditionally, the meat was placed in a cool, shaded pit in the ground, lined with wood, leaves, or animal skins, buried and left to ferment. When the meat was ripe, it was harvested and served.

Traditional recipes for igunaq, conditions for ageing and length of preparation time vary within, and among, communities. The termination of the ageing process is sometimes determined by the timing of social events, in some cases resulting in igunaq consumption occurring relatively early in the fermentation process (Forbes, Measures, Gajadhar, & Kapel, 2003). Types of igunaq include: walrus, seal (ringed seal), seal-flipper, caribou, fish, fish-head and bird (Arnaqaq et al., n.d.).

Walrus, Seal and Seal-flipper Igunaq

Traditionally, walrus and seal igunaq was cached under rocks and gravel in a cool, dark (shaded) place. The internal organs, except the liver, were removed and the cavity was laced together with rope. Pressing down on the cavity removes air so the meat would not spoil. The meat was placed on the ground and covered with rocks (not too heavy). Holes were covered to prevent entry of weasels. Meat that is cached is called ungirlaaq (Arnaqaq et al., n.d.).

Today walrus and seal igunaq makers also use unheated sheds, porches, large boats, refrigerators and houses. Metal basins are used for ageing meat. It is suggested that the metal basins be covered with cardboard or plywood (not sealed completely to allow entry of air) for optimal results. When the seal fat added to the meat becomes liquid (oil), the meat is aged sufficiently and is ready to eat (Arnaqaq et al., n.d.).

Sometimes whole seal flippers mixed with chunks of seal fat and covered with blubber are placed in a steel pail or basin. The process is known to be complete when the skin separates easily from the meat. Aged seal flippers are called ujjaq. During the summer, this process is completed outdoors, but ujjaq can be made in the refrigerator year round (Arnaqaq et al., n.d.).

Igunaq production begins in mid-August in South Baffin communities. The process is usually completed in a little more than a month. In North Baffin communities, igunaq production starts in June because of lower temperatures. The seal or walrus is buried underground just above the permafrost where it ages until winter. Ungirlaaq is usually harvested in October or later depending on the weather (Arnaqaq et al., n.d.).

Caribou Igunaq
Caribou is skinned, gutted and the legs removed. The stomach containing caribou fat and meat is placed in the body cavity. The caribou skin is wrapped around the body and tied together. It is then placed in an upright position and cached, covered properly with rocks. After a couple of months the caribou is ready for a feast. Aged caribou meat is called pavunnaaq (Arnaqaq et al., n.d.).

Fish and Bird Igunaq
Other varieties of igunaq that are not common today include birds, cod and char fish heads aged inside sealskin. Fish head igunaq was made more frequently in North Baffin and Northern Québec communities, while bird igunaq was common in Northern Québec. Since these types of igunaq are not prevalent today, little is known about their preparation methods (Arnaqaq et al., n.d.).

3.3.3.2Misiraq

Misiraq is aged oil made from the blubber of sea mammals (Arnaqaq et al., n.d.). Inuit have been making misiraq for centuries. It is used as a dip to accompany meat and fish (dried or frozen) for more flavour.

Inuit use the fat from seal, (ringed or bearded), walrus, and whale (beluga, bowhead, and narwhal) which liquefies faster than the fat from other marine mammals. Sometimes, a piece of skin is added. Traditionally, seal skins sewn together with a layer of blubber left on the inside were used. Today, blubber is cut into tiny strips or small chunks and placed in metal or glass containers without a lid or covered with perforated tin foil. The container can be placed in the refrigerator or outside in a shed in July and August. The ageing process takes longer in the refrigerator because of the lower temperature. Once ripened, the misiraq is placed in the freezer so it does not become rancid. If misiraq is aged too long it cannot be used. The pieces of fat that have not liquefied are also eaten. Misiraq has the consistency of vegetable oil (Arnaqaq et al., n.d.).

3.3.3.3. Muktuk

Muktuk is fermented whale and is considered a delicacy. It consists of the skin of the whale, with about 2-4 cm of attached pink blubber layer (Centers for Disease Control and Prevention [CDC], 2002). It is often consumed raw.

3.3.3.4.Ooligan grease

Ooligan grease is prepared by netting ooligan, a type of smelt, in bulk and ''ripening'' in outdoor bins under evergreen branches at ambient spring temperatures for ten days to two weeks to develop the flavour (Kuhnlein, 2000). Decomposition of the carcass allows for easy release of the fat during cooking. The fish is cooked in water heated to near-boiling and subsequent straining, reheating, bottling, and storage (Kuhnlein et al., 1996).

3.4 Food Safety Issues withTraditional Food Preparation & Storage

Considerable traditional food safety knowledge exists in Aboriginal communities. Aboriginal people were among the first to draw attention to contaminants when they noted changes in the flesh and organs of the animals and fish they hunt (Furgal & Keith, 1998). Sometimes, a decayed carcass is found and used as food, or a carcass is kept for a considerable length of time in an underground pit, kept cold but not frozen (Wainwright, 1993). These microbiological risks wil be discussed in Chapter 4.

Ross, Olpinski, & Curtis (1989) studied the relationship between traditional dietary practices and handling procedures and parasite zoonoses in Northern Québec Inuit communities. This study noted that food safety rules to deem food edible or inedible (traditional knowledge) existed but not necessarily followed in times of food scarcity. Hunters reported awareness of safe food practices important for community food sharing. This study reported that food intended for storage was frozen or thoroughly dried. Fish were eviscerated immediately in summer to avoid migration of worms into the flesh. According to some respondents, animal/fish entrails should not be removed immediately to avoid softening the flesh. Polar bear and fox were thoroughly cooked before consumption and wolf was avoided entirely. These types of practices indicated that Inuit are aware of the risk from infected animals or poorly prepared food.

Food preparation and storage methods can also be risky. The handling of foods before consumption is a critical factor. Putrefaction/"fermentation" of foods, whether intentional, such as the preparation of "stink" foods or unintentional when fish and mammals are improperly stored and preserved is the main cause of botulism in northern Aboriginals. Cooking traditional foods is a recommended risk reduction method but culturally unacceptable to many Aboriginals. Safe food preparation methods to eliminate risks but preserve the flavour and texture of the traditional foods have not been developed and accepted by the native people (Wainwright, 1993). Three specific food handling/preparation methods are of concern regarding food safety: "fermentation", eating raw foods and eating viscera/organ meats.

3.4.1 Raw Food Consumption

All Aboriginal groups report eating raw foods (First Nations: some meats; Metis, Dene/ Metis: raw muskrat, caribou, beluga whale, lake trout; Inuit: caribou, seal, narwhal, beluga whale, duck). The Inuit eat the most raw food. Raw meat poses a health risk from parasites and other pathogens normally destroyed by cooking. The risk of foodborne illness from traditional foods is generally low; however, the sporadic and unexpected appearance of pathogens in unexpected hosts, as with *Trichinella* nativa in walrus can be problematic (Curtis, Rau, Tanner, Prichard, Faubert, Olpinski & Trudeau, 1988). (*Trichinella* spiralis is the species commonly implicated in southerly pork processing areas.) Walrus meat has been associated with at least two outbreaks. One study reported that under controlled conditions, that the pathogen remained active in freshly frozen meat but not in igunaq, the traditionally aged (fermented Inuit) preparation. Loss of infectivity was likely a result of the putrefaction process which takes place in the igunaq during the warmer months prior to freezing, compromising the capsule of the *Trichinella* larvae. This group of researchers recommended that further research is required to evaluate the food safety risk of traditional walrus igunaq aged under different field conditions and storage times (Leclair, Forbes, Suppa, Proulx, & Gajadhar, 2004).

Trichinella nativa larvae may remain infective even after prolonged periods of freezing and possibly in traditionally prepared walrus meat (igunaq). Walrus igunaq is produced by placing walrus meat and fat tissues into bags of seal skin which are sewn shut and aged for several weeks to months buried under rocks or gravel. Analysis of walrus meat associated with two outbreaks of trichinosis revealed that *Trichinella* larvae isolated from frozen walrus meat remained infective, while larvae from igunaq preparations lost infectivity (Leclair et al., 2004). Loss of infectivity was likely a result of the putrefaction process which took place in the igunaq during the warmer months prior to freezing, compromising the capsule of the *Trichinella* larvae. Under controlled laboratory conditions, however, Forbes et al. (2003) reported that infective *T. nativa* larvae were found to survive in igunaq, nikku, raw frozen sausage, and poorly cooked sausage for at least five months.

3.4.2 "Fermentation" of Traditional Foods

Two of the Aboriginal groups, the First Nations and the Inuit, used an uncommon, very specific food handling method, “fermentation”. For the First Nations,the Nuxalk are reported to use fermentation for salmon roe (also known as stink eggs or gink), salmon heads, beaver tails and seal flippers (Dawar et al., 2002). Métis and Dene/Métis do not use “fermentation” of food as a method of food preservation. Examples of Inuit fermentation of food have been described earlier in this chapter.

The process of fermenting or ageing meat used by Canadian Aboriginals is not a true fermentation; no conversion of carbohydrates into acid or alcohol occurs. True fermentation includes the production of lactic acid, acetic acid, or ethanol, all of which inhibit the growth of pathogenic organisms to varying degrees. The low pH required to inhibit growth of pathogens is not usually achieved by traditional Aboriginal fermentation which is more of a decomposition or putrefaction process (Hauschild & Gauvreau, 1985). Low temperature methods and aerobic conditions generally prevent the growth of pathogens such as *Clostridium botulinum* (Segal, 1992). Applications of fermentation of native foods have been based upon traditional knowledge, i.e. experience gained through trial and error by consecutive generations of Aboriginal users. Traditional knowledge usually implies no comprehensive understanding of the underlying principles of the fermentation process and the requirements for ensuring quality and safety. Such an approach represents a major pitfall, since it can lead to unsafe products depending upon the process, environmental conditions and the condition of the raw materials (Motarjemi, 2002). Fermentation provides a cost-effective means to preserve food and inhibit the growth of pathogenic bacteria even under conditions where refrigeration or other safe storage is not available. Fermentation as used by the Aboriginal population in Canada does offer a method of food preservation. What is missing is a scientifically researched evidence base to ensure food safety (Motarjemi, 2002).

Loss of traditional food preparations methods appears to vary among Aboriginal communities. Some place the fish heads in a pit lined with moss and grass; others place the food for fermentation into a seal skin bag which is buried or hung. The pit is then covered with more moss and grass and with soil/sand where the food remains for one to three weeks to ferment. When the pit is opened, the contents are eaten, usually with some type of oil, without being heated or cooked. The same pit may be used year after year (Wainwright, 1993).

The more modern way to "ferment" foods is similar to the old way, except that newer types of containers are used and kept aboveground inside the house or in the food cache (Wainwright, 1993). Shaffer, Wainwright, Middaugh & Tauxe (1990) reported that local fermentation methods had been modified by the Yupik of Alaska. Fish heads were traditionally fermented in clay pits dug in the ground and re-used each year. When wooden barrels became available they were filled with fish heads and placed in the pits. Many then stopped using the pits and placed the wooden barrels above ground, usually in the shade. Plastic bags and buckets have also been used, placing them indoors to accelerate the fermentation. Problems occur with plastic pail use and sealed containers because they create anaerobic conditions that favour the growth of *C. botulinum*. Leaving jars, pails, or wooden barrels above ground, or indoors, increases the temperature of the food, promoting bacterial growth (State of Alaska, 1998). The traditional slow, cool method of fermentation seems to reduce the risk of botulism. Holes dug in the permafrost keep food cool even in summer.

The first botulism outbreak among Aboriginals of Bristol Bay, Alaska was thought to be caused by the use of plastic containers which promote anaerobic growth (Shaffer et al., 1990). Despite high awareness of botulism in this population, some of fermented food preparers use plastic containers (Chiou, Hennessy, Horn, Carter, & Butler, 2002). Aboriginals are advised not to use plastic containers. Interviews with food preparers from

Bristol Bay Aboriginal communities revealed that they possessed limited knowledge of food fermentation and may have been taught by community members other than the family (Shaffer et al., 1990).

The foods involved in foodborne botulism outbreaks among northern native people are primarily fish (salmon most commonly) and sea mammals (whale, seal, walrus); occasionally, land mammals (caribou and beaver) (Wainwright, 1993). An outbreak of botulism in Alaska in 2001 was associated with fermented beaver tail and paw. The tail and paws had been wrapped in a paper rice sack and stored for three months in the patient's home. Some beaver tail and paw had been added to the sack as recently as one week before it was eaten (Centers for Disease Control & Prevention, 2001). Fermented beaver tail is not prepared or eaten by the Athabascans or Aleuts in Alaska.

Muktuk harvested from a beached adult beluga whale caused an outbreak of botulism in Alaska in 2002. The whale fluke (tail) was cut into pieces and stored in zipper-sealed plastic bags in a refrigerator until they were eaten one or two days later. People should avoid eating beached marine mammal carcasses. Boiling raw or fermented Alaska native dishes for 10 minutes before eating inactivates botulinum toxin (Centers for Disease Control & Prevention, 2002).

Alaskan outbreaks of botulism involving beaver tails prepared in several ways: wrapped in plastic bags and left by a stove for over two weeks, packed in moss and grass in a wooden barrel and set outside for two weeks when the temperature was above freezing, or placed in a wooden barrel with moss and water and set in a drying shed for about two weeks. In one outbreak, seal flippers were placed in a wooden bucket, covered with moss, and fermented in the shed house for five days in a warm place. Another outbreak involved salmon fish heads that were fermented with fish entrails in a wooden barrel covered with a canvas cloth. The barrel was placed above ground for more than two weeks, instead of in a pit as was traditionally practiced by the family (Shaffer et al., 1990).

A high proportion of Inuit are involved in foodborne botulism outbreaks, possibly because of geography or possibly cultural factors related to the methods of preparation of traditional foods (Wainwright, 1993). In a summary of botulism outbreaks in Canada between 1971 and 1985, 59% of the outbreaks were attributed to the consumption of marine mammal meat, mainly seals. The meat was eaten raw, parboiled or a faulty fermentation process may have been involved. Raw or undercooked meats were generally left at ambient temperature. Fermented meats responsible for outbreaks included urraq (ujjaq) (seal flippers in seal oil) and muktuk (chunks of skin with blubber and beluga meat) (Hauschild & Gavreau, 1985).

Fermented salmon eggs or fish accounted for 23% of the outbreaks. The eggs are generally fermented whole in their own juice, with or without added salt. They may also be kneaded into a firm mass before curing. A lack of carbohydrate prevents adequate production of acid and the food becomes putrid instead (Hauschild & Gavreau, 1985).

3.4.3 Viscera/Organ Meat Consumption

Aboriginals as true survivalists use all parts of the animal, including intestines, viscera/organ meats and eggs. Ruminant animals, such as moose, elk, caribou, deer, antelope and buffalo are frequently part of the traditional Aboriginal diet. The native practice is to use the entire animal, for food and other useful items. The muscle meat is eaten raw or boiled or roasted; heart, brain, liver and kidney are eaten raw; intestines are usually dried. In some instances, blood is mixed with flour or used to make sausage. Marrow, loaded with fat, can be eaten raw. While research shows that organ consumption can be important sources of nutrients in the diet of Indigenous people (especially calcium and vitamin A), detailed information on organ consumption in the traditional diet to estimate benefits and potential risks is missing (Batal, et al., 2005). The practice of consuming the entire animal can present food safety risks. Liver and kidney of many animals hunted by Inuit populations of northern Quebec, contain high levels of cadmium a chemical contaminant (Fontaine, Déwailly, Benedetti, Pereg, Ayotte, & Déry, 2008). Traditional knowledge held by people living in northern communities, accumulated through generations of year-round observation, combined with intimate familiarity with the local environment has led to non-consumption of polar bear livers and caribou lungs. These hunters have proven invaluable in focusing scientific inquiry into northern contaminants by suggesting good sampling locations (Furgal & Keith, 1998).

3.5 Food Sharing

Among the more interesting food practices of the three Aboriginal groupings is the customary sharing of food. This is an underlying value to avoid food wastage but also speaks to another value of caring for the whole community. The gathering of traditional foods serves to sustain the social bonds within societies through sharing of the hunt/harvest and feasting together (Deutch, 2003). The benefits of traditional foods emphasized by indigenous peoples include: well-being, health, leisure, closeness to nature, spirituality, sharing, community spirit, pride and self-respect, economy and the education of children (Van Oostdam et al., 1999; Van Oostdam et al., 2003). Kuhnlein, et al. (2004) reported that more than 80% of Inuit surveyed agreed that harvesting and using country food by the family gives a wide range of social, cultural, spiritual, economic and nutritional benefits.

Commonly, after a hunt or harvest, food is shared with married children and parents, elders and others in need, then other family and community members (DeLormier, Kuhnlein & Penn, 1993). Delicacies such as liver, kidney and heart are given to elders as a sign of respect. Eating is the culmination of a series of culturally meaningful activities involved in the harvesting, processing, distribution and preparation of food (Willows, 2005). Harvesting also helps young people develop qualities such as responsibility, patience and respect and provides the skills necessary for living off the land (Van Oostdam et al., 2003). In Northern Quebec, 30.3% of Cree reported fishing or hunting for themselves while others obtained fish, wildfowl or game from relatives (64%), parents (52%) and friends (31%) (Dewailly & Niebour, 2005).

Safe handling of shared food is especially important. Recently, there have been some efforts to commercialize specialty northern foods, such as Arctic char, muskox and caribou using retail, wholesale and online stores, such as the Kivalliq Arctic Foods Ltd. (Mason, Dana & Anderson, 2009). This new enterprise not only provides secure income for northern Aboriginals but may make traditional foods more accessible to urbanized Aboriginals if there is sufficient income to buy such products. Additionally, this standardizes food preparation processes that ensure food safety.

3.6 Foods Adapted from Europeans

Contact with Europeans introduced a change in dietary habits of the Native population, rather than food safety issues. The Europeans use more agricultural staples such as wheat, corn and beans and usurped tribal lands used for subsistence activities. The native population was introduced to market foods, usually highly refined and processed with poorer nutritional value and excess calories. Beef and pork were introduced in favour of the more traditional subsistence foods. This lifestyle was opposite to the traditional native ways, living from the land, hunting and gathering using a broad base of plants and wild animals for food. The Europeans introduced new staples: beef, pork, potatoes and wheat to replace the traditional meats and plant foods. Furthermore, these new foods had to be purchased or bartered in order to obtain them. Europeans also introduced new cooking habits and ingredients using refined flour and sugar, coffee and lards. The Europeans hoped to address the Aboriginal historical food insecurity issue resulting from a dependence upon traditional foods (Miewald, 1995).

Bannock is a simple pan-fried flat bread that has historically been an important food for many First Nations, Inuit and Métis across Canada. Native people had no access to white flour prior to the arrival of European traders, although some flour substitutes existed, such as wild turnips or corn, dried and ground to a powder. In precontact times, bannock was made from natural substances gathered from the woods: flour from roots, natural leavening agents and a sweet syrup made from the sap of trees. Because bannock could be quickly prepared from readily available ingredients, and because these ingredients lasted a long time without spoiling, bannock became a staple of the European fur traders and subsequently, the native people also. It can be baked, fried in a pan or sometimes even deep-fried. It can be made from virtually any kind of flour and almost any kind of fat available such as oil, lard, or bacon grease (Young et al., 2003).

The Métis, descended from French fur traders and indigenous Canadians may be somewhat responsible since their very existence is owed to mixing native and European cultures. This may explain the origin of the meat pie, a pastry filled with ground pork and mashed potatoes (Trifinopoulos et al., 1998). Similarly, pemmican (compacted meat, fat and fruit), jerky and even muktuk have changed with use of European convenience and processed ingredients.

3.7 Market Foods

The introduction of Western culture through television, radio and travel by the northern native peoples led to further changes in dietary patterns. While traditional foods are still a preference for many remote northern Aboriginals, the move into cities by many Aboriginals also brought dietary changes. Market foods range from perishable items such as fresh fruits and vegetables to expensive junk foods and are widely available arriving by air into the most remote places. The federal government subsidizes the cost of transporting nutritious food to remote, isolated communities, but even with a subsidy, these market foods are usually much more expensive than they would be in southern urban centres (Doran, 2004). Market foods also have more of an impact upon nutrition and health than food safety.

References

Chapter 3

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Chapter 4: Food Borne Illness and Traditional Food Consumption

Identification of the microorganisms or the microbial toxins of concern to the Aboriginal populations is important in risk analysis. In hazard identification, an association between disease and the presence of a pathogen in a food is documented. The information may describe conditions under which the pathogen survives, multiplies, causes infection and dies (Lammerding & Paoli, 1997). For microbial agents, hazards can be identified from relevant data sources such as scientific literature, databases, and solicitation of expert opinion. Relevant information for the hazard identification often includes review of clinical studies, epidemiological studies and surveillance, laboratory animal studies, investigations of the characteristics of microorganisms, interaction between microorganisms and their environment, and studies of analogous microorganisms and situations (Soller, 2006).

In this chapter, microbial hazards presenting the highest risks to Aboriginal populations are separated into three groups: parasitic agents, bacterial agents and others. The following is provided for each agent: description, hosts, prevalence, transmission, characteristics of illness, infectious dose, duration of illness and illness prevention. A list of outbreaks for each agent is presented in a table format with the year, food source, number of people exposed, number of confirmed cases, and method of preparation and description of affected people. Foodborne outbreaks due to market foods are not part of this review. Furthermore, although contaminated water sources have the potential to cause food-related outbreaks, since no such outbreaks attributed to country food are reported in the literature, the hazards posed by the aquatic parasites of *Giardia* spp. and *Cryptosporidium parvum* are excluded in this review

4.1. Parasitic Agents

Many North American Native populations have the habit of consuming their foods raw or undercooked. Parasite transfer from the raw infected food source to the consumer is of concern because incidents of parasitic disease are higher in Aboriginal populations than in the non-Native population. The food-borne parasites *Trichinella nativa*, *Toxoplasma gondii*, and *Anisakis simplex* are significant human pathogens. They are endemic in some regions and often related to the consumption of traditional foods. The risk of parasitic infection depends largely on the food source, the area of harvest and habits such as consuming raw or undercooked meats (Ahmed, 1992).

4.1.1. Terrestrial Parasites

Terrestrial wildlife parasites are susceptible to changes in temperature and humidity at several stages of their life cycle. In the past, survival of many of these parasites was limited by the extreme cold Arctic climate. Due to the impacts of climate change resulting in rising temperatures, the abundance of terrestrial parasites, and their transmission rates to humans, is becoming an increasingly important health concern among Aboriginal communities, particularly those with strong cultural habits of eating raw meats. Predicting the net impact of climate warming on these parasites is difficult because warming may increase both the development rates and the larval mortality rates of these terrestrial parasites (Gyorkos, MacLean, Serhir, & Ward, 2003). In this section, terrestrial parasitic diseases that are currently of public health concern among native communities in the Arctic and subarctic regions of North America are discussed.

4.1.1.1. *Toxoplasma gondii*

Disease: Toxoplasmosis

Description:
Toxoplasmosis is an infection caused by *Toxoplasma gondii*. This parasite has a very complex life cycle requiring felines and other animals as hosts for reproduction. A few weeks after infection, oocysts are formed and released in the feces of their hosts (usually cats) and are able to survive in the environment for prolonged periods of time to infect the next host. Although cats are primary hosts for this parasite, the disease can be passed to humans when they ingest the oocysts from raw of inadequately cooked meat or unwashed fruits or vegetables or through exposure to infected cat litter.

Hosts:
Toxoplasma gondii oocysts are usually transmitted from their definitive hosts, cats, to hundreds of other warm-blooded vertebrate species through feces contaminating food or water. Many animals typically consumed as food become infected, including sheep, pigs and wild game (rabbits, black bears, moose, bison, caribou, muskoxen and white-tailed deer) (Hill & Dubey, 2002; Kutz, Elkin, Panayi, & Dubey, 2001). Among wild game, *T. gondii* infection is most prevalent in black bears and white-tailed deer. Seropositivity for the parasite can be high in these animals, and human infection as a result of the consumption of bear meat or venison has been reported (Gill, 2007). Infection in cattle, horses and water buffaloes is generally not as common as infection in sheep or pigs (Hill & Dubey, 2002; Kutz et al., 2001). *T. gondii* is also present in coastal waters and may contaminate a variety of marine mammals including harbour seals, hooded seals, ringed seals, grey seals, Pacific walruses, bearded seals, and sea otters in several geographical regions of Canada and Alaska (Fayer, Dubey, & Lindsay, 2004).

Prevalence:
T. gondii has been detected in many animals used as a source of food in the Arctic and subarctic regions of North America. From 1979 to 1996, *T. gondii* antibodies were identified in various animal species in Alaska including 7% of 319 Dall sheep, 6% of 241 caribou, 1% of 240 moose and 1% of 241 bison tested (Zarnke, Dubey, Kwok, & Ver Hoef, 2000). Similarly, it is estimated that the seropositivity for *T. gondii* in North American deer can range between 0-50% (Ross, Stec, Werner, Blumenkranz, Glazer, & Williams, 2001).

In 1993 and 2004, blood samples were taken from 5 different caribou herds in the Northwest Territories and Nunavut to determine the presence of *T. gondii* antibodies. Results indicate that 44 of 147 (29.1%) caribou tested positive for *T. gondii* which is considerably higher than Alaskan caribou (6%). Among the Canadian herds studied, 37% (43/117) of mainland caribou and 4.3% (1/23) of Baffin Island caribou were infected with T. *gondii* (Kutz et al., 2001). Similarly, in 1994 and 1998, blood samples were taken from muskoxen in the Northwest Territories and Nunavut and results of this study indicate that 13 of 203(6.4%) muskoxen tested positive for *T. gondii.* Similar to what was observed for caribou in Canada, infection with *T. gondii* was higher in mainland muskoxen (4/10; 40%) compared to muskoxen in the arctic islands (9/193; 4.7%) (Kutz, Elkin, Gunn, & Dubey, 2000). The source of *T. gondii* oocysts in caribou and muskoxen is not known. Lynx and bobcats are the only felids in Northern North America that may be considered potential sources of infection for wild game. A study investigating the seroprevalence of *T. gondii* antibodies in lynx and bobcats trapped in Québec revealed that 47 of 106 (44%) lynx and 4 of 10 (40%) bobcats tested positive. The presence of *T. gondii* in these felids suggests that *T. gondii* may be widespread in the wild and that exposure to wild felids and game animals may represent a potential source of infection for humans. Although these felids generally remain below the tree line, wild game above the tree line, such as caribou, may become infected during seasonal migration (Labelle, Dubey, Mikaelian, Blanchette, Lafond, St-Onge, et al., 2001).

Toxoplasma gondii has also been detected in marine mammals in Canada and Alaska. Blood samples taken from seals located in several geographic areas in Canada revealed that 8.8% (3/34) harbour seals, 1.7% (1/60) hooded seals, 8.8% (3/34) ringed seals, 9.0% (11/ 122) grey seals, and 0% (0/112) harp seals tested positive for *T. gondii* antibodies. Similarly, blood samples taken from marine mammals located in several geographical areas in Alaska revealed that 0% (0/65) sea otters, 5.6% (3/53) Pacific walruses, 16.4% (51/311) harbor seals, 15.6% (5/32) ringed seals, 50% (4/8) bearded seals and 11.1% (1/9) spotted seals tested positive for *T. gondii* antibodies (Fayer et al., 2004). This information raises concern for the health of marine mammals in coastal waters and for humans who consume them raw (Bradley, Kutz, Jenkins, & O'Hara, 2005).

The prevalence of *T. gondii* in humans appears to be high in some of the Northern North American communities. During the 1970s, 40% of the population of Kuujjuaq in northern Québec and 28% of 1,572 Aboriginal people tested in Alaska were seropositive for *T. gondii* (Kutz et al., 2001). More recently, a seroprevalence rate of 105 for toxoplasmosis revealed in Native Indians from Northern Quebec and in Inuit form further north in Quebec, a rate of 48%. The higher Inuit rate is attributed to different hunting practices and dietary habits. This study comments that the 10% exposure rate to *T.gondii* is comparable with or lower than the reported rates in industrialized countries (Lévesque, Messier, Bonnier-Viger, Couillard, Côté, Ward, Libman, et al., 2007). Increasing age, female gender and a lower level of education are associated with seropositivity for *T.gondii* among the Inuit population of Nunavik. This study hypothesizes that drinking water and increased frequency of consumption of seal meat and feathered game are associated with *T.gondii* seropositivity. (Messier, Lévesque, Proulx, Rochette, Libman, Ward, et al., 2008).

Toxoplasmosis poses a higher risk to seronegative pregnant women. If these women become infected close to or during pregnancy, they may spread the disease to their unborn child. *T. gondii* has also been implicated in abortions among Aboriginal women in northern Québec and a statistical association was made between seroconversion and the consumption of raw caribou meat and the skinning of animals for fur (Kutz et al., 2001). Seroprevalence for *T. gondii* is high among pregnant women in northern North America. Between 1994 and 2003, an assessment was conducted to determine the overall seroprevalence of *T. gondii* among pregnant women, women of childbearing age and children born between 1994 and 2004 from 2 different regions of Nunavik (Western part: Hudson, Eastern part: Ungava). Results of this assessment indicated an overall seroprevalence of 50% (929 of 1860) which increased with age of the mother. Between the two regions, seroprevalence was higher in the western part of Nunavik (65%) compared to the eastern part (42%) (Lévesque, Davys-Ndassebe, Hubert, Lavoie, Proulx, & Libman, 2007).

Transmission:
Transmission of *T. gondii* to humans may occur: 1) through contact with oocysts shed in the feces of wild and domesticated felids, 2) by ingestion of tissue cysts from meat, or 3) congenitally (Fayer et al., 2004). Most often people become infected by ingesting tissue cysts in undercooked or uncooked meat or by ingesting food and water contaminated with oocysts from infected cat faeces (Hill & Dubey, 2002; Ross et al., 2001). The parasite can be transmitted to food by flies or cockroaches and to untreated water by rainfall runoff and wastewater outfalls (Bradley et al., 2005).

Congenital infection occurs only when a woman becomes infected several months before or during pregnancy. Mothers exposed more than six months before becoming pregnant are not likely to pass the infection to their child. While the mother rarely has symptoms of infection, she does have a temporary parasitemia and may infect the fetus. Although congenital transmission may occur, person-to-person transmission has not been reported (Fayer et al., 2004; Hill & Dubey, 2002).

Characteristics of Illness:
Most infections in humans are asymptomatic but at times the parasite can produce a devastating disease. Symptoms of toxoplasmosis typically occur 10-23 days after consuming contaminated meat. Toxoplasmosis is characterized by swollen lymph nodes, fever, headache, fatigue, muscle pain, sore throat and anemia. More severe manifestations include infection and tissue destruction of heart, liver, brain and eyes. *T. gondii* is a significant cause of infectious retinitis in humans (Ross et al., 2001). Persons with weakened immune systems are at greater risk of severe toxoplasmosis. In immunosuppressed patients, encephalitis is the most important manifestation as it causes the most severe damage to these patients. Toxoplasmosis ranks high on the list of diseases which lead to death in AIDS patients; approximately 10% of AIDS patients in

the USA and 30% in Europe are estimated to die from toxoplasmosis. Patients may also have disorientation, drowsiness; hemiparesis, reflex changes and convulsions, and many become comatose (Hill & Dubey, 2002).

If mothers are infected during pregnancy, congenital toxoplasmosis may result and abortion may occur. Many congenitally exposed infants are asymptomatic; however, a wide spectrum of clinical diseases may occur in congenitally infected children. Mildly diseased children may have slightly diminished vision, whereas severely diseased children may have the full tetrad of signs: retinochoroiditis, hydrocephalus, convulsions and intracerebral calcification. Of these, hydrocephalus is the least common, but it is the most dramatic lesion of toxoplasmosis. By far the most common sequel of congenital toxoplasmosis is ocular disease (Hill & Dubey, 2002).

Infectious Dose: Not known

Duration of Illness:
Symptoms of toxoplasmosis persist from two days to several weeks.

Illness Prevention:
Oocysts are the only stage that enter the environment and can remain infectious for a year under moist temperate conditions (Fayer et al., 2004). There are no commercial reagents available to detect *T. gondii* oocysts in the environment. Fortunately, the number of *T. gondii* tissue cysts in meat from food animals is very low. It is estimated that as few as one tissue cyst may be present in 100g of meat (Hill & Dubey, 2002). Tissue cysts in meat are destroyed by heating meat to an internal temperature of 67˚C. Conversely, freezing meat at -8 ˚C (18˚F) for three days, -7˚C (20˚F) for at least 17 days, or -1˚C (30˚F) for at least 34 days has been reported to render the organism non-infectious. *T. gondii* is also destroyed by exposure to gamma irradiation. Hygienic practices such as using soap and water for washing hands, cutting boards, sink tops, knives and other equipment before and after handling raw meat are also recommended and effective. Although *T. gondii* is resistant to most commonly used disinfectants, soap and water has been shown to destroy this parasite (Fayer et al., 2004).

Pregnant women, especially, should avoid contact with cats, soil and raw meat and avoid cleaning the litter box. An ongoing screening program for toxoplasmosis in northern Québec identified a cluster of four Inuit women who, over a four-month period, seroconverted during their pregnancy. All potential risk factors were assessed by a questionnaire administered to 22 Inuit women who had delivered babies in the previous year. Compared to the seronegative women, women who were seropositive were more than eight times more likely to have consumed raw caribou meat (p=0.054) more than once per week. Therefore, pregnant women should avoid eating raw meat (McDonald, Gyorkos, Albertson, MacLean, Richer, & Juranek, 1990).

Outbreaks:

Five separate cases of toxoplasmosis following the handling and consumption of raw or undercooked venison in young hunters. All cases involved previously healthy men presenting with flu-like symptoms ssociated with visual problems prompting suspicion about hunting and raw game meat ingestion from toxoplasmosis (Ross et al., 2001).

4.1.1.2. *Trichinella* spp.

Disease: Trichinosis

Description:
Trichinella species are intestinal nematodes (roundworms). The immature trichinella larvae can invade the muscle tissues of humans, animals and marine mammals. Five genotypes of *Trichinella* have been identified in North American wildlife, and each is capable of causing human disease. In Canada, most outbreaks are primarily caused by *Trichinella nativa* from the consumption of meat from wild animals in Arctic and subarctic regions. In contrast, most outbreaks reported globally are caused by *Trichinella spiralis* in pork. *T. nativa* is more resistant to freezing than *T. spiralis* and is especially adapted to arctic and subarctic areas (McIntyre, Pollock, Fyfe, Gajadhar, Isaac-Renton, Fung, et al. 2007; Schellenberg, Tan, Irvine, Stockdale, Gajadhar, Serhir, et al., 2003).

Hosts:
T. spiralis has been detected in wild game (polar bear, wolf, red fox and arctic fox) and marine mammals (walrus) harvested by Inuit communities in Northern Québec, Kuujjuaq and Salluit (Curtis et al., 1988).

Polar bear, black bear, brown bear, grizzly bear, polar fox, wolf, wolverine, lynx and walrus hunted in some areas of Canada are frequent hosts of *T. nativa* (McIntyre et al., 2007; Schellenberg et al., 2003).

Prevalence:
Trichinosis was first reported in Canada in the 1870s. It was not identified in animals in the Canadian Arctic until the 1930s and in humans until the 1940s. The majority of trichinosis outbreaks in Canada were attributed to eating meat from wild animals (Proulx et al., 2002). Limited prevalence surveys of Canadian wildlife suggest that less than 1.5% of black bears are infected with *Trichinella*, except in the Kootenay region of BC, where 12% (of 192 surveyed) were infected. In Alaska, 25% of black bears were infected (Schellenberg et al., 2003). In Nunavik, it is estimated that 60% of polar bears are carriers of *Trichinella* larvae (Proulx et al., 2002). *T. spiralis* was detected in dogs (22.2%), red foxes (15.7%), wolves (13.2%) and arctic foxes (6.0%) and in three of the five polar bears examined in the communities of Kuujjuaq and Salluit in northern Québec (Prichard, Rau, Tanner, Curtis, Faubert, 1986). The meat from these animals is only rarely eaten and is usually cooked thoroughly. One of 49 walruses in Kuuijuaq and Salluit and 2-4% of walruses examined in Nunavik were infected with *Trichinella* (Prichard et al, 1986;

Proulx et al., 2002). The meat from these animals represents a significant proportion of the marine mammal species that are traditionally hunted for subsistence in these areas and frequently eaten raw or fermented *(igunaq)*.A high prevalence of trichinosis associated with game meat has also been reported in the U.S.; during 1997-2001, of the 52 (72%) outbreaks in which the source of infection was known or suspected, 40% were associated with pork products and 60% were associated with wild game (CDC, 2003).

Canadian seroprevalence rates for Native people from Northern Quebec for trichinosis have been reported in at least two studies. Rates varied between 1 and 2% (Tanner, Staudt, Adamowski, Lussier, Bertrand & Pritchard, 1987; Messier et al., 2008). Another study for seropravelence for the Quebec Cree reported zero seropositivity for trichinosis (Lévesque et al., 2007).

Transmission:
Trichinella is not transmitted from person-to-person. Trichinosis is acquired by eating raw or undercooked meat that contains larvae of the tissue-dwelling nematode, *Trichinella*. If meat containing infective *Trichinella* cysts is consumed, stomach acid will dissolve the hard covering of the cysts and release worms. The worms then pass into the small intestine and mature. After mating, adult females lay eggs that develop into immature worms which are able to migrate through blood arteries to muscle tissues in the host body. Within the muscles, the worms curl into a ball and encyst (become enclosed in a capsule).

Characteristics of Illness:
The symptoms of trichinosis may range from very mild to severe and are generally related to the number of infectious worms consumed. Ingestion of a higher parasite load usually correlates with a shorter incubation period and more severe symptoms. Symptoms such as malaise, nausea, diarrhea and abdominal cramping may result when the larvae penetrate the intestinal mucosa and multiply, which occurs 24 to 72 hours after eating infected meat. If the larvae enter the bloodstream and become encapsulated in the muscles, symptoms such as muscle soreness, pain, chills, edema of the upper eyelids, eosinophilia, ocular pain, sensitivity to light or pneumonitis may appear two to eight weeks later. Remittent fever, cardiac and neurologic complications may also develop. Some infected people may be asymptomatic. Once *Trichinella* becomes enclosed in cysts within the muscle, the patient's clinical symptoms will begin to disappear and antiparasitic medicines become ineffective. If left untreated, the parasites will die within two to five years and become calcified (Maclean, Poirier, Gyorkos, Proulx, Bourgeault, Corriveau, et al., 1992; McIntyre et al., 2007; Moorhead, Grunenwald, Dietz, & Schantz, 1999).

Infectious Dose:
Limited field data indicate that walrus meat containing as few as one to four *Trichinella* larvae per gram can cause clinical illness in humans. Studies suggest that the tongue of a walrus typically contains more larvae than the pectoral and intercostal muscles (Leclair, Forbes, Suppa, & Gajadhar, 2003).

Duration of Illness:
Heavy infestations of *Trichinella* may be extremely painful and long-enduring. Symptoms of mild to moderate infections generally subside within a few months. Symptoms such as fatigue, weakness and diarrhea may persist for months.

Illness Prevention:
Although the incidence of trichinosis in more populated regions has declined with improved meat processing regulations, outbreaks in the Arctic, from Greenland to Alaska, continue to be an important public health concern. Although most *Trichinella* species isolated from pork products are susceptible to freezing (-15˚C for 30 days or -25˚C for 10 days), *T. nativa* remains viable for months, or years after freezing. (CDC, 2003; Prichard et al., 1986). *Trichinella* species are generally destroyed at 58.3˚C (137˚F). The Canadian Food Inspection Agency recommends that meat be brought to an internal temperature of 77˚C before being consumed in order to destroy any parasites that may be present. Also, boiling the meat appears to be more efficient than drying it (Schellenberg et al., 2003). To prevent infection, consuming meat from infected animals should be avoided. In 1992, a trichinosis prevention program for residents of Nunavik was offered to all municipalities; the program involves testing selected samples of meat from newly harvested walrus for the presence of *Trichinella* larvae. Hunters receive training in sample-collection procedures and were advised not to distribute or consume any walrus meat before the results of the analyses were made available (Proulx et al., 2002).

Trichinella nativa obtained from traditional igunaq preparations (muscle fat contained in a walrus hide bag sewn closed and fermented for four to 10 months) were not infective in guinea pigs; walrus meat stored in the freezer at -20˚C for 20 months remained infective. It was suggested that the ageing process in the igunaq under these conditions appeared to have either killed the *Trichinella* larvae or reduced their infectivity. Under adequate growth conditions, microorganisms causing putrefaction may have damaged the capsule of the *Trichinella* larvae and compromised their survival. It is suggested that the degradation process that occurred using traditional igunaq preparations can be sufficient to either kill *Trichinella* larvae or render them non-infective for guinea pigs. In contrast, laboratory studies have shown that infective *T. nativa* are able to survive in igunaq, nikku (air-dried meat), raw frozen sausage and poorly cooked sausage for at least five months (Forbes et al., 2003). Further research is needed to evaluate the food safety risk of traditional walrus igunaq aged under different field conditions and storage times (Leclair et al., 2004).

Table 7: ***Trichinosis Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of Outbreak (Reference)	Parasite Species Identified	Food Source	Number of people exposed	Number of confirmed cases	Method of Preparation	Description of people affected
2005 (Ancelle et al., 2005)	*Trichinella spp.*	American black bear meat hunted in Northern Québec	25	17	Raw and undercooked steaks and stew	Hunters from France
2005 (McIntyre et al., 2007)	*T. nativa*	Black bear meat hunted in Port Renfrew, British Columbia	42 26 probable	14	Meat was barbecued, fried or stewed.	Residents of Victoria B.C
2003 (Centers for Disease Control and Prevention, 2003)	*T. nativa*	Black bear hunted in Canada	6	2	Two affected ate steaks medium rare. Four unaffected ate steaks well done.	Residents of Tennessee, U.S.
2001 (Møller et al., 2005)	*Trichinella spp.*	Walrus and Polar bear caught in western Greenland.	6	3	Both walrus and polar bear meat were boiled for one hour.	Residents of Western Greenland
2000 (Schellenberg et al., 2003)	*T. nativa.*	Black bear hunted in Saskatchewan	78	31	Confirmed cases were more likely to have eaten dried bear meat, either by itself or combined with some boiled bear meat.	The people affected came from 2 communities consisting predominantly of Dene (First Nations) and Métis people.
1999 (Leclair et al., 2004)	*Trichinella spp.*	Walrus Igunaq harvested in Qikiqtarjuaq located on the east coast of Baffin Island	Unknown	34	Igunaq was stored under rock caches and remained unfrozen until consumption 2-3 months later.	Native population in Qikiqtarjuaq located on the east coast of Baffin Island

Table 7 (Continued): ***Trichinosis Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of Outbreak (Reference)	Parasite Species Identified	Food Source	Number of people exposed	Number of confirmed cases	Method of Preparation	Description of people affected
1982-1999 (Proulx et al., 2002)	*Trichinella spp.*	11 outbreaks of trichinosis: Walrus meat (9) Arctic fox (1) Polar bear (1) hunted in Nunavik	The number of people exposed is unknown.	86 people with trichinosis In 1987, 42 of 68 people exposed had trichinosis after eating meat from a walrus.	Raw or insufficiently cooked walrus, fox or bear meat.	Residents of Nunavik
1997 (Proulx et al., 2002; Leclair et al., 2004)	*T.nativa*	Five walruses harvested from Sleepers Islands in eastern Hudson Bay.	27	3 people	Raw and cooked walrus meat.	Hunters in Inukjuak, Nunavik
1991-1996 (Moorhead et al., 1999)	*Trichinella spp.*	A total of 230 cases reported in the United States; implicated foods available for 134 cases: Pork 78 Wild game:56 Bear 31 Walrus 13 Cougar 10 Wild boar 2	Unknown	230 45 (20%) of which occurred in Alaska: 7 cases in 1991, 34 cases in 1992, 4 cases in 1994	40 of the 56 cases in the United States involved uncooked wild game, 11 involved cooked wild game and for 5 cases the method of cooking is not known.	Residents in the United States, including Alaska.

4.1.1.3 Echinococcus spp.

Disease
Two forms of disease are significant for this review: 1) Cystic echinococcosis, also known as Hydatid disease or hydatidosis, causative agent: *E. granulosus*; and, 2) alveolar echinococcosis, also known as Alveolar hydatid disease, causative agent: *E. multilocularis* (Eckert & Deplazes, 2004).

Description
Echinococcosis is a parasitic disease that can affect animals and humans and is caused by tiny tapeworms. Most human infections are due to *Echinococcus granulosus* transmitted between domestic dogs and livestock, but this widespread species also cycles between wild carnivores (mostly canids such as wolves) and wild ungulates hosts (caribou or moose). Infection involves the development of cysts caused by the growth of the immature or larval tapeworms (Center for Food Security & Public Health, 2005). There are two forms of E. granulosus: a sylvatic or forest-wild animal cycle, most common in northern North America and a pastoral form involving domestic ungulates (sheep and dogs), more common in more southerly climates. The pastoral form is more virulent. Echinoccus multilocularis is usually sylvatic but domestic dogs and cats can be susceptible definitive hosts infected by predating wild intermediate hosts (Eckert, Schantz, Gasser, Torgerson, Bessonov, Movses-sian et al., 2001).

Reports on clinical aspects of E.granulosus and E.multilocularis infection in canids are rare and consist mainly of observations from experimental infections concerned with aspects of the biology of Echinococcus. The presence of either species does not appear to cause major ill effects to the definitive hosts even when heavily infected (Eckert, Deplazes, Craig, Gemmell, Gottstein, Heath et al., 2001)

Hosts:
Definitive hosts: canids e.g. coyote, wolf, fox, raccoon or dogs (wild or domestic)
Intermediate/incidental hosts: *E. granulosus*: moose, caribou and other herbivores with encysted larva, humans (Public Health Agency of Canada, 2001a).
E. multilocularis: rodents such as voles, lemmings,shrews and mice (Public Health Agency of Canada, 2001b).

Prevalence: Hunters, trappers and people working with fur may frequently be exposed to the eggs of *E.multilocularis*, but there is no evidence that these groups are at increased risk (Eckert & Deplazes, 2004). Human disease is caused almost exclusively by *E. granulosus* with rare cases caused by *E. multilocularis*. It is the sylvatic (forest-wild animal cycle) variant of the disease that is seen in North America and may be more benign than the pastoral variety seen in other parts of the world (Al Saghier, Taylor, Greenberg, 2001; Center for Food Security & Public Health, 2005).

In the 1980s, 3% of the sera of Native Indians from Northern Quebec tested positive for echinococcosis (hydatid disease) with seroprevalence rates for Northern Quebec Inuit people living further north at 1% (Tanner, Staudt, Adamowski, Lussier, Bertrand & Prichard, 1987). A more recent study with the Cree in Northern Quebec reported no seropositivity (Lévesque et al., 2007). Yet one further study of the Inuit in Northern Quebec reported 8.3% seropositivity (Messier et al., 2008). It is important to note that serological tests may also be negative in infected patients with inactive cysts, which further complicates drawing conclusions about prevalence from seroprevalence testing (Al Saghier, Taylor, Greenberg, 2001).

Despite the wide distribution of the parasite, human cases of echinococcosis have been rarely reported. Most cases have been diagnosed in aboriginal communities in Northern Canada and western Alaska (Al Saghier, Taylor & Greenberg, 2001; Castrodale, 2003). Although the likelihood of infection of *E. multilocularis* is decreasing with lifestyle changes in native and northern communities, one survey in western Alaska reported seroprevalence rates ranging from 7-8/100 000 to as high as 98/100 000 (Gyorkos, Maclean, Serhir & Ward, 2003).

Two species of Echinococcus are widely distributed in the subartic regions of Alaska and Canada: *E. granulosus, E. multilocularis.* The cervid strain of *E. granulosus* is prevalent in northern herbivores such as moose and caribou which are intermediate hosts as well as wild canines, principally wolves which are definitive hosts. The endemic area of North America includes the northern tundra zone of Alaska (USA) and Canada, and further south a northern central region, including parts of three Canadian provinces (Alberta, Saskatchewan, Manitoba) and thirteen States of the United States of America (Montana, Wyoming, North and South Dakota, Nebraska, Minnesota, Iowa, Wisconsin,Michigan, Missouri, Illinois, Indiana and Ohio). There are indications of widening of the range of the parasite. Most human cases have been reported from the northern zone and only two from the northern central region (Eckert et al., 2001). Moose with hydatid cysts have been found in every province of Canada west of the Maritimes and it is estimated that 50% of the moose in Ontario and British Columbia are infected with the parasite (Somily et al., 2005). Surveys in wild animals have demonstrated high prevalence rates of *E. granulosus* in moose (18-59%), caribou (9.5% of 286), and wolves (47% of 21) in northern regions (WHO, 2009). 28-50% of dogs in the Northwest Territories are infected with *E. granulosus* (Somily, Robinson, Miedzinski, Bhargava & Marrie, 2005). According to the World Health Organization, up to 100% of foxes are infected with *E. multilocularis (*WHO, 2009*).*

Transmission: All *Echinococcus* spp. have a complex indirect life cycle, alternating between a definitive host (i.e. species necessary for the life cycle of the worm) and an intermediate host. The definitive host is a carnivore, such as a fox, coyote, wolf, raccoon or a domestic dog or cat and usually no symptoms of infection. The definitive hosts become infected when they ingest cysts in the tissues of the intermediate hosts. The cysts develop into tapeworms, which mature in the host's small intestine. Eggs are shed in the feces and are immediately infective, sticking to an animal's fur or other objects. The intermediate hosts include a large number of domestic and wild animals, particularly herbivores and sometimes, humans. If an intermediate host ingests eggs, the larvae are released, penetrate the intestinal wall and are carried in blood or lymph to the target organs, primarily liver and lungs where they grow slowly (Craig, Rogan & Campos-Ponce, 2003; Center for Food Security and Public Health, 2005). A similar life cycle and transmission occurs for *E. multilocularis.*

E. granulosus: Hand-to-mouth transfer of tapeworm eggs from animal feces, fecally contaminated food and water and in Northwest Canada, disease is maintained in a wolf-moose cycle, from which the dog brings the parasite to humans (Public Health Agency of Canada, 2001a).

E. multilocularis: Ingestion of infected eggs passed in feces of infected Canidae, fecally soiled dog hair, harness and environmental fomites serve as vehicles of infection; vegetables and water contaminated with the parasite eggs (Public Health Agency of Canada, 2001b)

Characteristics of Illness: There are limited descriptions of the clinical course in humans and no clinical features that can reliably distinguish *E.granulosus* and *E. multilocularis* (Somily et al., 2005). There are variable clinical manifestations of the disease, determined by the site, size and condition of the cysts, ranging from no symptoms to severe disease, sometimes death. The course of infection in indigenous persons is typically benign, and self-cure, following rupture and expulsion of pulmonary cysts and fluid, is not uncommon (Rausch, 2003). There are often no symptoms until the cyst growth damages tissues and organs (Moro & Schantz, 2009). The disease is not transmitted from person to person. Infected humans can be asymptomatic for many years.

Infectious Dose: Not known.

Duration of illness: The disease process is very slow, taking months to 30 years to appear.

Illness Prevention: Preventive measures that have been used to control Echinococcus infections include avoidance of contact with dog or fox faeces, handwashing and improved sanitation, reducing dog or fox populations, treatment of dogs with arecoline hydrobromide or praziquantel or use of praziquantel-impregnated baits, incineration of infected organs, and health education. Despite ongoing control efforts, few countries have been able to substantially reduce or eradicate alveolar or cystic echinococcosis (McManus, Zhang, Li & Bartley, 2003).

Since the primary transmission cycle is almost always in the wild, efficient and cost-effective methods for control are unavailable. The best prevention of infection is by interrupting the parasites lifecycle. Suggested actions to prevent illness may include:

- Hunters and trappers should use gloves when handling fox, coyote or other wild canines, dead or alive
- Inspection of meat by hunters.
- Appropriate disposal of infected carcasses
- Wash hands well after contact with dogs or items that may be contaminated with dog feces
- Prevent dogs from eating viscera of potentially infected animals
- Do not keep wild animals as pets
- Wash all fruits and vegetables thoroughly before eating, especially if picked in wild or off ground
- Meat from hoofstock (ungulates) infected with Echinococcus is safe to eat if cooked thoroughly. Avoid eating organs with cysts
- Infections in dogs can be treated with praziquantel

Source: Castrodale, 2003

The interface between dogs, wildlife and humans in remote northern communities has recently been recognized as an important health issue. Since many northern communities have limited access to veterinary services and disease surveillance programs and routine preventive health measures such as vaccination and parasite control are rare, a new approach to domestic animal healthcare in the north is needed (Salb, Barkema, Elkin, Thompson, Whiteside, Black et al., 2008).

Table 8: ***Echinococcosis Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of Outbreak (Reference)	Parasite Species Identified	Food Source	Number of people exposed	Number of confirmed cases	Method of Prep-aration	Description of people affected
1987 to 1997 (Al Saghier et al., 2001)	*E. granulosus*	Unknown	Unknown	17	Unknown	6-70 yrs old, mean age 32.1 yrs; 6 from NW Ontario, 11 from Manitoba 82% male
1966-1972 (Pinch & Wilson, 1973)	*E. granulosus*	Lungs of moose or caribou fed to dogs	Unknown	32	Unknown	Alaska, mostly central interior parts Most with contact with dogs around the home
1966-1993 (Wilson et al., 1995)	*E.multilocu-laris*	Unknown	Unknown	42	Unknown	Alaskan Eskimos 16 cases asymptomatic
1950s to 2003	*Echinococcus* spp.			>300		Alaska with comparably large no. in Canada
1991-1999				3		
1990 to 2003 (State of Alaska, 2003)	*E. granulosus*	Unknown	Unknown	8	Unknown	Average age 35 yrs, 50% female, 63% native Alaskans
	E.multilocu-laris			0		
1991 to 2001 (Somily et al., 2005)	*E. granulosus* *E.multilocu-laris*	Unknown	42	19 definite 3 probable 20 possible	Unknown	5-87 yrs old 41% aboriginal 77% female No mortality

4.1.2. Aquatic Parasites

In 1995, the World Health Organization estimated that the number of people infected with fish-borne trematodes exceeded 18 million, but worldwide the number of people at risk, including those in developed countries, was more than half a billion. Compared with other well-studied parasitic diseases, fish-borne parasitic zoonoses transmission is often dependent on well-entrenched human behaviours. Fish-borne zoonoses such as opisthorchiasis, intestinal trematodiasis, anisakiasis or diphyllobothriasis are responsible for large numbers of human infections (Chai, Darwin Murrell, & Lymbery, 2005). In general, the prevention of infection is dependent on limiting the harvesting of seafood from high-risk areas, informing sports fishers of regionally important risks associated with certain species and the availability of alternative control strategies (e.g. freezing fish before raw consumption), and educating consumers on the importance of adequate cooking of seafood (Ahmed, 1992). Northern North American Natives are especially at risk of parasitic foodborne illness because of their cultural habits of eating raw fish and marine mammals that are infected with aquatic parasites. The following is a brief description of a few aquatic parasites prevalent among these communities.

4.1.2.1. *Anisakis simplex*

Illness: Anisakiasis

Description:
Anisakis simplex (herring worm) is an almost colorless nematode (roundworm) that is tightly coiled and encased in the gut and flesh of fish, particularly in the belly flaps. *A. simplex* is able to grow to two cm in length (State of Alaska Epidemiology, 1982; United States Food and Drug Administration [U.S. FDA], 1992b).

Hosts:
Anisakis simplex can occur frequently and in large numbers in the gut or flesh of certain species of fish such as herring, mackerel, whiting and blue whiting, cod, haddock, flounder, pacific salmon, flounder, and monkfish. Stomachs of whales and dolphins often harbor *A. simplex* (adult form) (Lymbery & Cheah, 2008; State of Alaska Epidemiology, 1982; U.S. FDA, 1992b).

Prevalence:
To date, only *A. simplex* is associated with human infections in North America. Fewer than 10 cases are diagnosed in the U.S. annually; it is suspected that many cases go undetected (Gyorkos et al., 2003; Lee, 2000; Weir, 2005). Anisakiasis is a significant Arctic human zoonosis, endemic to some regions and directly related to the consumption of country foods (Lymbery & Cheah, 2008; U.S. FDA, 1992b).

Transmission:
Some evidence exists that the nematode larvae move from the viscera to the flesh if the fish hosts are not gutted promptly after catching. *A. simplex* has been implicated in human infections following ingestion of roundworm larvae in raw or undercooked

seafood. The disease is transmitted by raw, undercooked or insufficiently frozen fish and shellfish, and its incidence is expected to increase in communities that eat raw fish such as at sushi and sashimi bars (Dixon, 2006; State of Alaska Epidemiology, 1982; U.S. FDA, 1992b).

Characteristics of Illness:
The term 'anisakiasis' is generally used when referring to the acute disease in humans. The range of clinical features is not dependent on the species of anisakid parasite in cases reported to date. In North America, anisakiasis is most frequently diagnosed when the affected individual feels a tingling or tickling sensation in the throat and coughs up or manually extracts a nematode. In more severe cases, violent and sudden abdominal pain accompanied by nausea and vomiting has been reported. If the larvae pass into the bowel they can produce symptoms similar to Crohn's disease. Severe cases of anisakiasis are extremely painful and require surgical intervention. Physical removal of the nematode(s) from the lesion is the only known method of reducing the pain and eliminating the cause (other than waiting for the worms to die). Clinical manifestations of anisakiasis can occur within an hour to two weeks after consumption of raw or undercooked seafood (U.S. FDA, 1992b).

Infectious Dose: Usually, one nematode is recovered from ill patients.

Duration of Illness:
This is not currently known. Studies suggest that anisakids rarely reach full maturity in humans and usually are eliminated spontaneously from the digestive tract within three weeks of infection. Anisakids that have invaded human tissue and subsequently died in situ are eventually removed by the phagocytic cells of the host (U.S. FDA, 1992b).

Illness Prevention:
A brief visual inspection on a light table (candling) is used by commercial processors to reduce the number of nematodes in certain white-flesh fish that are known to be infected frequently. This method is not totally effective, nor is it adequate to remove even the majority of nematodes from fish with pigmented flesh (U.S. FDA, 1992b; Levsen, Lunestad & Berland, 2005). *A. simplex* larvae are killed in one minute at a temperature of 60˚C (State of Alaska Epidemiology, 1982). Cooking a three cm thick fillet for 10 minutes at 60˚C will kill any worms present. The temperatures of a cold smoking process, such as kippering, are not high enough to kill parasites. Time-temperature combinations used for commercial hot smoking processes are designed to kill the parasite. Eviscerating fish immediately after catching and freezing fish at -20˚C for 60 hours kills any worms present. *A. simplex* larvae are resistant to salting; immersion in a brine solution (21% salt by weight) for 10 days will kill any larvae present. Immersion in brine of lower strength does not result in adequate inactivation of the larvae. Transmission of anisakiasis larvae to the human consumer can be prevented by limiting harvesting of seafood from high-risk areas and by informing sport fishermen of important risks associated with certain species of fish. Prevention of anisakiasis also depends on adequate cleaning in combination with effective modes of processing such as adequate cooking or freezing to at least -20°C for

60 hours if the seafood is eaten raw (State of Alaska Epidemiology, 1982; U.S. FDA, 1992b). No vaccine is available.

Table 9: ***Anisakiasis Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of outbreak (Reference)	Food source	Number of people exposed	Number of confirmed cases	Method of preparation	Description of people affected
1982 (State of Alaska Epidemiology, 1982)	Red salmon caught in Chitna, Alaska.	6	6	The salmon was kept in the refrigerator overnight, and baked at 350°F (177ºC) for less than 30minutes and appeared slightly raw.	Not specified.
No Year Given (Couture et al., 2003)	Wild salmon caught in the Pacific Ocean in Canada.	Unknown	1	The salmon was eaten raw.	A 50 year old man from Québec.
1987 (State of Alaska Epidemiology, 1987)	Halibut (information on where it was caught was not given)	4	2	The halibut was eaten raw.	A family of four residing in Glennallen, Alaska.

4.2. Bacterial Agents

4.2.1. Clostridium botulinum

Illness: Botulism

Description: *Clostridium botulinum* is an anaerobic, Gram-positive, spore-forming rod-shaped bacterium that produces a potent neurotoxin. The spores are widely distributed in the environment, occurring in soil, water and in the intestinal tracts of fish and mammals. The spores are heat-resistant and can survive in foods that are incorrectly or minimally processed. Most cases of foodborne botulism are caused by Types A, B and E toxins. Foodborne botulism is actually a foodborne intoxication caused by a neurotoxin produced by the bacteria. Once the contaminated food is eaten, the toxin binds to nerve endings and prevents release of the neurotransmitter, acetylcholine, which transfers messages to the next nerve. With transmission of nerve impulses blocked, weakness and paralysis result, beginning with the cranial nerves and then descending via a symmetrical paralysis (Segal, 1992).

Hosts:
The organism has been isolated from seal (flippers, meat), whale (meat and muktuk), salmon (stink eggs, stink heads, smoked salmon), whitefish, beaver (meat and tail) and caribou; dried foods and traditionally prepared condiments, such as seal oil. In Canadian cases of botulism, 46-50% implicated fish, primarily fermented salmon eggs and heads, as the source of infection, and 41-45% involved fermented marine mammal parts (Himelbloom, 1998).

Prevalence:
In Canada, foodborne botulism is a rare disease that primarily affects the First Nations and Inuit. Most cases occur in rural or remote areas of Northern Canada. A review of outbreaks from 1919 to 1973 revealed that two thirds of the total 62 outbreaks documented during this period involved Inuit and West Coast Aboriginal people consuming raw marine mammal products and salmon eggs (Dolman & Ilda, 1963). A subsequent paper reviewing cases of foodborne botulism from 1971 to 1984 reports 61 outbreaks involving a total of 122 cases with 21 fatalities. Most of these outbreaks occurred in northern Québec, the Northwest Territories and British Columbia and 59% were caused by raw, parboiled or fermented meats from marine mammals. Fermented salmon eggs or fish accounted for 23% of the outbreaks. Type E was the predominant toxin (Hauschild, & Gavreau, 1985). In 1995, seven outbreaks of foodborne botulism involving 13 cases with no deaths were confirmed. Traditional fermented Inuit foods were implicated in five of the outbreaks. Four of the seven outbreaks occurred in the Nunavik region of Québec where there have been 10 outbreaks of botulism in the last five years, all involving type E strains. Different types of seal products have been incriminated in most of these cases (Austin & Dodds, 1996). In 1996, five outbreaks of foodborne botulism involving 10 cases with no deaths were confirmed. All of the outbreaks involved *Clostridium botulinum* type E and traditional fermented Inuit foods.

Four of the outbreaks occurred in northern Québec and one in the Northwest Territories (Austin, Blanchfield, Proulx, & Ashton, 1997). Seven outbreaks of foodborne botulism, involving 18 cases with one death were confirmed in Canada in 1997. All of the outbreaks involved *Clostridium botulinum* type E and several involved traditional fermented Inuit foods. Four of the outbreaks occurred in Québec, two in the Northwest Territories, and one in British Columbia (Austin et al., 1999). Surveillance data from the British Columbia Centre for Disease Control (BCCDC) document that fermented salmon roe continues to contribute to botulism cases in B.C. with an annual average of one to three cases from 1994 to 2002 (Dawar et al., 2002).

Transmission:
Foodborne botulism is transmitted by the ingestion of improperly prepared or stored food contaminated with botulism toxin, a neurotoxin. Foods involved are usually fermented intentionally or unintentionally because of inadequate storage and preservation. A combination of conditions is required for spore germination and toxin production: low acidity (pH<4.6), high water activity, absence of preservatives, ambient temperature and an anaerobic milieu. Unfortunately, traditional food preparation methods (raw, parboiled, dried, and fermented) encourage the appropriate conditions for growth of botulinum toxin (Castrodale, 2005; Segal, 1992; Shaffer et al., 1990).

Characteristics of Illness:
Neurological symptoms usually appear within 12 -36 hours, but may range from six hours to eight days after ingestion of the toxin. Common symptoms include: eyelid drooping, double vision, difficulty speaking and swallowing, difficulty breathing, muscle weakness, abdominal distension and constipation. Eventually paralysis and respiratory arrest occur.

Infectious Dose:
A very small amount (a few nanograms) of toxin can cause illness (U.S. FDA, 2007).

Duration of Illness:
The duration of illness may be two hours to 14 days, although some symptoms may linger much longer.

Illness Prevention:
Two strategies are employed to prevent intoxication (Castrodale, 2005):

1. Reduce contamination of food with *C. botulinum* spores and prevent toxin production in food. Avoid use of glass jars or plastic bags/containers with tight fitting lids and fermentation above ground. The traditional method of placing food in a cool, shaded shallow pit in the ground lined with wood, animal skins or leaves and covered with moss or leaves is preferred because this way maintains an aerobic environment during fermentation. Duration for fermentation varies according to ambient temperature, from a few days to one to two months. The toxin can be destroyed if boiled for 10 minutes or longer. Suggestions to modify fermentation recipes for traditional foods have been ignored since flavour is lost

and the practice is viewed as culturally unacceptable. Spores survive smoking, cooking and salting and germinate between 29°C to 35°C but the bacteria can grow between 3°C to 48°C. Storing food in non-airtight containers and at 4°C or lower will prevent growth of the bacterium.

2. Prompt recognition and treatment of clinical illness is desirable. An antitoxin is available to destroy the neurotoxin and prevent onset of botulism if administered early in the course of illness.

Table 10: ***Botulism Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of outbreak (Reference)	Type of toxin	Food source and method of preparation	Number of people exposed	Number of confirmed cases	Description of people affected
Alaskan Summary for 1950-2004 **124 Outbreaks** (Castrodale, 2005)	Of the 251 cases: 101 type E 34 type B 9 type A	Implicated food was known for 69 of the outbreaks: 31 seal 15 salmon eggs 6 whale 5 salmon heads 5 beaver tail/paw 4 whitefish 3 other sources	Not known	251	All cases occurred in Alaska Natives.
2001 **2 outbreaks** (Dawar et al., 2002)	Both outbreaks involved type E	Both outbreaks involved Home-fermented salmon roe.	**Outbreak 1:** 4 people **Outbreak 2:** 2 people	**Outbreak 1:** 2 people **Outbreak 2:** 2 people	Both outbreaks in First Nations communities in North-western B.C.
Canadian Summary for 1997: **7 Outbreaks** (Public Health Agency of Canada, 1999)	All 18 cases were type E	Of the 18 cases: 11 seal igunaq 4 Beluga whale or caribou fat 1 muktuk 2 salmon (restaurant prepared or smoked)	Not known	18, 1 person died	12 from Québec, 5 from N.W.T, 1 from B.C.
Canadian Summary for 1996: **5 Outbreaks** (Public Health Agency of Canada, 1997a)	All 10 cases involved type E.	Of the 10 cases: 4 seal 4 beluga whale 1 fermented fish 1 involved miseraq	Not known	10 no deaths	9 from Québec 1 from N.W.T
Canadian Summary for 1995: **7 Outbreaks** (Public Health Agency of Canada, 1996c)	Of the 13 cases reported: 11 cases involved type E, 2 cases involved type B	Of the 12 cases reported: 5 walrus 3 seal 2 pate 1 marinated and smoked fish 1 muktuk, 1 miseraq	Not known	13 no death	11 from Québec, 1 from N.W.T 1 from Yukon.

4.2.2. *Shigella* spp.

Illness: Shigellosis

Description:
Shigella spp. are non-spore-forming, highly infectious Gram-negative bacteria that may be isolated from the human intestinal tract.

Hosts:
Humans are the only significant reservoir of *Shigella* bacteria. Therefore, in order to be a source of infection, water and food must be contaminated with human feces containing *Shigella*. As a result, communities with inadequate systems for sewage disposal are at increased risk for developing shigellosis. Those using wells may also be at risk if septic systems are located near the well, or a well water source. In many cases, sewage systems and drinking water sources in First Nations communities do not meet provincial design installation standards (Clark, 2002).

Prevalence:
Based on the 2003 Annual Infectious Disease Report, the incidence of shigellosis in Alaska was 1.72 per 100,000 Alaskans and 8.19 per 100,000 Americans in the rest of the U.S. (Chambers, 2005). In Canada, many First Nations communities experience a disproportionate burden of shigellosis infections as a result of a range of environmental conditions (Clark, 2002).

In 1999, the reported incidence of shigellosis in Canada was 3.6 per 100,000 people. Overall rates were higher in the Prairie provinces than in other parts of Canada, with the highest rates in Manitoba (14 per 100,000).

Clark (2002) compared the 1999 reported shigellosis rates from the First Nations on-reserve population with data for the entire Canadian population. The First Nations on-reserve population for which cases of shigellosis were reported represents 1.1% of the Canadian population. However, 23% of all reported shigellosis cases and 47% of cases among children aged 0-14 years occurred in the First Nations on-reserve population in 1999. The incidence rate of 74.1 per 100,000 was 26 times higher than in non-First Nations people.

The vast majority of First Nations cases (93.6%) in 1999 occurred in Alberta, Saskatchewan and Manitoba. Reported incidence rates during the late 1990s were consistently higher among First Nations communities than in the non-First Nations populations in these provinces (Alberta, Saskatchewan and Manitoba). Over 80% of First Nations patients diagnosed with shigellosis and hospitalized in Saskatchewan and Manitoba during this period were children aged 0-14 years. An epidemic in Manitoba during the early 1990s affected more than half of the First Nations communities in that province (Clark, 2002).

Transmission:
Shigellosis is acquired by ingesting food, or water contaminated with *Shigella* spp., or through fecal-oral, person-to-person spread (Clark, 2002). Poor sewage systems or inadequate water supplies have been associated with increased risk of shigellosis (Clark, 2002). *Shigella* bacteria can contaminate food when infected people do not adequately wash their hands after using the washroom or as a result of other poor hygienic practices. Food such as shellfish may become infected if it comes in contact with human sewage. Flies can also spread the bacteria to food.

Characteristics of Illness:
Shigellosis is an acute, bacterial disease characterized by diarrhea (usually bloody), abdominal cramps, fever and vomiting. These symptoms often appear one to three days after ingestion of contaminated food, or water (Clark, 2002). Some individuals may appear to be asymptomatic but are capable of spreading the bacteria to others.

Infectious Dose: *Shigella* is highly infectious; as few as 10 bacteria can cause illness in susceptible individuals.

Duration of Illness:
Symptoms of shigellosis may last between four to 14 days or longer and recovery is generally slow.

Illness Prevention:
Shigella can survive for 11 days in feces, for two to three days in water and for 12 days in flies. *Shigella* grows best at temperatures higher than 8˚C and lower than 45˚C. Cooking food thoroughly should destroy any bacteria present. They are also inhibited at pH below 4.8 or above 9.3 and by the presence of 5.2% salt. Researchers have identified important links between shigellosis and a number of factors in the environment such as sewage disposal methods, water supply systems and housing conditions (Clark, 2002). In many cases, sewage systems in First Nations communities do not meet provincial design installation standards and access to a sufficient water supply for basic hygiene is also a problem in many First Nations communities. As a result, these communities are at increased risk of fecal-oral and person-to-person spread of *Shigella* bacteria (Clark, 2002).

Table 11: ***Shigellosis Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of outbreak (Reference)	***Shigella* type:**	**Food source**	**Number of people exposed**	**Number of confirmed cases**	**Method of preparation**	**Description of people affected**
Manitoba Summary: 1992-1994 (Rosenberg et al., 1997)	*S. sonnei* was the most frequent species isolated	89% of all cases occurred in communities without wells or running water.	Not known	513 The incidence rate was 29 times greater among Aboriginal communities than the rest of Manitoba.		All cases involved residents of Manitoba.
1991 (Gessner & Beller, 1994a)	*S. sonnei*	Compared with controls, case-patients were nearly 4 times more likely to report eating moose soup on one day and 30 times more likely to report eating moose soup on two or more days.	Estimated 300 to 500 persons attended the potlatch (potluck).	Of the 100 persons interviewed, 23 who attended the event met the case definition of shigellosis	Moose soup was prepared by boiling moose meat for several hours and cooled for one to more than 5 hours and served without reheating.	The potlatch took place in Galena which is predominantly an Alaska Native village.

4.2.3. *Vibrio parahaemolyticus*

Illness: Gastroenteritis

Description:
Vibrio parahaemolyticus is a halophilic bacterium meaning that it is an organisms that requires salt and thus lives in brackish saltwater in order to survive. This bacterium naturally inhabits coastal waters in the U.S. and Canada. It is present in higher concentrations during the summer as it prefers to grow at temperatures of 30 to 35°C (86 to 95°F). This bacterium can be isolated from marine silt during the winter (CDC, 2005a).

Hosts:
Coastal waters and marine silt are common reservoirs for this bacterium. *Vibrio parahaemolyticus* has also been isolated from saltwater fish and shellfish, particularly shrimp, crab, lobster and oysters (U.S. FDA, 2001).

Prevalence:
Disease caused by vibrio is always associated directly or indirectly with seafood, particularly with oysters. An estimated 4500 cases of V. parahaemolyticus infection occur each year in the U.S. though the number of reported cases is lower (CDC, 2005a).

Transmission:
The bacteria can be transmitted through consumption of contaminated seawater, raw or inadequately cooked seafood, particularly shellfish (oysters, clams and mussels) and less commonly, infection in the skin when an open wound is exposed to warm seawater (PHAC, 2001c).

Characteristics of Illness:
When ingested, V. parahaemolyticus causes watery diarrhea often with abdominal cramping, nausea, vomiting, fever and chills. These symptoms occur within 12 to 24 hours of ingestion, but range between 4 to 96 hours (PHAC, 2001c). Others, although infected, may be asymptomatic. Severe disease is rare and generally occurs more often in those with weakened immune systems. V. parahaemolyticus can also cause an infection of the skin when an open wound is exposed to warm seawater (PHAC, 2001c).

Infectious Dose:
The number of bacteria necessary to cause illness is high; more than one million organisms are required by ingestion (PHAC, 2001c).

Duration of Illness:
Among healthy individuals the illness is usually self-limiting lasting approximately three days. Immediate antibiotic therapy is required for those with weakened immune systems, particularly those suffering from liver disease as their mortality rate has been reported as being 50% (CDC, 2005a).

Illness Prevention:
V. parahaemolyticus grows best at temperatures 12.8 to 40 °C and will persist in frozen seafood for long periods of time. Most infections caused by V. parahaemolyticus can be prevented by thoroughly cooking seafood to more than 65°C. The Center for Disease Control & Prevention (CDC) recommends boiling shellfish until the shells open followed by an additional five minutes of boiling. Alternatively, shellfish may be steamed until the shells open followed by boiling for nine minutes or if the shellfish has been shucked, one can boil the contents for three minutes or fry in oil for 10 minutes at 190° C (375F). The most effective means of controlling the spread of infection are the application of rigorous sanitary practices to prevent bacterial growth and prevent cross-contamination from raw seafood to cooked food. Vibrio parahaemolyticus is susceptible to many disinfectants. Cooked seafood should be eaten within two hours of preparation or promptly refrigerated at temperatures less than 5°C. Keep shellfish refrigerated from harvest to cooking. Wound infections can be prevented by avoiding exposure to open wounds to warm seawater and to wear protective clothing and/or gloves over wounds when handling shellfish or seawater. Before harvesting any shellfish, check to see if there are any warnings in placed by health officials and avoid harvesting at any locations in which warnings have been set (CDC, 2005a).

4.2.4. *Vibrio vulnificus*

Illness: Gastroenteritis

Description:
Vibrio vulnificus is considered the most virulent non-cholerae *Vibrio* and is an important cause of septicemia, wound infections and gastroenteritis. More than 100 strains of V. vulnificus has been identified but not all cause illness. Like *V. parahaemolyticus*, *V. vulnificus* is a halophilic bacterium that requires salt and thus lives in brackish saltwater in order to survive. This bacterium naturally inhabits shallow, coastal waters, both Atlantic and Pacific coasts, in temperate climates (CDC, 2005b; U.S. FDA, 1992c).

Hosts:
Coastal waters and marine silt are common reservoirs for this bacterium however; they have also been isolated from saltwater fish and shellfish, particularly oysters, clams, scallops, crabs and finfish (U.S. FDA, 1992c).

Prevalence:
Disease caused by *V. vulnificus* is always associated directly or indirectly with seafood, particularly oysters. Oysters, clams or mussels, accounted for 40% of *V. vulnificus* cases reported in the U.S. from 1999 to 2004. During this time, 94% of cases were associated with raw oysters, 4% with under-cooked oysters and 2% with hard clams or other shellfish. The remaining 60% of cases in humans was associated with wound infections by *V. Vulnificus* (University of Georgia, 2007).

Transmission:
V. Vulnificus can be transmitted through consumption of contaminated seawater, raw or inadequately cooked seafood or through cross contamination. *V. vulnificus* infections can also occur through open wounds that have been exposed to contaminated seawater. Those with weakened immune systems are particularly vulnerable to *V. vulnificus* infection. According to the CDC, a recent study showed that people with pre-existing medical conditions were 80 times more likely to develop *V. vulnificus* bloodstream infections than health people (CDC, 2005b).

Characteristics of Illness:
Among healthy people, ingestion of *V. vulnificus* can cause vomiting, diarrhea, and abdominal pain. In those with weakened immune systems, particularly those with chronic liver disease, the bacterium can infect the bloodstream, causing a severe and life-threatening illness characterized by fever and chills, decreased blood pressure (septic shock), and blistering skin lesions. Bloodstream infections with *V. vulnificus* are fatal about 50% of the time (U.S. FDA, 1992c).

Infectious dose:
The infective dose for gastrointestinal symptoms in healthy individuals is unknown but for predisposed persons, septicemia can presumably occur with less than 100 organisms (U.S. FDA, 1992c).

Duration of Illness:
In healthy individuals, gastrointestinal symptoms are self-limiting and last a few days to a week. If septicemia occurs, death can occur very quickly, especially among those with weakened immune systems.

Illness prevention:
V. vulnificus concentrations in seawater are highest during warm weather months. Do not eat raw oysters or other raw shellfish. Cook shellfish thoroughly. Shellfish in the shell either boil until the shells open and continue boiling for five more minutes, or steam until the shells open and continue cooking for nine more minutes. Do not eat shellfish that do not open during cooking. Boil shucked oysters for at least three minutes, or fry them in oil for at least 10 minutes at 375° F. Avoid cross contamination of cooked seafood and other foods with raw seafood. Eat shellfish promptly after cooking and refrigerate leftovers. Avoid exposure of open wounds or broken skin to warm salt or brackish water, or to raw shellfish harvested from such waters. Wear protective clothing (gloves) when handling raw shellfish. *V. vulnificus* is sensitive to high salt concentrations (> 28 parts per thousand) (CDC, 2005b).

Table 12: *Vibrio Gastroenteritis Outbreaks in North American Arctic and Sub Arctic Communities.*

Year of outbreak (Reference)	Food source	Number of people exposed	Number of confirmed cases	Method of preparation	Description of people affected
2004 (McLaughlin et al., 2005; Bradley et al., 2005)	Oysters harvested from Alaskan oyster farms.	Unknown	54	Raw oysters	The people were passengers of a cruise ship that sails in Prince William Sound.
1997 (Centers for Disease Control and Prevention, 1998)	Oysters and crabs eaten in British Columbia	Unknown	9	7 ate raw oysters 1 ate crab.	Residents of British Columbia.
1997 (Public Health Agency of Canada, 1997b)	Implicated food is known for 38 laboratory-confirmed cases: 35 ate oysters 2 ate crab 1 ate clams	Unknown	43	Most people ate raw or undercooked oysters.	The cases were reported to BC Center for Disease Control.

4.3. Other Agents

4.3.1. Harmful Algal Blooms (HABs)

Outbreaks of neurotoxic food poisoning from seafood, almost exclusively shellfish, are usually attributed to phytoplankton, composed of unicellular algae, particularly dinoflagellates floating or suspended in water. Under certain conditions of wind and tide, and in the presence of favourable concentration of nutrients, a population explosion occurs resulting in a dense accumulation of dinoflagellates at the surface of the sea. These are referred to as "blooms" and can vary in color from milky white to red. The so-called red tides are well documented (Barrow, 1973). During normal metabolism, dinoflagellates produce potent heat-stable toxins that affect only vertebrate animals. When ingested by fish, considerable marine mortality may result and the consumption of fish containing the toxin can be lethal. Invertebrates, particularly filter feeding bi-valve molluscs, including oysters, mussels, cockles, scallops and clams, are particularly dangerous to humans because they are able to accumulate the toxins in their tissues without harm to themselves. Healthy shellfish can thus be responsible for food poisoning by transmission of very potent dinoflagellates or algal toxins (Barrow, 1973). These toxins are tasteless, odourless, and heat and acid stable; thus, normal screening and food preparation procedures will not prevent intoxication if the fish or shellfish is contaminated. The diseases they cause in humans include: amnesic shellfish poisoning (ASP), diarrheic shellfish poisoning (DSP), neurotoxic shellfish poisoning (NSP), azaspiracid shellfish poisoning (AZP), and paralytic shellfish poisoning (PSP) (Fleming, Broad, Clement, Dewailly, Elmir, Knap, et al., 2006).

4.3.1.1 Alexandrium spp.

Illness: Paralytic shellfish poisoning (PSP)

Description:
Paralytic shellfish poisoning (PSP) is caused by a group of toxins produced by planktonic algae (in most cases dinoflagellates) upon which shellfish feed. In Alaska, and in the Pacific Northwest, PSP is caused by dinoflagellates of the genus, *Alexandrium*. Three species of *Alexandrium* occur on the North American west coast: *A. catenella* (occurs from southern California to southeast Alaska) forms blooms when the water temperature is about 20˚C and occurs in both estuarine and open coast environments; *A. tamarense* (occurs at Unimak Island in the Gulf of Alaska) prefers lower temperatures and less saline water than *A. catenella,* and *A. fundyense* which are prevalent at Porpoise Island, Alaska (Homer, 1996).

To date, there are 21 known toxins responsible for PSP. All are derivatives of saxitoxin, a potentially fatal, heat-stable neurotoxin that stops the flow of nerve impulses leading to numbness, disorientation and paralysis. The extreme potency of the PSP toxins has resulted in an unusually high mortality rate (Himelbloom, 1998; RaLonde, 1996; U.S. FDA, 1992a).

Hosts:
According to the U.S. FDA, all shellfish (filter-feeding mollusks) feeding on these toxic algae are subject to toxicity (U.S. FDA, 1992a). In the Arctic and Sub Arctic regions of North America, PSP is generally associated with mussels (including blue mussels), clams (including butter clams, razor clams and littleneck "steamer" clams), cockles, scallops (including pink, spiny, and purple hinge rock scallops) and occasionally crab. Bivalve shellfish feeding on these toxic algae may accumulate PSP toxins to concentrations unsafe for human consumption. Although lethal to many zooplankton, saxitoxins can be passed along the food chain and have been implicated in the deaths of fish and marine mammals (RaLonde, 1996; U.S. FDA, 1992a).

Prevalence:
The prevalence of saxitoxins in North American shellfish depends on the species of shellfish and their ability to concentrate and retain the saxitoxins after ingestion of toxic dinoflagellates. Saxitoxin molecules may also undergo chemical transformations that change one molecular form to another, decreasing or increasing the toxicity of the original saxitoxin. Shellfish eventually clean themselves of saxitoxins through a process termed depuration. The time required for depuration is greatly influenced by environmental conditions and is extremely variable and unpredictable for wild shellfish. For example, the level of saxitoxin in blue mussels can decrease from 700 micrograms (µg), to below the FDA limit of 80µg, within 20 to 50 days (RaLonde, 1996).

In Alaska, the blue mussel, *Mytilus edulis*, can accumulate in excess of 20,000µg of saxitoxin per 100 grams of tissue, an extremely dangerous level considering the allowable limit enforced by the FDA is 80µg per 100 grams of tissue. The extreme toxicity of blue mussels is caused primarily by their insensitivity to high toxin accumulations allowing them to continue feeding while the saxitoxin builds up to high levels. This high tolerance combined with continued feeding on toxic algae can result in an initially toxin-free blue mussel accumulating toxin levels exceeding the FDA allowable limit of 80µg/100g tissue in less than an hour (RaLonde, 1996).

Alaskan butter clams can also be highly toxic, partially because their nerve cells appear to have a special resistance to saxitoxin STX, one of the two most potent forms of saxitoxin. They are also able to chemically bind the STX saxitoxin in their siphon tissue and can retain PSP toxins for up to two years after initial ingestion. High saxitoxin concentrations begin to accumulate in the butter clam's digestive system after initial consumption of toxic algae. Within one month, saxitoxins migrate to the siphon and undergo transformation from the relatively less toxic, GTX saxitoxin, to the highly toxic STX form (RaLonde, 1996).

Alaskan "steamer" or littleneck clams can also become toxic; however they have the ability to transform highly toxic forms of saxitoxins to moderately toxic forms, making these clams relatively less toxic than butter clams who do the opposite. Butter clams and littleneck clams coexist on the same beach, and, to the inexperienced harvester, are similar in appearance. Littleneck clams were also found to be about 11-25% as toxic as butter clams (RaLonde, 1996).

In the Kodiak area, pink and spiny scallops have high saxitoxin concentrations, at times exceeding 11 grams, and are able to retain these toxins for an extended period of time. Thus, consumers should avoid eating scallop harvested anywhere in the state. In recent years the Alaska crab fishery was drastically impacted by PSP toxins in crab viscera. Crabs are opportunistic feeders, not filter feeders, and toxicity may vary significantly for each crab based upon the toxins contained in the food they choose to eat. Since saxitoxins are water soluble, boiling live crab with the viscera intact may spread the toxins from the viscera to the other tissues. The Alaska Department of Environmental Conservation recommends cleaning crabs of viscera before boiling (RaLonde, 1996).

Recordings of human cases of PSP in Alaska are centuries old and toxic algal blooms are becoming an increasing menace. A recent survey of Kodiak Island conducted by the Alaska Division of Public Health revealed that long-term residents are 11.8 times more likely to report symptoms of PSP than short term residents and Alaskan Native populations are 11.6 times more likely to report symptoms of PSP than non-Native populations. The incidence of PSP in Alaska is generally low; four per 100,000 Alaskans in 1994 and one per 100,000 Alaskans in 1995 (Himelbloom, 1998). A possible explanation for this low incidence of PSP is that diagnosis is based entirely on observed symptomology and recent dietary history. The illness is not only rarely reported, but also frequently incorrectly diagnosed. The extreme potency of the PSP toxins has, in the past, resulted in an unusually high mortality rate. The majority of outbreaks (74%) in Alaska occur during late spring and summer (May, June and July) and are related to the seasonal production of harmful algal blooms. Off-season occurrences are most often related to toxin retention from the harmful algal blooms produced in the summer. In general, occurrences of PSP are the consequences of subsistence users who ignore, or are unaware of warnings against harvesting shellfish from untested shores (Himelbloom, 1998; RaLonde, 1996; U.S. FDA, 1992a).

Transmission:
Paralytic shellfish poisoning is caused by consumption of raw or cooked shellfish or broth from cooked shellfish that contains either concentrated saxitoxin or related compounds (U.S. FDA, 1992a).

Characteristics of Illness:
Ingestion of contaminated shellfish results in a wide variety of symptoms depending on the type of toxin(s), concentration in the shellfish and the amount of contaminated shellfish consumed. Symptoms of PSP are predominantly neurological and include tingling, burning, numbness, drowsiness, incoherent speech and respiratory paralysis. Symptoms such as vomiting, weakness and shortness of breath are also reported. These symptoms develop fairly rapidly, within half an hour to two hours after the ingestion of the shellfish, depending on the amount of toxin consumed. Respiratory paralysis is common in severe cases and death may occur if respiratory support is not provided; if

respiratory support is provided within 12 hours of exposure the affected person will fully recover with no lasting side effects. In rare cases, death may occur from cardiovascular collapse despite respiratory support (Himelbloom, 1998; U.S. FDA, 1992a).

Infectious Dose:
The toxicity of PSP toxins is estimated to be 1,000 times higher than cyanide and has an estimated lethal dose of about 0.3 to 1.0mg of saxitoxin. According to the U.S FDA, the safe level of toxin in shellfish is estimated at 80 μg/100 g of shellfish (Clemence & Guerrant, 2004; RaLonde, 1996; U.S. FDA, 1992a).

Duration of Illness:
Depending on the amount of toxin consumed, PSP usually lasts three days; however, muscle weakness may persist for weeks (Arnold, 2007). If the amount of ingested toxin is low and adequate medical treatment is provided, symptoms should diminish in approximately nine hours (RaLonde, 1996).

Illness Prevention:
Currently, there is no antidote for PSP. All cases require immediate medical attention which may include the application of life support equipment. As a result, preventative strategies are needed to reduce the risk of exposure to PSP. Shellfish can become toxic not only when toxin-producing dinoflagellates produce massive algal blooms, but also in the absence of such blooms. Surveillance programs are established to take periodic samples of susceptible mollusks in the coastal states and test for the presence of toxin by mouse bioassay. When toxin levels exceed 80 μg/100g of shellfish, affected growing areas are quarantined and sale of shellfish is prohibited. Warnings are posted in shellfish-growing areas and on beaches and media alerts are issued to the public. It is very important to abide by these warnings and avoid consuming any shellfish from affected areas until such warnings have been lifted. Detoxification may require a month or more in clean waters. Since saxitoxins are heat-stable they are unaffected by standard cooking or steaming and, since they are also water-soluble, they can become concentrated in broth. Before harvesting shellfish, the potential consumer must at least consider the recent history of PSP for the area, the species harvested and their ability to concentrate and retain the toxin, the season of the year and the method of cleaning and preparing the shellfish (Berner & Furgal, 2005; Gessner, Messner, & Middaugh, 1995; RaLonde, 1996).

Table 13: ***Shellfish Poisoning Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of outbreak (Reference)	Food source	Number of people exposed	Number of confirmed cases	Method of preparation	Description of people affected
1997 **2 Outbreaks in Juneau Alaska** (State of Alaska Epidemiology, 1997a)	**Outbreak 1:** Littleneck clams harvested at Pt. Louisa in Juneau Alaska	3	3	1 person ate a raw clam 2 other people ate boiled clams.	A family of three consisting of a mother, father and a 12 year old son.
	Outbreak 2: Clams harvested in Amalga Harbor in Juneau, Alaska	2	1	Clams were steamed to make chowder.	Both persons were residents of Juneau.
1997 **3 Outbreaks in Kodiak Island, Alaska** (State of Alaska Epidemiology, 1997b)	**Outbreak 1:** Butter and Littleneck clams harvested at Sturgeon River Lagoon, Alaska	1	1 person developed respiratory arrest and died.	6-8 raw butter clams were eaten.	The person was a resident of Karluk, Alaska
	Outbreak 2: Butter clams harvested in Larsen Bay, Alaska	3	2 confirmed cases 1 person refused to be evaluated.	Method of preparation was not specified, 20-25 clams were consumed.	Two confirmed cases were residents of Larsen Bay.
	Outbreak 3: Mussels harvested from Gardner Point, Alaska	2 fishermen	2	10-15 cooked mussels were consumed	Not specified
1995 (State of Alaska Epidemiology, 1995)	Butter clams harvested from Crooked Island, Alaska	1	1	Not specified	Resident of Kodiak
1995 (State of Alaska Epidemiology, 1995)	Razor clams harvested from Humpback Bay, Alaska	Unknown	7	Not specified	All people were residents of Perryville, Alaska.

Table 13: (Continued): ***Shellfish Poisoning Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of outbreak (Reference)	Food source	Number of people exposed	Number of confirmed cases	Method of preparation	Description of people affected
1994 **7 outbreaks in Kodiak Island, Alaska** (State of Alaska Epidemiology, 1994, Gessner et al., 1997)	4 outbreaks involved mussels, 2 outbreaks involved butter clams 1 outbreak involved cockles Shellfish were harvested from different regions in Alaska.	Not specified	16 3 required mechanical ventilation 1 died	Not specified	All 16 people were residents of Kodiak Island.
1973-1994 **71 outbreaks in Alaska** (State of Alaska Epidemiology, 1995)	Of the 71 outbreaks: (49%) butter clams, (25%) mussels, (11%) cockles, (4%) little neck and razor clams, (6%) "steamers"	Not specified	141 ill: 81unadmitted hospital patients, 34 required emergency evacuation by plane, 8 received mechanical ventilation 2 people died	Not specified	All implicated outbreaks were reported to the Alaska Division of Public Health.

Note: Paralytic Shellfish Poisoning (PSP) was the only type of shellfish poisoning reported in these communities.

4.3.2. Hepatitis A Virus (HAV)

Illness: Type A Viral Hepatitis

Description:
The hepatitis A virus (HAV) is an enterovirus member of the *Picornaviridae* family. It has a single molecule of RNA surrounded by a small (27 nm diameter) protein capsid (U.S. FDA, 1998). One serotype has been identified. The virus infects the liver.

Hosts:
The virus is shed exclusively in feces of infected people. If sewage is not treated and disinfected before discharge it represents a potentially significant source of virus contamination for shellfish in estuaries and drinking water supplies.

Prevalence:
Hepatitis A Virus is common in communities where sanitation is poor. Canada has a relatively low incidence of hepatitis A. Each year, 100 to 3000 cases are reported with the rate varying from 10.77 per 100 000 people in 1991 to 3.6 /100 000 in 1998. The incidence varies with geography, economic and environmental conditions. Incidence is higher in males than in females (approximately 3:1), possibly related to differences in exposure factors. While the incidence and prevalence of hepatitis A has decreased, the average age of exposure, and subsequent infection, has increased (Alberta Health & Wellness, 2005).

For the past decade, reported cases for Hepatitis A in British Columbia have exceeded the national average. In 1998, 386 cases(9.65 cases per 100,000) were reported in the province. Men who have sex with men (MSM) and injection drug users were identified as primary risk factors for HAV contraction following an outbreak in the MSM population of Vancouver between 1997 and 1998 (Harb, Lem, Fyfe, Patrick, Ochnio, & Hockin, 2000).

In past years, cases involving Aboriginal populations have contributed significantly to provincial statistics. A 1995 central Vancouver Island outbreak involving a First Nations community accounted for 14% of the provincial cases that year. In August of 1999, 14 cases of hepatitis A were reported in the Northern Interior Health Region, an almost 10-fold increase from 1998 when only two cases were confirmed. Three cases were confirmed in 1997 (Harb et al., 2000).

Between April and September of 1999, 23 confirmed, outbreak-related, cases of hepatitis A were reported. Eighteen of the cases (78%) were members of a First Nations band in Northern British Columbia. Of these 18 cases, two were permanent residents on the reserve and the remainder were from Prince George. There were no cases related to foreign travel or contaminated water supplies. Children between one and 14 years of age accounted for 57% of the cases. The remainder of cases (43%) were between the ages of 25 and 32.

The investigation revealed that the six initial cases were comprised of one First Nations family whose members were all infected around the same time. The family included five males and one female and the source of the infection was never identified. The remaining 12 cases involving First Nations people were linked to other cases through familial and social contacts.

Of the five non-Aboriginal cases, one was a classmate of an index case, and two were believed to have resulted from food-borne transmission. Those two individuals frequented an establishment where a known positive case worked as an occasional food-handler. Notably, the final case reported that his high risk contact consisted of sharing food and cigarettes with an identified case (Harb et al., 2000).

Previous analyses of hepatitis A outbreaks in Aboriginal communities have identified inadequate water supplies and high housing density on reserves as risk factors for outbreaks. In the 1999 outbreak, the First Nations cases had satisfactory community drinking water and sanitary sewage systems. Household density may have been a contributing factor and over half of the children in this outbreak were under the age of 14. Children are often asymptomatic carriers and may shed viruses for extended periods of time. Poor hygiene and play activities may contribute to an increased risk of transmission between children. The decision to immunize the population on the reserve with the hepatitis A vaccine was made before the conclusions of the investigation were known (Harb et al., 2000).

Transmission:
The most common route of infection is person to person fecal-oral transmission of the virus. Other vehicles of infection may include consumption of contaminated ice/water or by ingestion of uncooked or undercooked foods that have been washed in contaminated water. Raw shellfish is a particularly common source of infection. Factors contributing to contamination in shellfish-related outbreaks may include inappropriate or illegal shellfish harvesting near known sources of sewage, inappropriate discharge of sewage from fishing boats or oil platforms near shellfish beds and use of feces contaminated water to immerse live harvested shellfish in. Transmission resulting from exposure to contaminated water generally occurs in areas with poor sanitation (Fiore, 2004).

Characteristics of Illness:
Symptoms appear abruptly within 10 to 50 days (usually about 30 days) after exposure to HAV and are dependent upon the number of infectious particles an individual has been exposed to. Infection with very few particles results in longer incubation periods. Symptoms can be mild and go unnoticed or can appear abruptly. Typical symptoms include poor appetite, fever, nausea and vomiting, stomach discomfort, general malaise, dark urine and jaundice (yellowing of skin and eyes). Many young children have no or mild symptoms and illness is not accompanied by jaundice. A person is capable of infecting others for one or two weeks before the appearance of symptoms. Most people

are no longer infectious after the first week of jaundice. Death from HAV is rare. A blood test is necessary to diagnose hepatitis A (Fiore, 2004).

Infectious Dose: 10-100 virus particles (U.S. FDA, 2008).

Duration of Illness: Symptoms can persist one to two weeks to several months. Most people recover completely and are immune to re-infection.

Illness Prevention:
Hygiene: Hand washing after toileting and before handling, preparing or eating food.
Disinfection of potentially contaminated food: The hepatitis A virus can survive for prolonged periods in foods or in the food handling environment. It survives 30 days on porous and non-porous surfaces and three to four hours in foods. Hepatitis A virus is rapidly killed by boiling. The most effective ways of inactivating the virus include heating, ultraviolet radiation or strong oxidizing agents. The virus will persist longer when refrigerated or frozen than at ambient temperatures. Hepatitis A is not inactivated by drying.

A vaccine is available for people at high risk and immunoglobulin can be administered after exposure with 85% effectiveness (Fiore, 2004).

Table 14: ***Hepatitis A Outbreaks in North American Arctic and Sub Arctic Communities.***

Year of outbreak (Reference)	**Hepatitis type:**	**Potential food source**	**Number of confirmed cases**	**Description of people affected**
1999 (Public Health Agency of Canada, 2000)	All were type A	Of the 23 confirmed cases two may have resulted from food-borne transmission	23	18 were First Nations 5 were non-Aboriginal people from Northern B.C.
1988 (Beller, 1992)	All 53 cases were type A	14 primary cases had consumed at least one ice slush beverage believed to have been prepared by an infected employee.	Of the 53 people who tested positive: 32 were primary cases, 23 secondary cases (infected by a person with a primary case), and 2 tertiary cases (people lived with a person with secondary infection)	All 53 cases were residents or visitors of residents in Anchorage, Alaska

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Chapter 4

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Chapter 5: Factors Influencing the Incidence of Foodborne Infections and Intoxications from Traditional Foods

Climate change is predicted to have an impact upon food security for Aboriginals. However, the effects and resulting adaptive changes in response to climate change by Aboriginals dependent upon traditional food use is very much an unknown (Paci, Dickson, Nickels, Chan & Furgal, 2004). Experts predict that future changes in the weather, including higher temperatures, increased rainfall, summertime droughts and extreme weather conditions are likely to cause important changes in the incidence and distribution of infectious diseases, including water and foodborne diseases with the far northern regions most affected.

Habitats of animal species known to be carriers of zoonotic diseases will expand and pathogen dynamics in environmental reservoirs and pathogen transmission cycles will be altered (Greer, Ng & Fisman, 2008; Jaykus, Woolridge, Frank, Miraglia, McQuatters-Gollop, Tirado et al., 2008). Changing environmental conditions will affect wildlife and likely introduce new diseases with a negative effect upon human health and wellbeing (Natural Resources Canada, 2007a).

In this chapter, the effects of climate change on food safety risks will be discussed. Also, a brief overview of the importance of a safe water supply and adequate waste management will be included since these factors influence the incidence of foodborne infections and intoxications.

5.1. Climate Change

Canada's North is already experiencing the effects of climate change. West and Central Arctic has experienced a 2-3°C increase over the past 30-50 years, the effects of which are more pronounced in the winter. In the last 15 years this warming has extended to east Arctic regions. Impacts include: thinning of sea- and freshwater-ice, shorter winters, reduced snow cover, changes in wildlife and plant distribution, melting of permafrost, and erosion of coast and shorelines. Predictions are for an average increase of 3 to 4°C and up to 7°C in the winter. Areas most affected are the southern Baffin Island and Hudson Bay regions. An increase of 30% in precipitation is predicted by the end of the 21st century in these areas (Furgal & Seguin, 2006).

The majority of Aboriginal people populate Canada's North, i.e. the Yukon, Northwest Territories and Nunavut and the Nunatsiavut region of Labrador and Nunavik in northern Quebec. The northern Aboriginal peoples share a deep and long connection to the land and continue to rely on local resources for their physical and spiritual wellbeing. Over the last hundred years, they have experienced the socially disruptive effects of disease, federal relocation programs and centralization, and are now facing the implications of resource development and climate change (Simeone, 2008).

It is generally accepted that climate change will have greater consequences for the North than for other regions in Canada, and that northern Aboriginal communities are likely to be most affected because of their close connection to the land and their limited resources to adapt to changing conditions (Simeone, 2008). The traditional livelihoods of northern Aboriginal communities, which depend heavily on natural resources, are directly threatened by melting ice shields and permafrost.

5.1.1. Permafrost

Hunting, gathering, and traditional food preparation are becoming more difficult as the permafrost melts (Environment Canada, 2003). Increased retreat of glaciers means less late-season runoff which poses a risk to fish habitat and water supplies. Mine-tailing ponds and landfill sites have permafrost beds which may become compromised. Receding ice packs and melting permafrost may uncover new pathogens in frozen feces and soil which may or may not pose an increased disease risk (Hoberg, Polley, Jenkins, Kutz, Veitch, & Elkin, 2008). Flooding and/or heavy rain may also increase the incidence of diseases caused by parasites (i.e. *Giardia*, *Cryptosporidium parvum*) and bacteria (i.e. *E. coli*, *Salmonella*, *Shigella*), in addition to damaging sanitation infrastructure (Parkinson & Butler, 2005).

5.1.2. Infectious Diseases

Climate change will alter the relationships between micro organisms, insect vectors, animal reservoirs of infectious diseases and humans and alter the burden and distribution of infectious diseases (Greer, Ng & Fisman, 2008). Insects, bacteria, and the free-living stages of parasites are susceptible to temperature changes; low temperatures tend to kill or inhibit the growth and survival of these agents. Water- or soil- borne parasites, cold sensitive bacteria and insect-borne pathogens will benefit from higher Arctic temperatures (Bradley, Kutz, Jenkins & O'Hara, 2005). Longer and warmer seasons may increase the window for transmission and allow for faster development times (Hoberg et al.,2008). Climate change is also predicted to increase drought in some areas, which may be detrimental to some pathogens that require adequate moisture (Bradley et al., 2005).

Many zoonotic diseases currently exist in Arctic host species (e.g. *Trichinella* in walrus and polar bear, and *Cryptosporidium* in both marine and terrestrial mammals), and some regions have reported significant cases of zoonotic diseases in humans in the past (Proulx, McLean, Gyorkos, Leclair, Richter, Serhir et al., 2002). Increased illness and parasitic infection in terrestrial mammals, marine mammals, birds, fish and shellfish in Arctic regions points to a relationship between zoonotic diseases and temperature, associated with past warm years related to El Niño Southern Oscillation events (Parkinson & Butler, 2005; Kutz, Hoberg, Nagy, Polley & Elkin, 2004). It is likely that longer warm seasons resulting from changing climate will be associated with a change in the type and incidence of disease in these species, which can be transmitted to northern residents (Bradley et al., 2005).

The most common forms of food and waterborne diseases in the Northwest Territories are caused by *Giardia* (from drinking contaminated water), and *Salmonella* and *Campylobacter* (from eating raw or poorly cooked contaminated foods (Government of the Northwest Territories, 2005). Despite the consumption of some foods that are traditionally eaten raw in Aboriginal communities, the rates for *Campylobacter* and *Salmonella* have declined in recent years in the Northwest Territories (Government of the Northwest Territories, 2005). Communities in the central and eastern Arctic, have identified an increase in parasites in caribou over recent years, an observation that has been corroborated by studies of muskox (Kutz et al., 2004), raising concerns about whether this meat is safe for consumption (Nickels, Furgal, Buell & Moquin, 2006).

An increased in temperature positively impacts upon overwintering survival and distribution of some insect species, leading to increased risk from human and animal vector-borne diseases already present in the region, providing opportunities for the introduction of new diseases into Arctic regions (Parkinson and Butler, 2005). In the western Arctic, Inuvialuit residents have reported seeing increased numbers of insects and species not observed there previously, including biting flies and bees (Furgal & Seguin, 2006).

Additional evidence is available demonstrating that higher water temperatures have already been implicated in outbreaks of foodborne diseases. *Vibrio* species are water-borne bacterial pathogens that flourish at water temperatures above 15°C (Parkinson & Butler, 2005). In 2004, *Vibrio parahaemolyticus* was thought to be responsible for an Alaskan outbreak of gastroenteritis among cruise ship passengers who consumed raw farmed oysters. Water temperatures above 16.7°C were observed at a Prince William Sound area oyster farm (Bradley et al., 2005). Water temperatures in this area have been increasing since 1997 whereas before this time, *Vibrio*-related illness had been confined to the warmer waters of northern British Columbia (Parkinson & Butler, 2005).

Outbreaks of Paralytic Shellfish Poisoning (PSP), caused by neurotoxins produced by dinoflagellates (Section 4.3.1.1.), may also increase. Changes in temperature and weather patterns can result in the concentration of these toxins. Artic communities have a high reported incidence of PSP likely from the consumption of shellfish collected from unmonitored beaches. Monitoring programs measure toxin levels in susceptible molluscs. If the level exceeds 80µg/100g of shellfish tissue, the areas are quarantined and sale/consumption is prohibited (Parkinson & Butler, 2005).

Botulism is known to occur in traditional fermented foods such as fish, fish eggs, seal, beaver, and whale meat. These foods are consumed raw by many Aboriginal people. *Clostridium botulinum* spores will germinate at temperatures above 4°C, therefore higher temperatures and melting permafrost may increase the risk of foodborne botulism (Parkinson & Butler, 2005).

5.1.3. Host Changes

5.1.3.1. Animal Hosts

The interaction between parasitic microorganisms and their animal hosts is often highly influenced by environmental factors. The current diversity of parasitic organisms in the Arctic is a result of a dynamic climate change involving periods of glaciation/deglaciation and isolation/expansion over the past 3 million years (Hoberg et al., 2008). Arctic climate change could lead to an increased prevalence of parasitic diseases. Bradley et al. (2005) conducted an extensive review of the potential impacts of climate change and reported that 80% of 1500 species of free-living disease agents had shifted their ranges towards the poles. Altered migration patterns of animals will allow for range expansion of parasites as their hosts move into new geographic areas. Increasing temperatures will decrease the ecological and developmental barriers for parasites and favour host switching (Hoberg et al., 2008). Potential changes could include: increased range and activity and ecology of waterborne and foodborne infective agents, with potential increased incidence of diarrheal and other diseases, and emergence of new diseases (Furgal & Seguin, 2006).

Climate warming has been associated with sickness in marine mammals, birds, fish, and shellfish. Disease agents included botulism, Newcastle disease, duck plague, influenza in seabirds, and a herpes-like virus epidemic in oysters. Species expanding into new regions, and carrying disease agents, expose resident species to new pathogens. Beaver spread *Giardia* in this way. *Giardia* is a water-borne disease, and beaver dams increase the surface water habitat that promotes the spread of the parasite to other animals such as caribou and humans. Infected caribou may also increase the spread of the parasite as they migrate to other parts of their range (Berner & Furgal, 2005).

A direct relationship between temperature and development of parasites in intermediate hosts has been reported. Historical data indicate that in 2006, the Mackenzie District of the North West Territories experienced an increase of 2.2°C, the highest temperature deviation from normal in the past 60 years. The authors determined that warming led to an increase in parasite populations in disease-endemic areas due to faster reproduction times and longer seasons for parasite transmission. They further demonstrated that particular parasites have switched from multi-year to single-year transmission cycles that probably started in the 1980s and may have been responsible for incidences of muskoxen disease at that time. Thus, a warming Arctic is already having an impact on the prevalence of parasites. Parasites can not only cause death but have sublethal effects such as impaired physical and intellectual development in humans and reduced productivity and fecundity in livestock (Hoberg et al., 2008).

Zoonotic infections may increase as host/vector ranges expand due to increasing temperature and less-severe winters. Expansion of habitat (vegetation etc.) has allowed the beaver, a host of *Giardia lamblia*, to migrate further North (Parkinson & Butler, 2005). Parasites may spread as host ranges change and animals intermingle, as with *Echinococcus multilocularis* in foxes, dogs, and voles, and *E. granulosis* in wolf, reindeer, and elk. Expansion of the Red fox range may have spread *E. multilocularis* (which can be fatal to humans) to brown lemmings in Alaska (Bradley et al., 2005). Other zoonotic diseases that are endemic to the Arctic and could spread include: rabies (foxes), brucellosis (bison, caribou, reindeer, foxes, bears), and tularemia (hares, rabbits, muskrats, voles, beaver, squirrels) which are transmitted during skinning or by arthropod bites.

A recent review of infectious diseases of Arctic fauna revealed that climate change is already having an impact. According to Bradley et al. (2005), warming of the Bering Sea may have been responsible for increased abnormalities observed among Alaskan salmon in 1997. *Elaphostrongylus rangiferi* causes cerebrospinal elaphostrongylosis (CSE) in ruminants. Higher temperatures in Norway were thought to be responsible for an increase in CSE among reindeer, and the transmission of CSE from reindeer to domestic sheep and goats. A 2002 outbreak of canine *Leptospirosis* in Ontario was related to a warm, wet fall. *Leptospira* spp. are endemic in Arctic animals, therefore higher temperatures could lead to expansion of this disease into the Arctic. Eastern Canadian harp seals migrate to the high Arctic in summer. Harp seals are known to harbour *Giardia* spp. and phocine distemper virus, diseases that affect mammals and seals, respectively. Altered ranges may be responsible for the transmission of phocine virus from harp seals to Arctic ringed-seals (Bradley et al., 2005).

Invasive species and loss of biodiversity caused by climate change represent a potential risk to the food safety of Aboriginals. Fish in warming lakes are expected to harbour more parasites (Haldane, 2002). Environment Canada (2003) predicts changes in the distribution of many species; southern fish species are expected to migrate northward while cold-water fish at the northern limit could experience an increase in population density attributable to enhanced survival and favourable conditions for growth. Cool-water fish such as trout, whitefish and grayling could decline as a result of lower water levels in streams and rivers and poor nutrient levels in the Canadian Shield. As a consequence, the fast-moving, adaptable species of the Taiga and Boreal forests are expected to move northward leading to a considerable decrease in the size of these forest zones. Long-lived, slow growing trees may not respond to changing conditions quickly enough to adapt to new environments and could face extinction. The temperate range could increase dramatically in northern Ontario, Québec, Manitoba, northern Alberta, and the southern limit of the Mackenzie District. Grasslands are expected to increase; forests will be at greater risk from drought, fire, and pests, in frequency, area, and intensity. These factors will put many habitats and species at risk, and will become an economic burden. The loss of biodiversity and introduction of new species could upset the environmental balance between pathogens and hosts. Native plants may be displaced by foreign species which could pose a health and allergen problem (Environment Canada, 2003).

Higher temperatures may bring people and agriculture further north into what has traditionally been Aboriginal territory. Expansion of animal husbandry into the Arctic may bring diseases associated with domestic animals into this new environment and into contact with new hosts (Bradley et al., 2005). Domestic sheep harbour pathogens fatal to wild sheep. The spread of para-influenza 3 from domestic cattle to bison has been observed in Alaska. Cattle shed *Giardia* and *Cryptosporidium* parasites into water, contaminating water supplies and other species such as Alaska Western Arctic caribou. People who migrate north and bring domestic animals such as cats with them could spread feline viruses to lynx and wild cats, and spread *Toxoplasma gondii* through cat feces. Domestic animals may also act as new intermediate hosts for indigenous pathogens. The migratory bird habitat is shrinking in the Arctic. Birds are hosts for poultry pathogens such as Newcastle, paramyxo, and avian influenza viruses. Increased contact between wild and domestic birds carrying the H5N1 virus may accelerate development of a human pandemic strain of the virus (Bradley et al., 2005).

5.1.3.2. Insect Hosts

Many insect-borne diseases are tropical but some have temperate and Arctic ranges. The distribution of arthropods and insects is limited by minimum and maximum temperatures, moisture, and availability of breeding sites, all of which could be altered by climate change (Parkinson & Butler, 2005). Temperature and precipitation changes could promote range expansion of insect hosts, and warmer weather and shorter cold seasons could allow insects to spread northward and to reproduce more often. Diseases of concern include Rocky Mountain Spotted Fever, Lyme disease, mosquito-borne malaria, and encephalitis (Environment Canada, 2003). Range expansion of tick-borne encephalitis in Sweden and mosquito-borne encephalitis viruses in the Arctic has been observed (Bradley et al., 2005). Studies in Alaska revealed evidence of Jamestown Canyon virus and snowshoe hare virus among many Arctic animals. Both of these viruses cause encephalitis in humans (Bradley et al., 2005). West Nile Virus (WNV) could easily spread to the Arctic. The range of WNV has spread from New York State in 1999 to northern Alberta in 2004 and mosquito species which transmit WNV are present in the Arctic (Parkinson & Butler, 2005). Furthermore, increased numbers of biting insects and the arrival of bees in the Arctic have led to allergy concerns (Furgal & Seguin 2006).

5.1.4. Impact on Traditions

Climate changes can affect traditional food gathering by altering distribution and health of animal populations. The unhealthy appearance of animals, distance to hunting grounds, and seasonal availability of certain species are known to limit access to traditional Aboriginal foods. Studies carried out in Aboriginal communities indicate that Natives are already coping with the effects of climate change. Focus groups consisting of volunteers from two Aboriginal communities were interviewed. The communities were located in different regions of the North West Territories and had similar traditional food sources, including various fish, waterfowl, and moose. Both community groups reported changes in the prevalence of animal species, water availability, weather, and ice. Reported similarities included changes in bird migration, new species seen (cougars), greater numbers of beaver and eagles, fewer numbers of caribou and rabbits, animal diseases (spots on beaver, hair-loss on moose), dry rivers and land, altered weather patterns (storms at different times, season shifted by two months, higher temperatures).

The differences included more rain and flooding in one region with no rain and less snow in the other and variable ice cover on lakes and rivers (Guyot, Dickson, Paci, Furgal, & Chan, 2006).

The availability of traditional food is threatened by climate change. Seaweed is a nutritionally and culturally important food for the First Nations of coastal British Columbia. It is prepared and served in many ways, it is an important gift and trade item, and has historic medicinal importance. Its harvest from the sea is threatened by pollution, competition with exotic species, or genetic change of local stocks as a result of climate change (Turner, 2003). Caribou is an important source of meat and skins for many Northern Aboriginals. The migration routes of caribou herds have shifted by 10 km as a result of higher temperatures, requiring greater distances to hunt. Beavers are also moving north where they build dams and alter the course of streams and rivers, further impacting fishing and trapping practices (Haldane, 2002).

5.2. Contamination of Water

Aboriginals depend on both surface and ground water. Surface water is highly revered by Aboriginals for its purity, although it is more susceptible to contamination because of its exposure to the environment. Organisms are not generally capable of contaminating deep ground water; however, slow flowing ground water can be contaminated by the percolating of surface water. A 1994 survey of 600 Aboriginal water treatment plants established that 61% were supplied by groundwater and 34% by surface water (Bethune, 1997). Nunavimmiut communities draw water from lakes, rivers, and melting ice. Reliance on fishing and hunting by many Aboriginals exposes them to waterborne and foodborne pathogens. A high portion of the population is composed of young children who are at greater risk from pathogens (Martin, 2006).

Water can become contaminated by pathogens, dissolved metals or non-metals, and synthetic organic compounds, all of which may be introduced via human sewage, agricultural runoff, solid waste disposal, industry and dam construction. Parasites, bacteria, and viruses commonly present in human and animal feces can contaminate water. While large-scale outbreaks have occurred, the majority of Native water contamination problems are small-scale. Contamination often occurs close to the reserve or community and these problems require local management solutions (Bethune, 1997).

The incidence of food and waterborne diseases among First Nations is considerably higher than the national average for Canada (Health Canada, 2003). Parasites are often shed in animal feces and can contaminate municipal and surface water supplies through the water table and run-off. A high presence of *Toxoplasma gondii* was detected in water tanks in a Nunavik community exposing this population to higher risk than the rest of the province (Simard, 2007). *Toxoplasma gondii* is resistant to chlorine treatment and is commonly shed by lynx and other wild cats. Water supplies are also suspected to be a route for transmission of *Giardia* and *Cryptosporidium* in the Yukon, particularly in surface water (Roach, 1992). Episodes of diarrhea among James Bay area Cree were linked to the presence of parasites and enteropathogenic *Escherichia coli* strains in stool samples (Brassard, Hoey, Ismail, & Gosselin, 1985). The presence of *Escherichia coli* and *Enterococcus* spp. in water supplies and households revealed a potential fecal-contamination problem in an Alaskan Native community (Chambers, 2005). Shigellosis was shown to be 26 times higher among on-reserve First Nations than among the non-First Nations population (Clark, 2002). Humans are a significant reservoir of *Shigella*, and fecal-oral transmission resulting from overcrowding and poor sanitation was implicated in numerous First Nations outbreaks (Martin, Bélanger, Gosselin, Brazeau, Furgal, & Déry, 2007; Rosenberg, Kendall, Blanchard, Martel, Wakelin, & Fast, 1997). *Helicobacter pylorus* is another human pathogen that has been associated with First Nations water supplies (McKeown, Orr, Macdonald, Kabani, Brown, Coghlan, et al., 1999).

Climate change may also play a role in water quality and availability. Nunatsiavumiut Aboriginals have indicated that their sources of natural water were drying up. A preliminary study comparing the microbiological quality of raw water sources available to Northern and Southern Nunatsiavumit communities indicated that water quality in Southern communities was of poorer quality compared to Northern communities. These findings could be explained by warming of rivers and lakes in the Southern Arctic (Martin et al., 2007).

In Canada, First Nations communities have a higher than average incidence of food and water borne illnesses, such as giardiasis, hepatitis A, and shigellosis (Health Canada, 2003). According to data submitted to Health Canada, the incidence of shigellosis for First Nations in 1999 was 26 times higher than that of non-First Nations people (Clark, 2002). The majority of cases (93.6%) were reported in Alberta, Saskatchewan, and Manitoba. Humans are a significant reservoir of *Shigella*; therefore, sewage disposal plays a vital role in preventing fecal-oral transmission. An adequate water supply is also necessary for adequate hygiene and hand washing. Overcrowding increases the risk of human-to-human and fecal-oral transmission, exacerbated by the sewage and water supply problems previously mentioned. Recommendations for combating shigellosis include awareness of safe practices pertaining to personal hygiene and community food safety. Long term solutions include improving community infrastructure such as an adequate water supply, sewage disposal and treatment systems, and reduction of overcrowding in homes (Clark, 2002).

5.3 Waste Management

Mismanagement of solid waste disposal can have serious ramifications for human health and the environment. First Nations are traditionally connected to the land and are experiencing the impacts of environmental pollution of land, rivers, and air (Bharadwaj, Nilson, Judd-Henrey, Ouellette, Parenteau, Tournier, et al., 2006). Degradation of their environment is closely linked to degradation of the traditional way of life and community health of First Nations. Recognition of this threat to the health of First Nations is being addressed in a limited fashion through government programs and partnerships between native communities and local municipalities (Bharadwaj et al., 2006).

Solid waste dumps located on First Nations lands are common sources of pollution and threaten the safety of local wells and water supplies (Bethune, 1997; Bharadwaj et al., 2006). Most First Nations communities dispose of their waste on their own land; the lack of documentation for these waste dumps makes it difficult to evaluate their safety. Waste disposal practices vary; households may bury their waste on their property, while some communities ship their waste to nearby land fills. Open dumps on First Nations land pose a serious health risk because the water supply becomes contaminated with run-off, and the transmission of vector borne disease (Bharadwaj et al., 2006). Lack of resources or inadequate infrastructure in landfill sites may result in the spread of leachate, a highly contaminated liquid containing biological and chemical contaminants (Bethune, 1997).

A considerable number of First Nations and Northern Aboriginals rely on pit privies, buckets, or other manual forms of raw sewage disposal (Rosenberg et al., 1997). Raw sewage is highly contaminated with pathogenic microorganisms and poor disposal practices were implicated in several disease outbreaks on reserves (Chambers, 2005; Rosenberg et al., 1997). Investigation of diarrhea outbreaks among Alaskan mountain climbers revealed an association between crowded tents and unsanitary disposal of human feces (McLaughlin, Gessner, & Bailey, 2005). Sewage is also high in organic compounds such as ammonia, nitrates, and phosphates, which can result in the eutrophication of surface waters (Bethune, 1997).

Assistance to First Nations communities can take various forms, such as government sponsored initiatives or partnerships with local municipalities. The First Nations Emergency Services Society (FNESS) assisted 16 First Nations communities in British Columbia with the development of environmentally friendly waste management activities including hazardous waste disposal, composting, and recycling. The government of Canada launched the Infrastructure Canada Program (ICP) in 2000 to assist First Nations, Inuit, and northerners in building health and sustainable communities. Financial contributions totaling about $90 million over three years helped develop water quality, wastewater, and solid waste management systems in First Nations communities (Bharadwaj et al., 2006).

First Nations communities have formed partnerships with local governments in order to deal with their waste management issues. Some of these partnerships are aimed at reducing waste through recycling and composting, or waste management through shared landfill use, or waste equipment and collection trucks. The Lytton Solid Waste Transfer Station is an example of a successful joint venture between First Nations, regional municipality, and industry in British Columbia (Bharadwaj et al., 2006). This station offers recycling, waste removal, and effluent disposal services. The success of the Lytton Station could serve as a model for future partnerships.

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Chapter 5

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Chapter 6: Programs to Prevent Foodborne Illness from Traditional Foods

The literature search resulted in 724 citations that were alphabetically compiled in a bibliography (Appendix B). An abundance of papers on chemical contaminants and their effects on the traditional Aboriginal food supply and health were not retained for this bibliography because this subject has already received attention and the sponsor of the present project requested that this aspect of food safety be excluded from the review. The bibliography revealed that very few papers dealt with food safety and Canadian Aboriginals. Many of these papers related to outbreaks. Fewer still were papers relating to risk reduction methods and very rare were those that dealt directly with the efficacy of methods aimed at reducing foodborne illness. This chapter is a review of various programs aimed at preventing foodborne illness from traditional foods.

Very few studies about food safety in Aboriginal communities have been conducted, particularly in recent years. Despite climate change, migration of Aboriginals to different locations and the availability of new technologies to accelerate testing procedures, food safety information geared to Aboriginal populations is scarce (Himelbloom, 1998; Messier, Lévesque, Proulx, Ward, Libman & Couillard et al., 2007; Proulx , MacLean, Gyorkos, Leclair, Richter, Serhir et al., 2002; Shaffer, Wainright, Middaugh & Tauxe, 1990; Ross, Olpinski & Curtis, 1989). Much of the Arctic research data about food safety issues and traditional food preparation methods is more than a decade old. Experts suspect that there is considerable under-reporting of foodborne illness and subsequent investigation from remote northern communities (Shaffer et al., 1990). Additionally, few data are available on the distribution of pathogens and their hosts. Prevalence is generally unknown among wildlife and human populations.

Until recently, the principal food safety issue in the mind of Aboriginal communities was environmental contamination. Considerable effort has been focused upon contaminants in the North and in water and animals used as a food source. Zoonotic diseases (infectious diseases transmitted from animals to humans), poor quality and questionable safety of food remain a concern (Castrodale, 2005; Himelbloom, 1998; Sutmoller,1998). Despite several serious food safety incidents in Aboriginal communities, educational programs dealing with food safety are limited and mainly concerned with problems associated with dented cans, or botulism in food fermented in plastic closed containers (Castrodale, 2005; Chiou, Hennessy, Horn, Carter & Butler, 2002; Myers & Furgal, 2006; Shaffer et al., 1990).

Research has shown the benefits of consuming traditional/country foods to the nutritional, social, physical, cultural and spiritual health of northerners. Although harvesting traditional/country food is physically demanding, the benefits of staying fit, helping people feel closer to the community and reinforcing a sense of culture, are recognized (Dawar, Moody, Martin, Fung, Isaac-Renton & Patrick, 2002; Kuhnlein & Chan, 2000). There has been minimal research examining the food safety risks that occur with traditional/country food preparation practices, and there is a definite need to consider risk management, particularly how such risks could be reduced. Ideally, identification of specific hazards in traditional/country foods and identification of control measures that focus upon prevention will increase food safety or at least reduce food safety risks to acceptable levels. Aboriginal populations are at greater risk of acquiring infections related to wildlife because of their lifestyle and food habits. Yet, maintaining cultural traditions, including food choices and preparation methods necessitates an examination of food safety risks and new recommendations for food preparation and storage using a blend of cultural tradition and modern science, with recommendations based upon available evidence, not theories.

Information available on the microbiological conditions of meats from game animals is limited. Further investigation of the risks from parasites and from pathogenic bacteria associated with game meats is recommended (Gill, 2007).

In general, factors that contribute to outbreaks of food borne illnesses include: inadequate cooling; long interval between preparation and serving; inadequate reheating; inadequate cooking; infected person handling food; raw food consumption; extra large quantity prepared; incorrect fermentation; contaminated water; flies on food; food from unsafe source and cross-contamination (Bryan, 2000).

In the case of the Aboriginals of Canada, outbreaks of foodborne diseases have been attributed mainly to the consumption of raw food from animal or marine origins and to changes in traditional food preparation, particularly in the "fermentation" of meat and fish (Chapter 4). Other factors contributing to foodborne illness from game animals include the health of the animal before killing, the method of killing and butchering in the field, specifically contamination from gut contents.

Among the various risk reduction methods, the following have received attention in the context of the present research: traditional knowledge, prevention of growth of risk agents, monitoring and surveillance and education. Effectiveness of a various preventive interventions will be reported if available.

6.1. Traditional Knowledge

There are stories from whalers and explorers describing the decimation of entire families with the cause of death now understood to be botulism (Segal, 1992). Hunters report knowledge of foods to avoid, and one study reports regional differences in food safety knowledge (Ross et al., 1989). When asked if some traditional/country foods should be avoided, respondents from four Nunavut and Labrador communities stated that polar bear liver, narwhal brain, shellfish, aged meat/old food, black bear, polar bear, robins should be avoided by some individuals, or be avoided at certain times of the year (Myers & Furgal, 2006; Ross et al., 1989).

Cultural traditions regarding food preferences and food preparation methods have been passed from generation to generation, and the Aboriginal people understand that the consumption of wildlife and fish, hunting and handling of furbearing animals and traditional methods of food preparation can be risky and sometimes dangerous (Desjardins & Govindaraj, 2005; Chiou et al., 2002; Ross et al., 1989; Segal, 1992). Home processed fish or sea mammals such as whale blubber, seal flippers and seal blubber can foster contamination and growth of *Clostridium botulinum.* Wild game can harbour parasitic zoonoses, such as *trichinella* in walrus or seal leading to human illness from improper food preparation. Yet, the Aboriginals have survived many hundreds of years, using Native knowledge and science to circumvent foodborne illness. Continuous interaction with the land has helped the Aboriginal population in developing an enormous body of knowledge related to subsistence foods, ecosystems, and health and healing that is embedded in local culture and practice (Kuhnlein, Erasmus, Creed-Kanashiro, Englberger & Okeke, 2006; Smylie Kaplan-Myrth, McShane, Métis Nation of Ontario Ottawa Council, Pikwakanagan First Nations, & Tungasuuvingat Inuit Family Resource Centre, 2008). Spiritual and ethical values are intertwined into this knowledge, creating a system encouraging survival (Desjardins & Govindaraj, 2005).

Considerable food safety knowledge appears to exist in Aboriginal communities but little written documentation exists (Shaffer et al., 1990). Also, there is little documentation on Native food preparation techniques i.e. fermentation, smoking, drying, or consumption practices (Castrodale, 2005; Desjardins & Govindaraj, 2005; Chiou et al., 2002).

6.2. Prevention/Intervention Programs

The traditional preparation of food such as muktuk and igunaq (Chapter 2) involve the risk of botulism. In Alaska, reports of botulism increased from 1.2 to 15.2 per 100,000 in 1966 and 1988, respectively. The national Centre for Disease Control (CDC) in Atlanta started to stock its Arctic Research Station with botulism antitoxin because the problem was so acute. Education campaigns directed at Native groups did not decrease the number of outbreaks (Segal, 1992). The introduction of modern materials such as plastic bags, plastic pails and glass jars complicated the problem. Instead of ageing (fermenting) the food in pits lined with grass, as was traditionally done, new practices place the food in buckets or glass jars with the lids tightly closed, providing an anaerobic environment; instead of burying the containers in the ground, they are often placed in a warm room to accelerate the fermentation process (Shaffer et al., 1990). The process is not a true fermentation as there is no sugar or carbohydrate to produce acid that would act to inhibit the growth of bacteria (Segal, 1992). Above ground or higher temperature fermentation increases the speed of fermentation but favours the production of botulism toxin. Many outbreaks of botulism were the result of these new preparation methods (Chapter 4). Some recommendations that change revered traditional recipes such as heating foods to temperatures that would inactivate toxins, and adding sugar, or salt to the fermentation process to inhibit bacterial growth and allow for a true fermentation, have met with considerable resistance. Such changes alter desired flavours and may be scorned as cultural encroachment (Dolman & Ilda, 1963; Dawar et al., 2002). Shaffer et al. (1990) noted that Alaska Natives were unlikely to stop consuming fermented foods and thus proposed to promote slow, low temperature fermentation techniques and to avoid fermenting non-traditional foods such as beaver tail.

Interestingly, the only descriptions located for this literature review, that directly associates risk reduction methods and traditional food preparation involve botulism resulting from fermented food in the Inuit population. The U.S. CDC experienced some success with the education of Native Alaskans about botulism and fermentation techniques. The Arctic Investigation Program produced video and written materials (Arctic Investigations Program & the Bristol Bay Health Corporation, 1998) using community members, Elders, survivors of botulism and health professionals (both Native and non-Native), to promote a return to original methods of slow, low temperature fermentation and to dissuade use of plastic containers to prevent botulism (Chiou et al., 2002). This program has been evaluated for effectiveness. Castrodale (2005) reported that the fatality rate due to botulism declined from 31% during 1950–1959 to 0% for the 10 year, 1995-2004, period. The average annual incidence among Alaska Natives increased from 3.5 cases per 100,000 during 1950–1954 to a peak of 12.6 cases per 100,000 during 1985–1989. Reasons for the increase were unclear but may have been related to changes in food preparation practices or improved recognition of mild cases. Since 1989, rates have slowly declined to reach 4.9 cases per 100,000 in 2000–2004. The author added that the reasons for this decline were not clear.

There are no Canadian experimental data to suggest that following traditional fermenting practices will reduce or eliminate the risk of botulinum toxin production (Dawar et al., 2002). A summary of botulism outbreaks in Canada between 1971 and 1985, 59% of outbreaks were attributed to the consumption of marine mammal meat, mainly seals. The meat was eaten raw, parboiled or a faulty fermentation process was involved. Raw or undercooked meats were generally left at ambient temperature. Fermented meats responsible for outbreaks included urraq/ujjaq (seal flippers in seal oil) and muktuk (chunks of skin with blubber and beluga meat). Aboriginal fermentation is more a decomposition or putrefaction process, not a true fermentation process (Hauschild & Gavreau, 1985).

Western food science knowledge encourages cooking meats at risk for being contaminated with *trichinella* to appropriate temperatures i.e. cook to 77ºC since freezing, smoking, drying, salting and microwave cooking are not reliable ways of killing the *trichinella* parasite (Forbes, Measures, Gajadhar & Kapel, 2003; Leclair, Forbes, Suppa, Proulx & Gajadhar, 2004). Yet, Aboriginals continue to prefer eating some traditional meat raw and assume the risk of foodborne illness.

Trichinella is present in traditional preparations of freshly frozen walrus meat and traditionally air-dried walrus meat and in seals (Forbes et al., 2003; Kapel, Measures, Moller, Forbes & Gajadhar, 2003; Leclair et al., 2004). The rather unexpected finding of trichinosis in whales and seals was speculated to have been the result of the animals ingesting fish that had nibbled at the carrion of carnivores (dead bears, foxes, walrus or dogs) deposited in the ocean. *Trichinella* isolated in Arctic marine mammals was described as an unusually cold tolerant variety and also infectious in humans. In 2002, public health authorities in Nunavik established a monitoring system for the meat of walrus. A similar system was established in Repulse Bay, Nunavut. The Inuit communities in Nunavik (northern Québec) and in Repulse Bay, Nunavut have established innovative sampling programs whereby hunters collect samples of walrus meat from the fresh carcass and airmail the samples to regional laboratories for testing. Further, these hunters agree not to share meat with their communities until results are available showing the absence of contamination (Banks, 2003; Proulx et al., 2002). Such programs require education and training of hunters for compliance with tagging and sampling, quick shipping availability, laboratory compliance for reliable and fast turnaround of results, and community cooperation for recalls as necessary. Since formalized federal and provincial meat inspections are not feasible in the widespread and remote areas frequented by Aboriginal and Northern hunters, education and training of hunters along with regulatory means such as licensing, tagging of animals and sampling programs appear to be the most effective risk reduction options.

While passive surveillance systems for reportable diseases exist in Canada, infections are often underreported because of non-specific clinical presentations/symptoms and/or mild manifestations (Messier et al., 2007). Following outbreaks of trichinosis in the 1980s and 1990s, a novel prevention program, in which walrus meat was sampled by hunters before being any community meat sharing and distribution by hunters, has demonstrated positive results and is being continued (Messier et al., 2007; Proulx et al., 2002).

Throughout the literature review, there were very few papers that dealt directly with the effectiveness of specific risk reduction methods for traditional Aboriginal foods, and even fewer included education on the subject. Health education in relation to food safety should be one of the principal tasks of primary health care networks. Culture-specific health education is essential for food preparers and schoolchildren (Kaferstein & Abdussalam, 1999). Education and training of health professionals can be an important way to educate communities in proper food handling and storage practices for traditional foods. Researchers can study and disseminate findings concerning perishability of traditional fermented and raw foods. Cooperation and assistance within communities, using agencies, institutions and community organizations in research studies of traditional foods to foster communication, education and collaboration should be encouraged (Swick, 2000).

Health risk advisories for drinking water, or fish consumption, are a specific form of education. Compliance with fish advisories varies widely and is dependent on awareness and knowledge of the advisory, the format and mechanism of communication, the type and level of information conveyed and trust in the institution or agency responsible for issuing the advisory (Jardine, 2003). This author indicated that one of the unanticipated outcomes of her research was that the issuance of fish consumption advisories cannot be isolated from the larger problem of resource management and protection of the environment. In order to change behaviour, the public needs to understand the underlying cause of a consumption advisory.

The British Columbia Head Start Program incorporates traditional foods into the menus at child care centres. For example, children learned how to traditionally smoke deer jerky. Knowledge of the process and how to build the smoker is transferred by a band elder and staff take many precautionary steps to prevent foodborne illness (BC First Nations Head Start, 2003).

6.3 Available Resources

Various manuals are available on the Internet regarding the safety of wild game and fish, describing parasites, bacteria, viruses and other pathogens. Such manuals are usually produced by provincial Ministries of Natural Resources, or academic researchers on behalf of wildlife organizations, and can be difficult to locate. These manuals, even if simply written and with many illustrations included, may not be seen as culturally appropriate and are available mainly in the English language. The Food Safety Network (FSN) research team has prepared a summary table of disease agents of concern to Aboriginal populations based upon traditional hunting, fishing and scavenging methods (Appendix C).

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Chapter 6

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Chapter 7: Effectiveness of Risk Reduction Methods Not Associated with Traditional Food

This chapter will review existing food safety programs, specifically educational approaches to the public and food handlers, including handwashing, as a method of risk reduction in food safety. Programs in Canada, the United States and the United Kingdom are reviewed. Of all the risk reduction methods, government laws and regulations provide discussion of public health protection. A section on the general role of laws and regulations at the various levels of government agencies with some comments on the implications for food safety for Canadian Aboriginals is provided.

7.1. Food Safety Public Education Programs in Canada and the United States

Despite advances in methods to detect and prevent microbial contamination of foods, and the efforts of food safety programs, foodborne illness is still a prevalent cause of disease. PHAC estimates there are eleven million cases of foodborne illness each year in Canada (PHAC, 2007c).

Federal government agencies in the U.S. and Canada initiated food safety awareness campaigns directed at consumers in the 1990s. The U.S. introduced the Safe Food Handling Label for raw meat and poultry in 1994 (U.S. FDA, 1998). The U.S. Fight BAC! Campaign was launched in 1997 (Partnership for Food Safety Education [PFSE], 2006) and the Thermy campaign was launched in 2000 (U.S. Department of Agriculture/Food Safety and Inspection Service, [USDA/FSIS], 2008a). Both programs used social marketing techniques to induce behaviour change in specific target audiences. The Canadian Partnership for Consumer Food Safety Education (CPCFSE) adopted the Fight BAC! Program in 1998 (CPCFSE, 2006a). The U.S. Be Food Safe campaign was launched in 2006 building on the messages of the FightBAC! campaign (USDA/FSIS, 2008b). Modest positive results have been attributed to these campaigns but the effects on long-term knowledge and behaviour modification are not sufficiently reported.

The Safe Food Handling Label lists safe food handling instructions and is placed on all packages of raw and partially cooked meat and poultry products. A USDA/FSIS (2000) survey indicated that 64% of customers recalled seeing the label, but few read its contents. In another survey, 51% of respondents reported seeing the label and of those, 79% read it and 37% reported changing their preparation methods for raw meat (Yang, Angulo, & Altekruse, 2000). There was a wide variability among different demographics. Criticisms of the label were that it was too small, did not attract attention, was too wordy, and did not provide enough information. Yang et al. (2000) suggested that, in addition to the label, food safety education programs are needed to inform consumers about proper food-handling and preparation practices and to motivate behaviour change.

Fight BAC! was developed by the U.S. Partnership for Food Safety Education as a comprehensive public education campaign. The four main messages are: 1) Clean; wash hands and surfaces, 2) Separate; avoid cross-contamination, 3) Cook; cook food to proper temperatures, and 4) Chill; refrigerate foods promptly. Criticisms include a general lack of awareness of the program among consumers and a failure to positively impact consumer behaviour (USDA/FSIS, 2000). The Canadian Partnership for Consumer Food Safety Education adopted this program for use in Canada.

Anderson, Shuster, Hansen, Levy, & Volk (2004) videotaped people preparing a meal in their homes. Many errors were made during food preparation. The authors observed that Fight BAC! messages are not resonating with consumers. The majority of hand washing attempts did not meet FightBAC! recommendations. Surface cleaning and vegetable cleaning were inadequate for food safety. Nearly all subjects handled foods in a way that caused cross contamination. Meat and poultry were undercooked and very few meat thermometers were used. Many participants were unaware of how to safely refrigerate large pots of soup or stew.

It is unknown why consumers are not following recommendations, or why they practice risky behaviours (Anderson et al., 2004). Survey data from the Anderson et al. (2004) study showed that people know more about food safety than their behaviour demonstrates. Results of the Pathogen Reduction/HACCP program by the USDA showed that, although consumers reported high awareness of food safety, and felt that they used safe practices, observations revealed that this knowledge was flawed, incomplete or ignored (USDA/FSIS, 2000). The challenge for food safety education is to compel people to take action.

Self-reported survey results obtained from pregnant women in Miami, Florida indicated that participants had difficulty understanding the "cook" and "chill" messages of the Fight BAC! program. Using a food thermometer, refrigerating foods within 2 hours, and thawing foods safely had the lowest reported compliance scores in this study (Trepka, Newman, Dixon, & Huffman, 2007).

In a study of American Latino households, it was revealed that exposure to the Fight BAC! literature increased the reported incidence of thawing meats in the refrigerator from 7% to 14%, and improved food safety knowledge scores and comprehension of the term "cross-contamination" (Dharod, Perez-Escamilla, Bermudez-Millan, Segura-Perez, & Damio, 2004).

Thermy the Thermometer is an FSIS mascot designed to promote the correct use of food thermometers. The message that food colour and appearance is not a good indicator of food safety resonates well with the public. Many people reported that they would buy and use a food thermometer, but 30% did not start to use one, citing forgetfulness and lack of perceived risk (USDA/FSIS, 2002). While there is little evidence of a significant change in the use of thermometers among consumers, a joint FDA/FSIS food safety survey indicated that food thermometer use increased from 3% in 1998 to 6% in 2001 (McCurdy, Takeuchi, Edwards, Edlefsen, Kang, Mayes, & Hillers, 2006). The obvious targeting towards children may prevent adults from taking Thermy seriously. Elderly persons tend to have inflexible food preparation and handling practices and rely on physicians and health care professionals for advice, therefore, social marketing campaigns may not be effective in reaching this section of the population (Kendall, Hillers, & Medeiros, 2006).

In 2005, the FSIS introduced the *Is It Done Yet?* campaign to promote the use of a food thermometer, targeted to general audiences. This program reiterates the 4 principles from Fight BAC!: clean, separate, cook, chill and describes the proper use of food thermometers (USDA/FSIS, 2007). The impact of this program is unclear. A 2006 study funded by the USDA indicated that thermometer use among consumers who received their educational intervention reported an increase in thermometer use (from 4% to 16%) and ownership (from 34% to 42%) (McCurdy et al., 2006). This study suffered from a high dropout rate among participants and the long term impact on consumer behaviour is unknown.

The lack of safe food handling behaviour has led the USDA to develop the *Be Food Safe* campaign in cooperation with the Partnership for Food Safety Education, FDA and CDC. The *Be Food Safe* campaign, which is grounded in social marketing, behaviour change, and risk communication theories, is designed to inform and raise the level of awareness of the dangers associated with improper handling and undercooking of food (USDA/FSIS, 2008b). Extensive focus group testing was used in the design of the program. No published evaluation on its effectiveness is available to date.

The efficacy of these programs may be diminished because of conflicting messages to consumers. For instance, Thermy cites one temperature for the proper cooking of ground beef for consumers (71ºC/160F), and a different one for food services (68ºC/155F). Thermy also claims that only a food thermometer can be used as a reliable indicator of food safety, while Fight BAC! suggests that colour and appearance can be used to indicate doneness when a thermometer is unavailable. Literacy and language barriers may also diminish the effectiveness of food safety messages. In one survey, 75% of respondents did not understand the meaning of "cross-contamination" (U.S. FDA/FSIS, 2000). Other common food safety jargon such as separate, pathogens, cook to proper temperatures, danger zone, two-hour rule, and refrigerate promptly are not understood (USDA/FSIS, 2000).

The U.S. FDA surveyed consumer knowledge of food safety in the years 1988, 1993, and 1998. In general, food safety awareness increased over time. Awareness of microbial hazards in particular increased; by the end of the survey period, 55% of respondents reported that microbes were a serious food safety concern, and 93% were aware of *Salmonella*. Awareness of the risks of leaving perishable foods at ambient temperatures was also seen to increase. It is important to remember, however, that the self reporting nature of these surveys is difficult to interpret and open to bias.

A comprehensive review of food safety efficacy studies published over a 25-year period indicated that 75% used surveys, 17% used direct observation, and 8% used focus groups (Redmond & Griffith, 2003a). Despite the frequent use of surveys and questionnaires, the results are unreliable because of the tendency of participants to over-report behaviours perceived to be correct (McCurdy et al., 2006). Direct observation often reveals inappropriate behaviours that contradict self reporting surveys. Kendall, Elsbernd, Sinclair, Schroeder, Chen, Bergmann, et al. (2004) developed a food safety questionnaire that could be used reliably to evaluate the food handling behaviour of consumers by comparing detailed interview questions with recorded observations conducted by graduates of a nutrition education program.

7.2 Hand washing

The Canadian Fight BAC! program recommends that hands be washed for at least 20 seconds before and after handling food (CPCFSE, 2006b). Video-recording of food preparation methods practiced by 99 randomly selected participants revealed that time spent for hand washing was significantly less than 20 seconds, and only 1/3 attempted to use soap (Anderson et al., 2004). An observational study on hand washing among food service employees revealed that the number and thoroughness of hand washing attempts was lower than would be expected for food workers (Green, Selman, Radke, Ripley, Mack, Reimann, et al., 2006). This study also showed that the practice of wearing gloves significantly reduces the frequency of hand washing, which could lead to increased cross-contamination. Indeed, *Salmonella typhimurium* was transferred more frequently between fresh produce and gloved hands than bare hands (Jimenez, Siller, Valdez, Carrillo, & Chaidez, 2007). Hand washing with soap and use of alcohol or iodine based sanitizers significantly reduces the presence of bacteria on hands. According to Green, Radke, Mason, Bushnell, Reimann, Mack, et al. (2007), hand washing among food workers was more likely to occur in establishments that had food safety training programs and with more than one highly visible hand sink.

Montville, Chen, & Schaffner (2002) conducted a literature review and experimental analysis on the impact of various factors on hand washing. They concluded that using soap and towel drying were effective in significantly reducing bacterial cross-contamination. Factors that reduced contamination included using antimicrobial soaps and hand sanitizers, while direct contact with faucets and hot-air dryers increased contamination. Wearing a ring had a slight negative effect on hand washing, while no difference was observed between alcohol-based and alcohol-free hand sanitizers. The use of alcohol-based sanitizers reduced pathogen load on hands contaminated with raw ground beef by a factor of 2 to 3 log colony-forming units (CFU) (Schaffner & Schaffner, 2007).

7.3. Food Safety Programs in the United Kingdom

A home hygiene training initiative was carried out in a deprived area of Liverpool, U.K. in 2000 (Ghebrehewet & Stevenson, 2003). This initiative used a community development approach that combined education, training, and observation by health professionals. Homes were visited twice: on the first visit, hygiene training information was disseminated and observations were made in the home; on the second visit, questionnaires and observations were collected. Refrigerator thermometers were distributed on the first visit and temperatures were recorded on the following visit. A significant increase, from 69.3% to 84.2%, in the number of refrigerators operating at safe temperatures (0 – 4 °C) was recorded on the second visit. A decrease in the number of improperly stored items in the refrigerator (items past use-by date, storage of raw meat and cooked foods) was also observed. This study indicated the value of using a community development approach and the impact of making refrigerator thermometers available to consumers.

An evaluation of local food safety education programs by local health authorities in the U.K. revealed that 95% of health authorities reported providing food safety information to consumers (Redmond & Griffith, 2006). The majority of this information was in the form of printed materials (leaflets) and telephone advice, and dealt with hygiene issues such as hand washing, cross-contamination, and cooking. Less than one third of responding local health authorities reported evaluating the effectiveness of their food safety advice. These health authorities primarily employed self-reported surveys and questionnaires. This lack of rigorous evaluation of U.K. food safety programs is consistent with those used in North America.

7.4. Educational Messaging in Food Safety

Educational messages should address the factors leading to the highest incidence of foodborne illness (Bryan, 1988; Medeiros, Hillers, Kendall, & Mason, 2001). The ultimate goal of food safety messages or programs is to influence food handling behaviours in order to reduce the incidence of foodborne illness. Contradictory food safety messages and the use of food safety jargon impede the success of food safety education programs. Research has shown that food safety knowledge does not always translate into practice. Although many communication efforts have been developed, there is a need for improvement.

7.5 Regulation of Food Safety in Canada

All levels of government in Canada play a role in food regulation. Canada has a cooperative structure with clear lines of authority and accountability. Food policy decisions are made within ha context that is transparent and science based. Canada has internationally recognized risk assessment procedures that provide consistent, comprehensive and scientific means to identify, assess and manage potential health and environmental risks. The success of the Canadian food safety system depends on effectie partnerships between federal, provincial and territorial authorities, industry and consumers. Various levels of government collaborate with non-governmental organizations to ensure the integrity and comprehensiveness of the regulatory system and, through improved incentives and inspection processes, encourage industry to voluntarily improve food safety. Nevertheless, government retains the capacity to intervene when necessary, particularly where public health is concerned.

7.5.1. Federal responsibilities

Health Canada, the Public Health Agency of Canada, Agriculture and Agri Food Canada, Fisheries & Oceans Canada and Environment Canada all share responsibility for environmental and health protection matters.

Federal authorities establish and enforce:

- Health and safety standards for import, export and domestic consumption
- Quality standards for interprovincial and international trade
- Requirements for food safety to protect the public from product misrepresentation and fraud in food consumption, packaging, labeling and advertising.

Health Canada establishes policies, regulations and standards governing the safety and nutritional quality of all food sold in Canada, and for carrying out foodborne disease surveillance for early detection and warning. Health Canada is responsible for assessing the Canadian Food Inspection Agency's activities related to food safety. The Department also evaluates the safety of veterinary drugs used in food-producing animals. The Pest Management Regulatory Agency (PMRA) and the Canadian Food Inspection Agency (CFIA) are responsible for the enforcement/regulation of food safety (HC & CFIA, 2207; Forge, 2003).

The **Canadian Food Inspection Agency (CFIA)** administers and enforces all federal legislation related to food inspection, agricultural inputs and animal and plant health. The CFIA performs this role on behalf of Health Canada, Agriculture and Agri-Food Canada and Fisheries and Oceans Canada. The CFIA is responsible for inspecting and regulating federally registered establishments, which are generally those that move products across provincial or national boundaries. The Canadian Food Inspection Agency is responsible for the administration and enforcement of several Acts: Canadian Agricultural Products Act (and various relevant regulations), Consumer Packaging & Labelling Act (as it relates to food), Feeds Act, Fertilizers Act, Fish Inspection Act and the Food and Drugs Act (as it relates to food), Health of Animals Act, Meat Inspection Act, Plant Protection Act and the Seeds Act (HC & CFIA, 2207; Forge, 2003).

The **Pest Management Regulatory Agency (PMRA)** is the federal agency responsible for the regulation of pest control products in Canada. Its prime objective is to prevent unacceptable risks to people and the environment from the use of pest control products (HC & CFIA, 2207; Forge, 2003).

The **Public Health Agency of Canada** collaborates with the provinces and territories to keep Canadians healthy and helps to reduce pressures on the health care system. Its food safety responsibilities include foodborne disease surveillance for early detection and warning provided through the Laboratory for Foodborne Zoonoses. Enhanced public health surveillance systems are in place at all times to provide immediate information on outbreaks of foodborne illnesses (HC & CFIA, 2207; Forge, 2003).

At present, the core of Canada's food safety system is the federal **Food and Drugs Act & Regulations**, which derives its powers from criminal law, and several other agricultural, consumer, and trade statutes. The Food & Drugs Act and Regulations (FDAR) outline the food standards and requirements established by Health Canada. The FDAR defines the limits allowed in foods for:

a) food additives
b) agricultural chemicals or veterinary drugs
c) ingredients in foods
d) vitamins, minerals or amino acids

Enforcement of the FDAR is carried out by the inspection process via CFIA (HC & CFIA, 2207; Forge, 2003).

7.5.2. Provincial responsibilities

Provincial/territorial authorities enact regulations for foods produced or sold within their jurisdictions. These laws are complementary to federal statutes. There is also legislation to govern animal husbandry, agricultural practices, and the licensing of meat and dairy establishments selling their products interprovincially. Provincial inspection programs apply to food processing and food service, retail food, hospitals, nursing homes, community kitchens and food banks. Most provinces and territories have established cooperative approaches to food safety and inspection. Provincial legislation also authorizes municipalities to enact bylaws affecting food inspection. In most of the provinces and territories, this falls under the health or the agricultural ministry (HC & CFIA, 2207; Forge, 2003).

7.5.3.Municipal Responsibilities

The provinces and territories enact legislation to provide regional authorities with broad powers to investigate and take, or order taken, any measures which are necessary to eliminate, or minimize, the effects of hazards to public health. This is usually the responsibility of community/public health units. Public health inspectors are responsible for inspecting food premises across the province/territory. The key responsibilities of the regional/municipal public health units include food service and food retail establishments, and food processing plants that are not federally registered.

Health Units are also responsible for communicating information about food safety to the community and responding to food-related complaints. Food safety for fish and fish plant inspection for products harvested and offered for sale may be under the jurisdiction of a different department (HC & CFIA, 2207; Forge, 2003).

7.6. Aboriginal Rights

Treaty and aboriginal rights relating to hunting, fishing and trapping are recognized and affirmed as part of the Constitution of Canada by Section 35 of the Constitution Act, 1982. While the three Aboriginal groups are named in the Constitution, the Métis did not sign Treaty or land claim agreements with the federal government and thus remain outside the Indian Act which grants certain entitlements. Before a Métis hunting and fishing right can be recognized, it requires a challenge in a court of law. Several test cases in the Supreme Court of Canada have permitted the exercise of harvesting or other rights where no claim is made to the land itself (Mease, 2006; Government of Manitoba, 2006).

7.6.1.Aboriginal Health including Food Safety

For the First Nations and Inuit, Health Canada has established a special First Nations and Inuit Health Branch (FNIHB) to be responsible for on-reserve environment and health issues. The Environmental Health Program (EHP) is a community-based program under FNIHB to protect and improve the health of First Nations (south of 60° latitude). The EHP addresses the following areas: drinking water and sewage, food safety, facility health inspections, housing, transportation of dangerous goods, and West Nile Virus. Its objectives are to monitor, identify, and mitigate water, food, and vector-borne illnesses, define health risks, improve health risk awareness, and build community resources to manage risks. Health Canada works with First Nations through the Chiefs and Councils to ensure that programs are in place to monitor drinking water quality and assess potential public health risks in distribution systems. Food safety is focused on minimizing the incidence of illness through inspection programs for grocery stores, restaurants, cafeterias, public buildings and special events such as festivals, pow wows, rodeos and traditional games, and offering food handling courses. The inspection of solid waste management facilities, community facilities, special event facilities, and recreational facilities are carried out at least on a yearly basis. Housing is investigated for general safety, structural defects, water supply; solid and liquid waste treatment and disposal, indoor air quality, including mould, overcrowding and occupant awareness of health related issues. Health Canada also initiated the Environmental Research program which carries out laboratory and field studies, research, monitoring and surveillance and modeling efforts, in the context of risks posed by environmental contamination (Health Canada, 2007).

7.7. How Food Safety Laws and Regulations Affect Canadian Aboriginals

In Canada, for Aboriginals recognized by treaty, Health Canada exerts a major influence upon food safety. Aboriginals do not have to obtain permits and licenses to hunt, trap or fish. Aboriginals have the right to hunt and trap game and fish for food at all seasons of the year on all unoccupied Crown lands and on any other lands they have the right of access. Aboriginals may be asked to provide proof of Aboriginal rights when exercising these rights, i.e. an Indian status card rather than a hunting or fishing license. This can be problematic to prove for those without recognized status under Bill C-31, the Indian Act which primarily recognizes the rights of the First Nations and the Inuit (Government of Manitoba, 2006).

Aboriginals also have the responsibility to follow restrictions set for conservation or safety purposes similar to any licensed hunter or fisher. All provincial and federal regulations apply to Aboriginals engaged in commercial activities involving fish and wildlife (Government of Manitoba, 2006). Foods obtained through recreational or subsistence activities are not regulated under the Food and Drug Act and Regulations and they are not regularly inspected by provincial or federal officials. Many provinces regularly monitor wild foods, particularly sport fish and wild game, for possible chemical contamination. This means that wild game and fish, for traditional food use of Aboriginals are not inspected. It is not permitted legally to serve wild game except in one's home. No individual hunters, trappers and fishers, whether Aboriginal or not, are required to have game and fish inspected at federal or provincial/territorial meat inspection plants. For Aboriginals, this also means that there is no required inspection o f such foods before distribution to other community members via food sharing traditions. Hunters are permitted to use wild game animals and fish for personal but not commercial use.

The voluntary walrus sampling program used in northern Quebec works well to test for trichinellosis before distribution of the hunt among community members. However, this means that traditional foods such as wild game cannot legally be served in public institutions and community events unless inspected. This seems to interfere with Aboriginal cultural traditions, when preferred foods cannot be legally served.

Non-status First Nations people and Métis people (who represent close to 40% of Canadian Aboriginals) do not have access to services provided by the First Nations Inuit Health Branch (FNIHB) of Health Canada. For those status natives, the services of the FNIHB are only provided for those living on-reserve or to Inuit living in the north. These populations represent about one third of Canada's Aboriginal population. Non-status First Nations people and Métis use provincially administered services, since many of these people live in urban areas. Thus services are fragmented for Aboriginals in Canada.

For First Nations and Inuit, the EHP program provides public health inspectors who monitor and enforce regulations for food served in public settings such as feasts (potlatch, pow-wow) or in health institutions and childcare centres. There is no intervention for food sharing, such as the distribution of a hunt with other family and community members. It is not legal to serve wild game without inspection on reserves or elsewhere in Canada. This is another instance where basic safety overrides Aboriginal traditions. Consideration is needed to adapt the food safety regulations to Aboriginal cultural practices. Alternatively, basic safety precautions can be adapted to legally permit cultural traditions and food preferences.

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Chapter 7

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Chapter 8: Successful Initiatives

In this chapter, general health promotion initiatives used in Aboriginal communities are reviewed. These initiatives, while successful, do not specifically describe risk reduction to traditional food preparation and storage, but do provide guidance about what works to use in the development of food safety risk reduction messaging.

A review of both the Internet and the published literature was conducted retrieving relevant information about disease prevention and health promotion efforts aimed at Aboriginal populations. Some of the most relevant work is aimed at the area of knowledge exchange or knowledge translation. Accordingly, in order to learn about success factors and recommendations to help develop effective messages for safe food preparation and storage of traditional/country foods, the search was limited to Canadian and Alaskan descriptions of work with Native populations in remote and urban locations. In the majority of the retrieved articles, the health promotion initiatives among the Inuit and First Nations were discussed. Missing in the research literature are descriptions of research conducted in urban Aboriginal communities and with the Métis population. Urban Aboriginals straddle two cultures and may need different strategies for effective communication and connection with their cultural heritage. Minimal research has been conducted with Métis populations. A summary of information from the literature follows.

There is growing recognition both in Canada and internationally that Aboriginal people have a unique knowledge about their culture, environment and foods. Educational efforts must be structured using traditional Aboriginal knowledge, and specific cultural beliefs and values. Aboriginal traditional knowledge is defined as knowledge that is held by, and unique to, Aboriginal peoples (Fletcher, 2003; Kuhnlein, Erasmus, Creed-Kanashiro, Englberger, Okeke, Turner et al., 2006). This body of knowledge is cumulative and dynamic, held by a group of people who have lived in close contact with nature for generations, and builds upon historical experiences of a people who have adapted to social, economic, environmental, spiritual and political change (Dawar, Moody, Martin, Fung, Isaac-Renton & Patrick, 2002; Petrucka, Bassendowski, & Bourassa, 2007). A vital realization when working in Aboriginal communities is that Western scientific frameworks and strategies that work in mainstream Canadian society are unlikely to work because of the lack of cultural fit. Mainstream approaches must be specifically designed for use in Aboriginal communities (Smylie, Martin, Kaplan-Myrth, Tait, Steele & Hogg, 2004).

Past educational efforts have not always met with success in Aboriginal communities. Early efforts to prevent botulism in Native Alaskans, and to inform them about the dangers in traditional food preparation, were spurned, viewed as outsiders coming into the North to interfere with Aboriginal culture. Instead, efforts must be made by health professionals, government agencies and academic researchers to connect with Aboriginal communities using strategies that are comfortable and fit with Native cultures and communities. Community capacity building and community empowerment techniques are recommended (Abonyi & Jeffery, 2006; Chino, & DeBryn, 2006; Fisher, & Ball, 2005; Kinnon, 2002; Smylie et al., 2008). Community capacity building is defined as a community's potential for responding to issues (Chino & DeBryn, 2006). Involving the community members in projects is the most effective method to make change and build understanding. Projects must be relevant to communities in order to bring about change (Smylie et al., 2004).

Community participation using Native leaders and respected community members is one key to success. Each project is challenged to work closely within specific Aboriginal communities because of the very apparent diversity of ethnicity, culture, history and governance systems between communities (Fletcher, 2003; Furgal, Powell, & Myers, 2005; Ho, Gittelsohn, Harris, & Ford, 2006; McShane, Smylie, Hastings, & Martin, 2006; McShane & Smylie, 2006; Smylie et al., 2008). Information offered to communities may not be appreciated or understood for various reasons i.e. not all community members read or understand English, the information may be devoid of cultural relevance, or may not be specific, or important to a particular community. The information provided must be adapted to the community and be in a form that is easily understood by community members (Hanson, & Smylie, 2006).

The Métis, the Inuit and the First Nations have wide regional and geographic variations concerning traditional food preferences and availability of what is hunted and gathered. These are in addition to the seasonal variations in their diet. Some of the Aboriginal populations in Canada remain on reservations, some are in remote, Northern locations, and some have moved into urban locations. Despite the range in cultural and geographical demographics, common patterns among the various Aboriginal groups can be identified.

One recent study describing pathways of health information in three Indigenous communities, the Inuit, the Métis and the Algonquins of Pikwàkanagàn First Nations, provides some direction to sort out the various Aboriginal groupings (Smylie et al., 2008). The following cultural themes were identified as specific to the Inuit community:

- The importance of face-to-face interactions,
- Story telling: sharing of stories is an integral component of health information dissemination, often told by female Elders
- Role of Elders in decision making: Elders are the foundation of Inuit oral traditions and are the preferred first line for health information, sought because of experience; sharing of oral traditions occurs despite geographic barriers
- Community cohesion: Even if individuals are not directly related but are from the same community of origin belonging to a larger Inuit community.
- Inuit/non-Inuit distinction: Aboriginal services not targeted to Inuit are perceived as outside the community and therefore, less relevant.
- Cultural interpreters: Interpreter shortage is a serious problem because Inuktitut-speaking Elders cannot transmit knowledge to non-Inuktitut-

speaking health professionals and community members without interpreter.

For the Algonquin Pikwàkanagàn First Nation community, these cultural themes are described as follows:

- Traditional knowledge and medical pluralism: The influences of residential schooling and more recent urbanization are identified by community members as playing a central role in the erosion of traditional knowledge; the majority of individuals combine traditional and biomedical approaches
- Privacy and stigma: There is a preference for individual, rather than group, health care consultations because of higher degree of confidentiality and privacy within a small community. There is a perceived stigma with mental health and addiction.

For the Métis Community, the following cultural variables were noted:

- Dispersed community structure: With the increased migration of Métis to urban centers there is a disruption within the traditional networks of family and community. It becomes difficult to connect with other Métis and the cohesive community information network is missing.
- Impact of colonization on identity: There is no connection with other First Nations people and repeated disruption and dislocation of families and communities over multiple generations has led to marginalization and a feeling of invisibility.
- Métis see themselves as outsiders in both the mainstream and the First Nations health systems and often, Métis-specific health services are not available.

Overall for the three Aboriginal groups, some common cultural patterns are recognized as follows:

- Experiential knowledge, based on evidence from personal experiences, is valued.
- There is a strong influence of community structure on health information dissemination, i.e. for Inuit: word of mouth is very effective however; for Pikwàkanagàn First Nation there is social fragmentation within the community and the Métis experience significant challenges in identifying and engaging their dispersed population.
- Preference for within-community messages, messages that incorporate culturally appropriate icons, symbols and,
- Or languages are strongly preferred, reflected in some of the artwork used in pamphlets and posters and in the written text of existing health information.
- Dissemination through family and community networks.

- Local effects of colonization: Forcible replacement of traditional community knowledge with European equivalents, with differing levels of tension between indigenous and western European knowledge systems.

Communications and educational messages have an increased chance of success if they follow certain guiding principles (Fletcher, 2003; Hanson & Smylie, 2006; Rikhy, Jack, Campbell, & Tough, 2008). Guiding principles reported in the literature are listed and described below:

- Communications are best received when culturally appropriate. Since Aboriginal communities are diverse, strategies are required to accommodate specific contexts and need to be aligned with the culture and values of the Aboriginal communities.
- All of the tribal communities value the inclusion of Elders. Support of Elders facilitates participation within the community, and ensures traditional wisdom and experiences, highly valued by Aboriginal peoples. (An Elder is defined as a representative of the community and is identified as a leader by the community).
- The history of the Aboriginal population has contributed to a legacy of mistrust in government and community outsiders. Considerable time and effort need to be invested to develop mutually trusting and respectful relationships when researchers/newcomers arrive in an Aboriginal community.
- Community empowerment works. Partnerships need to be equal to support the development of trusting and open relationships and need to be established from the start of projects.
- Respect for indigenous/traditional knowledge is essential. Holistic approaches seeking connections between body, mind, spirit and heart are recommended.
- There are cross-cultural communication challenges: language, both in terms of complexity (some words cannot be translated from/into English) and dialect can be a barrier. Also, there are a limited number of cultural and linguistic interpreters available to assist with communication.
- Another critical issue is the establishment of long-term commitment. It is challenging to develop partnerships with Aboriginal communities without sufficient time and funding resources.
- Ownership and stewardship: Many of the First Nations communities follow a policy of OCAP (Ownership, Control, Access and Possession) related to control of information and data. This policy becomes complicated when considered alongside existing provincial/territorial and federal laws related to privacy, confidentiality and intellectual property.

An examination of several successful health promotion strategies reveals the need to tailor programs individually to ensure that content and process are locally based and locally relevant, because of variations in health beliefs and attitudes and environmental conditions. Community input needs to be balanced with proven health promotion and knowledge translation strategies (Dickson & Green, 2001; Ho et al., 2006; Potvin, Cargo, McComber, Delormier, & Macaulay, 2003; Kinnon, 2002; Rikhy et al., 2008). Most importantly, evaluation needs to be built into projects from the start and be ongoing. Several of the older strategies have not been evaluated for effectiveness (Rikhy et al., 2008; Myers & Furgal, 2006; Chiou, Hennessy, Horn, Carter & Butler, 2002).

So what works? Various factors are recognized that may influence communication in Arctic communities. Most northern Aboriginal communities accept the benefits and risks of eating traditional foods and trust in the environment which has supported their communities historically. However, language and communication patterns are very different from those in mainstream Canadian society. Knowledge systems also vary with oral and visual strategies preferred. Additionally, northern communities tend to distrust government and outside experts (Myers & Furgal, 2006).

Strong evidence exists describing the use of community-based participatory action research, incorporating the principles of collaboration, and using input from community members and organizations. This dynamic strategy is aligned well with Aboriginal values; it is inclusive and respects the wisdom and participation of the group and recognizes the importance of relationships (Abonyi & Jeffery, 2006; Dickson & Green, 2001; Fisher & Ball, 2005; Fletcher, 2003; Kinnon, 2002; McShane & Smylie, 2006a; McShane, Smylie, Hastings, Martin & Tungasuvvingat Inuit Family Resource Centre, 2006b; Petrucka, et al., 2007; Potvin et al., 2003; Rikhy et al., 2008).

Face-to-face/verbal/visual transmission strategies, rather than written, have proven more effective in some Aboriginal communities. Examples of this strategy include meetings, either with an individual or via groups and use of video to educate and inform (Furgal, Powers & Myers, 2005; McShane et al., 2006; Rikhy et al., 2008; Smylie et al., 2008). One of the few articles describing interventions with urban Aboriginals mentioned a prenatal health intervention presented by remote-based Elders using CD-ROM technology (McShane et al., 2006). Another article uses evidence of a well developed logic model methodology for program development which was adapted to the visual communication preferences (poster) of an Aboriginal community in northern Saskatchewan (Abonyi & Jeffery, 2006).

Use of multiple and varied media ensures that the message is received (Furgal et al., 2005; Abonyi & Jeffery, 2006). The Northern Contaminants Program, administered by Indian & Northern Affairs Canada (2006), provides much relevant and useful information about messages, networks, materials and processes in the NCP Communications Report, 2007. This report validates that effective materials provide simple, easy-to-understand messages in culturally appropriate and sensitive ways. Useful general guidelines for media (print, video and radio) are provided online.

Yet another strategy for effective transfer of knowledge is use of community gatherings, a culturally valued inclusive strategy, supporting dialogue and encouraging opinions and identification of community priorities. Among the effective strategies provided by the

Quesnel Aboriginal Diabetes Prevention and Awareness Program in British Columbia are culturally appropriate workshops, fact sheets and educational activities at community events (Quesnel Tillicum Society, 2004; Rikhy et al., 2008).

Talking circles are an important traditional practice, reflecting the oral nature of many Aboriginal communities. Here, a symbolic object is passed around while the community members speak, thus actively encouraging discussion and opinion-sharing, while creating a space for mutual respect and reflection (Rikhy et al., 2008). Storytelling is one additional traditional strategy, conveying cultural traditions and values and providing a good foundation to build knowledge and discussion. This strategy is particularly effective for sharing health information (Smylie et al., 2004).

Effective messaging for food safety with Aboriginal populations includes evidence-based interventions combined with culturally appropriate knowledge translation strategies. These strategies need to be aligned with Aboriginal culture, values and preferred learning styles. As new food safety messages are developed around the preparation and storage of traditional foods, both formative and summative evaluations are needed to test message effectiveness in accordance with the guiding principles discussed.

A list of various programs targeting Aboriginal populations is provided in Appendix D.

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Chapter 8

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Chapter 9: Conclusion & Recommendations

9.1 Conclusions

The Aboriginal people of Canada belong to three groups: Indians (First Nations), Métis and Inuit. These three groups have a higher rate of population increase than non-Native Canadians. In 2006, children and youths under the age of 24 represented 48% of the Aboriginal population, and approximately 9% and 10% were under the age of 4 and aged 5 to 9 years, respectively. Infants and children are more susceptible to infections because of their immunological immaturity. Typically, the younger the child, the more susceptible he/she is to contract illness. Aboriginal children are twice as likely as non-Aboriginal children to live in a multiple family home; over-crowding and below standard housing negatively affect health status. An increasing population implies that there are many pregnant Aboriginal women. These women are at risk of toxoplasmosis, a foodborne disease without outbreaks but with potential for severe outcomes.

The food security of Canada's Aboriginal population is far below that of most Canadians. The high level of food insecurity in the Aboriginal population is a result of several factors, including low incomes, high risk of chemical contaminants in traditional Aboriginal foods due to pollution, poor access to fresh, wholesome produce and other perishable foods due to inappropriate shipping and handling, and disruptions to food access caused by interruption in shipping or changes in migratory patterns of animals.

Over the past 50 years, while traditional food remains an important source of nutrients for many Aboriginal communities, consumption of these traditional foods has decreased, with a coinciding increase in the consumption of commercial (market) foods from the south. This increase in market food consumption has resulted in several health problems including obesity, diabetes and cardiovascular disease in the Aboriginal population. Much of the health research has been focused on the incidence of diabetes and obesity in Aboriginal populations. While these are important indicators of population health, very little research has been conducted on food safety issues.

Many Aboriginal communities consume their foods raw or undercooked. Parasite transfer from the raw infected food source to the consumer is of concern because incidents of parasitic disease are higher in Aboriginal populations than in the non-Native population. The parasites Trichinella nativa, Toxoplasma gondii, Anisakis simplex and Giardia spp. and the bacteria Clostridium botulinum, Shigella spp. and Vibrio spp. are significant human pathogens affecting these populations. Additionally, Aboriginal cultural preference and historical practice includes the use of food preparation and storage practices, such as "fermentation"/putrefaction and consumption of viscera/organ meats. The "fermentation" practices have caused a large number of outbreaks of Clostridium botulinum due to improper techniques. Public health officials have reacted by producing educational programming about appropriate containers and food safety practices. Little research has examined the risks and benefits from the consumption of viscera.

Climate changes can affect traditional food gathering by altering distribution and health of animal populations, and affecting the land, water and ice. Insects, bacteria, and parasites are susceptible to temperature changes; low temperatures tend to kill or inhibit the survival and growth of these agents. Water- or soil- borne parasites, cold sensitive bacteria and insect-borne pathogens will benefit from increasing Arctic temperatures. Longer and warmer seasons may increase the window of opportunity for disease transmission and allow for faster development of illness. Increased temperatures could increase the incidence of foodborne illnesses such as gastroenteritis, paralytic shellfish poisoning and botulism, introduce new pathogens as host or vector ranges expand, and contaminate water supplies by flooding. Emerging pathogens, such as Echinococcus multilocularis require ongoing vigilance regarding the effect upon wild game hosts and humans.

Outbreak reports provide details of relationships between food practices, foodborne pathogens and zoonoses causing illness in Aboriginal populations. Past efforts to prevent outbreaks have involved suggestions to modify food preparation techniques. Suggestions to modify the revered traditional recipes by heating foods to appropriate temperatures or to change preparation practices may be considered cultural encroachment.

While traditional food is more economical and offers nutritional benefits, barriers to its consumption have arisen. These include declining skills to harvest, hunt, fish and trap; changes in food preference patterns; decreasing food supplies due to global climate changes and migratory patterns; and environmental contaminants that make food unsuitable for consumption. Documenting and examining existing Indigenous knowledge related to traditional Aboriginal foods, food preparation and sustainable food systems in our country can benefit the development of risk reduction strategies.

Aside from reports on outbreaks, very few studies about food safety in Aboriginal communities have been conducted. Until recently, the principal food safety issue in the mind of Aboriginal communities was environmental contamination. Minimal research has been conducted examining the food safety risks that occur with traditional/country food preparation practices. Aboriginal populations are at greater risk of acquiring infections related to wildlife because of their lifestyle and food habits. There is a definite need to consider risk management strategies, particularly those targeted at reducing such risks. For the Aboriginal people of Canada, outbreaks of foodborne diseases have been attributed mainly to the consumption of raw foods of animal or marine origin, and to changes in traditional food preparation, particularly in the “fermentation” of meat and fish.

Four risk reduction methods that concern Aboriginal people were identified: maintenance of traditional knowledge, prevention of growth of risk agents, public health monitoring and surveillance and education. Considerable food safety knowledge appears to exist in

Aboriginal communities but little written documentation exists. There is a lack of documentation on Native food preparation techniques i.e. fermentation, smoking, drying, or consumption practices. Very few programs have been tested for their effectiveness in preventing foodborne illness in Aboriginal populations. One program relates to the control of botulism in the Alaska Native population and another is concerned with the surveillance of Trichinella in walrus in Nunavik. Pre-consumption sampling of meat from harvested walrus in Nunavik has been demonstrated to be an effective risk reduction method to prevent trichinosis. Rapid dissemination of test results to communities affected by a trichinosis outbreak was reported to be an effective prevention measure. More research based upon foodborne illness outbreak data can guide future preventive programming.

The efficacy of food safety education programs has not been clearly demonstrated but studies in risk communication have indicated that some programs may not function because of conflicting messages to consumers. Literacy and language barriers may also diminish the effectiveness of food safety messages. Most initiatives lack evaluation. Research studies have shown that knowledge of safe food practices does not always translate to behaviour.

Aboriginal people have a unique knowledge about their culture, environment and foods. Educational efforts must be structured using traditional Aboriginal knowledge, and specific cultural beliefs and values. Involving the community members in projects is an effective method to create change and build understanding. To account for variations in health beliefs, attitudes and environmental conditions, programs should be tailored individually to ensure that content and process is locally based and locally relevant. Effective messaging for food safety with Aboriginal populations should include evidence-based interventions combined with culturally appropriate knowledge translation strategies.

9.2 Research Recommendations

The recommendations follow from the literature review of traditional foods. It is readily apparent that food safety of Aboriginal traditional foods has not been studied in any detail beyond nutrient analysis. The following recommendations are organized following the process from food harvest to consumption. Due to the difficulties conducting randomized controlled trials in isolated communities and the ethical dilemma of such research when using humans, the level of the research is not evidence-based but originates from non-randomized trials, observational studies and most frequently, expert opinion.

There is a need to study the food safety of the various food sources, preparation and storage methods since there is insufficient research evidence to conduct a systematic review of the effectiveness of risk reduction methods on the preparation and storage of safe Aboriginal traditional/country foods, either at home or for public consumption.

Throughout the literature review, there were very few papers that dealt directly with the effectiveness of specific risk reduction methods for traditional Aboriginal foods, and even fewer included education on the subject. The only descriptions located for this literature review, that directly associates risk reduction methods and traditional food preparation involve botulism resulting from fermented food in the Inuit population.

9.2.1 GENERAL OVERARCHING RESEARCH RECOMMENDATIONS

Note: There is no particular significance to the order in which recommendations are presented.

1. Investigate a collaborative, multi-agency approach to examine the microbiological risks of traditional foods.

Rationale: The Northern Contaminants Program has successfully addressed environmental issues in the North of Canada using a collaborative, multi-agency approach, resulting in identification of chemical hazards in foods and risk reduction strategies. However, there is a need to go beyond chemical contamination issues. Microbiological issues such as Clostridium botulinum, Echinococcus multilocularis, etc. and their impact upon those following a subsistence lifestyle, need a similar systemic approach.

2. Develop a food safety risk assessment and management program for traditional foods, building upon the model used by Health Canada for the Northern Contaminants Program (NCP).

Rationale: While the benefits of a traditional diet have been accepted, research on the food safety of traditional foods is limited. Safe foods begin with healthy plants and animals. Similar approaches to the NCP are needed for traditional food harvesting, preparation and storage to reduce the incidence of foodborne pathogens and improve the nutritional quality of the food supply.

3. Address multi-jurisdictional issues to consumption of wild game in public settings and institutions.

Rationale: While Aboriginals under the Constitution of Canada and in some cases, the Indian Act, have been granted historical rights to hunt and fish and certain other entitlements, the food safety laws need to be clear and transparent and similar for all Canadians.

9.2.2 SPECIFIC RESEARCH RECOMMENDATIONS

9.2.2.1.Harvest

1. Continue monitoring and surveillance to investigate risks from parasites and from pathogenic bacteria associated with game meats.

Rationale: Raw meat poses a health risk from parasites and other pathogens that can sporadically and unexpectedly appear in unexpected hosts. With climate change, zoonotic disease from several emerging pathogens (e.g. Echinococcus multilocularis) is expected to present food safety issues.

2. Extend the sampling program for trichinella to all regions where walrus is hunted.

Rationale: The voluntary walrus sampling program used in northern Quebec works well to test for trichinosis in advance of distribution of the hunt more widely among community members. Condsiderable development work is required to have all parts of such a system work: hunter education and cooperation, quick pick-up of samples and laboratory turnaround time etc.

3. Pursue research efforts to identify the hosts (animals, water etc.) of Toxoplasma gondii and other pathogens such as Echinoccoccus spp. in specific communities, i.e. Nunavik

Rationale: Information available on the microbiological conditions of meats from game animals is limited. Once the presence of pathogens is confirmed, research will be required to manage risk.

4. Consider licensing of Aboriginal hunters, requiring tagging of animals and promoting ‘healthy at time of slaughter’ practices

Rationale: Factors contributing to foodborne illness from game animals include the health of the animal before killing, the method of killing and butchering in the field, specifically contamination from gut contents. Hunters/fishers are in the best position to detect changes in the flesh and organs of animals and fish. When sickness in an animal is recognized, the animal should be killed, but not consumed. Preventive actions for hunters include such activities as follows:

- How to inspect carcasses;
- Wear gloves and masks while handling carcasses;
- Butcher, dress, transport and store carcasses as quickly as possible after kill in order that food will not cause significant health hazards or potential for human illness;
- Wash hands, knives and clothes in hot soapy water after handling meat, when and where possible;

- Keep meat frozen (below -18ºC) or at refrigeration (below 4ºC) temperatures;
- Help wildlife agencies monitor wildlife disease and parasites by reporting and sampling animals when concerned;
- Teach how to collect samples,
- Encourage compliance with speedy airmail shipping of samples to laboratory and patience to await results before any sharing or distribution of meats.

9.2.2.2. Food Preparation & Storage

1. Study the perishability of fermented and other traditional food products (particularly viscera/organ meats and raw meats), often stored in food caches or permafrost (which is melting due to climate changes).

Rationale: Outbreaks of foodborne diseases have been attributed mainly to the consumption of raw food from animal or marine origins and to changes in traditional food preparation, particularly in the "fermentation" of meat and fish. Existing research is more than a decade old with many gaps into food safety. Researchers can study and disseminate findings concerning perishability of traditional fermented and raw foods. There has been minimal research examining the food safety risks that occur with traditional/country food preparation practices, and there is a definite need to consider risk management, particularly how such risks could be reduced. Ideally, identification of specific hazards in traditional/country foods and identification of control measures that focus upon prevention will increase food safety or at least reduce food safety risks to acceptable levels. Aboriginal populations are at greater risk of acquiring infections related to wildlife because of their lifestyle and food habits.

2. Seek cooperation and assistance from other agencies, institutions and community organizations in studies of traditional foods.

Rationale: Research to evaluate the safety of traditionally prepared and high risk foods should be promoted using collaborations between Aboriginal communities and academic researchers, and using community-based participatory action research methods. Cooperation and assistance within communities, using agencies, institutions and community organizations in research studies of traditional foods to foster communication, education and collaboration should be encouraged.

3. Investigate ways to share knowledge with various communities (public and health professionals) in the identification, preparation and handling practices for traditional Aboriginal foods, using a proactive approach.

Rationale: Traditional approaches to educate the general public and health professionals have been reactive following serious outbreaks of foodborne illness. Safe food preparation methods to eliminate risks but preserve the flavour and texture of traditional foods have not been developed nor accepted by the Aboriginal people of Canada. Cultural traditions regarding food preferences and food preparation methods have been passed from generation to generation, and the Aboriginal people understand that the consumption of wildlife and fish, hunting and handling of furbearing animals and traditional methods of food preparation can be risky and sometimes dangerous. Applying modern scientific knowledge in conjunction with traditional knowledge increase safety since users understand the underlying principles.

4. Collaborate with tribal health organizations (many are already actively involved in identifying and assessing chemical contaminants) to increase food safety programs and food safety awareness. Home processed fish or sea mammals such as whale blubber, seal flippers and seal blubber can foster contamination and growth of Clostridium botulinum. Wild game can harbour parasitic zoonoses, such as trichinella in walrus or seal leading to human illness from improper food preparation. Activities could include:

- Collection of Native knowledge regarding foods, food preparation and storage is recommended.
- Documentation of recipes and food preparation methods such as fermentation.

Rationale: Cultural acceptance is increased through involvement of Aboriginal leaders and community groups. With increased urbanization of Aboriginals and families, food traditions are being lost or altered. Considerable food safety knowledge appears to exist in Aboriginal communities but little written documentation exists. Also, there is little documentation on Native food preparation techniques i.e. fermentation, smoking, drying, or consumption practices. Some recommendations that change revered traditional recipes such as heating foods to temperatures that would inactivate toxins, and adding sugar, or salt to the fermentation process to inhibit bacterial growth and allow for a true fermentation, have met with considerable resistance. Such changes alter desired flavours and may be scorned as cultural encroachment

5. Consider increased use of video technology which is culturally acceptable, can use appropriate language/dialect and share elder wisdom with urban natives

Rationale: All Aboriginal groups in Canada value oral traditions and respect for elders.

6. Target high risk subgroups of Natives should be targeted including those who have modified traditional practices.

Rationale: A high percentage of the Aboriginal population belong to the groups most at risk for foodborne illness: the young, the elderly, pregnant women and those with immune weakened systems. Children and youth (and we can assume many pregnant women) comprise over 50% of the population. Additionally, the incidence of chronic diseases such as diabetes mellitus and heart disease is disproportionately high when compared to the Canadian population in general.

7. Consider dissemination of BC HeadStart programming using experienced Aboriginal hunters to teach about traditional foods with the goal of promoting Aboriginal culture and food safety.

Rationale: This program has demonstrated success in teaching cultural tradition and promoting food safety.

9.2.2.3. Consumption

1. Sources of uncontaminated water and adequate waste management systems are required for all Canadians, particularly in remote, rural Aboriginal communities.

Rationale: Clean water and adequate waste management systems prevent bacterial infections such as shigellosis and diseases from Vibrio spp.and/or viral infections such as Hepatitis A.

2. Examine risks and benefits of consumption of viscera/organ meats.

Rationale: Very little research deals with this topic. What does exist has been developed following research into Northern chemical contamination. More detailed research evidence could assist decision making and risk reduction efforts.

3. Legislation is needed to incorporate use of traditional foods in institutional settings, e.g. hospitals, childcare centres in cooperation with federal and provincial/territorial authorities.

Rationale: Consideration is needed to adapt the food safety regulations to Aboriginal cultural practices, or basic safety precautions instituted to permit cultural traditions and food preferences.

4. Develop specific programs to transfer knowledge of safe handling and preparation of Aboriginal traditional foods for food handlers/preparers both on-reserve and in urban areas. Necessary content includes the following:

- Age meats such as whale, seal or walrus in a cool place (below 4ºC) in containers that allow air in and, if aged in oil, keep in a cool place and stir frequently to allow the meat to have contact with air.
- Provide information relevant to Aboriginal groups regarding traditional food preparations that pose a risk: botulism, trichinosis. For example, provide materials translated into native languages used in various communities, use examples of traditional foods and wild game, such as walrus, salmon heads (i.e. not just mainstream foods such as beef, pork, poultry), and incorporate control of risk for foods that are prepared and stored in traditional ways such as foods that are

fermented and eaten raw (i.e. it is pointless to insist upon foods cooked to certain temperatures).

Rationale: There is a need for further educational efforts (culturally and linguistically appropriate) that provide information on general safe food handling practices and specifically target food preparation practices and handling of traditional foods. Efforts should be targeted to specific populations: hunters, pregnant women, immune-compromised individuals (diabetes), children and food handlers.

Appendix A: Databases, Search Engines and Keywords

Databases

Agricola National Agricultural Library
Alaska Native Knowledge and Native Foods Database
Analytical Abstract
Arctic Science and Technology Information System (ASTIS)
Biological and Agricultural index
Arctic Science and Technology Information System
CAB abstract
Canadian institute for health information
CINAHL
Cochrane
Conference Papers Index
Elsevier current awareness in biological sciences (CABS)
ERIC
Indian and Northern Affairs Canada
Inside conference
Institut de l'information scientifique et technique
Institut national de santé publique du Québec
Inuvialuit Settlement Region Database
ISI web of knowledge
Life science collection
Medline
National technical information service
NED
NTIS (national technical info service)
Nunavik Bibliography
Nunavut Environmental Database
Proquest
Protemp
Pubmed
Science
Scirus
Trellis
University of Guelph Aboriginal Education and Academic Resource – Camosun College

Search Engines

Google
Google Scholar
Yahoo
University of Guelph Trellis

Appendix A (Continued): Databases, Search Engines and Keywords

Keywords

Aboriginal
Aboriginal
Alaska
Aleut
Arctic
Botulism
Buffalo
Canadian arctic
Canadian Indian
Circumpolar
Community/ies
Denmark
Dietary practice/s
Education
Eskimo
Food
Foodborne illness
First nation/s
Food education
Food preparation
Food safety
Game (animals)
Giardia
Greenland
HACCP
Harvest
Health Branch
Health risk
Illness
Innu
Innuit, Inuit
Intoxication
Marine food
Métis/metis
Microbe
Muktuk
Native American
Native Canadian
Native food
Norway
Nunavik
Nunavut
Nutrition
Nuxalk
Outbreak
Parasites
Powwow
Risk analysis
Risk reduction
Scandinavia
Seal
Siberia/foodborne
Statistics
Strategy
Subsistence food
Traditional food
Trichinellosis/trichinellaWalrus
Virus/viral
Waste
Waterborne illness
Zoonosis/zoonos NT

Appendix B1: Master List of References Retrieved

A, B, C,D, E, F, G, H, I,J, K, L, M, N, O,P,Q,R, S, T, U, V, W.X,Y,Z

A

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Abulreesh, H., Paget, T., & Goulder, R. (2006). Campylobacter in Waterfowl and Aquatic Environments: Incidence and Methods of Detection. *Environmental Science and Technology, 40* (23), 7122-7131. doi: 10.1021/es060327l.
Abstract:
Campylobacters are emerging as one of the most significant causes of human infections worldwide, and the role that waterfowl and the aquatic environment have in the spread of disease is beginning to be elucidated. On a world scale campylobacters are possibly the major cause of gastrointestinal infections. Campylobacters are common commensals in the intestinal tract of many species of wild birds, including waterfowl. They are also widely distributed in aquatic environments where their origins may include waterfowl as well as sewage effluents and agricultural runoff. Campylobacters have marked seasonal trends. In temperate aquatic environments they peak during winter, whereas spring-summer is the peak period for human infection. Campylobacter species may survive, and remain potentially pathogenic, for long periods in aquatic environments. The utility of bacterial fecal indicators in predicting the presence of campylobacters in natural waters is questionable. Viable but nonculturable Campylobacter cells may occur, but whether they have any role in the generation of outbreaks of campylobacteriosis is unclear. The routine detection of Campylobacter spp. in avian feces and environmental waters largely relies on conventional culture methods, while the recognition of a particular species or strain is based on serotyping and increasingly on molecular methods. Thus, PCR combined with selective enrichment enhances the detection of campylobacters in water and feces, while DNA sequencing facilitates recognition of particular species and strains.

Ackerman, L., Schwindt, A., Massey Simonich, S., Koch, D., Blett, T., Schreck, C., et al. (2008). Atmospherically Deposited PBDEs, Pesticides, PCBs, and PAHs in Western U.S. National Park Fish: Concentrations and Consumption Guidelines. *Environmental Science and Technology*. doi: 10.1021/es702348j.

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Ahmed, F. (1992). Review: Assessing and managing risk due to consumption of seafood contaminated with microorganisms, parasites, and natural toxins in the US. *International Journal of Food Science and Technology, 27*, 243-260. Retrieved from, http://www.blackwellpublishing.com/journal.asp?ref=0950-5423&site=1.

Abstract:
While most seafoods consumed in the US are wholesome, a variety of infectious agents and toxins have been implicated in disease aetiology. The major risk of acute illness is associated with consumption of raw molluscan shellfish. Most reported seafood-associated illness (55%) have unknown aetiologies; they are believed to be due mainly to Norwalk, Norwalk-like, or human enteric virus infection, with a smaller proportion caused by Vibrio bacteria. Parasites are less common than microbiological infections, with anisakids and cestodes having the greatest risks. People consuming tropically-caught fish have a risk of acquiring ciguatera poisoning. Other common natural intoxications (mainly scombroid and to a lesser extent paralytic poisonings) occur due to consumption of finfish and shellfish, respectively. Reduction of risks from the consumption of raw molluscs and other fishery products can be achieved by the following means: research to develop valid human enteric virus indicators, implementing and maintaining proper treatment and disposal of sewage, efforts aimed at identifying and limiting the number of pathogenic Vibrio species in shellfish, developing new diagnostic methods and improved processing technologies, applying risk-based control measures for potential microbial pathogens in raw shellfish, cooking of seafoods, and proper application of a Hazard Analysis Critical Control Point (HACCP) system to processing and preparation operations of fishery products.

Alberta Health & Wellness. (2005). *Public Health Notifiable Disease Guidelines: Hepatitis A*. Retrieved from, http://health.gov.ab.ca/professionals/ND_Hepatitis_A.pdf.

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Abstract:
A comprehensive review of available PCDD/F time trend data is presented. This focuses on industrialized countries, drawing heavily on those countries that have been actively involved in PCDD/F monitoring and research, notably Germany, the United States, Sweden, The Netherlands, and the U.K. Information on temporal trends comes from the analysis of date able deposits (e.g., sediments), retrospective analysis of preserved or archived samples, and ongoing monitoring programs. The data on changes in air concentrations, deposition, sediments, soil, biota, food, and human tissues are reviewed.

The evidence for natural input/formation of PCDD/Fs is also briefly reviewed and discussed. Human activity has dominated PCDD/F inputs to the environment this century. Conceptually, it is probably appropriate to consider a 'pulse' of PCDD/Fs arising from human activities entering the environment in the 1930/1940s, peaking in the 1960/1970s, and continuing to a lesser degree today. A series of measures introduced in the past, recently, and anticipated for the future have reduced emissions to the atmosphere of industrialized countries and are projected to continue to reduce emissions over the coming decade. Comprehensive monitoring programs are required to confirm the interpretation of past changes and projected future declines presented here.

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Andersen, S., Hvingel, B., Kleinschmidt, K., Jorgensen, T., & Laurberg, P. (2005). Changes in iodine excretion in 50-69-y-old denizens of an Arctic society in transition and iodine excretion as a biomarker of the frequency of consumption of traditional Inuit foods. *American Journal of Clinical Nutrition, 81* (3), 656-663.

Abstract:

Background: Iodine intake in Greenland has been hypothesized to exceed 10 times the recommended amount. The transition from a traditional Arctic society may change the iodine intake, but no field studies have been performed. Objective: We aimed to ascertain iodine intakes, factors affecting iodine intake in circumpolar populations, and the usefulness of urinary iodine excretion as a biomarker for validation of Inuit food-frequency questionnaires. Design: Data were collected in a cohort study of 4 Greenland population groups: Inuit living in the capital city, the major town, and settlements in East Greenland and non-Inuit. Supplement use and lifestyle factors were evaluated with questionnaires, and dietary habits were ascertained with a food-frequency questionnaire. Iodine was measured in spot urine samples. Results: One percent of the population of Greenland was invited, and the participation rate was 95%. Less than 5% of Inuit but 55% of non-Inuit had urinary iodine excretion < 50 microgram/24 h. Median urinary iodine excretion declined with the degree of decrease in the traditional lifestyle: it was 198, 195, 147, and 58 microgram/24 h among Inuit in settlements, town, and city and in non-Inuit, respectively (P < 0.001). Participants were divided into diet groups calculated from Inuit food frequency. Iodine excretion decreased with increasing intake of imported foods (P < 0.001). In regression models, type of diet and the subject's lifestyle, sex, weight, ethnicity, and intake of iodine-containing supplements affected urinary iodine excretion. Conclusions: Circumpolar non-Inuit are at risk of iodine deficiency. Departure from the traditional Inuit diet lowers iodine intake, which should be monitored in Arctic societies. Urinary iodine excretion may be a useful biomarker of traditional Inuit food

frequency.

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Abstract:
Chemical investigation of the Antarctic sponge Dendrilla membranosa collected from the vicinity of Palmer Station on Anvers Island, Antarctica, yielded three new diterpenes, membranolides B-D (2-4), as well as three previously reported sponge metabolites. Membranolides C and D (3, 4), bearing carboxylic acid functional groups, display Gram-negative antibiotic and antifungal activities.

Archer, D. (2004). Freezing: An underutilized food safety technology? International *Journal of Food Microbiology, 90* (2), 127-138. doi: 10.1016/S0168-1605(03)00215-0.
Summary:
Freezing is an ancient technology for preserving foods. Freezing halts the activities of spoilage microorganisms in and on foods and can preserve some microorganisms for long periods of time. Frozen foods have an excellent overall safety record. The few outbreaks of food-borne illness associated with frozen foods indicate that some, but not all human pathogens are killed by commercial freezing processes. Freezing kills microorganisms by physical and chemical effects and possibly through induced genetic changes. Research is needed to better understand the physical and chemical interactions of various food matrices with the microbial cell during freezing and holding at frozen temperatures. The literature suggests that many pathogenic microorganisms may be sublethally injured by freezing, so research should be done to determine how to prevent injured cells from resuscitating and becoming infectious. Studies on the genetics of microbial stress suggest that the induction of resistance to specific stresses may be counteracted by, for example, simple chemicals. Research is needed to better understand how resistance to the lethal effect of freezing is induced in human pathogens and means by which it can be counteracted in specific foods. Through research, it seems possible that freezing may in the future be used to reliably reduce populations of food-borne pathogens as well as to preserve foods.

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Abstract:
PURPOSE: Salmonella serotypes are among the most common bacterial causes of foodborne gastroenteritis in the United States, associated with approximately 1.4 million human illnesses annually. Studies on trends of the serotypes and host-related factors are necessary for the development of effective prevention plans for foodborne diseases caused by these pathogens. MATERIALS AND METHODS: To determine the epidemiologic trends of human infections with the most common Salmonella serotypes in Michigan, we analyzed cases of culture-confirmed salmonellosis at the Michigan Department of Community Health (MDCH) from 1995 to 2001. RESULTS: A total of 6797 cases were reported, with an average annual incidence per 100,000 population (AAI) of 9.9. Among cases for which information on Salmonella serotype were available (6292 cases), the most common serotypes were S. Typhimurium (1596 cases, 26%), followed by S. Enteritidis (1309, 22%), S. Heidelberg (466, 8%) and S. Newport (222, 4%). From 1998 to 2001, the incidence of S. Typhimurium and S. Enteritidis decreased significantly by 39% (95% confidence interval [CI], 49% to 26% decrease) and 32% (95% CI, 44% to 18% decrease) respectively. Whereas the incidence of S. Newport increased by 101% (95% CI, 25% to 225% increase) and S. Heidelberg remained stable. Infection with these serotypes frequently occurred in the summer months. As a group, infants had the highest AAI for all Salmonella serotypes (75.0), S. Typhimurium (21.9), S. Enteritidis (14.0), S. Heidelberg (5.4), and S. Newport (1.7). Among patients whose race was known, blacks had a significantly higher AAI compared to whites for S. Typhimurium (2.5 vs. 1.3; RR = 2.3, 95% CI, 1.6-3.3), S. Enteritidis (1.4 vs. 1.1; relative rate (RR) = 1.4; 95% CI, 1.1-1.6), S. Heidelberg (0.8 vs. 0.3; RR = 3.6; 95% CI, 2.8-4.6), and S. Newport (0.3 vs. 0.1; RR = 2.8; 95% CI, 1.9-4.2). Among patients whose ethnicity was known, Hispanics had a significantly higher AAI for S. Enteritidis compared to non-Hispanics (1.0 vs. 0.5; RR = 1.9; 95% CI, 1.2-3.0), but not different significantly for S. Typhimurium, S. Heidelberg, and S. Newport. CONCLUSION: This study revealed the emergence of S. Newport and the high incidence of the most common Salmonella serotypes among infants, people of African descent, and Hispanics. This information can be used by the state and local health departments of Michigan to enhance salmonellosis prevention efforts by rationalizing the allocation of appropriate public health resources and personnel.

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Abstract:

A survey of the parasites of Greenland halibut (Reinhardtius hippoglossoides) caught in Canadian Atlantic waters extending from Cumberland Sound, Northwest Territories, to the Gulf of St. Lawrence and Saguenay Fjord was conducted during the period January 1990 to March 1991. From examination of 350 fish a total of 46 parasite taxa were identified (4 Myxosporea, 1 Monogenea, 19 Digenea, 6 Cestoda, 8 Nematoda, 5 Acanthocephala, 2 Crustacea, and 1 Hirudinoidea). Included among these are 15 taxa previously unreported from this fish (Genolinea laticauda Manter, 1925; Gonocerca phycidis Manter, 1925; Neophasis sp.; Podocotyle reflexa (Creplin, 1825); Prosorhynchus squamatus Odhner, 1905; Steringophorus sp.; Eubothrium parvum Nybelin, 1922; Proteocephalus sp.; Ascarophis arctica Polyansky, 1952; Ascarophis filiformis Polyansky, 1952; Spirurida gen. sp. larva; Corynosoma validum Van Cleave, 1953; Corynosoma wegeneri Heinze, 1934; Gnathia elongata (Krøyer, 1849); and Notostomum laeve Levinsen, 1882). New Canadian records include only Steringophorus sp. and N. laeve. The parasite fauna of Greenland halibut is characterized by a large number of ubiquitous species, including many larval forms that show little host specificity, and a smaller number of species typical of pleuronectiform fishes, two of which (Myxoproteus reinhardti (Wierzbicka, 1986) and Hatschekia reinhardtii Wierzbicka, 1989) are known only from this fish. A complete listing of all parasites reported from Greenland halibut is included as an appendix. (Au)

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Abstract:
Very little is known about the occurrence of Clostridium perfringens and of diseases caused by this anaerobic bacterium in marine mammals, especially those that are free-living. During a scientific expedition to the Greenland Sea (West Ice) in spring 1999, faeces samples from 70 hooded seals (Cystophora cristala) were taken to isolate C perfringens. Subsequently, PCR analysis of the isolates was performed with oligonucleotide primers of the genes encoding the four major lethal toxins (aoba, beta, epsilon and iota) for classification of toxin type and of the genes encoding C: perfringens beta2-toxin and enterotoxin for further subclassification. In addition, a commercial ELISA kit for detection of C: perfringens alpha-, beta- and epsilon-toxin was used. C. perfringens was isolated in samples from 38 (54.3%) hooded seals. All isolates were C: perfringens toxin type A (alpha-toxin positive). This is the first report on the occurrence of C. perfringens in this arctic marine mammal species. Myositis and enerotoxemia caused by C. perfringens were described in other marine mammals and it may be assumed that the pathogenesis of an outbreak of disease is similar to that encountered in terrestrial animals. Although there is some controversy surrounding the

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Auclair, R. (2003). *Des ordres sociaux: Marché et réciprocité dans l'Arctique.* (Unpublished master's thesis, Université Laval, Laval, 2003).
Summary:
This thesis focuses on the social changes within Inuit society through a specific case study: how households get food supplies. The field of observation is the North American Arctic. The data for this study stems from literature on the Inuit and a probabilistic sample survey titled Households Food Supply Networks in the Circumpolar Arctic. The questionnaire was administered in four regions of the Arctic during the course of 2000 and 2001. The analysis of the data as a whole revealed that donations and trade are two practices thatcontribute to the food supply process for Inuit households. However, the relative importance of donations isnot enough to ensure the essentials in terms of Inuit food supplies; they must also rely on trade. A sociological perspective has allowed us to observe that Inuit society is still partaking in societal reproduction that is cultural in nature, but it would appear that economics is now having a greater and greater impact on this society.

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Austin, J., & Dodds, K. (1996). Botulism in Canada - Summary for 1995. *Canadian Communicable Disease Report, 22*, 182-3. Retrieved from, http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/96vol22/dr2221ec.html.

Ayotte, P., Dewailly, E., Ryan, J.J., Bruneau, S., & Lebel, G. (1997). PCBs and Dioxin-like Compounds in Plasma of Adult Inuit Living in Nunavik (Arctic Quebec). *Chemosphere, 34* (5/7), 1459-1468. doi: 10.1016/S0045-6535(97)00442-6.

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Baike, M., Ratnam, S., Bryant, D., Jong, M., & Bokhout, M. (1989). Epidemiologic Features of Hepatitis B-Virus Infection in Northern Labrador. *Canadian Medical Association Journal, 141* (8), 791-795. Retrieved from, http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1451300&blobtype=pdf.

Bailie, R.S., & Runcie, M.J. (2001). Household infrastructure in Aboriginal communities and the implications for health improvement. *Medical Journal of Australia, 175*(7), 363-366.

Abstract:
Objective: To evaluate housing survey data, describe the state of household infrastructure in Aboriginal communities in the Northern Territory (NT), and to discuss implications for health improvement for people in these communities. Design: Quantitative analysis of survey data and qualitative analysis of the survey process. Setting: All NT houses funded for repairs and maintenance through the Indigenous Housing Authority of the Northern Territory (IHANT). Main outcome measure: Status of infrastructure necessary for four key "healthy living practices" (washing people, washing clothes and bedding, waste removal, and food storage and preparation). Results: 3906 houses (79% of all houses funded by IHANT) were surveyed. Infrastructure components most frequently identified as not functional or not present were those required for the storage and preparation of food (62% not functional). The facilities required for personal hygiene and safe removal of human waste were not functional in 45%-46% of houses. Conclusions: These findings highlight the significance of absent or non-functioning household infrastructure as a potential contributory factor in the poor nutritional status and high rates of respiratory, skin and gastrointestinal infections in Indigenous communities. The environmental health and housing survey in the NT is an important tool for monitoring progress on addressing a key underlying determinant of the health of Indigenous people, and potentially for facilitating research aimed at gaining an improved understanding of the relationship of the household environment to health in Indigenous communities.

Ball, A., Hopkinson, R., Farrell, I., Hutchison, J., Paul, R., Watson, R. et al. (1979). Human Botulism Caused by Clostridium Botulinum Type E-Birmingham Outreak. QJM, 48: 473-491. Retrieved from, http://qjmed.oxfordjournals.org/.

Banerji, A. (2001). High rates of hospitalisation for bronchiolitis in Inuit children on Baffin Island. *International Journal of Circumpolar Health, 60* (3), 375-379.

Abstract:
It has been suspected that Inuit Children on Baffin Island suffer from severe, recurrent episodes of bronchiolitis, but this has never been documented previously. This study is a retrospective chart review of children less than 48 months of age hospitalised at Baffin Regional Hospital, Nunavut with a diagnosis of bronchiolitis over a one year period. This study documented that the admission rate for bronchiolitis in the first year of life was 306 per 1000 infants on Baffin Island, with an intubation rate of 12.8% in admitted children. One quarter of the infants were born prematurely, and half had their first presentation for bronchiolitis at less than 3 months of age. Ten of the 78 cases (12.8%) were identified as having a positive test for C. trachomatis by EIA, and Respiratory syncytial Virus was

identified in 14 of 50 (28%) of those tested. This study documents that bronchiolitis in Inuit children on Baffin Island is a serious health concern and needs to be studied further.

Banks, A. (2003). Trichinellosis—Canada (Repulse Bay). In *ProMED Summary of trichinellosis outbreaks (2001-2005).* Retrieved from, http://www.trichinella.org/epidemiology/epid_canada.htm

Bargagli, R., Agnorelli, C., Borghini, F., & Monaci, F. (2005). Enhanced Deposition and Bioaccumulation of Mercury in Antarctic Terrestrial Ecosystems Facing a Coastal Polynya. *Environmental Science and Technology, 39* (21), 8150-8155. doi: 10.1021/es0507315.

Abstract:
Mercury emitted by anthropogenic and natural sources occurs in the atmosphere mostly in the gaseous elemental form, which has a long lifetime in tropical and temperate regions. Once deposited in terrestrial and aquatic ecosystems the metal is partly re-emitted into the air, thus assuming the characteristics of global pollutants such as persistent volatile chemicals. In polar regions, during and after the sunrise, the photochemically driven oxidation of gaseous Hg by reactive halogens may result in areas of greatly enhanced Hg deposition. Mercury concentrations in soils, lichens, and mosses collected in a stretch between 7430' S and 7600' S, in ice-free coastal areas of Victoria Land facing the Terra Nova Bay coastal polynya, were higher than typical Antarctic baselines. The finding of enhanced Hg bioaccumulation in Antarctic terrestrial ecosystems facing a coastal polynya strongly supports recent speculations on the role of ice crystals ("frost flowers") growing in polynyas as a dominant source of sea salt aerosols and bromine compounds, which are involved in springtime mercury depletion events (MDEs). These results raise concern about the possible environmental effects of changes in regional climate and sea ice coverage, and on the possible role of Antarctica as a sink in the mercury cycle.

Barnes, P., Adams, P., & Powell-Griner, E. (2005). *Health characteristics of the American Indian and Alaska native adult population, United States, 1999-2003.* Maryland: U.S. Department of Health and Human Services, Centres for Disease Control and Prevention, National Centre for Health Statistics. Retrieved from, http://www.cdc.gov/nchs/data/ad/ad356.pdf.

Barr, H. (2007). Interprofessional education: the fourth focus. *Journal of Interprofessional Care, 21* (2), 40-50.

Abstract:
Three complementary and overlapping foci for interprofessional education (IPE)--preparing individuals for collaborative practice; learning to work in teams; and developing services to improve care--have been presented previously as a threefold classification derived from a systematic review (Barr et al., 2005). This paper adds discussion of a fourth: improving the quality of life in communities. The fourth focus is less often found in the literature and is described more fully in this paper. It embodies six approaches to interprofessional learning, discussed in the paper, that are thought to be particularly relevant to the work of Pathways into Health with American Indian and

Alaska Native tribes, and more widely wherever collaborative learning and practice are invoked to improve quality of community life.

Barrett, D., Eisenberg, M., Bender, T., Burks, J., Hatheway, C., & Dowell V. Jr. (1977). Type A and type B botulism in the North: first reported cases due to toxin other than type E in Alaskan Inuit. *Canadian Medical Association Journal, 117*(5), 483-489.
Abstract:
Botulism outbreaks shown to be due to type A and type B toxin occurred in Alaska, a region previously known for only type E botulism. The outbreak due to type A toxin involved three people, two of whom died. The outbreak due to type B toxin involved nine people, none of whom died. Both outbreaks were in Inuit villages, and native foods were incriminated. The occurrence of these outbreaks strongly suggests that Clostridium botulinum, types A and B are indigenous to Alaska. The outbreaks underscore the need for initial treatment of patients with antitoxin that is trivalent (ABE), even in Arctic regions.

Barrow, G.I. (1973). Marine micro-organisms and food poisoning. In, B.C. Hobbs & J.H.B. Christioan (Eds). *Microbiological Safety of food.* Academic Press: London.

Bartlett, J. (2004). Conceptions and dimensions of health and well-being for Métis women in Manitoba. *International Journal of Circumpolar Health, 63 Suppl* (2), 107-113.
Abstract:
Because of the continuing poor health status of Aboriginal populations in Canada, along with increasing opportunity for Aboriginal designed health surveys, it is argued that policies and programs, and the research from which they are derived, should be more solidly grounded within Aboriginal understandings of health and well-being. Survey research for Aboriginal populations usually draws on questions developed by and for mainstream Canadians. This paper stems from the author's master's thesis study that elicited adult and elder Métis women's description of 'what constitutes health' and 'what constitutes well-being'. Outlined are descriptions of Métis women's Conceptions of Health and Conceptions of Well-being, as well as Dimensions of Well-Being that should be included in health survey research.

Bartlett, J. (2005). Health and well-being for Métis women in Manitoba. *Canadian Journal of Public Health, 96 Suppl,* S22-27.
Abstract:
BACKGROUND: Continuing compromised Aboriginal health status and increasing opportunity for new Aboriginal health surveys require that Aboriginal understandings of health and well-being be documented. This research begins exploration of whether the Aboriginal Life Promotion Framework may increase culturally pertinent planning, collection and analysis of health survey data. METHODS: A quasi-phenomenological tradition of enquiry was employed to gain understanding of the lived experience of participants. Data were collected through focus groups utilizing a 'talking circle' methodology. A participatory research approach involved three large Aboriginal

organizations. RESULTS: Conceptions of health and of well-being are different entities for these Métis women. Health was most often more reflective of physical issues. Well-being was much broader, holistic and inclusive of the dimensions of spiritual, emotional, physical and mental/intellectual aspects of living, consistent with the first circle of the Aboriginal Life Promotion Framework. CONCLUSIONS: The implications of this study should be important to health providers, and policy developers regardless of sector. Métis women in this study show significant strengths in the spiritual, emotional and intellectual/mental aspects of life, areas that could be incorporated into health promotion approaches. Physical health was focussed on ensuring a healthy diet and exercise, yet most adult women in the study experienced stress around goals that are seen as relatively unattainable. The data produced in this study should be utilized to develop and test survey questions that can be applied to a larger portion of the Métis population. The Aboriginal Life Promotion Framework is useful as an organizing tool for systematically exploring elements of living.

Bartlett, J., Madariaga-Vignudo, L., O'Neil, J., & Kuhnlein, H. (2007). Identifying indigenous peoples for health research in a global context: a review of perspectives and challenges. *International Journal of Circumpolar Health*, *66* (4), 287-307.

Abstract:

OBJECTIVES: Identifying Indigenous Peoples globally is complex and contested despite there being an estimated 370 million living in 70 countries. The specific context and use of locally relevant and clear definitions or characterizations of Indigenous Peoples is important for recognizing unique health risks Indigenous Peoples face, for understanding local Indigenous health aspirations and for reflecting on the need for culturally disaggregated data to plan meaningful research and health improvement programs. This paper explores perspectives on defining Indigenous Peoples and reflects on challenges in identifying Indigenous Peoples. METHODS: Literature reviews and Internet searches were conducted, and some key experts were consulted. RESULTS: Pragmatic and political definitions by international institutions, including the United Nations, are presented as well as characterizations of Indigenous Peoples by governments and academic researchers. Assertions that Indigenous Peoples have about definitions of indigeneity are often related to maintenance of cultural integrity and sustainability of lifestyles. Described here are existing definitions and interests served by defining (or leaving undefined) such definitions, why there is no unified definition and implications of "too restrictive" a definition. Selected indigenous identities and dynamics are presented for North America, the Arctic, Australia and New Zealand, Latin America and the Caribbean, Asia and Africa. CONCLUSIONS: While health researchers need to understand the Indigenous Peoples with whom they work, ultimately, indigenous groups themselves best define how they wish to be viewed and identified for research purposes.

Bassendowski, S., Petrucka, P., Smadu, M., Redman, C., & Bourassa, C. (2006). Relationship building for research: the Southern Saskatchewan/Urban Aboriginal Health Coalition. *Contemporary Nurse, 22*(2), 267-74.

Abstract:

The Southern Saskatchewan/Urban Aboriginal Health Coalition is an interdisciplinary, intersectoral team of researchers and communities dedicated to exploring what 'culturally respectful' care means in Aboriginal communities. Although the purpose of the research project was to examine this concept in an effort to improve health care service delivery and education for health professions, the members of the Coalition realized early in the process that one of the primary factors related to the success of the project would be the building and sustaining of relationships. This paper describes a relational process that was used to initiate, facilitate, and support a research partnership with the Aboriginal communities. Through a community-based process, two communities and the Coalition used sharing circles and workshops as a method to create relationships and begin a discussion about what constitutes key elements of culturally respectful health care and education. These elements have not yet been determined as the Coalition and community members have focused on fostering relationships which have been critical to building the partnership with the Aboriginal communities.

Batal, M. (1999). *Sociocultural determinants of traditional food intake across indigenous communities in the Yukon and Denendeh*. (Unpublished doctoral dissertation, McGill University, Montreal, 1999).

Batal, M., Gray-Donald, K., Kuhnlein, K.V. & Receveur, O. (2005). Estimation of traditional food intake in indigenous communities in Denendeh and the Yukon. *International Journal of Circumpolar Health, 64*(1), 46-54. Retrieved from, http://ijch.fi/.

B.C. Center for Disease Control. (2004). *Health Topics: Tularemia*. Retrieved from, http://www.bccdc.org/topic.php?item=117.

Beck, W. (1992). Aboriginal Preparation of Cycas Seeds in Australia. *Economic Botany, 46* (2), 133-147.
Abstract:
The seeds of cycad plants are a toxic food used by many Aboriginal groups in northern Australia. Acute symptoms produced after consumption of untreated Cycas seeds are due to azoxyglycosides, especially cycasin, although the toxic dose depends on the animal species tested. There are three traditional methods used to treat these seeds: brief leaching in water; prolonged leaching in water; and aging. Aboriginal people living at Donydji outstation in northeast Arnhem Land, most regularly consume aged seeds of Cycas angulata R.Br. Analyses of fresh seeds and seeds prepared at Donydji and in the laboratory indicate that cycasin is effectively removed by all the traditional preparation techniques, although each technique has an end product with different storage and handling properties. The social implications of processing need further elaboration, but these techniques have a long history and archaeological remains of seeds in Australia may date back to the Pleistocene.

Behr, M.A., Gyorkos, T.W., Kokoskin, E., Ward, B.J., & MacLean, J.D. (1998). North American liver fluke (Metorchis conjunctus) in a Canadian aboriginal population: a submerging human pathogen? *Canadian Journal of Public Health, 89*, 258-259.

Beineke, A., Siebert, U., McLachlan, M., Bruhn, R., Thron, K., Failing, K. et al. (2005). Investigations of the Potential Influence of Environmental Contaminants on the Thymus and Spleen of Harbor Porpoises (Phocoena phocoena). *Environmental Science and Technology*, *39* (11), 3933 – 3938. doi: 10.1021/es048709j.
Abstract:
Harbor porpoises from the German North and Baltic Seas exhibit a higher incidence of bacterial infections compared to whales from less polluted arctic waters. The potential adverse effect of environmental contaminants such as polychlorinated biphenyls (PCBs) and heavy metals on the immune system and the health status of marine mammals is still discussed controversially. The aim of the present study was to investigate the possible influence of PCB, polybrominated diphenyl ether (PBDE), toxaphene, (p,p'-dichlorodiphenyl)trichlorethane (DDT), and (p,p'-dichlorodiphenyl)dichlorethene (DDE) on the immune system of harbor porpoises. Lymphoid organs are influenced by a variety of factors, and therefore special emphasis was given to separating the confounding effect of age, health status, nutritional state, geographical location, and sex from the effect of contaminant levels upon thymus and spleen. Contaminant analysis and detailed pathological examinations were conducted on 61 by-caught and stranded whales from the North and Baltic Seas and Icelandic and Norwegian waters. Stranded harbor porpoises were more severely diseased than by-caught animals. Thymic atrophy and splenic depletion were significantly correlated to increased PCB and PBDE levels. However, lymphoid depletion was also associated with emaciation and an impaired health status. The present report supports the hypothesis of a contaminant-induced immunosuppression, possibly contributing to disease susceptibility in harbor porpoises. However, further studies are needed to determine if lymphoid depletion is primarily contaminant-induced or secondary to disease and emaciation in this cetacean species.

Belinsky, D., & Kuhnlein, H. (2000). Macronutrient, Mineral, and Fatty Acid Composition of Canada Goose (Branta canadensis): An Important Traditional Food Resource of the Eastern James Bay Cree of Quebec. *Journal of Food Composition and Analysis*, *13* (2), 101-115.
Abstract:
Female and male Canada geese were harvested in the Cree community of Wemindji, Québec in fall 1995 and spring 1996. Nutrient analyses (proximate composition, trace elements, fatty acids and heavy metals) were performed on several parts and preparation modes. Nutrient data for Canada goose (Branta canadensis) has not been previously reported, with the exception of iron. Fat content of Canada goose parts ranged from 3.55 to 26.4 g/100 g; protein content ranged from 25.0 to 44.3 g/100 g. Lung and liver samples contained high amounts of iron (44.2 and 49.2 mg/100 g, respectively). Heavy metals were found to be below levels of concern, with the exception of several samples containing high lead (>2 µg/g). Canada goose is a highly valued traditional food, providing important amounts of energy, protein, iron, zinc and copper.

Beller, M. (1992) Hepatitis A Outbreak in Anchorage, Alaska, traced to ice slush beverages. *Western Journal of Medicine, 156*(6), 624-627.

Beller, M. (1998). Botulism in Alaska: a guide for physicians and health-care providers-1998 update. Anchorage, Alaska: Alaska Department of Health and Social Services. Retrieved March 26, 2008 from http://www.epi.hss.state.ak.us/pubs/botulism/bot_01.htm.

Beller, M., Ellis, A., Lee, S., Drebot, M., Jenkerson, S., Funk, E. et al. (1997). Outbreak of Viral Gastroenteritis Due to a Contaminated Well - International Consequences. *Journal of the American Medical Association, 278* (7), 563-568. doi:10.1016/S0168-1605(99)00176-2.
Abstract:
Context.-Small round-structured viruses (SRSVs) are known to cause viral gastroenteritis, but until now have not been confirmed in the implicated Vehicle in outbreaks. Objective.-Investigation of a gastroenteritis outbreak. Design.-After applying epidemiologic methods to locate the outbreak source, we conducted environmental and laboratory investigations to elucidate the cause. Setting.-Tourists traveling by bus through Alaska and the Yukon Territory of Canada. Participants.-Staff of a restaurant at a business complex implicated as the outbreak source, convenience sample of persons on buses that had stopped there, and bus employees. Main Outcome Measures.-Odds ratios (ORs) for illness associated with exposures. Water samples from the restaurant and stool specimens from tourists and restaurant staff were examined by nucleic acid amplification using reverse transcription polymerase chain reaction and sequencing of viral amplification products. Results.-The itineraries of groups of tourists manifesting vomiting or diarrhea were traced back to a restaurant where buses had stopped 33 to 36 hours previously, Water consumption was associated with illness (OR, 5.3; 95% confidence interval [CI], 2.3-12.6). Eighteen of 26 employees of the business complex were ill; although not the index case, an employee ill shortly before the outbreak lived in a building connected to a septic pit, which was found to contaminate the well supplying the restaurant's water, Genotype 2/P2B SRSV was identified in stool specimens of 2 tourists and 1 restaurant employee. Stools and water samples yielded identical amplification product sequences. Conclusions.-The investigation documented SRSVs in a vehicle epidemiologically linked to a gastroenteritis outbreak. The findings demonstrate the power of molecular detection and identification and underscore the importance of fundamental public health practices such as restaurant inspection, assurance of a safe water supply, and disease surveillance.

Beller, M. & Middaugh, J. (1990). Repeated type E botulism in an Alaskan Eskimo. *New England Journal of Medicine, 322*(12). Retrieved from, http://content.nejm.org/cgi/content/citation/322/12/855.

Berezovikova, I. & Mamleeva, F. (2001). Traditional foods in the diet of Chukotka natives. *International Journal of Circumpolar Health, 60* (2), 138-142. Retrieved from, http://ijch.fi/.
Abstract:
During several medical expeditions the recipes and technology of traditional foods of the indigenous population of Chukotka have been collected. Traditional foods are important sources of fat, protein and essential nutrients. The traditional diet of Chukotka natives

consists of caribou meat, marine animals and fish, depending on the place of residence. All meat products or fish are eaten with local plants: roots, green leaves, berries or seaweed. Local foods are usually eaten raw frozen and dipped into seal oil or melted caribou fat. However, it has been shown that the traditional way of food preparation in the Far North does not meet modern sanitary and hygiene regulations. Based on data collected about the traditional diet of Chukotka native recipes and technology have been changed and approved by the Association of Indigenous Nationalities of Chukotka. Dietary recommendations for natives that are based on traditional eating patterns have been presented for consideration.

Berger, T. (1985). *Village Journey: The Report of the Alaska Native Review*. New York: Hill and Wang.

Berkes, F. (2005). Breaking Ice: Renewable Resource and Ocean Management in the Canadian North. University of Calgary: Arctic Institute of North America.

Berkes, F., & Farkas, C.S. (1978). Eastern James Bay Cree Indians: Changing patterns of wild food use and nutrition. *Ecology of Food and Nutrition*, 7, 155-172.

Berkes, F., & Jolly, D. (2001). Adapting to Climate Change: Social-Ecological Resilience in a Canadian Western Arctic Community. *Conservation Ecology 5*(2), 18.
Abstract:
Human adaptation remains an insufficiently studied part of the subject of climate change. This paper examines the questions of adaptation and change in terms of social-ecological resilience using lessons from a place-specific case study. The Inuvialuit people of the small community of Sachs Harbour in Canada's western Arctic have been tracking climate change throughout the 1990s. We analyze the adaptive capacity of this community to deal with climate change. Short-term responses to changes in land-based activities, which are identified as coping mechanisms, are one component of this adaptive capacity. The second component is related to cultural and ecological adaptations of the Inuvialuit for life in a highly variable and uncertain environment; these represent long-term adaptive strategies. These two types of strategies are, in fact, on a continuum in space and time. This study suggests new ways in which theory and practice can be combined by showing how societies may adapt to climate change at multiple scales. Switching species and adjusting the "where, when, and how" of hunting are examples of shorter-term responses. On the other hand, adaptations such as flexibility in seasonal hunting patterns, traditional knowledge that allows the community to diversity hunting activities, networks for sharing food and other resources, and intercommunity trade are longer-term, culturally ingrained mechanisms. Individuals, households, and the community as a whole also provide feedback on their responses to change. Newly developing co-management institutions create additional linkages for feedback across different levels, enhancing the capacity for learning and self-organization of the local inhabitants and making it possible for them to transmit community concerns to regional, national, and international levels.

Berner, J., & Furgal, C. (2005). *Human Health. Chapter 15. Arctic Climate Impact Assessment.* Retrieved from, http://www.acia.uaf.edu/PDFs/Ch15_Pre-Release.pdf.

Bernier, S. (2003a). Traditional Inuit food and store-bought food choices of a Canadian Arctic population: A test of different social cognition theories. 2nd Annual Conference of the International Society for Behavioral Nutrition and Physical Activity, Quebec.

Bernier, S. (2003b). *Determinants of food choices in Arctic populations.* (M.Sc. Thesis, Université Laval, Quebec, 2003).
Abstract:
Research has documented changes in traditional Inuit food consumption, and noted an increased reliance on imported food. Given the health effects of some of these changes, such as an increasing risk of cardiovascular disease and diabetes, and the fact that diet is a modifiable risk factor, a better understanding of food choices is needed in order to facilitate health worker's abilities to devise programs to promote healthy choices. Triandis' theory of interpersonal behaviours guided the development and application of a questionnaire to measure the determinants of traditional Inuit food consumption in one Nunavik community: Kuujjuaq. In order of decreasing importance, perceived behavioural control, affect, personal normative belief, habit and attitude were the most important determinants of intention to eat traditional Inuit food. Combined, the determinants identified in this study explained nearly half (49%) of the variance in intention and should contribute to the tailoring of necessary interventions in health promotion taking into account what people want/expect in terms of their ideal diet.

Berti, P., Chan, H., Receveur, O, MacDonald, C., & Kuhnlein, H. (1998). Population exposure to radioactivity from consumption of caribou among the Dene/Métis of Denendeh (western Northwest Territories, Canada). *Journal of Exposure Analysis and Environmental Epidemiology, 8* (2), 145-158.
Abstract:
There has been long-standing concern with exposure to radioactivity through the consumption of caribou, particularly in indigenous populations in the western Northwest Territories, Canada, who are traditionally high consumers. We conducted a dietary survey in this region in 1994 to estimate population exposure levels. Dietary information was collected from 1012 individuals in sixteen communities (1012 days of 24-hour dietary recalls, 1012 food frequency questionnaires) and radionuclide levels in caribou flesh, liver and kidneys were measured. Monte Carlo statistical methods were employed to integrate these data sets and estimate the distribution of radiation exposure for people in five regions (Gwich'in, Sahtú, Dogrib, Deh-Cho, South Slave). The exposure levels were highest in the South Slave region and in older males (40+ years), and lowest in the Gwich'in region and in younger females (20-40 years). Median exposure level ranged from 0.95 to 5.31 mSv per year (mean of medians = 2.96 mSv/y). In each group the 95th percentile of exposure was 2-3 times greater than the median. These exposure levels are comparable to exposure levels in Alaskan Eskimos and Marshall Island residents, and are much higher than European or American urban populations. Caribou meat is a very nutritious food. We conclude that, although there is some radiation exposure from

consuming caribou, the associated health risks are low and are outweighed by the physical, social and cultural benefits derived from hunting and eating caribou.

Berti, P.R., Hamilton, S.E., Receveur, O., & Kuhnlein, H.V. (1999). Food use and nutrient adequacy in Baffin Inuit children and adolescents. *Canadian Journal of Dietetic Practices and Research, 60* (2), 63-70.

Abstract:
In evaluating adequacy of nutrient intake and relative contribution of locally harvested food (i.e.,"traditional" food) and imported market food for 164 Baffin Inuit children and adolescents, 604 24-recalls were obtained over a one-year (1987 to 1988). Market food contributed an average of 84% of dietary energy and traditional food, 16%. Total and saturated fat intakes corresponded closely to current recommendations, while sucrose intakes were higher than recommended. Most age and gender categories had a low prevalence of inadequate intakes of iron, zinc, and protein; over 50% of dietary iron and zinc was provided by traditional food. Calcium and vitamin A were obtained largely through market food, and there was a high risk of inadequacy for both nutrients in all age groups. The diets of 16-18-year-old girls were the most often inadequate, due to consumption of low nutrient-dense food and low consumption of traditional food. Food items rich in vitamin A and calcium should be promoted, and 16-18-year-old girls specifically targeted for education on food choices and health.

Berti, P., Receveur, O., Chan, H., & Kuhnlein, H. (1998). Dietary exposure to chemical contaminants from traditional food among adult Dene/Métis in the western Northwest Territories, Canada. *Environmental Research, 76* (2), 131-142. doi:10.1006/enrs.1997.3797.

Abstract:
Environmental contaminants such as organochlorines and heavy metals have been reported to bioaccumulate in Arctic and subarctic wildlife. The Indigenous Peoples in northern and Arctic Canada rely on local wildlife as an important food source, and it is thus hypothesized that they may have high intakes of these contaminants. Herein, an assessment of dietary exposure to selected organochlorines and heavy metals for Indigenous Peoples of the western Northwest Territories (NWT) is presented. Dietary data were collected from 1012 adults with 24-h recalls in 16 communities in the western NWT (Denendeh). A comprehensive survey of the literature, as well as in-house analysis, formed the basis of a large traditional food-contaminant database. By combining the dietary and contaminant data, dietary exposure to 11 chemical contaminants was calculated. Dietary exposure to chemical contaminants in Denendeh is generally low and there is little, if any, associated health risk. However there are specific contaminants in certain communities for which exposure on a single day approaches the tolerable daily intake levels. These situations are detailed and monitoring needs are described.

Bethune, D.N. (1997). Environmental Damage and Aboriginal Health Contamination of Aboriginal Water Resources. Retrieved from, http://www.niichro.com/Environ/Enviro4.html

Bharadwaj, L., Nilson, S., Judd-Henrey, I., Ouellette, G., Parenteau, L., Tournier, C. et al. (2006). Waste disposal in First-Nations communities: the issues and steps toward the future. *Journal of Environmental Health, 68* (7), 35-39.
Abstract:
The interests of First Nations communities in Canada have traditionally had little voice at the various points of authority that maintain the equilibrium or balance necessary to get environmental protection laws ratified, regulations distributed, and enforcement actions initiated on First Nations lands. (First Nations is the term commonly used in Canada to describe the various societies of indigenous peoples who are accorded status as "Indians" by the Indian Act of 1985 and who are not of Inuit or Métis descent.) Along with a lack of adequate funding to address human and environmental issues-as well as past industrial exploitation of First Nations lands-the safety and acceptability of many solid waste management practices in Canadian First Nations communities have become a serious concern for many members from both human and environmental health perspectives. A history of poor management, monitoring, and remediation of solid waste facilities across Canada's First Nations Communities and the lack of current resolve over this issue has left First Nations people feeling the consequences of pollution to their environment: rivers, land, and air. First Nations people are traditionally connected to the land, and consequently the degradation of the environment also leads to a decline in a way of life for the people and thus a decline in the cultural health of communities. This article examines the issues surrounding waste management on First Nations communities, looks at how First Nations are trying to handle their solid waste, and considers the larger issues of environmental degradation that First Nations communities face throughout Canada.

Bishop, R., Masendycz, P., Bugg, H., Carlin, J., & Barnes, G. (2001). Epidemiological patterns of rotaviruses causing severe gastroenteritis in young children throughout Australia from 1993 to 1996. *Journal of Clinical Microbiology, 39*(3), 1085-1091.
Abstract:
Rotavirus strains that caused severe diarrhea in 4,634 (2,533 male) children aged less than 5 years and admitted to major hospitals in eight centers throughout Australia from 1993 to 1996 were subject to antigenic and genetic analyses. The G serotypes of rotaviruses were identified in 81.9% (3,793 of 4,634) children. They included 67.8% (from 3,143 children) serotype G1 isolates (containing 46 electropherotypes), 11.5% (from 531 children) serotype G2 isolates (27 electropherotypes), 0.8% (from 39 children) serotype G3 isolates (8 electropherotypes), and 1.6% (from 76 children) serotype G4 isolates (9 electropherotypes). G6 (two strains) and G8 (two strains) isolates were identified during the same period. G1 serotypes were predominant in all centers, with intermittent epidemics of G2 serotypes and sporadic detection of G3 and G4 strains. With the exception of two strains (typed as G1P2A[6] and G2P2A[6]) all serotype G1, G3, and G4 strains were P1A[8] and all serotype G2 strains were P1B[4]. Two contrasting epidemiological patterns were identified. In all temperate climates rotavirus incidence peaked during the colder months. The genetic complexity of strains (as judged by electropherotype) was greatest in centers,vith large populations. Identical electropherotypes appeared each winter in more than one center, apparently indicating the spread of some strains both from west to east and from east to west. Centers caring for children in small aboriginal communities showed unpredictable rotavirus peaks unrelated

to climate, with widespread dissemination of a few rotavirus strains over distances of more than 1,000 km. Data from continued comprehensive etiological studies of genetic and antigenic variations in rotaviruses that cause severe disease in young children will serve as baseline data for the study of the effect of vaccination on the incidence of severe rotavirus disease and on the emergence of new strains.

Bjerregaard, P., Dewailly, E., Ayotte, P., Pars, T., Ferron, L., & Mulvad, G. (2001). Exposure of Inuit in Greenland to organochlorines through the marine diet. *Journal of Toxicology and Environmental Health, 62* (2), 69-81.

Abstract:
High organochlorine concentrations have been found among the Inuit in eastern Canada and in Greenland. The present study was undertaken to assess the exposure to organochlorines in relation to age, sex, and diet in a general population sample of Inuit from Greenland. Survey data and plasma concentrations of 14 polychlorinated biphenyl (PCB) congeners and 16 pesticides, including 5 toxaphene congeners, were recorded in a random population survey of 408 adult indigenous Greenlanders. In a two-stage design, the survey response rate was 66%, and 90% of those randomly selected for blood testing participated. This was equivalent to an overall response rate of 59%. The median plasma concentration of the sum of PCB congeners was 13.3 microg/L; the lipid-adjusted value was 2109 microg/kg. The PCB concentration was twice as high as among the Inuit of Nunavik, Canada, 25 times higher than in a control group from southern Canada, and several times higher than the values found in European studies. Concentrations were similarly elevated for all PCB congeners and pesticides. The PCB congener pattern was similar to previous observations from the eastern Canadian Arctic and Greenland. Concentrations showed statistically significant positive associations with age, marine diet, and male sex in multiple linear regression analyses. The exceptionally high plasma concentrations of several organochlorines among the Inuit of Greenland are attributed to a lifelong high intake of seafood, in particular marine mammals. Concentrations of PCB adjusted for the consumption of marine food increased until approximately 40 yr of age, which is equivalent to the birth cohorts of the early 1950s. The age pattern indicates that bioaccumulation of PCB started in the 1950s, which is a likely date for the introduction of the compounds into the Arctic environment.

Bjerregaard, P., Pedersen, H., & Mulvad, G. (2000). The associations of a marine diet with plasma lipids, blood glucose, blood pressure and obesity among the Inuit in Greenland. *European Journal of Clinical Nutrition, 54* (9), 732-737.

Bjerregaard, P., Young, T., Dewailly, E., & Ebbesson, S. (2004). Indigenous health in the Arctic: an overview of the circumpolar Inuit population. *Scandinavian Journal of Public Health, 32*, 390–395.

Abstract:
The health of the Inuit has undergone substantial changes over the past five centuries, as a result of social, cultural, and economic changes brought about by interactions with Europeans. This process was accelerated considerably in the second half of the twentieth century. The incidence of infectious diseases has declined considerably but is still high compared with Western societies. Chronic diseases such as diabetes and cardiovascular

disease are on the increase, while accidents, suicides, violence, and substance abuse are of major importance for the pattern of ill health in most Inuit communities. Lifestyle changes, social change, and changes in society and the environment are major determinants of health among the Inuit.

Blanchard, R., & Kearney, J. (1967). Natural radioactivity and cesium-137 in Alaskan caribou and reindeer samples. *Environmental Science and Technology, 1* (11), 932-939.

Blanchet, C., Dewailly, E., Ayotte, P., Bruneau, S., Receveur, O., & Holub, B. (2000). Contribution of selected traditional and market foods to the diet of Nunavik Inuit women. *Canadian Journal of Dietetic Practice and Research, 61*(2), 50–59.

Blaser, M., Pollard, R., & Feldman, R. (1983). Shigella Infections in the United States, 1974-1980. *Journal of Infectious Disease*, *147* (4), 771-775.

Abstract:
During the seven-year period 1974-1980, 93,516 Shigella isolates from humans were reported to the Centers for Disease Control, Atlanta, through a nationwide surveillance system. Over the past 30 years, the reported incidence of shigellosis has been declining in contrast to that reported for salmonellosis. Shigella sonnei (group D) now accounts for approximately 70% of the Shigella isolates reported, since most of the decline has been due to the increasingly less frequent infections caused by Shigella flexneri (group B); Shigella dysenteriae infections are now uncommon. The highest reported rates of shigellosis are from the western states and among children from one to five years of age. Among the total population of the United States, the ratio of S. flexneri to S. sonnei isolates was 0.28 among persons from one to 19 years of age and 0.45 among persons greater than or equal to 20 years of age; among American Indians the proportion of S. flexneri was much greater, the corresponding ratios being 2.1 and 2.9, respectively; in both groups the ratios for children younger than one year of age resembled those obtaining for adults. Age-related acquisition of immunity to S. sonnei may explain these observations

Bollella, M.C., Spark, A., Boccia, L., Nicklas, T., Pittman, B., & Williams, C. (1999). Nutrient intake of head start children: Home vs. school. *Journal of the American College of Nutrition*, *18,*(2), 108-114.

Borga, K., Gabrielsen, G.W., Skaare, J.U., Kleivane, L., Norstrom, R.J., & Fisk, A.T. (2005). Why Do Organochlorine Differences between Arctic Regions Vary among Trophic Levels? *Environmental Science and Technology, 39* (12), 4343-4352.

Abstract:
Statistical analysis of organochlorine contaminants (OCs) in marine mammals has shown that, for most OCs, the European Arctic is more contaminated than the Canadian and U.S. Arctic. Recently, comparison of OC concentration ranges in seabirds, arctic cod (Boregadus saida), and zooplankton, found no difference between these regions. To address these inconsistencies, marine food web OC data from the European (central

Barents Sea (CBS)) and Canadian Arctic (Northwater Polynya (NOW)) were simultaneously statistically analyzed. In general, concentra tions of OCs were greater in seabirds and ringed seals (Phoca hispida) from the CBS as compared to the NOW; consistent with circumpolar trends observed in marine mammals. In contrast, levels of OCs were generally similar in zooplankton and arctic cod between the CBS and NOW. The main exception is HCH which had greater levels in the NOW across all trophic levels because of the greater proximity to sources in eastern Asia. The lack of differences in OC concentrations in zooplankton and Arctic cod from the European and Canadian Arctic suggest that regional differences in OC contamination in the Arctic have evened out. Reduced regional differences were not observed in marine mammals or seabirds because they are long-lived and also acquire contaminants from maternal transfer and hence reflect levels from the past when the European Arctic was more contaminated than the Canadian Arctic. In addition, seabirds may reflect exposure from other areas. This study highlights the potential problem of comparing spatial trends by using means and confidence intervals as compared to simultaneous statistical analysis of raw data. Differences in the spatial trends of OCs between trophic levels in the Arctic are important for consideration when assessing regional differences in spatial and temporal trends of discontinued and current-use contaminants.

Borre, K. (1994). The Healing Power of the Seal-The Meaning of Inuit Health Practice and Belief. *Arctic Anthropology, 31* (1), 1-15.
Abstract:
Little is known about the production of health in Inuit society. Seal meat, oil, broth, and skin are products of North Baffin Island Inuit subsistence that are used to treat and prevent sickness. By studying the ethnomedical practice of using seal as a medicinal, the Inuit concept of health is revealed. This concept is best viewed as a synthesis of the individual state of being combining the concepts of soul or mind and body, the social well-being of the community maintained through the hunting ritual and food sharing, and the body politic through which individuals exercise political power to provide health and well-being to others in the family and within the larger community. It contrasts with the narrow definition of health offered by western medical experts. The Inuit concept of health influences health-seeking behavior, compliance with western medical treatment plans, and classification of illness. The health status of the community would be better served by open respect and cooperation between the two health care systems.

Boswell-Purdy, J., Clark, M., & Paradis, S. (2001). *EAGLE Project Eating Patterns Survey*. Retrieved from, http://www.chiefs-of-ontario.org/environment/docs/EPSFin2.pdf

Boucher, R., Davies, K., Hanley, S., & Holden, R. (2001). EAGLE Health Survey. Retrieved from, http://www.chiefs-of-ontario.org/environment/docs/EHS2.pdf.

Boult, D. (2004). *Food (In)security in Inuit Communities: A Discussion Paper. National Aboriginal Health Organization*. Retrieved from, http://www.naho.ca/inuit/english/documents/FoodSecurityPaper_final.pdf
Abstract:

Inuit families across Canada continue to face significant challenges in accessing adequate nutritional food. Low income, changing dietary habits, high cost of food, lack of awareness of healthy eating habits, and a number of other factors have combined to ensure hunger and poor nutrition continue to impact many Inuit families. The long-term effects of these factors on Inuit health raise a number of serious concerns for both Inuit communities and agencies (government and non-governmenta) charged with providing health care programs and services to Inuit. This discussion paper provides an initial overview of some of the issues concerning Inuit food security. The primary issues addressed are: a review of the major findings of a recent report on the Food Mail Program in Kugaaruk, Nunavut, Health implications of food insecurity and factors impacting food security (Retail food operations in the North, Country food, Community/regional and government initiatives related to food security). The Food Mail Program highlighted the severity of the food security issue in the community- five out of six (83.3%) Inuit households were classified as ”food insecure” and more than half of the families had experienced hunger in the past year. Reasons for the lackof food in Kugaaruk included lack of sufficient money to buy adequate amounts of food, lack of sufficient income and employment opportunities and more than 33% of families were on social assistance. In regards to the purchase of most perishable foods, the quality of these items was an issue (fair to poor). More than one in four respondents felt their health was fair or poor- nearly four times that reported by similar groups in southern Canada. Nearly all women surveyed, including pregnant women, smoked. Country food consumption in Kugaaruk was lower, providing only 10% of energy intake (primarily from char and caribou). Little fat, seal, walrus, muktuk, or organ meat consumption was reported. This is of particular interest as Kugaaruk has been considered one of the communities with the highest level of harvesting activity in Nunavut. Inadequate food and nutrition among school-aged children reduces psychosocial functionning and can worsen other developmental problems these children may have. Fresh food has a higher spoilage factor and requires a greater degree of soft food handling and storage to ensure it arrives at its destination in a reasonable condition. Combined with the fact that many Inuit do not consume adequate amounts of fruits and vegetables, this increases the amount of food likely to be discarded and raises the overall cost of the food to the retailer.

Bowie, W.R., & King, A.S. (1997). Outbreak of toxoplasmosis associated with municipal drinking water. *Lancet, 350*(9072), 173-177.

Bradley, M.J., Kutz, S.J, Jenkins, E., & O’Hara, T.M. (2005). The Potential Impact of Climate Change on Infectious Disease of Arctic Fauna. *International Journal of Circumpolar Health, 64*(5), 468-477.

Abstract:
Climate change is already affecting Arctic species including infectious disease agents and greater changes are expected. Some infectious diseases are already increasing but future changes are difficult to predict because of the complexity of host-agent-environment relationships. However mechanisms related to climate change that will influence disease patterns are understood. Warmer temperatures will benefit free living bacteria and parasites whose survival and development is limited by temperature. Warmer temperatures could promote survivability, shorter development rates and transmission.

Insects such as mosquitoes and ticks that transmit disease agents may also benefit from climate change as well as the diseases they spread.Warming could lead to increased agriculture and other economic opportunities in the Arctic bringing people, domestic food animals, pets and invasive species and their disease agents into Northern regions. Climate warming may also favor the release of persistent environmental pollutants some of which can affect the immune system and may favor increased rates of some diseases. This document talks about diseases found in marine fish – Alaskans began noticing increasing numbers of salmon with abnormalities suggestive of diseases such as furunculous, ichthyophonus and whirling disease which occurred at the same time as the dramatic reduction in the number of salmon returning to spawn. The document also talks about terrestrial parasitic diseases- temperature and moisture strongly influence development and survival rates of nematode parasites and even small changes in temperature can have tremendous impacts on Arctic parasite epizootiology. Bacterial diseases are also discussed- bacterial pathogens may also benefit from warming. A marked increase in canine Leptospirosis was observed in Ontario Canada in the fall of 2002 following the warmest fall and the third wettest in a decade. Insect-borne diseases such as the Jamestown Canyon disease and the Snowshoe virus are also influenced by temperature and moisture levels in the environment. Both Jamestown Canyon and Snowshoe virus can cause encephalitis in humans. Other parasites and diseases among other Alaskan animals are discussed.

Brady M. (1995). Culture in treatment, culture as treatment. A critical appraisal of developments in addictions programs for indigenous North Americans and Australians. *Social Science & Medicine. 41*(11):1487-98.

Abstract:
Indigenous people in Australia and in North America have been creating innovative interventions in the addictions field for several years now--incorporating traditional healing practices and cultural values into otherwise western programs--although this process is more developed in Canada and the U.S. than it is in Australia. Through a process of cultural diffusion, Australian Aborigines have incorporated many ideas from Native Canadian treatment models. As a result, residential treatment utilizing adapted forms of the 12 steps of Alcoholics Anonymous is being promoted by indigenous Australians. This paper examines comparative material on the uses of culture as a form of healing and traces the rationale for the argument that cultural wholeness can serve as a preventive, or even curing agent in drug and alcohol abuse. This is a qualitative leap from the now universally accepted notion that treatment and rehabilitation for native people should be culturally appropriate. There are, however, certain dilemmas confronting native treatment directors attempting these syncretic approaches, given aspects of cultural contexts which can serve to foster drug and alcohol use rather than discourage it. Additionally, North American Indians have at their disposal a rich heritage of communal healing techniques; some (such as the sweat lodge) have been adapted and incorporated into the treatment both of solvent abuse by adolescents, and alcohol abuse by adults. In Australia on the other hand, traditional healing techniques have been less amenable to adaptation. On neither continent are indigenous people attempting to adapt recent mainstream models of intervention to suit their needs (such as Brief Intervention) which is currently receiving international attention in addictions research and treatment.

Brassard, P., Hoey, J., Ismail, J., & Gosselin, F. (1985). The prevalence of intestinal parasites and enteropathogenic bacteria in James Bay Cree Indians, Québec. *Canadian Journal of Public Health, 76*(5), 322-325.

Abstract:
We concluded a survey to identify the intestinal parasites and enteropathogenic bacteria involved in episodes of diarrhea in the James Bay (Quebec) Cree, a previously unsurveyed area of Canada. 382 stool samples obtained from a random sample of the population were examined; 29.3% were positive for at least one parasite and 21 different serotypes of enteropathogenic Escherichia coli (EPEC) were isolated from 6.5% of the stool samples. Stepwise discriminant analysis showed that, in order of importance, age, number of persons per household and the specific village were significantly correlated with parasitic infection. The presence or absence of running water was weakly associated with infection. We conclude that overcrowding is an important and potentially reversible causal factor accounting for the high prevalence of intestinal parasites in this population.

Braune, B.M., & Simon, M. (2003). Dioxins, Furans, and Non-Ortho PCBs in Canadian Arctic Seabirds. *Environmental Science and Technology, 37*(14), 3071-3077.

Abstract:
This is the first account of PCDDs, PCDFs, and non-ortho PCBs in Canadian Arctic seabirds. Livers and eggs of thick-billed murres, northern fulmars, and black-legged kittiwakes were collected in 1975 and 1993 from Prince Leopold Island in Lancaster Sound, Canada. Detectable concentrations of PCDDs, PCDFs, and non-ortho PCBs were found in all the Arctic seabird samples analyzed. Of the PCDD congeners assayed, only 2,3,7,8-substituted PCDDs were detected in the samples, whereas non-2,3,7,8-substituted PCDFs were found in addition to 2,3,7,8-substituted PCDFs in some of the samples. The predominant PCDD/F congener found in the livers of all three species was 2,3,4,7,8-PnCDF, both in 1975 and 1993. Concentrations of most dioxins and furans decreased in the fulmars and kittiwakes between 1975 and 1993 but increased in the murres. Of the non-ortho PCBs measured, PCB-126 occurred in the highest concentrations and contributed the majority of the non-ortho PCB-TEQ in all three species in both years. The highest concentrations of dioxins and furans as well as the highest TEQ values were found in the northern fulmar livers in both 1975 and 1993. Concentrations of some of the PCDDs and PCDFs are among the highest reported for Canadian Arctic biota.

British Columbia First Nations Head Start (BCFNHS). (2003). *Using Traditional Foods. (BCFNHS Growing Together newsletter, Issue 5)*. Retrieved from, http://www.bcfnhs.org/downloads/newsletters/Nsl_4_Summer03_web.pdf

Britov, A. (1997). Trichinellosis in Kamchatka. *Wiadomosci Parazytologiczne, 43* (3), 287-288.

Brooke, C., Riley, T., & Hampson, D. (2005). Comparison of prevalence and risk factors for faecal carriage of the intestinal spirochaetes Brachyspira aalborgi and Brachyspira pilosicoli in four Australian populations. *Epidemiology and Infection, 000*, 1-8.

Abstract:
This study examined the prevalence of the intestinal spirochaetes Brachyspira aalborgi and Brachyspira pilosicoli in different Western Australian (WA) populations. Faecal samples included 287 from rural patients with gastrointestinal symptoms, comprising 142 from non-Aboriginal and 145 from Aboriginal people; 227 from recent healthy migrants to WA from developing countries; and 90 from healthy non-Aboriginal individuals living in Perth, WA. DNA was extracted from faeces, and subjected to PCR assays for both species. B. pilosicoli-positive individuals were confined to the rural Aboriginal (14(.)5 %) and migrant (15(.)0 %) groups. B. aalborgi was detected at a lower but similar prevalence in all four groups: rural non-Aboriginals, 5(.)6 %; rural Aboriginals, 6(.)9 %; migrants, 7(.)9 %; controls, 5(.)6 %. In migrants and Aborigines, the presence of B. pilosicoli and B. aalborgi was associated (P < 0(.)001), suggesting that colonization by B. pilosicoli may be facilitated by colonization with B. aalborgi. Amongst the Aboriginal patients, logistic regression identified both spirochaete species as being associated with chronic diarrhoea, failure to thrive and being underweight. Both species may have pathogenic potential, but B. aalborgi appears more host-adapted than the opportunistic B. pilosicoli.

Bruneau, S., Furgal, C., Dewailly, E., & Grey, M. (2001). Incorporation of scientific knowledge into Inuit knowledge in Nunavik. Department of Indian Affairs and Northern Development, 291-293.

Bryan, F. L. (1988). Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases. *Journal of Food Protection, 51*, 663-73.

Bryan, F.L. (2000). Food Safety Information and Advice in Developing Countries. In J.M. Farber & E.C.D. Todd (Eds). *Safe handling of foods*. Chapter 13. Marcel Dekker, Inc.: New York.

Burger, J., & Gochfeld, M. (2006). A framework and information needs for the management of the risks from consumption of self-caught fish. *Environmental Research, 101* (2), 275-285. doi:10.1016/j.envres.2005.11.004.
Abstract
Governmental agencies deal with the potential risk from consuming fish contaminated with toxic chemicals by issuing fish consumption advisories. Yet such advisories are often ignored by the general public, who continue to fish and consume self-caught fish that are the subject of advisories and are from contaminated waters. Further, people are often unaware of specific warnings (which species to avoid, who is vulnerable, when they are vulnerable). In this paper we propose a more inclusive framework for examining consumption behavior of self-caught fish and identify information needs for effective communication. We include not only the usual variables that are used for calculating risk from fish consumption (meal frequency, meal size, contaminant levels) but also other aspects of behavior that contribute to risk. These include attitudes (trust, risk aversion, environmental concerns), behavior (sources of information, cultural mores, personal preferences), exposure (physical proximity, ingestion rates, bioavailability, target tissues), contaminant levels, individual host differences, and hazards (levels of

contaminants). We suggest that attitudes and behavior shape risk as much as exposure and hazards and that all four of these factors must be considered in risk management. Factors such as gender, age, pregnancy status, and nutrition all influence who is at risk, while other consumption factors affect these at-risk populations, including meals/week, meal size, cooking method, fish species and sizes eaten, and years of fish consumption. Similarly, contaminant levels in fish vary by fish species, fish size and age, part of the fish, and collection location. Elucidating the risk to individual consumers involves integrating this range of factors, and managing the risk likewise involves incorporating these factors. We suggest that development of appropriate advisories and compliance with advisories will occur only if managers, risk assessors, and public policy makers consider this whole range of factors and not just the traditional fish consumption rate (often underestimated) and contaminant levels in fish (often undersampled). Merely informing the public of contaminant levels or the risk from contaminants will not ensure a public that has enough information to make informed decision, or to be in compliance with consumption advisories, or to effect changes in consumption behavior where public health is at risk.

Burns Kraft, T., Dey, M., Rogers, R., Ribnicky, D., Gipp, D., Cefalu, W., et al. (2008). Phytochemical Composition and Metabolic Performance-Enhancing Activity of Dietary Berries Traditionally Used by Native North Americans. *Journal of Agriculture and Food Chemistry, 56* (3), 654-660.

Butler, C., Miller, W., Marrow, C., & Evans, R. (1966). Salmonella Anatum: Report of an Alaskan Outbreak. *Alaska Medicine, 10* (3), 145-147.

Abstract:
In the central part of Alaska, gastroenteritis is a perennial problem, with the incidence rate reaching almost epidemic proportions in the early summer and early autumn. The causative agents appear to be both viral and bacterial. In 1964 during the autumn epidemic, Salmonella anatum invaded the University of Alaska campus along with a probable viral infection. Approximately 300 students developed symptoms of gastroenteritis during this outbreak but only a very small percentage became acutely ill. Thirty-five students and eight food handlers were found to be infected with Salmonella anatum. A therapeutic history of the outbreak showed (ampicillin) Polycillin to be very effective in eradicating the organisms from the patients

Butler Walker, J., Houseman, J., Seddon, L., McMullen, E., Tofflemire, K., Mills, C., et al. (2006). Maternal and umbilical cord blood levels of mercury, lead, cadmium, and essential trace elements in Arctic Canada. *Environmental Research, 100* (3), 295-318.

Abstract:
Maternal and umbilical cord blood levels of mercury (Hg), lead (Pb), cadmium (Cd), and the trace elements copper (Cu), zinc (Zn), and selenium (Se) are reported for Inuit, Dene/Métis, Caucasian, and Other nonaboriginal participants from Arctic Canada. This is the first human tissue monitoring program covering the entire Northwest Territories and Nunavut for multiple contaminants and establishes a baseline upon which future comparisons can be made. Results for chlorinated organic pesticides and PCBs for these

participants have been reported elsewhere. Between May 1994 and June 1999, 523 women volunteered to participate by giving their written informed consent, resulting in the collection of 386 maternal blood samples, 407 cord samples, and 351 cord:maternal paired samples. Geometric mean (GM) maternal total mercury (THg) concentrations ranged from 0.87 microg/L (SD = 1.95) in the Caucasian group of participants (n = 134) to 3.51 microg/L (SD = 8.30) in the Inuit group (n = 146). The GM of the Inuit group was 2.6-fold higher than that of the Dene/Métis group (1.35 microg/L, SD = 1.60, n = 92) and significantly higher than those of all other groups (P<0.0001). Of Inuit women participants, 3% (n = 4) were within Health Canada's level of concern range (20-99 microg/L) for methylmercury (MeHg) exposure. Of Inuit and Dene/Métis cord samples, 56% (n = 95) and 5% (n = 4), respectively, exceeded 5.8 microg/L MeHg, the revised US Environmental Protection Agency lower benchmark dose. GM maternal Pb was significantly higher in Dene/Métis (30.9 microg/L or 3.1 microg/dL; SD = 29.1 microg/L) and Inuit (31.6 microg/L, SD = 38.3) participants compared with the Caucasian group (20.6 microg/L, SD = 17.9) (P < 0.0001). Half of all participants were smokers. GM blood Cd in moderate smokers (1-8 cigarettes/day) and in heavy smokers (> 8 cigarettes/day) was 7.4-fold higher and 12.5-fold higher, respectively, than in nonsmokers. The high percentage of smokers among Inuit (77%) and Dene/Métis (48%) participants highlights the need for ongoing public health action directed at tobacco prevention, reduction, and cessation for women of reproductive age. Pb and THg were detected in more than 95% of all cord blood samples, with GMs of 21 microg/L and 2.7 microg/L, respectively, and Cd was detected in 26% of all cord samples, with a GM of 0.08 microg/L. Cord:maternal ratios from paired samples ranged from 0.44 to 4.5 for THg, from 0.5 to 10.3 for MeHg, and 0.1 to 9.0 for Pb. On average, levels of THg, MeHg, and Zn were significantly higher in cord blood than in maternal blood (P < 0.0001), whereas maternal Cd, Pb, Se, and Cu levels were significantly higher than those in cord blood (P < 0.0001). There was no significant relationship between methylmercury and selenium for the range of MeHg exposures in this study. Ongoing monitoring of populations at risk and traditional food species, as well as continued international efforts to reduce anthropogenic sources of mercury, are recommended

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Cameron, M., & Weis, I. (1993). Organochlorine Contaminants in the Country Food Diet of the Belcher Island Inuit, Northwest Territories, Canada. *Arctic*, *46* (1), 42-48.

Abstract:
An initial assessment of the country food diet at the Belcher Islands' community of Sanikiluaq, Northwest Territories, was made by interviewing 16 families during May - July 1989. Estimates of consumption per day were established over a two-week period for 10 of these families. This information was utilized along with previously published harvest data for the community to estimate country food consumption in grams/day and kg/year. Beluga (Delphinapterus leucas), ringed seal (Phoca hispida), arctic charr (Salvelinus alpinus), common eider (Somateria mollissima) and Canada goose (Branta canadensis) were found to be important components in the diet during this period. Results of analysis for organochlorine contaminants reveal that ringed seal fat and beluga muktuk (skin and fat layer) samples have the highest concentration of DDE and total PCBs

among the country food species. Average DDE and total PCB values were 1504.6 mug/kg and 1283.4 mug/kg respectively in ringed seal fat and 184.3 mug/kg and 144.7 mug/kg respectively in beluga muktuk. Comparison of contaminants in seal fat indicates concentrations approximately two times higher in samples from the Belcher Islands than from sites in the Canadian Western Arctic, but lower than concentrations reported from various European sites. The daily consumption estimates in grains/day were used along with organic contaminant analysis data to calculate the estimated intake levels of 0.22 mug/kg body weight/day of total DDT and 0.15 mug/kg body weight/day of total PCBs during the study period. Although limited in sample size, studies such as this provide a framework from which to establish future consumption guidelines more applicable to arctic systems and native diets.

Campbell, M., Diamant, R., Macpherson, B., & Halladay, J. (1997). The contemporary food supply of three northern Manitoba Cree communities. *Canadian Journal of Public Health*, *88*(2),105-8.

Abstract:
A complex set of social, economic, cultural and environmental circumstances affecting native Canadians in northern regions has resulted in the dietary replacement of indigenous foods with marketed products not always of equivalent nutritional value. This article examines the current food supply in three northern Manitoba Cree communities by looking at the availability and preservation of traditional foods, the price of marketed foods and perceptions of the food supply. Data were obtained by questionnaire from older adults (over 55 years) and younger women (16-45 years) in each community. The food supply comprised a mix of traditional and marketed foods, with limited use of traditional methods of food preservation. Marketed food prices were high in communities without all-weather road access. Respondents expressed a desire for more traditional food. Promotion of traditional foods could increase nutrient intake, decrease food costs and contribute to a revival of interest in Cree culture.

Canadian Cooperative Wildlife Health Centre (CCWHC). (1999). Emerging diseases. CCWHC Newsletter, 6(1), online. Retrieved March 24, 2008, from http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1039&context=icwdmccwhcnews.

Canadian Environmental Assessment Agency. (2005). Aboriginal-Based Criteria for Determining the Significance of Environmental Effects. Retrieved from, http://www.ceaa.gc.ca/015/001/003/5_e.htm.

Summary:
In the previous section of this report, the concerns expressed by Aboriginal peoples included a failure on the part of EA processes to consider the full range of components of the environment important to them, and included and addressed environmental values important to them (an Aboriginal version of “valued ecosystem components [VECs]”). These two factors, in addition to the contrasting worldviews of Aboriginal and non-Aboriginal peoples, contribute to Aboriginal peoples’ perception of EA as failing to comprehensively identify significant environmental effects. This section of the report lists: 1) components of the environment of particular importance to Aboriginal peoples,

2)values that are attached to these components, and 3)indicators of changes and/or impacts to the components likely to be deemed as significant environmental effects by Aboriginal peoples. Information from the literature review, case studies and interviews was synthesized to develop the list. It also includes the knowledge and experience of the researchers. Serves to illustrate the broad range of concerns likely to be raised by most Aboriginal communities involved in a federal EA. The researchers believe that the clear articulation of information by Aboriginal peoples, in a framework similar to the one presented in this section, can promote better understanding by governments and proponents of Aboriginal peoples' positions, needs and expectations. In so doing, the potential exists for better quality assessments and greater participation of Aboriginal peoples in the examination and interpretation of project-related impacts. The lists include: Treaty and/or Aboriginal Rights (e.g. Limitations or restrictions on the exercise of harvesting rights), Harvested Animal and Plant Species (e.g. decline in food qualities and/or safety: nutritional value, contaminants, texture, colour, taste, appearance (e.g. tumor growth on wildlife, parasites in fish)), Ecosystem (e.g. Habitat loss, damage, disturbance or fragmentation and disruption of food webs), Water/ice for Travel and Consumption (e.g. Reduced or increased water flow impacts on: ice formation or degradation, travel, access to shorelines, wildlife and fish, water quality (turbidity, debris)), Economy (e.g. Impact on the ability of future Aboriginal people to care for themselves in either the traditional way or cash economy), Social/Cultural (e.g. Negative impact on language, spiritual teachings, knowledge transfer), Other Community Health and Safety (e.g. Increased risk of accidents due to project related changes in water or ice regime).

Canadian Food Inspection Agency. (2001). *Food Safety Facts on Toxaplasma*. Retrieved from,http://www.inspection.gc.ca/english/fssa/concen/cause/toxoplasmae.shtml

Canadian Food Inspection Agency. (2006). *Trichinellosis.* Retrieved from, http://www.inspection.gc.ca/english/anima/heasan/disemala/trich/trichfse.shtml

Canadian Institute for Health Information. (2003). *Urban Aboriginal Communities.* Proceedings of the Roundtable on the Health of Urban Aboriginal People. Retrieved from, http://www.cihi.ca/cihiweb/en/downloads/UrbanAboriginalProceedings_e.pdf.

Canadian Partnership for Consumer Food Safety Education. (2006a). About Us, FAQs. Retrieved from, http://www.canfightbac.org/cpcfse/en/about/faq/

Canadian Partnership for Consumer Food Safety Education. (2006b). Canadian Fight BAC! Focus on Clean Factsheet. Retrieved from,http://www.canfightbac.org/cpcfse/en/safety/safety_factsheets/clean/

Canuel, R., de Grosbois, S., Atikesse, L., Lucotte, M., Arp, P., Ritchie, C., et al. (2006). New evidence on variations of human body burden of methylmercury from fish consumption. *Environmental Health Perspectives, 114* (2), 302-306.
Abstract:

Epidemiologic studies commonly use mercury (Hg) level in hair as a valid proxy to estimate human exposure to methylimercury (MeHg) through fish consumption. This study presents the results yielded by a complete data set on fish consumption habits, Hg levels in edible fish resources, and corresponding Hg accumulation in hair, gathered in three distinct communities of eastern Canada. For one of these communities, the average hair Hg concentration was 14 times less than the expected value based on calculated daily oral exposure and current knowledge of MeHg metabolism. This finding could be explained by differences in specific genetic characteristics and/or interactive effects of other dietary components.

Cardinal, N. & Adin, E. (2005). *An Urban Aboriginal Life. The 2005 Indicators Report on the Quality of Life of Aboriginal People in the Greater Vancouver Region. Centre for Native Research and Policy.* Retrieved from, http://www.cnpr.ca/assets/documents/An_Urban_Aboriginal_Life%20-%20Executive_Summary.pdf.

Carroll, G. (1976). Utilization of Bowhead Whale. *Marine Fisheries Review, 38* (8), 18-21.

Abstract:

Changes in the use of various parts of the bowhead whale over the years for food, heat and light, Eskimo implements, animal traps and spears, and crafts are described. The most important whale parts are the meat and muktuk (layer of blubber with skin attached) which provide a large part of the food supply for Eskimos in whaling villages and are eaten raw, frozen, boiled or fried. Meat can be made into 'mekiqag' by placing it in a warm place and slow-cooking in its own juices for a few weeks. Other edible parts are the liver, brain, heart and kidney. The small intestine is turned inside out, cleaned and eaten during the spring whaling celebration. The white gum material from around the base of the baleen is eaten raw; clumps of blood from around the heart are sometimes consumed.

Castrodale, L. (2005). *Botulism in Alaska: A guide for physicians and healthcare providers*. State of Alaska Department of Health & Social Services Division of Public Health Section of Epidemiology. Retrieved from http://www.epi.hss.state.ak.us/pubs/botulism/Botulism.pdf.

Castrodale, L., & Beller, M. (2001). Outbreak of botulism associated with fermented beaver. *American Journal of Epidemiology, 153*(11), S273.

Caswell, A. (1998). Valuing the benefits and costs of improved food safety and nutrition. *The Australian Journal of Agricultural and Resource Economics, 42* (4), 409–424. doi:10.1111/1467-8489.00060.

Abstract:

Assuring the quality of food products, especially their safety and nutrition levels, is an increasing focus for governments, companies, and international trade bodies. In choosing quality assurance programs, public and private decision-makers must assess the benefits and costs of expected improvements in food safety and nutrition. This article discusses

methods for measuring these benefits and costs as well as how these valuations are related to the mix of voluntary and mandatory quality management systems used in particular countries or trading blocs. These relationships are illustrated by a short case study of safety assurance systems for meat and poultry products.

Cates, S., Carter-Young, H., Conley, S., & O'Brien, B. (2004). Pregnant Women and Listeriosis: Preferred Educational Messages and Delivery Mechanisms. *Journal of Nutrition Education and Behaviour, 36* (3), 121-127. doi:10.1016/S1499-4046(06)60148-6.

Caughey, A., Bewster, J., Korgak, A., Osborne, G., Talbot, J., Kilabuk, P., et al. (2004). *Risk management communications in Nunavut.* Department of Indian Affairs and Northern Development. Retrieved from, http://www.ainc-inac.gc.ca/ncp/edu_e.html.

Center for Food Safety & Applied Nutrition. (1998). Hepatitis A Virus. In *the Bad Bug Book. Foodborne Pathogenic Microorganisms and Natural Toxins Handbook.* Washington, DC: US Food & Drug Administration. Retrieved from, http://www.fdahaccp.com/SeafoodData/BadBugBook/CHAP31.HTML.

Centers for Disease Control and Prevention. (1998a). Update: Outbreak of influenza A infection: Alaska and the Yukon Territory. *Morbidity and Mortality Weekly Report, 47*(33), 685-688.

Centers for Disease Control and Prevention. (1998b). Outbreak of Vibrio parahaemolyticus Infections Associated with Eating Raw Oysters—Pacific Northwest, 1997. *Mortality and Morbidity Weekly Report, 47*(22), 457-462.

Centers for Disease Control and Prevention. (2001). Botulism outbreak associated with eating fermented food--Alaska, 2001. *Morbidity and Mortality Weekly Report, 50*(32), 680-2.

Centers for Disease Control and Prevention. (2002). Outbreak of Botulism Type E Associated with Eating a Beached Whale- Western Alaska. *Morbidity and Mortality Weekly Report, 52* (2), 24-26.

Centers for Disease Control and Prevention. (2003). Trichinellosis Surveillance--- United States, 1997-2001. *Mortality and Morbidity Weekly Report, 52*(ss06), 1-8. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5206a1.htm.

Centers for Disease Control and Prevention. (2004). Trichinellosis associated with bear meat--New York and Tennessee. *Mortality and Morbidity Weekly Report, 53* (27), 606-610.

Centers for Disease Control and Prevention. (2005a). *Shigellosis.* Retrieved from,http://www.cdc.gov/ncidod/dbmd/diseaseinfo/shigellosis_t.htm

Centers for Disease Control and Prevention. (2005b). *Vibrio vulnificus*. Retrieved from, http://www.cdc.gov/ncidod/dbmd/diseaseinfo/vibriovulnificus_t.htm

Centres for Indigenous Peoples' Nutrition and Environment Global Health Initiative. (2007). *Global Health Case Study- . – Gwich'in*. Retrieved from, http://www.mcgill.ca/cine/resources/data/gwichin/

Centres for Indigenous Peoples' Nutrition and Environment Global Health Initiative. (2008). *Global Health Case Study- Nuxalk*. Retrieved from, http://www.mcgill.ca/cine/resources/data/nuxalk/

Chabot, M. (2001b). *Inuit women and food security: overview of the issue and stakes in Nunavik*. Unpublished presentation at the Fourth Congress of the Arctic Social Sciences, Quebec.
Abstract:
This paper aims at raising the gender issue regarding food security in the Arctic and some of the problems that threaten food security of Inuit families and communities of Nunavik. Women in general play a significant role in sustaining food security at community and household levels. In the Arctic, Inuit women make a considerable contribution to food production activities. They often contribute to the provision of food for the family, if not producing, then by earning money to purchase it. However, as in many places of the world, the Inuit women's contribution to food security still remains invisible or underestimated and poorly understood. For instance, woman's production is rarely taken into account in official statistics because it often falls within the sphere of the informal economy. The quasi-absence of recognition of women's roles and specific situations is a factor that can jeopardize food security since their needs and concerns may not be considered by policy-makers. In Nunavik, the economic, cultural and socio-demographic conditions affect Inuit women in very specific ways. The author explores some of these conditions that should be taken into consideration by researchers and policy planners when assessing the food security and insecurity in Arctic communities.

Chai, J., Darwin Murrell, K., & Lymbery, A. (2005). Fish-borne parasitic zoonoses: status and issues. *International Journal of Parasitology, 35* (11-12), 1233-1254.
Abstract:
The fish-borne parasitic zoonoses have been limited for the most part to populations living in low- and middle-income countries, but the geographical limits and populations at risk are expanding because of growing international markets, improved transportation systems, and demographic changes such as population movements. While many in developed countries will recognize meat-borne zoonoses such as trichinellosis and cysticercosis, far fewer are acquainted with the fish-borne parasitic zoonoses which are mostly helminthic diseases caused by trematodes, cestodes and nematodes. Yet these zoonoses are responsible for large numbers of human infections around the world. The list of potential fish-borne parasitic zoonoses is quite large. However, in this review, emphasis has been placed on liver fluke diseases such as clonorchiasis, opisthorchiasis and metorchiasis, as well as on intestinal trematodiasis (the heterophyids and

echinostomes), anisakiasis (due to Anisakis simplex larvae), and diphyllobothriasis. The life cycles, distributions, epidemiology, clinical aspects, and, importantly, the research needed for improved risk assessments, clinical management and prevention and control of these important parasitic diseases are reviewed. "Metorchis conjunctus, the Canadian liver fluke, is a parasite of carnivorous mammals in Canada and USA (MacLean et al., 1996). Human infections with this fluke have occurred in Canada since 1946 (Yamaguti, 1958), particularly in aboriginal populations from Quebec to Saskatchewan, and the eastern coast of Greenland (MacLean et al., 1996; Behr et al., 1998) (Table 1)."

Chai, T., & Liang, K. (1991). Thermal resistance of spores from five type E Clostridium botulinum strains in eastern oyster homogenates. *Journal of Food Protection, 55*(1), 18-22.

Abstract:
Thermal resistance of spores from 5 type E Clostridium botulinum strains, Alaska, Minnesota, G21-5, 25V-1 and 25V-2, in oyster homogenates was determined at 73.9, 76.7, 79.4, 82.2degreesC. Thermal death times (TDT) were determined in TDT tubes containing 1-g sample and heated using a constant temp. water bath for different time intervals. D values ranged from 0.07 to 0.43 min at 82.2degreesC and from 2.00 to 8.96 min at 73.9degreesC. 1 strain (Minnesota) isolated from a botulism outbreak in Minnesota was the most heat resistant while strains isolated from crabs (G21-5, 25V-1, and 25V-2) were least resistant. The z values were 4.2 to 5.4degreesC for the strain Alaska, associated with an outbreak, and 6.0 to 7.1degreesC for the 4 other strains. Results indicate that these organisms are less heat resistant in oyster homogenate than other seafood products. However, current oyster pasteurization methods are not sufficient to guarantee safety from type E C. botulinum spores, and further studies are needed to assure product safety.

Chambers, M. (2005). *Transport of Fecal Bacteria in a Rural Alaskan Community*. (Master's Thesis, University of Alaska Fairbanks, 2005). Retrieved from, http://www.uaf.edu/water/publications/MKChambersThesis.pdf

Summary
People living without piped water and sewer can be at increased risk for fecal-oral diseases. One Alaskan village that relies on hauled water and honeybuckets was studied to determine the pathways of fecal contamination of drinking water and the human environment so that barriers can be established to protect health. Samples were tested for the fecal indicators Escherichia coli and Enterococcus. Several samples were also tested for the pathogens Giardia lamblia and Cryptosporidium parvum. All terrain vehicle (ATV) use and foot traffic transported bacteria within the village and into the home. Surface water flow transported bacteria within the community during spring thaw, but flow from the dump did not appear to contribute to contamination in town. Within the home, viable fecal bacteria were found on water dippers, kitchen counters and floors, and in washbasin water. Giardia was found at the dump, but not in water from the river adjacent the community. Exposure to fecal contamination could be reduced by cleaning up after dogs, careful disposal of honeybucket bags and gray water, and by protecting stored drinking water.

Chan, H. (1998). A database for environmental contaminants in traditional foods in northern and Arctic Canada: development and applications. *Food additives and Contaminants, 15* (2), 127-134.

Abstract:
The potential health effects of environmental contaminants in traditional food has become a concern among northern communities because of the presence of environmental contaminants in the Arctic ecosystem. Exposure assessments are needed but they require comprehensive dietary information and contaminant data. Over the last 10 years, there has been considerable effort to monitor the level of contaminants in fish and wildlife collected from different regions in northern and Arctic Canada.The development of a database and its application for dietary contaminant exposure assessment are described. We conducted an extensive literature review on levels of environmental contaminants in northern and Arctic Canada. The ranges of levels of four contaminants of major concern (chlordane, mercury, polychlorinated biphenyls and toxaphene) in 81 species of marine mammals, terrestrial mammals, birds, fish and plants are summarized. These data represent 69% of the 117 species
of fish, wildlife and plants mentioned in our dietary interviews conducted in the northern communities. A significant percentage of the foods had contaminant levels exceeding the guidelines used by Health Canada for market food consumed by the 'southern' populations. Mathematic modelling of the distributions of the data showed that contaminant levels in most food groups are log-normally distributed and have a typical coefficient of variation of about 100%. Examples are presented to demonstrate the use of the data for contaminant exposure assessment. Average contaminant exposure levels estimated using the database for two communities are comparable to those obtained previously using community specific data. With the current knowledge of environmental contaminant levels in the northern traditional food system, it may be feasible to conduct preliminary risk assessment of dietary exposure of environmental contaminants when some diet information for a community is available. Further sampling and analysis may be needed only for confirmation purposes.

Chan, H., & Egeland, G. (2004). Fish Consumption, Mercury Exposure, and Heart Diseases, *Nutrition Reviews, 62* (2).

Chan, H., Fediuk, K., Hamilton, S., Rostas, L., Caughey, A., Kuhnlein, H., et al. (2006). Food security in Nunavut, Canada: barriers and recommendations. *International Journal of Circumpolar Health, 65*(5), 416-31.

Abstract:
OBJECTIVES: The food supply of Inuit living in Nunavut, Canada, is characterized by market food of relatively low nutritional value and nutrient-dense traditional food. The objective of this study is to assess community perceptions about the availability and accessibility of traditional and market foods in Nunavut. STUDY DESIGN: A qualitative study using focus group methodology. METHODS: Focus groups were conducted in 6 communities in Nunavut in 2004 and collected information was analyzed. RESULTS: Barriers to increased traditional food consumption included high costs of hunting and changes in lifestyle and cultural practices. Participants suggested that food security could be gained through increased economic support for local community hunts, freezers and

education programs, as well as better access to cheaper and higher quality market food. CONCLUSIONS: Interventions to improve the dietary quality of Nunavut residents are discussed.

Chance, N. (1971). *Modernization and educational reform in native Alaska*. Minnisota: Training Center for Community Programs.

Chandler, B., Beller, M., Jenkerson, S., Middaugh, J., Roberts, C., Reisdorf, E. et al. (2000). Outbreaks of Norwalk-like viral gastroenteritis - Alaska and Wisconsin, 1999. *Morbidity and Mortality Weekly Report, 49*(10), 207-211. Retrieved from, http://www.cdc.gov/mmwR/.

Chen, M., Lin, Y., Tsai, H., & Yuo, H. (2002). Efficiency of hurdle technology applied to raw cured meat (Si-raw) processing. *Asian-Australasian Journal of Animal Sciences, 15*(11), 1646-1652. Retrieved from, http://www.ajas.info/.
Abstract:
Si-Raw is a raw cured meat (raw, cured meat fermented with steamed rice) produced by the aboriginal people of Taiwan. In order to prevent food poisoning or intoxication from botulism, new methods of monitoring the production base on hurdle technology were investigated. New methods investigated incorporated citric acid, sodium hypophosphite, Monascus anka mash, plum paste or lactic acid bacteria inoculum added separately to meat with steamed rice and salt to lower the Aw (water activity) and pH values of the products to control the microbial growth. Results showed that anaerobic bacterial counts, lactic acid bacterial counts and aerobic bacterial counts for the products of all treatments were less than 10(6), 10(5) and 10(2) cfu/g, respectively. Sodium chloride content of all products was above 5.46%, water activity was below 0.939 and pH value was below 4.27. IMP was lower and ATP and hypoxanthine were higher. ATP concentrations were higher in the samples which contained the anka mash. Result of sensory panel test indicated that most people preferred the products with added sodium hypophosphite. Except for the fact that the content of tryptamine in the sample with Monascus anka mash was higher, the amine concentrations for all treatments were lower than those of other fermented meat products. The amino acid nitrogen content was higher in the product made from raw meat treated with citric acid, but lower in the other products. Neither Clostridium botulinum nor Trichinella spiralis were detected in any of the treatments. The result may indicate that hurdle technology is effective for hygiene and safe producing Si-Raw.

Chiefs of Ontario. (2005). *Environment Department.* Retrieved from, http://www.chiefs-of-ontario.org/

Chino, M., & Debruyn, L. (2006). Building true capacity: indigenous models for indigenous communities. *American Journal of Public Health, 96* (4), 596-599. doi: 10.2105/AJPH.2004.053801.
Abstract:
Within the past 2 decades, community capacity building and community empowerment have emerged as key strategies for reducing health disparities and promoting public

health. As with other strategies and best practices, these concepts have been brought to indigenous (American Indian and Alaska Native) communities primarily by mainstream researchers and practitioners. Mainstream models and their resultant programs, however, often have limited application in meeting the needs and realities of indigenous populations. Tribes are increasingly taking control of their local health care services. It is time for indigenous people not only to develop tribal programs but also to define and integrate the underlying theoretical and cultural frameworks for public health application.

Chiou, L., Hennessy, T., Horn, A., Carter, G., & Butler, J. (2002). Botulism among Alaska natives in the Bristol Bay area of southwest Alaska: a survey of knowledge, attitudes, and practices related to fermented foods known to cause botulism. *International Journal of Circumpolar Health, 61*(1), 50-60. Retrieved from, http://ijch.fi/.

Abstract:

OBJECTIVES: Botulism cases due to traditional Alaska Native fermented foods occur periodically in Southwest Alaska. In this population, we conducted a survey on knowledge, attitudes, and practices related to botulism and fermented foods. METHODS: We interviewed 140 adults randomly chosen from nine villages. Data collected included fermented food consumption frequency; knowledge about the cause and symptoms of botulism; and fermented food preparation methods. RESULTS: Most respondents (81%) had eaten Alaska Native fermented foods at least once. Over 70% identified botulism as a foodborne illness, and over 87% believed eating certain Native fermented foods could cause botulism. One-third of fermented food preparers used plastic containers for fermentation. To prevent botulism, 45% vwould consider boiling fermented foods, and 65% would not eat foods fermented in plastic or glass containers. CONCLUSIONS: Despite high awareness of botulism in this population, one-third of fermented food preparers use plastic containers, a practice which may increase the risk of botulism. Misconceptions and acceptable prevention messages about botulism, such as using traditional nonplastic fermentation methods, were identified and included in an educational video.

Christofides, A., Schauer, C., Sharieff, W., & Zlotkin, S. (2005). Acceptability of micronutrient sprinkles: a new food-based approach for delivering iron to First Nations and Inuit children in Northern Canada. *Chronic Disease in Canada, 26*(4), 114-20.

Abstract:

Iron deficiency anemia (IDA) is a significant public health problem among Canadian Aboriginal children. The objectives of this study were to determine the acceptability and safety of microencapsulated-iron sprinkles, a new powdered form of iron packaged in a single-serving sachet for prevention of IDA. A total of 102 non-anemic children aged 4 to 18 months from three communities were randomized to receive sprinkles containing 30 mg Fe/day (NR = 49) or placebo (NR = 53) for six months. To assess acceptability, adherence and side effects were monitored bi-weekly. To assess safety, serum ferritin (SF) concentration and anthropometry were measured at baseline and end. Mean adherence was 59.6 +/- 27.7 percent. There were no differences in adherence, SF, anthropometric status or side effects between groups. Although there were no differences

in hemoglobin (Hb) concentration and anemia prevalence from baseline to end and between groups, the Hb curve shifted to the right (increased) for the sprinkles group and to the left (decreased) for the placebo group. Sprinkles may provide a safe and acceptable option to the current standard of care (i.e. ferrous sulphate drops) for the provision of iron in Canadian Aboriginal populations.

Clark, M. (2002). Primary Health Care and Public Health Directorate, First Nations and Inuit Health Branch, Health Canada. Shigellosis and First Nations Communities. In, *Health and the Environment: Critical Pathways.* Retrieved February 27, 2008, from http://www.hc-sc.gc.ca/sr-sr/pubs/hpr-rpms/bull/2002-4-environ/method_e.html

Clemence, M.A., & Guerrant, R.L. (2004). At the Shore. In D. Schlossberg (Ed.), *Infections of Leisure*: *Third Edition*, (pp. 4-7). Washington, D.C.: ASM Press.

Colby, S., & Haldeman, L. (2007). Peer-led Theater as a Nutrition Education Strategy *Journal of Nutrition Education and Behavior, 39*(1), 48-49. doi:10.1016/j.jneb.2006.09.007.

Conder, J., Hoke, R., Wolf, W., Russell, M., & Buck, R. (2008). Are PFCAs Bioaccumulative? A Critical Review and Comparison with Regulatory Criteria and Persistent Lipophilic Compounds. *Environmental Science and Technology, 42*(4), 995 – 1003. doi: 10.1021/es070895g.
Abstract:
Perfluorinated acids, including perfluorinated carboxylates (PFCAs), and perfluorinated sulfonates (PFASs), are environmentally persistent and have been detected in a variety of wildlife across the globe. The most commonly detected PFAS, perfluorooctane sulfonate (PFOS), has been classified as a persistent and bioaccumulative substance. Similarities in chemical structure and environmental behavior of PFOS and the PFCAs that have been detected in wildlife have generated concerns about the bioaccumulation potential of PFCAs. Differences between partitioning behavior of perfluorinated acids and persistent lipophilic compounds complicate the understanding of PFCA bioaccumulation and the subsequent classification of the bioaccumulation potential of PFCAs according to existing regulatory criteria. Based on available research on the bioaccumulation of perfluorinated acids, five key points are highlighted in this review: (1) bioconcentration and bioaccumulation of perfluorinated acids are directly related to the length of each compound's fluorinated carbon chain; (2) PFASs are more bioaccumulative than PFCAs of the same fluorinated carbon chain length; (3) PFCAs with seven fluorinated carbons or less (perfluorooctanoate (PFO) and shorter PFCAs) are not considered bioaccumulative according to the range of promulgated bioaccumulation,"B", regulatory criteria of 1000–5000 L/kg; (4) PFCAs with seven fluorinated carbons or less have low biomagnification potential in food webs, and (5) more research is necessary to fully characterize the bioaccumulation potential of PFCAs with longer fluorinated carbon chains (>7 fluorinated carbons), as PFCAs with longer fluorinated carbon chains may exhibit partitioning behavior similar to or greater than PFOS. The bioaccumulation potential of perfluorinated acids with seven fluorinated carbons or less appears to be several orders of

magnitude lower than “legacy” persistent lipophilic compounds classified as bioaccumulative. Thus, although many PFCAs are environmentally persistent and can be present at detectable concentrations in wildlife, it is clear that PFCAs with seven fluorinated carbons or less (including PFO) are not bioaccumulative according to regulatory criteria.

Cooke, M., Mitrou, F., Lawrence, D., Guimond, E., & Beavon, D. (2007). Indigenous well-being in four countries: An application of the UNDP'S Human Development Index to Indigenous Peoples in Australia, Canada, New Zealand, and the United States. *BMC International Journal of Health and Human Rights, 7*, 9. doi:10.1186/1472-698X-7-9.
Abstract:
BACKGROUND: Canada, the United States, Australia, and New Zealand consistently place near the top of the United Nations Development Programme's Human Development Index (HDI) rankings, yet all have minority Indigenous populations with much poorer health and social conditions than non-Indigenous peoples. It is unclear just how the socioeconomic and health status of Indigenous peoples in these countries has changed in recent decades, and it remains generally unknown whether the overall conditions of Indigenous peoples are improving and whether the gaps between Indigenous peoples and other citizens have indeed narrowed. There is unsettling evidence that they may not have. It was the purpose of this study to determine how these gaps have narrowed or widened during the decade 1990 to 2000. METHODS: Census data and life expectancy estimates from government sources were used to adapt the Human Development Index (HDI) to examine how the broad social, economic, and health status of Indigenous populations in these countries have changed since 1990. Three indices - life expectancy, educational attainment, and income - were combined into a single HDI measure. RESULTS: Between 1990 and 2000, the HDI scores of Indigenous peoples in North America and New Zealand improved at a faster rate than the general populations, closing the gap in human development. In Australia, the HDI scores of Indigenous peoples decreased while the general populations improved, widening the gap in human development. While these countries are considered to have high human development according to the UNDP, the Indigenous populations that reside within them have only medium levels of human development. CONCLUSION: The inconsistent progress in the health and well-being of Indigenous populations over time, and relative to non-Indigenous populations, points to the need for further efforts to improve the social, economic, and physical health of Indigenous peoples.

Copeman, L.A., & Parrish, C.C. (2004). Lipids Classes, Fatty Acids, and Sterols in Seafood from Gilbert Bay, Southern Labrador. *Journal of Agriculture and Food Chemistry, 52*(15), 4872 – 4881. doi: 10.1021/jf034820h.
Abstract:
Seafood from Gilbert Bay, southern Labrador, was sampled for lipid classes, fatty acid, and sterol composition. Gilbert Bay is a proposed Marine Protected Area, and the composition of seafood from this region is interesting from both human health and ecological perspectives. Analyses included four species of bivalves and flesh and liver samples from four fish species. Lipids from a locally isolated population of northern cod

(Gadus morhua) were also compared to lipids from other cod populations. Lipid classes were analyzed by Chromarod/Iatroscan TLC-FID, fatty acids by GC, and sterols by GC-MS. Three cod populations had similar levels of total lipid per wet weight (0.6%) with triacylglycerols (TAG), sterols, and phospholipids comprising on average 13, 11, and 51%, respectively, of their total lipids. Fatty fish such as capelin and herring contained on average 8.4% lipid with 86% present as TAG. Fish livers from cod and herring showed opposite trends, with cod having elevated lipid (27%) and TAG (63%) and herring containing only 3.8% lipid and 20% TAG. Shellfish averaged 0.6% lipid; however, significant lipid class differences existed among species. Fatty acid analysis showed few significant differences in cod populations with on average 57% polyunsaturated fatty acids (PUFA), 18% monounsaturated fatty acids (MUFA), and 24% saturated fatty acids (SFA). Cod livers had lower PUFA (34%) and elevated MUFA (44%) relative to flesh. Bivalves averaged 25% SFA, 18% MUFA, and 57% PUFA, whereas scallop adductor muscle had the highest PUFA levels (63%). Bivalves contained 20 different sterols with cholesterol present as the major sterol (19-39%). trans-22-Dehydrocholesterol, brassicasterol, 24-methylenecholesterol, and campesterol individually accounted for >10% in at least one species. High levels of PUFA and non-cholesterol sterols observed in Gilbert Bay seafood demonstrate their positive attributes for human nutrition.

Corne, S., Gebre, Y., Manfreda, J., & Hershfield, E.S. (1994). Outbreak of Tuberculosis in an Inuit (ESKIMO) Community. *European Respiratory Journal*, *7* (Suppl 18), 474S. Retrieved from, http://erj.ersjournals.com/.

Couture, C., Measures, L., Gagnon, J., & Desbiens, C. (2003). Human Intestinal Anisakiosis due to consumption of raw salmon. *American Journal of Surgical Pathologies, 27*(8), 1167-1172. Retrieved from, http://www.ajsp.com.

Crapo, C., Himelbloom, B., Vitt, S., & Pedersen, L. (2004). Ozone efficacy as a bactericide in seafood processing. *Journal of Food Product Technology, 13* (1), 111-123. DOI: 10.1300/J030v13n01_10.

Abstract:

Efficacy of ozonated water (0.6-1.5 ppm) as a bactericidal agent for sanitation of food contact surfaces and treatment of raw sea food (Alaska salmon roe and fillets) was evaluated. The presence of ozone reduced bacterial levels on stainless steel surfaces markedly and on plastic cutting boards to a lesser extent. Ozone was about as effective as Cl in lowering levels of Listeria innocua on inoculated food contact surfaces. Fish processing residuals present on the surface greatly reduced sanitizer effectiveness. In high organic conditions, chlorinated water was slightly more effective than ozonated water. However, ozonated water applied to fish fillets and roe was not effective for bacterial control. The presence of organic material reduced the effectiveness of ozone, particularly in the case of fish fillets. Ozone accelerated the development of rancidity in frozen roe and fish fillets, resulting in reduced shelf life. On the basis of these results, ozonated water is recommended only as a sanitizer for cleaned sea food contact surfaces.

Crump, J. (2002). Balancing the Message on Contaminants and Food. *Indigenous People's Secretariat IPS, 2*(1).

Curtis, M.A., Rau, M.E., Tanner, C.E., Prichard, R.K., Faubert, G.M., Olpinski, S. et al. (1988). Parasitic zoonoses in relation to fish and wildlife harvesting by Inuit communities in northern Québec, Canada. *Arctic Medical Research, 47*(Suppl. 1), 693-696.

Abstract:
During 1983-86 we conducted necropsies on fish and game harvested by the Inuit communities of Kuujjuaq and Salluit to determine parasite prevalences. Several parasites of human health significance occur in the region: Trichinella spiralis in polar bear, walrus, wolf, red fox and arctic fox; and Diphyllobothrium spp. salmon, in arctic char, brook trout, lake trout and whitefish. Antibody tests on 264 human sera samples obtained from Kuujjuaq and Salluit revealed diagnostic titres for toxoplasmosis, trichinellosis, echinococcosis and toxocariasis. Traditional dietary preferences and food preparation practices by the Inuit of northern Quebec ensure that risk of infection by zoonotic disease organisms is generally low, but the sporadic and unexpected appearance of parasites in atypical hosts (eg. Trichinella in walrus) remains a problem for community health. (Au)

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Dallaire, F., Dewailly, E., Vezina, C., Bruneau, S., & Ayotte, P. (2004). Acute infections and environmental exposure to organochlorines in Inuit infants from Nunavik. *Environmental Health Perspectives, 112*(14), 1359-65. doi:10.1289/ehp.7255.

Abstract:
The Inuit population of Nunavik (Canada) is exposed to immunotoxic organochlorines (OCs) mainly through the consumption of fish and marine mammal fat. We investigated the effect of perinatal exposure to polychlorinated biphenyls (PCBs) and dichlorodiphenyldichloroethylene (DDE) on the incidence of acute infections in Inuit infants. We reviewed the medical charts of a cohort of 199 Inuit infants during the first 12 months of life and evaluated the incidence rates of upper and lower respiratory tract infections (URTI and LRTIs, respectively), otitis media, and gastrointestinal (GI) infections. Maternal plasma during delivery and infant plasma at 7 months of age were sampled and assayed for PCBs and DDE. Compared to rates for infants in the first quartile of exposure to PCBs (least exposed), adjusted rate ratios for infants in higher quartiles ranged between 1.09 and 1.32 for URTIs, 0.99 and 1.39 for otitis, 1.52 and 1.89 for GI infections, and 1.16 and 1.68 for LRTIs during the first 6 months of follow-up. For all infections combined, the rate ratios ranged from 1.17 to 1.27. The effect size was similar for DDE exposure but was lower for the full 12-month follow-up. Globally, most rate ratios were > 1.0, but few were statistically significant ($p < 0.05$). No association was found when postnatal exposure was considered. These results show a possible association between prenatal exposure to OCs and acute infections early in life in this population.Inuit

Dallaire, R., Dewailly, E., Vezina, C., Bruneau, S., & Ayotte, P. (2006). Portrait of outpatient visits and hospitalizations for acute infections in Nunavik preschool children. *Canadian Journal of Public Health, 97*(5), 362-368.

Abstract:
OBJECTIVE: Inuit children from around the world are burdened by a high rate of infectious diseases. The objective of this study was to evaluate the incidence rate of infections in Inuit preschool children from Nunavik (Northern Québec). METHODS: The medical chart of 354 children from a previously recruited cohort was reviewed for the first five years of life. All outpatient visits that led to a diagnosis of acute infection and all admissions for acute infections were recorded. RESULTS: Rates of outpatient visits for acute otitis media (AOM) were 2314, 2300, and 732 events/1000 child-years for children 0-11 months, 12-23 months, and 2-4 years, respectively. Rates of outpatient visits for lower respiratory tract infections (LRTI) were 1385, 930, and 328 events/1000 child-years, respectively. Rates of hospitalization for pneumonia were 198, 119, and 31 events/1000 child-years, respectively. CONCLUSION: Inuit children from Nunavik have high rates of AOM and LRTI. Such rates were higher than that of other non-native North-American populations previously published. Admission for LRTI is up to 10 times more frequent in Nunavik compared to other Canadian populations

Damman, S., Eide, W., & Kuhnlein, H. (2007). Indigenous peoples' Nutrition Transition in a Right to Food Perspective. *Food Policy, 33*(2), 135-155. doi:10.1016/j.foodpol.2007.08.002.
Abstract:
In indigenous communities the nutrition transition characterized by a rapid westernization of diet and lifestyle is associated with rising prevalence of chronic disease. Field work and literature reviews from two different policy environments, Argentina (Jujuy) and Canada (Nunavut), identified factors that add to indigenous peoples' disease risk. The analytical framework was the emerging human right to adequate food approach to policies and programmes. Indigenous peoples' chronic disease risk tends to increase as a result of government policies that infringe on indigenous peoples' livelihoods and territories, undermining their economic system, values and solidarity networks. Policies intended to increase food security, including food aid, may also fuel the nutrition transition. There is a need to explore further the connection between well-intended policies towards indigenous peoples and the development of chronic diseases, and to broaden the understanding of the role that different forms of discrimination play in the westernization of their lifestyles, values and food habits. Food policies that take due account of indigenous peoples' human rights, including their right to enjoy their culture, may counteract the growth of chronic disease in these communities.

Dan, M., Yossepowitch, O., Gotesman, T., Assous, M., & Marva, E. (2004). A familial outbreak of opisthorchiasis due to consumption of raw fish imported from Siberia. *Interscience Conference on Antimicrobial Agents and Chemotherapy, 44,* 450-451. Retrieved from, http://www.icaac.org/icaac07.asp.

Daniel, M., Green, L. W., Marion, S. A., Gamble, D., Herbert, C. P., Hertzman, C., et al. (1999). Effectiveness of community-directed diabetes prevention and control in a rural Aboriginal population in British Columbia, Canada. *Social Science & Medicine, 48,* 815–832. DOI: 10.1016/S0277-9536(98)00403-1.
Abstract:

This report presents the process and summative evaluation results from a community-based diabetes prevention and control project implemented in response to the increasing prevalence and impact of non-insulin-dependent diabetes mellitus (NIDDM) in the Canadian Aboriginal population. The 24-month project targeted the registered Indian population in British Columbia's rural Okanagan region. A participatory approach was used to plan strategies by which diabetes could be addressed in ways acceptable and meaningful to the intervention community. The strategies emphasised a combination of changing behaviours and changing environments. The project was quasi-experimental. A single intervention community was matched to two comparison communities. Workers in the intervention community conducted interviews of individuals with or at risk for diabetes during a seven-month pre-intervention phase (n = 59). Qualitative analyses were conducted to yield strategies for intervention. Implementation began in the eighth month of the project. Trend measurements of diabetes risk factors were obtained for 'high-risk' cohorts (persons with or at familial risk for NIDDM) (n = 105). Cohorts were tracked over a 16-month intervention phase, with measurements at baseline, the midpoint and completion of the study. Cross-sectional population surveys of diabetes risk factors were conducted at baseline and the end of the intervention phase (n = 295). Surveys of community systems were conducted three times. The project yielded few changes in quantifiable outcomes. Activation of the intervention community was insufficient to enable individual and collective change through dissemination of quality interventions for diabetes prevention and control. Theory and previous research were not sufficiently integrated with information from pre-intervention interviews. Interacting with these limitations were the short planning and intervention phases, just 8 and 16 months, respectively. The level of penetration of the interventions mounted was too limited to be effective. Attention to process is warranted and to the feasibility of achieving effects within 24 months.

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Davis, S., & Reid, R. (1999). Practicing participatory research in American Indian communities. *American Journal of Clinical Nutrition, 69,* 755S–759S. Retrieved from, http://www.ajcn.org/.

Dawar, M., Moody, L., Martin, J.D., Fung, C., Isaac-Renton, J., & Patrick, D. (2002). Two outbreaks of botulism associated with fermented salmon roe--British Columbia, August 2001. *Canadian Communicable Disease Report, 28*(6), 45-9. Retrieved from, http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/index-eng.php.

Day, R.D., VanderPol, S.S., Christopher, S.J., Davis, W.C., Pugh, R.S., Simac, K.S. et al. (2006). Murre Eggs (Uria aalge and Uria lomvia) as Indicators of Mercury Contamination in the Alaskan Marine Environment. *Environmental Science and Technology, 40*(3), 659 – 665. doi: 10.1021/es051064i.
Abstract:
Sixty common murre (Uria aalge) and 27 thick-billed murre (Uria lomvia) eggs collected by the Seabird Tissue Archival and Monitoring Project (STAMP) in 1999-2001 from two

Gulf of Alaska and three Bering Sea nesting colonies were analyzed for total mercury (Hg) using isotope dilution cold vapor inductively coupled mass spectrometry. Hg concentrations (wet mass) ranged from 0.011 g/g to 0.357 g/g (relative standard deviation = 76%), while conspecifics from the same colonies and years had an average relative standard deviation of 33%. Hg levels in eggs from the Gulf of Alaska (0.166 g/g ± 0.011 g/g) were significantly higher ($p < 0.0001$) than in the Bering Sea (0.047 g/g ± 0.004 g/g). Within the Bering Sea, Hg was significantly higher ($p = 0.0007$) in eggs from Little Diomede Island near the arctic than at the two more southern colonies. Although thick-billed and common murres are ecologically similar, there were significant species differences in egg Hg concentrations within each region ($p < 0.0001$). In the Bering Sea, eggs from thick-billed murres had higher Hg concentrations than eggs from common murres, while in the Gulf of Alaska, common murre eggs had higher concentrations than those of thick-billed murres. A separate one-way analysis of variance on the only time-trend data currently available for a colony (St. Lazaria Island in the Gulf of Alaska) found significantly lower Hg concentrations in common murre eggs collected in 2001 compared to 1999 ($p = 0.017$). Results from this study indicate that murre eggs may be effective monitoring units for detecting geographic, species, and temporal patterns of Hg contamination in marine food webs. The relatively small intracolony variation in egg Hg levels and the ability to consistently obtain adequate sample sizes both within and among colonies over a large geographic range means that monitoring efforts using murre eggs will have suitable statistical power for detecting environmental patterns of Hg contamination. The potential influences of trophic effects, physical transport patterns, and biogeochemical processes on these monitoring efforts are discussed, and future plans to investigate the sources of the observed variability are presented.

Dean, L., & Furgal, C. (2004). *Labrador's North Coast communities: Where Communication and Environmental Contaminants Converge*. The Arctic Institute of North America, Calgary, Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_contents

Abstract:

Research has shown that Labrador Inuit are exposed to contaminants in their traditional diet of wild foods (sea and land mammals, birds and fish). Due to the relationship between Inuit and these foods, and the cultural, nutritional and social value of a diet rich in traditional foods, it is vital that there is a dissemination and discussion of accurate information about the risk of contaminant exposure through this diet. Further, being aware of the risks of raising fears or creating confusion in the communities is imperative. The paper will identify the challenges in the communication process and include Labradorimiut perspectives. This project used both informal meetings with community individuals via a community tour, and a mixed quantitative and qualitative survey conducted with individuals from the communities in order to assess the awareness, comprehension, perception and response to the issue of contaminants in Labrador among the Inuit population.

deBruyn, A.M.H., Trudel, M., Eyding, N., Harding, J., McNally, H., Mountain, R., Orr, C., et al. (2006). Ecosystemic Effects of Salmon Farming Increase Mercury

Contamination in Wild Fish. *Environmental Science and Technology, 40* (11), 3489-3493. doi: 10.1021/es0520161.

Abstract:

Net-pen salmon aquaculture has well-known effects on coastal ecosystems: farm waste increases sediment organic content and the incidence of sediment anoxia, supports increased production of deposit-feeding invertebrates, and attracts higher densities of demersal fish and other mobile carnivores. These impacts are widely considered to be localized and transitory, and are commonly managed by imposing a period of fallowing between cycles of production. The implications of these ecosystemic effects for contaminant cycling, however, have not previously been considered. We found elevated levels of mercury in demersal rockfishes near salmon farms in coastal British Columbia, Canada, attributable to a combination of higher rockfish trophic position and higher mercury levels in prey near farms. Mercury concentrations in long-lived species such as rockfishes change over a longer time scale than cycles of production and fallowing, and thus at least some important effects of fish farms may not be considered transitory.

Degani, N., Navarro, C., Deeks, SL., & Lovgren, M. (2008). Invasive bacterial diseases in Northern Canada. *Emerging Infectious Diseases*, *14*, 34-40. Retrieved from, http://www.cdc.gov/EID/content/14/1/34.htm.

Abstract:

International Circumpolar Surveillance (ICS) is a population-based invasive bacterial disease surveillance network. Participating Canadian regions include Yukon, Northwest Territories, Nunavut, and northern regions of Quebec and Labrador (total population 132,956, 59% aboriginal). Clinical and demographic information were collected by using standardized surveillance forms. Bacterial isolates were forwarded to reference laboratories for confirmation and serotyping. After pneumococcal conjugate vaccine introduction, crude annual incidence rates of invasive Streptococcus pneumoniae decreased from 34.0/100,000 population (1999-2002) to 23.6/100,000 population (2003-2005); substantial reductions were shown among aboriginals. However, incidence rates of S. pneumoniae, Haemophilus influenzae, and group A streptococci were higher in aboriginal populations than in non-aboriginal populations. H. influenzae type b was rare; 52% of all H. influenzae cases were caused by type a. Data collected by ICS contribute to the understanding of the epidemiology of invasive bacterial diseases among northern populations, which assists in formulation of prevention and control strategies, including immunization recommendations.

de Lisle, G., Mackintosh, C., & Bengis, R. (2001). Mycobacterium bovis in free-living and captive wildlife, including farmed deer. *Revue Scientifique et Technique, 20* (1), 86-111.

Abstract:

Mycobacterium bovis has been isolated from a wide range of wildlife species, in addition to domestic animals. This review examines the role played by various species in the maintenance of M. bovis in wildlife communities and the spread to domestic animals. Badgers (Meles meles), brushtail possums (Trichosurus vulpecula), deer (Odocoileus virginianus), bison (Bison bison) and African buffalo (Syncerus caffer) are examples of wildlife that are maintenance hosts of M. bovis. The importance of these hosts has been

highlighted by the growing realisation that these animals can represent the principal source of infection for both domestic animals and protected wildlife species. The range of methods for controlling M. bovis in wildlife is limited. While population control has been used in some countries, this approach is not applicable in many situations where protected wildlife species are concerned. Vaccination is a potential alternative control method, although as yet, no practical, effective system has been developed for vaccinating wildlife against bovine tuberculosis. Tuberculosis caused by M. bovis has also been a problem in captive wildlife and in recently domesticated animals such as farmed deer. Control of M. bovis in this group of animals is dependent on the judicious use of diagnostic tests and the application of sound disease control principles. The advances in the development of bovine tuberculosis vaccines for cattle and farmed deer may offer valuable insights into the use of vaccination for the control of tuberculosis in a range of captive wildlife species.

Demers, M.J., Kelly, E.N., Blais, J.M., Pick, F.R., St.Louis, V.L., & Schindler, D.W. (2007). Organochlorine Compounds in Trout from Lakes over a 1600 Meter Elevation Gradient in the Canadian Rocky Mountains. *Environmental Science and Technology, 41*(8), 2723-2729. doi: 10.1021/es062428p.

Abstract:
The effect of altitude on the concentration and composition of organochlorine compounds (OC) in trout was investigated along an elevation gradient of 1600 m in the Canadian Rocky Mountains. The eight lakes sampled were within or adjacent to national parks in sparsely settled parts of Alberta and British Columbia, thus contaminants were assumed to have derived from long-range atmospheric transport. Concentrations of several OCs in trout increased significantly with lake elevation. In general, these increases were most pronounced for the higher Kow pesticides (i.e., dieldrin and DDTs), and less pronounced for lower Kow pesticides (e.g., HCHs and HCB) and PCBs. Most OC concentrations in trout were inversely correlated with fish growth rate. Growth rate explained more of the variation for some OCs (particularly PCBs) than lake elevation. Differences in trophic position (indicated by 15N) explained little of the variation in OC concentration in comparison to other factors such as lake elevation and the growth rate and age of trout. Using principal component analysis (PCA), we identified the importance of lake elevation and octanol/water partition coefficient (Kow) to the OC composition of trout.

Demma, L., Holman, R., Mikosz, C., Curns, A., Swerdlow, D., Paisano, E. et al. (2006). Rocky Mountain spotted fever hospitalizations among American Indians. *American Journal of Tropical Medicine and Hygiene, 75*(3), 537-41.

Abstract:
To describe the epidemiology of Rocky Mountain spotted fever (RMSF) among American Indians/Alaska Natives (AI/ANs), we conducted a retrospective analysis of hospitalization records with an RMSF diagnosis using Indian Health Service (IHS) hospital discharge data for calendar years 1980-2003. A total of 261 RMSF hospitalizations were reported among AIs, for an average annual hospitalization rate of 1.21 per 100,000 persons; two deaths were reported (0.8%). Most hospitalizations (88.5%) occurred in the Southern Plains region, where the rate was 4.23 per 100,000 persons. Children 1-4 years of age had the highest age-specific hospitalization rate of

2.50 per 100,000 persons. The overall annual RMSF hospitalization rate declined during the study period. Understanding the epidemiology of RMSF among AI/ANs and educating IHS/tribal physicians on the diagnosis of tick-borne diseases remain important for the prompt treatment of RMSF and the reduction of the disease occurrence among AI/ANs, particularly in high-risk areas

DeLormier, T., Kuhnlein, H., & Penn, A. (1993). *Traditional food of the James Bay Cree of Quebec (Observations report).* Sainte-Anne-de-Bellevue, QC: McGill University. Retrieved from, http://www.creepublichealth.org/public/files/Traditional%20Food%20of%20the%20James%20Bay%20Cree%20of%20Quebec-%20Delormier.pdf

Department of Justice Canada. (2008a). Canada Health Act. (R.S., 1985, c. C-6). Retrieved from, http://laws.justice.gc.ca/en/C-6/

Department of Justice Canada. (2008b). Indian Act (R.S., 1985, c. I-5). Retrieved from, http://laws.justice.gc.ca/en/I-5/

DeSilva, A.O., & Mabury, S.A. (2004). Isolating Isomers of Perfluorocarboxylates in Polar Bears (Ursus maritimus) from Two Geographical Locations. *Environmental Science and Technology*, *38*(24), 6538-6545. doi: 10.1021/es049296p.

Abstract:
The source of involatile, anthropogenic perfluorocarboxylate anions (PFCAs) in biota from remote regions is of heightened interest due to the persistence, toxicity, and bioaccumulation of these materials. Large-scale production of fluorinated compounds is carried out primarily by one of two methods: electrochemical fluorination (ECF) and telomerization. Products of the two processes may be distinguished based on constitutional isomer pattern as ECF products are characteristically comprised of a variety of constitutional isomers. The objective of this research was to develop a method for identifying the constitutional isomer profile of PFCAs in environmental samples and to apply the method to polar bear livers from two different locations. Resolution of constitutional isomers of derivatized PFCAs (8-13 carbons) was ac complished via GC-MS. Seven isomers of an authentic ECF perfluorooctanoate (PFOA) standard were separated. The linear isomer comprised 78% of this standard. Isomer profiles of PFCAs in liver samples of 15 polar bears (Ursus maritimus) from the Canadian Arctic and eastern Greenland were determined by GC-MS. The PFOA isomer pattern in Greenland polar bear samples showed a variety of branched isomers while only the linear PFOA isomer was determined in Canadian samples. Samples of both locations had primarily (>99%) linear isomers of perfluorononanoate and perfluorotridecanoate. Branched isomers of perfluorodecanoate, perfluoroundecanoate, and perfluorododecanoate were determined in the polar bear samples. Unlike the PFOA isomer signature, only a single branched isomer peak on the chromatograms was observed for these longer chain PFCAs. The presence of branched isomers suggests some contribution from ECF sources. However, in comparison to the amount of branched isomers in the ECF PFOA standard, such minor percentages of branched PFCAs may suggest additional input from an exclusively linear isomer source.

Desjardins, E., & Giovindaraj, S. (2005). Proceedings of the Third National Food Security Assembly. Waterloo, Ontario, Canada: Region of Waterloo, Public Health. Retrieved http://www.ryerson.ca/foodsecurity/publications/books_reports/ASSEMBLY_PROCEEDINGS.pdf

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Dewailly, E., Blanchet, C., Gingras, S., Lemieux, S., & Holub, B.J. (2003). Fish consumption and blood lipids in three ethnic groups of Quebec (Canada). *Lipids, 38* (4), 359-365. doi: 10.1007/s11745-003-1070-4.

Dewailly, É., Chaumette, P., Blanchet, C., Bjerregaard, P., Lawn, J., Nobmann, B., et al. (1999). A synthesis of contemporary Inuit diets: assessing nutrient sources and food safety. In J. Jenson & L. Walker (Eds.), *Synopsis of research conducted under the 1997/98 Northern Contaminants Program* (Vol. 75, pp. 299-303).

Dewailly, É., & Nieboer, E. (2005). *Exposure and Preliminary Health Assessments of the Oujé-Bougoumou Cree Population to Mine Tailings Residues – Report of the Survey*. Québec, Canada: Institut national de santé publique du Québec. Retrieved from http://www.inspq.qc.ca/english/publications/default.asp?NumPublication=349

Dewees, S. (2003). *Time for the Harvest: Renewing Native Food Systems Summit Report.* Native Food Summit, Albuquerque, New Mexico. Retrieved from, http://www.firstnations.org/Publications/NFSReport.pdf.

Dharod, J.M., Perez-Escamilla, R., Bermudez-Millan, A., Segura-Perez, S., & Damio, G. (2004). Influence of the Fight BAC! food safety campaign on an urban Latino population in Connecticut. *Journal of Nutrition and Education Behaviour, 36*(3), 128-132.

Dickson, G., & Green, K. (2001). Participatory action research: lessons learned with Aboriginal grandmothers. *Health Care Women International, 22*, 471–482. doi: 10.1080/073993301317094290.
Abstract:
Participatory action research is evolving as both a research methodology and an intervention for health promotion. Here we describe its use in conducting a health assessment as part of a larger project for older Aboriginal women (hereafter known as the grandmothers). The overall purpose of the project was to study the women's health needs and respond through health promotion programming. The experience of using participatory action research revealed a number of lessons, including challenges and

points of tension, and determinants and indicators of success. The research team identified some implications for consideration by others interested in participatory action research.

Dietz, R., Riget, F.F., Boertmann, D., Sonne, C., Olsen, M.T., Fjeldsa, J., et al. (2006). Time Trends of Mercury in Feathers of West Greenland Birds of Prey During 1851-2003. *Environmental Science and Technology, 40* (19), 5911-5916. doi: 10.1021/es0609856.

Abstract:

Temporal trends of mercury (Hg) in West Greenland gyrfalcons, peregrine falcons, and white-tailed eagles were determined over 150 years from 1851 to 2003. Hg was measured in the fifth primary feather. Results showed that Hg increased in the order gyrfalcon (lowest) < peregrine falcon (intermediate) < white-tailed eagle (highest). All species showed significant age accumulations, which were taken into account in the temporal trend analysis. Of eight time trend analyses (three species and three age groups of which one was missing), seven showed an increase in primary feather concentrations. Of these, four were significant at the 5% level, two were close to being significant, and one was not significant. The linear regressions of which three out of four showed significant increases were for juvenile and immature gyrfalcon and juvenile peregrine falcon, which covered only periods prior to 1960, owing to limited data from the last half-century. The two sample comparisons of Hg 10-year medians for adult peregrine falcons and juvenile and adult white-tailed eagles indicated a continued increase during recent decades. However, low levels of Hg in a few recent collections among gyrfalcons and peregrines could indicate a change in the increasing trend.

Dietz, R., Riget, F., Born, E.W., Sonne, C., Grandjean, P., Kirkegaard, M., et al. (2006). Trends in Mercury in Hair of Greenlandic Polar Bears (Ursus maritimus) during 1892-2001. *Environmental Science and Technology, 40*(4), 1120-1125. doi: 10.1021/es051636z.

Abstract:

Mercury concentrations in hair from 397 Greenland polar bears (Ursus maritimus) sampled between 1892 and 2001 were analyzed for temporal trends. In East Greenland the concentrations showed a significant ($p < 0.0001$, $n = 27$) increase of 3.1%/year in the period 1892-1973. In Northwest Greenland, a similar ($p < 0.0001$, $n = 69$) increase of 2.1%/year was found, which continued until 1991, when the most recent samples were obtained. In East Greenland, a significant ($p = 0.009$, $n = 322$) decrease of 0.8%/year was observed after 1973. Two Northwest Greenland samples from 1300 A.D. had a mean value of 0.52 mg/kg of dry weight, which can be considered as a baseline level. The Hg concentration during 1985-1991 from Northwest Greenland (mean value of 7.45 mg/kg of dry weight) was more than 14-fold higher than the assumed baseline level from 1300 A.D. from the same region (i.e., about 93% anthropogenic). Although a decrease was found in East Greenland after 1973, the concentration is still ca. 11-fold higher than the baseline level (i.e., about 90% anthropogenic).

DiGirolamo, A., Perry, G., Gold, B., Parkinson, A., Provost, E., Parvanta, I., et al. (2007). Helicobacter pylori, anemia, and iron deficiency - Relationships explored among

Alaska Native children. *Pediatric Infectious Disease Journal, 26* (10), 927-934. Retrieved from, http://www.pidj.com.

Dixon, B.R. (2006). Isolation and Identification of Anisakid Roundworm Larvae in Fish. *Health Canada: Health Products and Food Branch.* Retrieved from, http://www.hc-sc.gc.ca/fn-an/res-rech/analy-meth/microbio/volume5/opflp_02_e.html

Diyabalanage, T., Amsler, C.D., McClintock, J.B., & Baker, B.J. (2006). Palmerolide A, a Cytotoxic Macrolide from the Antarctic Tunicate Synoicum adareanum. *Journal of the American Chemical Society, 128*(17), 5630 – 5631.doi: 10.1021/ja0588508.

Dolman, C.E. (1960). Type E botulism : a hazard of the north. *Arctic, 13*(4), 230-256. Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_journal.

Dolman, C.E. (1974), Human botulism in Canada (1919-1973). *Canadian Medical Association Journal, 110*(2), 191-197. Retrieved from, http://www.cmaj.ca/.
Abstract:
Since 1919, in Canada, 62 authenticated outbreaks of human botulism have affected 181 persons, with 83 deaths, a fatality rate of 46%. Among these, 41 outbreaks were bacteriologically determined (31 in one laboratory) as six type A, four type B, one both A and B, and 30 type E. About two thirds of the total outbreaks, cases and deaths involved Eskimos and Pacific coast Indians consuming raw marine mammal products and salmon eggs, respectively. Other parts of Canada recorded seven occurrences due to miscellaneous vehicles, three being type B. Since January 1961 there have been 38 outbreaks, involving 94 cases with 33 deaths. These include 18 outbreaks among Eskimos, affecting 51 persons (of whom 24 died) in Labrador, southem Baffin Island, northern Quebec, and the Mackenzie area. Also, putrid salmon eggs caused 15 outbreaks among Pacific coast Indians, totalling 35 cases, of whom only six died, the low fatality rate reflecting the introduction of type E botulinus antitoxin during 1961.

Dolman, C., & Ilda, H. (1963). Type E botulism: its epidemiology, prevention and specific treatment. *Canadian Journal of Public Health, 54*, 293–308. Retrieved from, http://www.cpha.ca/en/cjph.aspx.

Dommergue, A., Ferrari, C.P., Poissant, L., Gauchard, P.-A., & Boutron, C.F. (2003). Diurnal Cycles of Gaseous Mercury within the Snowpack at Kuujjuarapik/Whapmagoostui, Quebec, Canada. *Environmental Science and Technology*, *37* (15), 3289-3297. doi: 10.1021/es026242b.

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Drotman, P. (2008). Centre for Disease Control Peer Reviewed Journal Tracking and Analyzing Disease Trends: International Polar Year. *Emerging Infectious*

Diseases, 14(1), 1-199. Retrieved from, http://www.cdc.gov/eid/content/14/1/pdfs/vol14no01.pdf.

Duffy, L., Bult-Ito, A., Castillo, M., Drew, K., Harris, M., Kuhn, T., et al. (2007). Arctic Peoples and Beyond: research opportunities in neuroscience and behaviour. *International Journal of Circumpolar Health, 66*(3), 264-75. Retrieved from, http://ijch.fi/.
Abstract:
OBJECTIVES: Arctic and northern peoples are spread across Alaska, Canada, Russia and the Scandinavian countries. Inhabiting a variety of ecosystems, these 4 million residents include Indigenous populations who total about 10% of the population. Although Arctic peoples have very diverse cultural and social systems, they have health issues related to environmental impacts and knowledge/treatment disparities that are common to other minority and Indigenous peoples around the world. Research that explores the neuroscience and behavioural aspects of these health disparities offers challenges and significant opportunities. As the next generation of neuroscientists enter the field, it is imperative that they view their contributions in terms of translational medicine to address health disparities. STUDY DESIGN: A workshop was designed to bring neuroscientists together to report on the current directions of neuroscience research and how it could impact health disparities in the North. This workshop produced research recommendations for the growth of neuroscience in the North. METHODS: On May 31, 2006 the National Institute of Neurological Disorders and Stroke, the Burroughs Wellcome Foundation, the Arctic Division of AAAS and the University of Alaska co-sponsored a workshop entitled "Arctic Peoples and Beyond: Decreasing Health Disparities through Basic and Clinical Research." Also, the role and goals of the International Union for Circumpolar Health (IUCH) were presented at the meeting. RESULTS: A set of recommendations related to research opportunities in neuroscience and behaviour research and ways to facilitate national and international partnerships were developed. CONCLUSIONS: These recommendations should help guide the development of future health research in circumpolar neuroscience and behaviour. They provide ideas about research support and informational exchange that will address health challenges.

Duhaime, G., Chabot, M., & Gaudreault, M. (2002). Food consumption patterns and socioeconomic factors among the Inuit of Nunavik. *Ecology of Food and Nutrition, 41* (2), 91-118.
Abstract:
This article examines the dietary patterns of the Inuit of Nunavik, based on data from a 1992 Government of Quebec survey. Using data primarily from the Food Frequency questionnaire on a sample of 178 women between 18 and 74 years of age, the study investigates the role of various socioeconomic factors and the influence of the socioeconomic status of the household to which each woman belongs. These factors are analyzed in relation to the proportion of traditional or industrial foods consumed by respondents. The study shows that the presence of a male head of the household and, to a lesser extent, access to an income, raise the proportionof country foods in the diet. Other findings reveal that the main mechanisms for the distribution of country foods, such as

sharing practices and a community freezer, play a significant role, but do not compensate when the above two conditions are not found in households.

Duhaime, G., Chabot, M., Fréchette, P., Robichaud, V., & Proulx, S. (2004). The impact of dietary changes among the Inuit of Nunavik (Canada): a socioeconomic assessment of possible public health recommendations dealing with food contamination. *Risk Analysis, 24*(4), 1007-18. doi: 10.1111/j.0272-4332.2004.00503.x.

Abstract:

Inuit populations meet a large portion of their food needs by eating country food in which pollutants are concentrated. Despite the fact that they contain pollutants, the consumption of country food has many health, social, economic, and cultural benefits. A risk determination process was set up in order to help regional health authorities of Nunavik to deal with this particular issue. Based on Nunavik health authorities' objectives to encourage the region's inhabitants to change their dietary habits, and on both the risks and the benefits of eating country food, several management options were developed. The options aimed at reducing exposure to contaminants by either substituting certain foods with others that have a lower contaminant content or by store-bought foods. This article aims at assessing the potential economic impact of these risk management options before being implemented. Relevant economic data (aggregate income and monetary outlays for the purchase of food and equipment required for food production by households) were collected and identified to serve as a backdrop for the various replacement scenarios. Results show that household budgets, and the regional economy, are not significantly affected by the replacement of contaminated foods with the purchase of store-bought meat, and even less so if the solution involves replacing contaminated foods with other types of game hunted in the region. When financial support is provided by the state, the households can even gain some monetary benefits. Results show that public health authorities' recommended changes to dietary habits among the Inuit of Nunavik would not necessarily involve economic constraints for Inuit households.

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Dworkin, M.S., Gamble, H.R., Zarlenga, D.S., & Tennican, P.O. (1996). Outbreak of trichinellosis associated with eating cougar jerky. *Journal of Infectious Disease, 174*(3), 663-666. Retrieved from, http://ejournals.ebsco.com/Journal2.asp?JournalID=103131.

Abstract:

There has been a decline in the number of human trichinellosis cases associated with consumption of commercial pork in the United States, while the relative importance of trichinellosis from game meats has increased. An investigation of an outbreak of trichinellosis in Idaho occurring after consumption of improperly prepared cougar jerky is described. Ten cases of trichinellosis were identified among 15 persons who ate the implicated meat. Viable Trichinella larvae were recovered from frozen cougar tissue.

Polymerase chain reaction on parasite DNA yielded results consistent with genotypes T. nativa and Trichinella type T6. This report of cougar meat as a source of human trichinellosis and the finding of freeze-resistant Trichinella organisms in wildlife in Idaho extends the range of this genotype. Consumers of game need to cook the meat thoroughly, since even frozen meat may harbor viable Trichinella that can cause illness.

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Eckert, J. (1996). Workshop summary: food safety: meat- and fish-borne zoonoses. *Veterinary Parasitology, 64* (1-2), 143-147.

Egeland, G.M., Feyk, L.A., & Middaugh, J.P. (1998). The use of traditional foods in a healthy diet in Alaska: risks in perspective. Alaska Department of Health and Social Services. Retrieved from, http://www.epi.hss.state.ak.us/bulletins/docs/rr2004_07.pdf.

Egeland, G.M., Ponce, R.A., & Middaugh, J.P. (1998). A public health perspective on the evaluation of subsistence food safety. *International Journal of Circumpolar Health, 57* (Suppl 1), 572-5. Retrieved from, http://ijch.fi/.

Abstract:

Persistent organic compounds and trace metals are found in the arctic food chain, generating concerns about the safety of subsistence food consumption. One approach for evaluating subsistence food safety is a process used extensively in regulating environmental clean-up and pollution standards. This process, regulatory risk assessment, is substantially different from approaches used in public health risk assessment. Limitations to the use of regulatory risk assessment in assessing public health threats from environmental exposures in the diet include a narrow scope, a lack of incorporation of the nutritional and health benefits of subsistence foods, and the overestimation of risks because of the incorporation of worst-case assumptions in the absence of scientific information. Sound public health policy recognizes that attempts to err on the side of safety for one exposure by recommending reduced consumption of a selected food may inadvertently err on the side of harm by reducing a coexisting exposure of potentially great health benefit. The following discussion should serve as a useful background for future multidisciplinary discussions on the safety of subsistence foods in the Arctic.

Eggertson, L. (2006). Safe drinking water standards for First Nations communities. *Canadian Medical Association Journal, 174*(9), 1248. Retrieved from, http://www.cmaj.ca/cgi/reprint/174/9/1248.

Egorova, L.S., Korsh, P.V., Ravdonikas, O.V., & Fedorova, T.N. (1965). Mixed Epizootic of Tularemia and Omsk Hemorrhagic Fever in Muskrats in Western Siberia. Defence Technical Information Center. Retrieved from, http://stinet.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=AD0640034.

Eidson, M., Mack Sewell, C., Graves, G., & Olson, R. (2000). Beef Jerky Gastroenteritis Outbreaks. *Journal of Environmental Health, 62*. Retrieved from, http://www.neha.org/JEH/.

Abstract
In New Mexico between 1966 and 1995, eight gastroenteritis outbreaks due to ingestion of contaminated meat jerky were reported, with 250 illnesses. Primarily implicated was a locally produced jerky, came seca, made by soaking beef strips in a spicy marinade and then dehydrating them. The process uses no other preservation methods, such as salt curing or the addition of chemical preservatives. Organisms isolated from samples included Staphylococcus aureus and several types of Salmonella (thompson, cerro, montevideo, kentucky, typhimurium, and newport). The primary risk factor may be failure during processing to reach a temperature sufficient to kill these organisms (145[degrees] F for three hours). New Mexico has established guidelines that address this issue, and regulatory agencies and jerky processors need to ensure that processing brings every piece of jerky to the appropriate internal temperature.

Eisenberg, M., & Bender, T. R. (1976). Botulism in Alaska, 1947 through 1974, Early Detection of Cases and Investigation of Outbreaks as a means of Reducing Mortality. *Journal of the American Medical Association, 235* (1), 35-38. Retrieved from, http://jama.ama-assn.org/.

Eklund, M., Peterson, M., Poysky, F., Paranjpye, R., & Pelroy, G. (2004). Control of bacterial pathogens during processing of cold-smoked and dried salmon strips. *Journal of Food Protection, 67* (2), 347-351. Retrieved from, http://uoguelph.library.ingentaconnect.com/content/iafp/jfp.

Abstract:
Microbiological and chemical changes were determined during the smoking and drying of salmon strips processed at 29 to 31degreesC for 4 days at a facility in Alaska in 1993. During the process, Staphylococcus aureus populations increased to more than 10(5) CFU/g after 2 to 3 days of processing. Subsequent laboratory studies showed that a pellicle (dried skinlike surface) formed rapidly on the strips when there was rapid air circulation in the smokehouse and that bacteria embedded in or under the pellicle were able to grow even when heavy smoke deposition occurred. Under these conditions, an inoculum of 26 CFU/g of S. aureus increased to 10(5) CFU/g after 3 days of processing. Elimination of preprocess drying and reduction in air flow during smoking resulted in smoke deposition before pellicle formation and enabled the product to reach levels of water-phase salt and water activity that inhibit the growth of S. aureus and Listeria monocytogenes. In 1994, these modifications were then applied during processing at an Alaskan facility, and S. aureus could not be detected in the finished product. L. monocytogenes was detected in the raw product area, on the processing tables, and on the raw salmon strips, but it was not detected in the finished product when the smoke was applied before pellicle formation.

English, K.C., Wallerstein, N., Chino, M., Finster, C.E., Rafelito, A., Adeky, S., et al. (2004). Intermediate outcomes of a tribal community public health infrastructure assessment. *Ethnicity & Disease, 16*(2 Suppl 2), S2-73-8. Retrieved from, http://www.ishib.org/ED_index.asp.

Abstract:
The purpose of this collaborative participatory project was to assess the strengths and needs of a tribal community as part of a larger public health capacity building program. Key project partners included: the Ramah Band of Navajo Indians, the Albuquerque Area Indian Health Board, the University of New Mexico Masters in Public Health Program, and the University of Nevada, Las Vegas, American Indian Research and Education Center. Principal intervention steps entailed: 1) relationship-building activities among tribal programs and between the Tribe and the scientific community; 2) an orientation to public health; 3) a comprehensive public health infrastructure assessment, utilizing a standardized CDC instrument; and 4) a prioritization of identified needs. The direct outcome was the development and beginning implementation of a community specific public health strategic action plan. Broader results included: 1) increased comprehension of public health within the Tribe; 2) the creation of a community public health task force; 3) the design of a tribally applicable assessment instrument; and 4) improved collaboration between the Tribe and the scientific community. This project demonstrated that public health assessment in tribal communities is feasible and valuable. Further, the development of a tribally applicable instrument highlights a significant tribal contribution to research and assessment.

Environment Canada. (2003). Science of Climate Change – Impacts of Climate Change. Retrieved from http://www.msc.ec.gc.ca/education/scienceofclimatechange/understanding/impacts_e.html

Environment Canada. (2007). The Green Lane: Climate Change – Science of Climate Change. Retrieved from http://www.ec.gc.ca/climate/overview_science-e.html

Environmental Health Services. (2008). *Cleaning Instructions For Drinking Water Storage Tanks.* Stanton Territorial Health Authority. Retrieved from http://www.hlthss.gov.nt.ca/pdf/brochures_and_fact_sheets/environmental_health/2008/english/cleaning_and_disinfecting_water_storage_tanks.pdf.

Evans, M., Sinclair, R.C., Fusimalohi, C., & Liava'a, V. (2001). Globalization, diet, and health: An example from Tonga. *Bulletin of the World Health Organization, 79*(9), 856-862. Retrieved from, http://www.who.int/bulletin/archives/79(9)856.pdf.

Abstract:
The increased flow of goods, people, and ideas associated with globalization have contributed to an increase in noncommunicable diseases in much of the world. One response has been to encourage lifestyle changes with educational programmes, thus controlling the lifestyle-related disease. Key assumptions with this approach are that people's food preferences are linked to their consumption patterns, and that consumption patterns can be transformed through educational initiatives. To investigate these assumptions, and policies that derive from it, we undertook a broad-based survey of food-

related issues in the Kingdom of Tonga using a questionnaire. Data on the relationships between food preferences, perception of nutritional value, and frequency of consumption were gathered for both traditional and imported foods. The results show that the consumption of health-compromising imported foods was unrelated either to food preferences or to perceptions of nutritional value, and suggests that diet-related diseases may not be amenable to interventions based on education campaigns. Given recent initiatives towards trade liberalization and the creation of the World Trade Organization, tariffs or import bans may not serve as alternative measures to control consumption. This presents significant challenges to health policy-makers serving economically marginal populations and suggests that some population health concerns cannot be adequately addressed without awareness of the effects of global trade.

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Faragher, J. (2003, August). *Proceedings of the 3rd National Herb, Native Foods and Essential Oils Convention, Workshops and Farm Visits, Lismore, NSW, Australia.* Australia: Rural Industries Research and Development Corporation. Retrieved from, http://www.rirdc.gov.au/reports/EOI/04-059.pdf.

Farber, J., & Todd, E. C. D. (2000). *Safe handling of foods.* New York: Marcel Dekker.

Fayer, R., Dubey, J., & Lindsay, D. (2004). Zoonotic protozoa: from land to sea. *Trends in Parasitology, 20*(11), 531-536. doi:10.1016/j.pt.2004.08.008.

Abstract:

Attention to worldwide pollution of the coastal marine environment has focused primarily on toxic algal blooms and pathogenic bacteria that multiply in nutrient-rich waters. However, massive but unseen amounts of feces from humans, their pets, and their domesticated animals are discharged, dumped, or carried in runoff, bringing encysted zoonotic protozoan parasites to estuaries and coastal waters. Here, they contaminate bathing beaches, are filtered and concentrated by shellfish eaten by humans and marine mammals, and infect a wide range of marine animal hosts, resulting in morbidity and mortality to some populations. This review addresses the extent of contamination and the animals affected by three genera of important zoonotic protozoa: Giardia, Cryptosporidium and Toxoplasma.

Federal House of Commons (n.d.). *The Standing Committee on Aboriginal Affairs and Northern Development Seventh Report, 39th Parliament, 1st Session.* Retrieved from, http://cmte.parl.gc.ca/cmte/CommitteePublication.aspx?SourceId=197734.

Fediuk, K., Hidiroglou, N., Madere, R., & Kuhnlein, H.V. (2002). Vitamin C in Inuit traditional food and women's diets. *Journal of Food Composition and Analysis, 15* (3), 221-235.

Abstract:

Vitamin C values for 37 traditional foods (TFs) of the Inuit of the Canadian Arctic and women's intakes from TF and market food (MF) are reported. This is the first report on vitamin C values in several traditional food samples. There are a variety of rich sources of vitamin C from animal and plant food with the most notable among items with multiple samples being raw fish (Coregonus spp.) eggs (49.6+/-12.3 mg/100 g, mean+/-S.D.), raw whale (Delphinapterus leucas and Monodon monoceros)
skin, locally termed "mattak", (36.0+/-8.7 and 31.5+/-7.0 mg/10 g), caribou liver (Rangifer tarandus) (23.8+/-4.9 mg/100 g), ringed seal liver (Phoca hispida) (23.8+/-3.8 mg/100 g), and blueberries (Vaccinium uliginosum) (26.2+/-4.9 mg/100 g). Dietary analysis of 20-40-year-old women's 24-h recalls for vitamin C as TF and MF revealed total mean intake of 60+/-8 mg/day (mean+/-S.E.). TF contributed only 20% of total intake, although there was significant seasonal variation (P < 0.02). While rich sources of vitamin C are present as TF, the primary contemporary dietary sources of this nutrient are fortified MF.

Fenger, H.J. (1988). The Pattern of Illness in Greenland Arctic Ocean. *Ugeskrift for Laeger, 150*(4), 251-253.

Fenn, D.C., Beiergrohslein, M., & Ambrosio, J. (2007). Southcentral Foundation tobacco cessation initiative. *International Journal of Circumpolar Health, 66*(Suppl 1), 23-28. Retrieved from, http://ijch.fi/.
Abstract:
OBJECTIVES: To describe the development of a comprehensive tobacco cessation program for Alaska Native and American Indian patients in a primary care setting utilizing current evidence-based guidelines. STUDY DESIGN: Cross-sectional. METHODS: A multidisciplinary team was assembled with representation from various departments including customers of the health care system to develop the tobacco cessation program. Feedback and guidance from the team were implemented and quit rates were calculated. RESULTS: In April 2005 the point prevalence of quitting among the 322 patients enrolled in the tobacco cessation program for 6 months was 21.1%. CONCLUSIONS: Recognized clinical interventions that reduce tobacco use were effective in reducing tobacco use among the Alaska Native and American Indian patients enrolled in the tobacco cessation program. Initial results with respect to the quit rate and tobacco use screening rate provide a baseline for future work.

Feskens, E.J.M., & Kromhout, D. (1993). Regional differences in Indian health: Epidemiologic studies on Eskimos and Fish Intake. *Annals of the New York Academy of Sciences, 683*, 9-15.

Fiore, A. (2004). Hepatits A transmitted by food. *Clinical Infections Disease, 38*(5), 705-15.

First Nations Agricultural Association. (2007). *First Nations Community Food Systems for Healthy Living – Guide to Applicants*. Retrieved from, http://www.fnala.com/CFSApplicaionGuidelines.pdf

First Nations and Inuit Health Branch. (2007). *Non-Insured Health Benefits.* Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/nihb-ssna/index_e.html

First Nations People of Canada. (2009). Encyclopedia. Woolwich, NSW, Australia: NationMaster.com. Retrieved from http://www.nationmaster.com/encyclopedia/First-Nation#Pacific_Coast_peoples

Fischer, J. R., Zhao, T., Doyle, M. P., Goldberg, M. R., Brown, C. A., Sewell, C. T., et al. (2001). Experimental and field studies of Escherichia coli O157:H7 in white-tailed deer. *Applied and Environmental Microbiology, 67*, 1218–1224. DOI: 10.1128/AEM.67.3.1218-1224.2001.

Fisher, P.A., & Ball, T.J. (2005). Balancing empiricism and local cultural knowledge in the design of prevention research. *Journal on Urban Health, 82*(2 Suppl 3), iii44-55. doi: 10.1093/jurban/jti063.

Abstract:
Prevention research aims to address health and social problems via systematic strategies for affecting and documenting change. To produce meaningful and lasting results at the level of the community, prevention research frequently requires investigators to reevaluate the boundaries that have traditionally separated them from the subjects of their investigations. New tools and techniques are required to facilitate collaboration between researchers and communities while maintaining scientific rigor. This article describes the tribal participatory research approach, which was developed to facilitate culturally centered prevention research in American Indian and Alaska Native communities. This approach is discussed within the broader context of community-based participatory research, an increasingly prevalent paradigm in the prevention field. Strengths and limitations of the approach used in the study are presented.

Fisk, A.T., Hobson, K.A., & Norstrom, R.J. (2001). Influence of Chemical and Biological Factors on Trophic Transfer of Persistent Organic Pollutants in the Northwater Polynya Marine Food Web. *Environtmental Science and Technology, 35* (4), 732-738. doi: 10.1021/es001459w.

Abstract:
Persistent organic pollutants (POPs) and stable isotopes of nitrogen (15N) were measured in zooplankton (6 species), a benthic invertebrate (Anonyx nugax), Arctic cod (Boreogadus saida), seabirds (6 species), and ringed seals (Phoca hispida) collected in 1998 in the Northwater Polynya to examine effects of biological and chemical factors on trophic transfer of POPs in an Arctic marine food web. Strong positive relationships were found between recalcitrant POP concentrations (lipid corrected) and trophic level based on stable isotopes of nitrogen, providing clear evidence of POP biomagnification in Arctic marine food webs. Food web magnification factors (FWMFs), derived from the slope of the POP-trophic level relationship, provided an overall magnification factor for the food web but over and underestimated biomagnification factors (BMFs) based on predator-prey concentrations in poikilotherms (fish) and homeotherms (seabirds and mammals), respectively. Greater biomagnification in homeotherms was attributed to their

greater energy requirement and subsequent feeding rates. Within the homeotherms, seabirds had greater BMFs than ringed seals, consistent with greater energy demands in birds. Scavenging from marine mammal carcasses and accumula tion in more contaminated winter habitats were considered important variables in seabird BMFs. Metabolic differences between species resulted in lower than expected BMFs, which would not be recognized in whole food web trophic level-POP relationships. The use of POP groups, such as PCB, is problematic because FWMFs and BMFs varied considerably between individual POPs. FWMFs of recalcitrant POPs had a strong positive relationship with log octanol-water partition coefficient (Kow). Results of this study show the utility of using 15 to characterize trophic level and trophic transfer of POPs but highlight the effects of species and chemical differences on trophic transfer of POPs that can be overlooked when a single magnification factor is applied to an entire food web.

Fitzgerald, W.F., Engstrom, D.R., Lamborg, C.H., Tseng, C.-M., Balcom, P.H., & Hammerschmidt, C.R. (2005). Modern and Historic Atmospheric Mercury Fluxes in Northern Alaska: Global Sources and Arctic Depletion. *Environmental Science and Technology, 39*(2), 557-568. doi: 10.1021/es049128x.

Abstract:

We reconstruct from lake-sediment archives atmospheric Hg deposition to Arctic Alaska over the last several centuries and constrain a contemporary lake/watershed mass-balance with real-time measurement of Hg fluxes in rainfall, runoff, and evasion. Results indicate that (a) anthropogenic Hg impact in the Arctic is of similar magnitude to that at temperate latitudes; (b) whole-lake Hg sedimentation determined from 55 210Pb-dated cores from the five small lakes demonstrates a 3-fold increase in atmospheric Hg deposition since the advent of the Industrial Revolution; (c) because of high soil Hg concentrations and relatively low atmospheric deposition fluxes, erosional inputs to these lakes are more significant than in similar temperate systems; (d) volatilization accounts for about 20% of the Hg losses (evasion and sedimentation); and (e) another source term is needed to balance the evasional and sedimentation sinks. This additional flux (1.21 ± 0.74 g m-2 yr-1) is comparable to direct atmospheric Hg deposition and may be due to some combination of springtime Arctic depletion and more generalized deposition of reactive gaseous Hg species.

Fleming, L.E.., Broad, K., Clement, A., Dewailly, E., Elmir, S., Knap, A. et al. (2006). Oceans and human health: Emerging public health risks in the marine environment. *Marine Pollution Bulletin, 53*(10-12), 545-560. doi:10.1016/j.marpolbul.2006.08.012.

Abstract:

There has been an increasing recognition of the inter-relationship between human health and the oceans. Traditionally, the focus of research and concern has been on the impact of human activities on the oceans, particularly through anthropogenic pollution and the exploitation of marine resources. More recently, there has been recognition of the potential direct impact of the oceans on human health, both detrimental and beneficial. Areas identified include: global change, harmful algal blooms (HABs), microbial and chemical contamination of marine waters and seafood, and marine models and natural products from the seas. It is hoped that through the recognition of the inter-dependence of the health of both humans and the oceans, efforts will be made to restore and preserve the oceans.

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Food and Agriculture Organization of the United Nations (FAO). (2003). Food security: concepts and measurement. In, *Trade reforms and food security. (pp. 44-53).* Retrieved from, http://www.fao.org/DOCREP/005/Y4671E/y4671e06.htm

Fontaine, J., Déwailly, E., Benedetti, J.-L., Pereg, D., Ayotte, P., & Déry, S. (2008). Re-evaluation of blood mercury, lead and cadmium concentrations in the Inuit population of Nunavik (Québec): a cross-sectional study. *Environmental Health, 7*, 25-37. doi:10.1186/1476-069X-7-25.

Forbes, L.B., Measures, L., Gajadhar, A., & C. Kapel. (2003). Infectivity of Trichinella nativa in Traditional Northern (Country) Foods Prepared with Meat from Experimentally Infected Seals. *Journal of Food Protection. 66*(10), 1857–1863.

Forge, F. (2003). *Food safety: An overview of Canada's approach.* Ottawa, Canada: Science and Technology Division, Depository Services Program. Retrieved from, http://dsp-psd.tpsgc.gc.ca/Collection-R/LoPBdP/BP/prb0240-e.htm

Foulkes, R.G. (1994). Mass Fluoride Poisoning, Hooper Bay, Alaska-A Review of the Final Report of the Alaska Department of Health and Human Services. *Fluoride, 37*(1), 32-36. Retrieved from, http://www.fluoridation.com/poison.htm.

Abstract:

The death of a 41-year-old male and the illness of approximately 296 others on May 21-23, 1992, in Hooper Bay Alaska has been shown to be due to acute fluoride intoxication caused by malfunction of the fluoridation equipment of system 1 of the village's two-system (well) water supply. Fluoride levels were reported to be as high as 150 ppm. The "Final Report" prepared by the Section of Epidemiology, Alaska Department of Environmental Conservation (DEC) and the US Public Health Service (USPHS) is dated April 12, 1993. This document shows that gastro-intestinal symptoms were predominant. The investigators "suggest" that the minimum lethal dose for fluoride, when consumed by humans over 24-32 hours, is 20 mg/kg. This is higher than the "probably toxic dose" of 5 mg/kg calculated for a single ingestion (Whitford 1989). Serum half life of 3.5 hours of the hospitalized patient was within the range previously reported (Ekstrand et al 1980). However, the recovery time of 19 days for plasma fluoride and systemic toxicity was longer than previously reported (Heifetz and Horowitz 1986). The level of dose causing illness, 0.3 mg/kg, was 27 times lower than the dose previously reported; for example, the "maximum safely tolerated dose" of 8.0 mg/kg (Heifetz and Horowitz 1986). The final report cites a number of reasons for the system failure. These include human error, mechanical failure, lack of safety features and failure to comply with regulations. The report recommends re-affirmation of fluoridation by the Alaska Division of Public

Health; the determination by USPHS and DEC that operational safety features are in place; and, that DEC should ensure compliance with regulations.

Foster, G., & Kaferstein, F.K. (1985). Food Safety and the Behavioural Sciences. *Social Science & Medicine, 21*(11), 1273-1277. doi:10.1016/0277-9536(85)90277-1.
Abstract:
International health programmes have been a major stimulus to the development of several specialties collectively known as medical behavioural science. Each new programme of the international and national agencies has led to an expansion of the areas of behavioural scientists in health research. This may also be expected from WHO's Food Safety Programme; its activities, and the findings contained in the report of a recently held meeting of a Joint FAO/WHO Expert Committee on Food Safety, are bringing to light the need for, and the opportunities in, behavioural science research on food safety. Although significant behavioural research has been done in nutrition and the treatment of diarrhoeal diseases, almost no attention has been paid to the ways in which food is rendered unsafe for human consumption or to the ways in which food safety can be increased. Suggestions are made as to the kinds of research needed, the data that must be gathered, and the ways in which, especially through health education, this information can be made operational.

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Furgal, C., & Seguin, J. (2006). Climate Change, Health, and Vulnerability in Canadian Northern Aboriginal Communities. *Environmental Health Perspectives*, 114(12), 1964-1970. Retrieved from, http://www.ehponline.org/.

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Furgal, C.M., Powell, S., & Myers, H. (2005). Digesting the Message about Contaminants and Country Foods in the Canadian North: A Review and Recommendations for Future Research and Action. *Arctic, 58*(2). Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_journal.

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Gadsby, P. (2004, October). The Inuit Paradox: How can people who gorge on fat and rarely see a vegetable be healthier than we are? *Discover*, 25 (10).

Gamberg, M., Braune, B., Davey, E., Elkin, B., Hoekstra, P.F., Kennedy, D. et al. (2005). Spatial and temporal trends of contaminants in terrestrial biota from the Canadian Arctic. *The Science of the Total Environment, 1*(351-352), 148-164.

Garrett, M., & Carroll, J. (2000). Mending the Broken Circle: Treatment of Substance Dependence Among Native Americans. *Journal of Counselling and Development, 78*(4), 379-388.

Garrett, E.S., Jahncke, M.L., & Tennyson, J.M. (1997). Microbiological hazards and emerging food-safety issues associated with seafoods. *Journal of Food Protection., 60*(11), 1409

Gaskov, A., Yu Savchenkov, M. F., & Yushkov, N. N. (2005). The specific features of the development of iodine deficiencies in children living under environmental pollution with fluorine compounds. *Gigiena I Sanitariya, 6*, 53-55.

Gebbink, W., Sonne, C., Dietz, R., Kirkegaard, M., Born, E., Muir, D.C.G., et al. (2008). Target Tissue Selectivity and Burdens of Diverse Classes of Brominated and Chlorinated Contaminants in Polar Bears (Ursus maritimus) from East Greenland. *Environmental Science and Technology, 42*(3), 752 – 759. doi: 10.1021/es071941f.

Abstract:
The tissue-specific composition of sum classes of brominated and chlorinated contaminants and metabolic/degradation byproducts was determined in adult male and female polar bears from East Greenland. Significantly ($p < 0.05$) higher concentrations of Σ-PCBs, various other organochlorines such as Σ-CHL, p,p′-DDE, Σ-CBz, Σ-HCHs, octachlorostyrene (OCS), Σ-mirex, dieldrin, the flame retardants Σ-PBDEs, and total-(α)-hexabromocyclododecane (HBCD), Σ-methylsulfonyl (MeSO2)-PCBs and 3-MeSO2-p,p′-DDE, were found in the adipose and liver tissues relative to whole blood and brain. In contrast, Σ-hydroxyl (OH)-PCB, 4-OH-heptachlorostyrene and Σ-OH-PBDE concentrations were significantly highest ($p < 0.05$) in whole blood, whereas the highest concentrations of Σ-OH-PBBs were found in the adipose tissue. Based on the total concentrations of all organohalogens in all three tissues and blood, the combined body burden was estimated to be 1.34 ± 0.12 g, where >91% of this amount was accounted for by the adipose tissue alone, followed by the liver, whole blood, and brain. These results show that factors such as protein association and lipid solubility appear to be differentially influencing the toxicokinetics, in terms of tissue composition/localization and burden, of organohalogen classes with respect to chemical structure and properties such as the type of halogenation (e.g., chlorination or bromination), and the presence or absence of additional phenyl group substituents (e.g., MeO and OH groups). The tissue- and blood-specific accumulation (or retention) among organohalogen classes indicates that exposure and any potential contaminant-mediated effects in these polar bears are likely tissue or blood specific.

Gebre, Y., Manfreda, J., & Hershfield, E. (1993). Outbreak of Tuberculosis in an Inuit (Eskimo) Community. *American Review of Respiratory Disease, 147*(4), A122. Retrieved from, http://ajrccm.atsjournals.org/cgi/content/full/168/11/1353.

Gelbart, B., Hansen-Knarhoi, M., Binns, P., & Krause, V. (2006). Rotavirus outbreak in a remote Aboriginal community: The burden of disease. *Journal of Pediatrics and Child Health, 42*(12), 775-780. doi: 10.1111/j.1440-1754.2006.00976.x.
Abstract:
Aim: To document the burden of disease caused by an outbreak of rotavirus (RV) gastroenteritis in a remote Aboriginal community. Methods: During an outbreak of RV gastroenteritis, data were collected from patients notes, hospital and laboratory data. Age, date of presentation, severity of illness, number of total presentations, presentations per patient, total clinic hours per presentation, stool analysis, treatment and outcomes were measured. These data were compared with a time period of equal duration in order to establish a baseline burden of gastroenteritis. Results: In a remote Aboriginal community 26 patients were managed for acute diarrhoea between 19 September 2005 and 5 October 2005. Gastroenteritis was the diagnosis in 24 cases for which there were 55 presentations. Stool specimens were analysed in 14 (58%) cases. RV was identified in eight (57%) of these specimens. The majority (80%) had mild disease. Moderate disease was noted in 15% and 5% were follow-up reviews. There were no severe cases of gastroenteritis. Four patients required evacuation to hospital. From a total of 607 presentations to the clinic during this time period, 55 (9%) were managed for acute diarrhoea. In the comparative time period there were five (0.9%) cases of acute diarrhoea from a total of 571 presentations. Conclusion: Rotavirus gastroenteritis places a large burden on remote Aboriginal communities and health-care centres in the form of morbidity, overworked clinic staff, economic cost and reduced capacity for primary health-care duties.

Genenah, A., & Shimizu, Y. (1981). Specific toxicity of paralytic shellfish poisons. *Journal of Agriculture and Food Chemistry, 29* (6), 1289-1291. doi: 10.1021/jf00108a047.

GeoGratis. (2009). Ecosystem 1. Sherbrooke, QC, Canada: Natural Resources Canada. Retrieved from, http://geogratis.cgdi.gc.ca/Ecosystem/1_ecosys/ecozon.htm

Gessner B., & Beller M. (1994a). Moose Soup Shigellosis in Alaska. *The Western Journal of Medicine, 160* (5), 430-433. Retrieved from, http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=8048226.
Abstract:
Following a community gathering held in early September 1991, an outbreak of gastroenteritis occurred in Galena, Alaska. We conducted an epidemiologic investigation to determine the cause of the outbreak. A case of gastroenteritis was defined as diarrhea or at least 2 other symptoms of gastrointestinal illness occurring in a Galena resident within a week of the gathering. Control subjects included asymptomatic residents who either resided with an affected person or were contacted by us during a telephone survey. Of 25 case-patients, 23 had attended the gathering compared with 33 of 58 controls. Among persons who attended the gathering and from whom we obtained a food consumption history, 17 of 19 case-patients and 11 of 22 controls ate moose soup. No other foods served at the gathering were associated with illness. Ten case-patients had culture-confirmed Shigella sonnei. Many pots of moose soup were served each day, and persons attended the gathering and ate moose soup on more than 1 day. Moose soup was

prepared in private homes, allowed to cool, and usually served the same day. We identified 5 women who had prepared soup for the gathering and in whose homes at least 1 person had a gastrointestinal illness occur at the time of or shortly before soup preparation. This investigation suggests that eating contaminated moose soup at a community gathering led to an outbreak of shigellosis and highlights the risk of eating improperly prepared or stored foods at public gatherings.

Gessner, B., & Beller, M. (1994b). Protective effect of Conventional Cooking versus Use of Microwave-ovens in an Outbreak of Salmenollosis. *American Journal of Epidemiology, 139*(9), 903-909. Retrieved from, http://aje.oxfordjournals.org/.

Abstract:

The authors conducted an investigation to determine the extent and source of an outbreak of Salmonella typhimurium gastroenteritis that occurred following a community picnic in Juneau, Alaska, in 1992, and to evaluate risk factors for illness. A case-control study among 54 picnic attendees and a retrospective cohort study among 60 members of 17 households who had taken home leftover food from the picnic were conducted. A case was defined as diarrhea with onset 12-72 hours after eating food that had been prepared for the picnic. The case-control study associated illness with eating roast pork from one of two pigs that had been flown in from a Seattle, Washington, restaurant. The roast pork was taken home by persons from at least the 17 households included in the cohort study. The cohort study identified 43 persons who ate roast pork, of whom 21 (49%) became ill. This compared with only one case of illness among 17 cohort members who had not eaten roast pork (relative risk = 8.3, 95% confidence interval 1.2-57.0). Of 30 persons who ate reheated meat, al 10 who used a microwave oven became ill, compared with none of 20 who used a conventional oven or skillet. The Seattle restaurant had prepared the roast pork by first thawing two frozen pigs for several hours at room temperature and then cooking them in a gas-fired flame broiler. One of the pigs was left unrefrigerated for 17-20 hours after cooking. Compared with conventional methods of reheating, microwave ovens had no protective effect in preventing illness. To prevent outbreaks such as this one, care must be taken to assure that food is both properly cooked and handled and properly reheated.

Gessner, B., & Wickizer, T. (1997). The contribution of infectious diseases to infant mortality in Alaska. *Pediatric Infectious Disease Journal, 16*(8), 773-779. Retrieved from, www.pidj.com/.

Abstract:

Background. Based on death certificates to determine cause of death, current research suggests that infectious diseases are less important causes of infant mortality than in the past. Methods. To determine the contribution of infectious diseases to infant mortality and the sensitivity of death certificates for identifying infectious disease causes of death, we examined information from multiple sources for a population-based sample of infant deaths that occurred in Alaska during 1992 through 1994. Results. We collected information for 181 of 272 reported infant deaths and identified 48 infants for whom an infection was a primary (n = 15), contributing (n = 12) or suspected (n = 21) cause of death (infectious disease-related infant mortality rate, 2.2/1000 live births). Of these 48 deaths 27 were associated with a maternal peripartum infection and 15 were associated with a postneonatal respiratory tract infection. A specific organism was identified for 15 of 29 infants who died during the neonatal period and for 5 of 19 infants who died during the postneonatal period (including 2 with coagulase-negative Staphylococcus and the rest with a variety of other organisms). Death certificates identified an in fectious disease as a primary or contributing cause of death for 19 infants (sensitivity, 40%) and reported a specific organism for 4 infants. Conclusions. infectious diseases caused or contributed to a high proportion of infant mortality in Alaska during 1992 through 1994. Death certificates had poor sensitivity for identifying infectious disease-related infant deaths.

Gessner, B., Beller, M., Middaugh, J., & Whitford, G. (1994). Acute Fluoride Poisoning from a Public Water-system. *New England Journal of Medicine*, *330*(2), 95-99. Retrieved from, http://content.nejm.org/cgi/content/full/330/2/95.

Abstract:

Acute fluoride poisoning produces a clinical syndrome characterized by nausea, vomiting, diarrhea, abdominal pain, and paresthesias. In May 1992, excess fluoride in one of two public water systems serving a village in Alaska caused an outbreak of acute fluoride poisoning. Methods. We surveyed residents, measured their urinary fluoride concentrations, and analyzed their serum-chemistry profiles. A case of fluoride poisoning was defined as an illness consisting of nausea, vomiting, diarrhea, abdominal pain, or numbness or tingling of the face or extremities that began between May 21 and 23. Results. Among 47 residents studied who drank water obtained on May 21, 22, or 23 from the implicated well, 43 (91 percent) had an illness that met the case definition, as compared with only 6 of 21 residents (29 percent) who drank water obtained from the implicated well at other times and 2 of 94 residents (2 percent) served by the other water system. We estimated that 296 people were poisoned; 1 person died. Four to five days after the outbreak, 10 of the 25 case patients who were tested, but none of the 15 control subjects, had elevated urinary fluoride concentrations. The case patients had elevated serum fluoride concentrations and other abnormalities consistent with fluoride poisoning, such as elevated serum lactate dehydrogenase and aspartate aminotransferase concentrations. The fluoride concentration of a water sample from the implicated well was 150 mg per liter, and that of a sample from the other system was 1.1 mg per liter. Failure to monitor and respond appropriately to elevated fluoride concentrations, an unreliable control system, and a mechanism that allowed fluoride concentrate to enter the well led to this outbreak. Conclusions. Inspection of public water systems and monitoring of fluoride concentrations are needed to prevent outbreaks of fluoride poisoning.

Gessner, B., Messner, B., & Middaugh, J. (1995). Paralytic Shellfish Poisoning in Alaska-A 20 Year Retrospective Analysis. *American Journal of Epidemiology, 141* (8), 766-770. Retrieved from, http://aje.oxfordjournals.org/cgi/content/abstract/141/8/766.

Abstract:

Outbreaks of paralytic shellfish poisoning have occurred worldwide. The authors reviewed records at the Alaska Division of Public Health to determine the epidemiologic characteristics of this disease. To assess risk factors for illness, the authors conducted a case-control study. A case was defined as illness compatible with paralytic shellfish poisoning within 12 hours of the consumption of shellfish, and a control was defined as a non-ill participant at a meal in which at least one case occurred. The authors documented 54 outbreaks of paralytic shellfish poisoning involving 117 ill persons from 1973 to 1992. One person died, four (3%) required intubation, and 29 (25%) required an emergency flight to a hospital. Outbreaks occurred with multiple shellfish species, during all four seasons, and at many locations. During the case-control study, illness was not associated with the shellfish toxin level, method of preparation, dose, race, sex, or age; alcohol consumption was associated with a reduced risk of illness (odds ratio = 0.05; p = 0.03). Although paralytic shellfish poisoning causes significant illness, the authors could not identify risk factors with clear implications for prevention strategies. This suggests that shellfish from uncertified beaches should not be eaten. Alcohol may protect against the adverse effects of paralytic shellfish poison.

Gessner, B., Bell, P., Doucette, G., Moczydlowski, E., Poli, M., VanDolah, F., et al. (1997). Hypertension and identification of toxin in human urine and serum following a cluster of mussel-associated paralytic shellfish poisoning outbreaks. *Toxicon, 35*(5), 711-722. doi:10.1016/S0041-0101(96)00154-7.

Abstract:

Following four outbreaks of paralytic shellfish poisoning on Kodiak Island, Alaska, during 1994, medical records of ill persons were reviewed and interviews were conducted, Urine and serum specimens were analyzed at three independent laboratories using four different saxitoxin binding assays, High-performance liquid chromatography was used to determine the presence of specific toxin congeners, Among 11 ill persons, three required mechanical ventilation and one died, Mean peak systolic and diastolic blood pressure measurements were 172 (range 128-247) and 102 (range 78-165) mmHg, respectively, and blood pressure measurements corresponded with ingested toxin dose, All four different laboratory methodologies detected toxin in serum at 2.8-47 nM during acute illness and toxin in urine at 65-372 nM after acute symptom resolution. The composition of specific paralytic shellfish poisons differed between mussels and human biological specimens, suggesting that human metabolism of toxins had occurred. The results of this study indicate that saxitoxin analogues may cause severe hypertension. In addition, we demonstrate that saxitoxins can be detected in human biological specimens, that nanomolar serum toxin levels may cause serious illness and that human metabolism of toxin may occur. Clearance of paralytic shellfish poisons from serum was evident within 24 hr and urine was identified as a major route of toxin excretion in humans. (C)

Ghebrehewet, S., & Stevenson, L. (2003). Effectiveness of home-based food storage training: a community development approach. *International Journal of Environmental Health Research*, 13, S169-S174.

Gilbert, T., Nobmann, E., & Zephier, E. (1992). *American Indian and Alaska native foods: special considerations*. National Nutrient Data Bank Conference, Maryland.

Gilbreath, S., & Kass, P. H. (2006). Adverse birth outcomes associated with open dumpsites in Alaska native villages. *American Journal of Epidemiology, 164*(6), 518-528. Retrieved from, http://aje.oxfordjournals.org/cgi/reprint/164/6/518.

Abstract:
This retrospective cohort study evaluated adverse birth outcomes in infants whose birth records indicated maternal residence in villages containing dumpsites potentially hazardous to health and environment. Birth records from 1997 to 2001 identified 10,073 eligible infants born to mothers in 197 Alaska Native villages. Outcomes included low or very low birth weight, preterm birth, and intrauterine growth retardation. Infants from mothers in villages with intermediate (odds ratio (OR) = 1.73, 95% confidence interval (CI): 1.06, 2.84) and high (OR = 2.06, 95% CI: 1.28, 3.32) hazard dumpsites had a higher proportion of low birth weight infants than did infants from mothers in the referent category. More infants born to mothers from intermediate (OR = 4.38, 95% CI: 2.20, 8.77) and high (OR = 3.98, 95% CI: 1.93, 8.21) hazard villages suffered from intrauterine growth retardation. On average, infants weighed 36 g less (95% CI: –71.2, –0.8) and 55.4 g less (95% CI: –95.3, –15.6) when born to highly exposed mothers than did infants in the intermediate and low exposure groups, respectively, an effect even larger in births to Alaska Native mothers only. No differences in incidence were detected across exposure levels for other outcomes. This is the first study to evaluate adverse pregnancy outcomes associated with open dumpsites in Alaska Native villages.
Alaska; environmental exposure; ethnic groups; fetal growth retardation; hazardous waste; infant, low birth weight; pregnancy outcome; premature birth
NED risk reduction

Gill, C.O. (2007). Microbiological conditions of meats from large game animals and birds. *Meat Science, 77*(2), 149-160. doi:10.1016/j.meatsci.2007.03.007.

Gilman, A. (2002). *Risk reduction strategies for Arctic peoples.* (Chapter 10). Arctic Monitoring and Assessment Programme, Norway.

Gittelsohn, J., Davis, S. M., Steckler, A., Ethelbah, B., Clay, T., Metcalfe, L., et al. (2003). Pathways: lessons learned and future directions for school-based interventions among American Indians. *Preventive Medicine, 37,* S107–S112. doi:10.1016/j.ypmed.2003.08.001.
Abstract:
BACKGROUND: Pathways, a multicenter study to test the effect of a school-based program to prevent obesity in American Indian children, yielded many benefits and encountered many challenges. This paper explores what we have learned from this study and examines possible future directions. METHODS: Information presented in this paper is based on formative research, study results, and discussions with staff and investigators. RESULTS: Some of the lessons learned relate to having a strong relationship with the tribes, how best to engage the communities, the importance of formative research and achieving standardization in culturally diverse settings, how to incorporate cultural information into curricula, and the importance of family involvement. One of the strengths of the study was the collaborative process that teamed American Indian and non-American Indian investigators and staff. Researchers recognized that they must work in cooperation with research participants including their schools and communities to address challenges, to ensure accurate findings and analyses, and to share benefits. CONCLUSIONS: The lessons learned from Pathways offer valuable insights for

researchers into successful approaches to the challenges inherent in research in American Indian communities, particularly in schools, and how to maximize the benefits of such a study.

Gittlesohn, J., Evans, M., Helitzer, D., Anliker, J., Story, M., Metcalfe, L., et al. (1998). Formative research in a school-based obesity prevention program for Native American school children (Pathways). *Health Education Research, 13*(2), 251-265. Retrieved from, http://her.oxfordjournals.org/cgi/content/abstract/13/2/251.

Abstract:

This paper describes how formative research was developed and implemented to produce obesity prevention interventions among school children in six different Native American nations that are part of the Pathways study. The formative assessment work presented here was unique in several ways: (1) it represents the first time formative research methods have been applied across multiple Native American tribes; (2) it is holistic, including data collection from parents, children, teachers, administrators and community leaders; and (3) it was developed by a multi-disciplinary group, including substantial input from Native American collaborators. The paper describes the process of developing the different units of the protocol, how data collection was implemented and how analyses were structured around the identification of risk behaviors. An emphasis is placed on describing which units of the formative assessment protocol were most effective and which were less effective.

Gittelsohn, J., Wolever, T., Harris, S., Harris-Giraldo, R., Hanley, A., & Zinman, B. (1997). Specific Patterns of Food Consumption and Preparation are Associated with Diabetes and Obesity in a Native Canadian Community. *Journal of Nutrition, 128,* 541-547.

Glassmeyer, S.T., Furlong, E.T., Kolpin, D.W., Cahill, J.D., Zaugg, S.D., Werner, S.L., et al. (2005). Transport of Chemical and Microbial Compounds from Known Wastewater Discharges: Potential for Use as Indicators of Human Fecal Contamination. *Environmental Science and Technology, 39* (14), 5157-5169. doi: 10.1021/es048120k.

Abstract:

The quality of drinking and recreational water is currently (2005) determined using indicator bacteria. However, the culture tests used to analyze for these bacteria require a long time to complete and do not discriminate between human and animal fecal material sources. One complementary approach is to use chemicals found in human wastewater, which would have the advantages of (1) potentially shorter analysis times than the bacterial culture tests and (2) being selected for human-source specificity. At 10 locations, water samples were collected upstream and at two successive points downstream from a wastewaster treatment plant (WWTP); a treated effluent sample was also collected at each WWTP. This sampling plan was used to determine the persistence of a chemically diverse suite of emerging contaminants in streams. Samples were also collected at two reference locations assumed to have minimal human impacts. Of the 110 chemical analytes investigated in this project, 78 were detected at least once. The number of compounds in a given sample ranged from 3 at a reference location to 50 in a WWTP effluent sample. The total analyte load at each location varied from 0.018 g/L at the reference location to 97.7 g/L in a separate WWTP effluent sample. Although most of the compound concentrations were in the range of 0.01-1.0 g/L, in some samples, individual concentrations were in the range of 5-38 g/L. The concentrations of the majority of the chemicals present in the samples generally followed the expected trend: they were either nonexistent or at trace levels in the upstream samples, had their maximum concentrations in the WWTP effluent samples, and then declined in the two downstream samples. This research suggests that selected chemicals are useful as tracers of human wastewater discharge.

Gosselin, P., Owens, S., Furgal, C., Martin, D., & Turner, G. (2002). *Public Health Surveillance and Climate Change Case Study Results in Nunatsiavut*. [Poster]. Arctic Net.

Gouteux, B., Lebeuf, M., Hammill, M.O., Muir, D.C.G., & Gagne, J.-P. (2005). Comparison of Toxaphene Congeners Levels in Five Seal Species from Eastern Canada: What Is the Importance of Biological Factors? *Environmental Science and Technology, 39*(6), 1448-1454. doi: 10.1021/es048886k.

Abstract:
Environmentally relevant chlorobornanes (CHBs) were measured in blubber samples of harbor (Phoca vitulina), gray (Halichoerus grypus), harp (Phoca groenlandica), and hooded seals (Cystophora cristata) sampled in different part of the St. Lawrence marine ecosystem (SLME) and ringed seals (Phoca hispida) sampled in the eastern Canadian Arctic waters. The purpose of this study was to compare the levels of six CHBs (Parlar-26, -40/-41, -44, -50, and -62) among the five seal species. Seal species could be separated into three groups based on their respective CHB mean concentrations (±standard error): gray (49 ± 3.9 ng/g lipid weight) and harbor (80 ± 20 ng/g lipid weight) seals were more contaminated than ringed seals (18 ± 7.6 ng/g lipid weight) but less contaminated than harp (370 ± 87 ng/g lipid weight) and hooded (680 ± 310 ng/g lipid weight) seals. These differences are not expected to be related to different sources of toxaphene contamination, since both the SLME and the eastern Canadian Arctic environments are thought to be mainly contaminated via atmospheric transport from the southeastern part of the United States. Thus, biological factors such as sex, age, nutritive condition, metabolism capacity, and diet of the animals collected were considered. Results reported in this study indicated that the diet is likely the main factor accounting for interspecies variations in toxaphene contamination in seals from eastern Canada.

Government of Canada. (2007). *Procedure for addressing drinking water advisories in first nation's communities south of 60^o*. Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/alt_formats/fnihb-dgspni/pdf/pubs/water-eau/2007_water-qualit-eau_e.pdf

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Government of Northwest Territories. (2005). The NWT health status report 2005. Yellowknife, NWT: Government of Northwest Territories, Northwest Territories Health and Social Services. Retrieved from, http://pubs.aina.ucalgary.ca/health/60751.pdf

Government of Western Australia: Department of Health, Office of Aboriginal Affairs. (2000). A Best Practice Model for Health Promotion Programs in Aboriginal Communities [Pamphlet]. Retrieved from, http://www.diabetes.health.wa.gov.au/docs/1887%20BestPraciceModel19402.pdf

Graham, J. (2003). *Policy Brief #14- Safe Water for First Nations: Charting a Course for Reform.* Retrieved from, http://www.iog.ca/publications/policybrief14.pdf

Greater Vancouver Regional District. (2003). *A profile of Aboriginal People, First Nations and Indian Reserves in greater Vancouver*. Retrieved from, http://www.gvrd.bc.ca/growth/pdfs/aboriginal-profile.pdf.

Greer, A., Ng, V., & Fisman, D. (2008). Climate change and infectious diseases in North American: the road ahead. *Canadian Medical Association Journal, 178*(6), 715-722.

Grainge, J., & Shaw, J. (1974). *Health and Sanitation Problems in the Arctic*. [Symposium]. Arizona: University of Arizona Press.

Green, L.R., Selman, C.A., Radke, V., Ripley, D., Mack, J.C., Reimann, D.W. et al. (2006). Food worker hand washing practices: an observation study. *Journal of Food Protection*, *69*(10), 2417-2423.

Green, L.R., Radke, V., Mason, R., Bushnell, L., Reimann, D.W., Mack, J.C., et al. (2007). Factors related to food worker hand hygiene practices. *Journal of Food Protection*, *70*(3), 661-666.

Greger, M., Malm, T., & Kautsky, L. (2007). Heavy metal transfer from composted macroalgae to crops [electronic resource]. *European Journal of Agronomy, 26*(3), 257. doi:10.1016/j.eja.2006.10.003.

Grey, M., Furgal, C., & Bruneau, S. (2004). *A Regional Approach to Managing and Communicating Environment, Health and Nutrition Issues in the North: The Nunavik Nutrition and Health Committee.* Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_contents

Grondin, J., Proulx, J., Hodgins, S., Dewailly, E., & Blanchette, C. (1985). Review of food borne diseases in Nunavik. *International Journal of Circumpolar Health, 57* (Suppl 1), 225-7. Retrieved from, http://ijch.fi/.

Guyot, M., Dickson, C., Paci, C., Furgal, C., & Chan, H.M. (2006). Local observations of climate change and impacts on traditional food security in two northern aboriginal communities. *International Journal of Circumpolar Health*, 65(5), 403-415. Retrieved from, http://ijch.fi/.

Gyorkos, T.W., Maclean, J.D., Serhir, B., & Ward, B. (2003). Prevalence of parasites in Canada and Alaska: epidemiology past and present. In H. Akuffo, E. Linder, I. Ljungstrom, & M. Wahlgren (Eds.), *Parasites of the Colder Climates* (pp.77-86). New York, CRC Press.

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Halderson, K. (1998). *Alaska native food practices, customs, and holidays.* Chicago: American Dietetic.

Hall, S. (1972). Lead Pollution and poisoning. *Environmental Science and Technology, 6*(1), 30-35. doi: 10.1021/es60060a008.

Hall, S., Gessner, B., Poli, M., Eilers, P., Conrad, S., Waldron, E., & Brewer, V. (1996). An outbreak of paralytic shellfish poisoning in Kodiak, Alaska: Comparison of toxin detection methods. *Toxicon, 34*(3), 338. doi: 10.1016/0041-0101(96)81010-5.

Hamilton, A., Stagnitti, F., Premier, R., & Boland, A. (2006). Is the risk of illness through consuming vegetables irrigated with reclaimed wastewater different for different population groups? *Water Science and Technology, 54* (11-12), 379-386. doi: 10.1016/j.compag.2007.02.004.

Hamilton, S., Martin, J., Guyot, M., Trifonopoulos, M., Caughey, A., & Chan, H. (2004). Healthy living in Nunavut: an on-line nutrition course for Inuit communities in the Canadian arctic. *International Journal of Circumpolar Health. 63*(3):243-50. Retrieved from, http://ijch.fi/.

Abstract:
OBJECTIVES: It is recognized that empowerment of Indigenous Peoples through training and education is a priority. The objective was to design a course that would provide an innovative training approach to targeted workers in remote communities and enhance learning related to the Nunavut Food Guide, traditional food and nutrition, and diabetes prevention. STUDY DESIGN: A steering committee was established at the

outset of the project with representation from McGill University and the Government of Nunavut (including nutritionists, community nurses and community health representatives (CHRs), as well as with members of the target audience. Course content and implementation, as well as recruitment of the target audience, were carried out with guidance from the steering committee. METHODS: An 8-week long course was developed for delivery in January - March, 2004. Learning activities included presentation of the course content through stories, online self-assessment quizzes, time-independent online discussions and telephone-based discussions. Invitations were extended to all prenatal nutrition program workers, CHRs, CHR students, home-care workers, Aboriginal Diabetes Initiative workers and public health nurses in Nunavut. RESULTS: Ninety-six health-care workers registered for Healthy Living in Nunavut, with 44 actively participating, 23 with less active participation and 29 who did not participate. CONCLUSIONS: Despite having to overcome numerous technological, linguistic and cultural barriers, approximately 40% of registrants actively participated in the online nutrition course. The internet may be a useful medium for delivery of information to target audiences in the North.

Hammitt, L., Block, S., Hennessy, T., DeByle, C., Peters, H., Parkinson, A. et al. (2006). Outbreak of invasive Haemophilus influenzae serotype a disease. *Pediatric Infectious Disease Journal, 24*(5), 453-456. doi: 10.1097/01.inf.0000160954.90881.29.

Abstract:
Haemophilus influenzae serotype a is a rare cause of invasive disease. We report 5 cases of invasive H. influenzae type a that occurred in 3 infants living in a remote region of Alaska during the last 6 months of 2003. H. influenzae type a isolates from this outbreak were closely related as determined by pulsed field gel electrophoresis. Continued surveillance is necessary to monitor trends in H. influenzae invasive disease.

Hanninen, M., Haajanen, H., Pummi, T., Wermundsen, K., Katila, M., Sarkkinen, H., et al. (2003). Detection and typing of Campylobacter jejuni and Campylobacter coli and analysis of indicator organisms in three waterborne outbreaks in Finland. *Applied and Environmental Microbiology, 69*(3), 1391-1396. doi: 10.1128/AEM.69.3.1391-1396.2003.

Abstract:
Waterborne outbreaks associated with contamination of drinking water by Campylobacter jejuni are rather common in the Nordic countries Sweden, Norway, and Finland, where in sparsely populated districts groundwater is commonly used without disinfection. Campylobacters, Escherichia coli, or other coliforms have rarely been detected in potential sources. We studied three waterborne outbreaks in Finland caused by C. jejuni and used sample volumes of 4,000 to 20,000 ml for analysis of campylobacters; and sample volumes of 1 to 5,000 ml for analysis of coliforms and E. coli, depending on the sampling site. Multiple samples obtained from possible sources (water distribution systems and environmental water sources) and the use of large sample volumes (several liters) increased the chance of detecting the pathogen C. jejuni in water. Filtration of a large volume (1,000 to 2,000 ml) also increased the rate of detection of coliforms and E. coli. To confirm the association between drinking water contamination

and illness, a combination of Penner serotyping and pulsed-field gel electrophoresis (digestion with SmaI and KpnI) was found to be useful. This combination reliably verified similarity or dissimilarity of C. jejuni isolates from patient samples, from drinking water, and from other environmental sources, thus confirming the likely reservoir of an outbreak.

Hansen, J. (1996). Human health and diet in the Arctic. *The Science of the Total Environment, 186*, 135. Retrieved from, http://www.sciencedirect.com/science/journal/00489697.

Abstract:

Many Arctic communities rely on local food, in particular marine food, which provides essential nutrients beneficial to health, such as polyunsaturated fatty acids and selenium. However, marine food is also the main source of exposure to contaminants. Two main groups are listed as priority contaminants in the ongoing AMAP (Arctic Monitoring and Assessment Programme)project. These are heavy metals (mercury, cadmium and lead) and the organochlorines (PCBs, dioxins/furans,and chlorinated pesticides). The presence of these contaminants in the Arctic is a result of the combined effect of long distance transport from industrialized areas and biomagnification in the oceanic food chains. This results in a human exposure level which in several communities reaches levels in excess of internationally recognized limits for intake. Human exposure to heavy metals and organochlorinesis discussed in relation to the potential health risks and health benefits of specific food components in the Arctic diet. Risk management must be based on schemes to reduce the intake in groups with high susceptibility, i.e. pregnant women, through carefully planned recommendations of food intake within the frame of traditional diets.

Hansen, J., Deutch, B., & Pedersen, H. (2004). Selenium status in Greenland Inuit. *Science of the Total Environment, 331*, 207-214. Retrieved from, http://www.sciencedirect.com/science/journal/00489697.

Abstract:

In Greenland, the human intake of selenium has always been relatively high and is closely connected to intake of the traditional food of marine origin. Analyses of historic and present day human and animal hair samples have indicated that the selenium level in the marine environment has been constant over time, while the levels in humans have declined corresponding to a decrease in intake of traditional food. The Inuit population in Greenland is in dietary transition where western-style food will increasingly dominate. As a consequence, the ample supply of selenium may not be sustained in the future. We report here the selenium status in three Greenlandic population groups, ittoqqortoormiit and Tasiilaq on the east coast and Uummannaq on the west coast. Mean whole blood concentrations ranged from 178 mug/l in Tasiilaq men to 488 mug/l in Uummannaq men. Plasma concentrations ranged from 79 mug/l in Tasiilaq women to 113 mug/l in Uummannaq men. With increasing Se concentrations in whole blood, the plasma concentrations increased but tended to stabilise a level approximately 140 mug/l. Selenium blood levels were highly significantly correlated with long chain marine fatty acids. Dietary survey and food composition data from the west coast showed that whale skin, muktuk, is the main source of Se followed by birds, seal meat and organs, and fish. Terrestrial animals contributed only insignificantly to the selenium intake. In West

Greenland, daily Se intake (235 mug/day) was estimated by dietary survey; it corresponded well with a calculated intake (220 mug/day) based on the mean blood concentration. (C) 2004 Elsevier B.V. All rights reserved.

Hansen, C., Vogel, B., & Gram, L. (2006). Prevalence and survival of Listeria monocytogenes in Danish aquatic and fish-processing environments. *Journal of Food Protection, 69* (9), 2113-2122. doi: 10.1016/j.scitotenv.2004.03.037.
Abstract:
Listeria monocytogenes contamination of ready-to-eat food products such as cold-smoked fish is often caused by pathogen subtypes persisting in food-processing environments. The purpose of the present study was to determine whether these L. monocytogenes subtypes can be found in the outside environment, i.e., outside food processing plants, and whether they survive better in the aquatic environment than do other strains. A total of 400 samples were collected from the outside environment, fish slaughterhouses, fish farms, and a smokehouse. L monocytogenes was not detected in a freshwater stream, but prevalence increased with the degree of human activity: 2% in seawater fish farms, 10% in freshwater fish farms, 16% in fish slaughterhouses, and 68% in a fish smokehouse. The fish farms and slaughterhouses processed Danish rainbow trout, whereas the smokehouse was used for farm-raised Norwegian salmon. No variation with season was observed. Inside the processing plants, the pattern of randomly amplified polymorphic DNA (RAPD) types was homogeneous, but greater diversity existed among isolates from the outside environments. The RAPD type dominating the inside of the fish smokehouse was found only sporadically in outside environments. To examine survival in different environments, L. monocytogenes or Listeria innocua strains were inoculated into freshwater and saltwater microcosms. Pathogen counts decreased over time in Instant Ocean and remained constant in phosphate-buffered saline. In contrast, counts decreased rapidly in natural seawater and fresh water. The count reduction was much slower when the natural waters were autoclaved or filtered (0.2-mu m pore size), indicating that the pathogen reduction in natural waters was attributable to a biological mechanism, e.g., protozoan grazing. A low prevalence of L monocytogenes was found in the outside environment, and the bacteria did not survive well in natural environments. Therefore, L. monocytogenes in the outer environment associated with Danish fish processing is probably of minor importance to the environment inside a fish production plant.

Hanson, G., & Smylie, J. (2006). *Knowledge Translation (KT) for Indigenous Communities: A Policy Making Toolkit*. Retrieved from http://www.iphrc.ca/resources/ KT_Policy_Toolkit_Sept26%5B1%5D.pdf

Harb, J., Lem, M., Fyfe, M., Patrick, D., Ochnio, J., & Hockin, J. (2000). Hepatitis A in the Northern Interior of British Columbia: An outbreak among members of a First Nations community. *Canada Communicable Disease Report, 26*(19). Retrieved from, http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/00vol26/dr2619e.html.

Harner, T., Kylin, H., Bidleman, T.F., Halsall, C., Strachan, W.M.J., Barrie, et al. (1998).

Polychlorinated Naphthalenes and Coplanar Polychlorinated Biphenyls in Arctic Air. *Environmental Science and Technology, 32*(21), 3257 – 3265. doi: 10.1021/es9803106.

Abstract:

Concentrations of polychlorinated naphthalenes (PCNs) are reported for the first time in arctic air. The data represent combined air samples from the Barents Sea (n = 2), eastern Arctic Ocean (n = 10), Norwegian Sea (n = 2), and two land-based monitoring stations at Alert, Canada (n = 5), and Dunai Island in eastern Siberia, Russia (n = 3). Values for PCN (pg m-3) were 6-49 for shipboard samples and 0.3-8 for land-based stations and were dominated by the 3-Cl and 4-Cl homologues, which accounted for 90-95% of the total mass. Average values for PCB (pg m-3) for the shipboard samples were 126, 24, and 75 for the Barents Sea, eastern Arctic, and Norwegian Sea, respectively. Three-dimensional 5-day air parcel back-trajectories arriving at the ship at 850 and 925 hPa suggested that elevated PCB and PCN concentrations for shipboard samples originated in Europe. Concentrations (fg m-3) of coplanar PCBs in artic air were 3-40 (PCB 77) and 0.3-8 (PCB 126)-about an order of magnitude lower than in urban air. Higher concentrations of PCB 77 and PCB 126, 347 and 5.0 (fg m-3), respectively, were found in the Barents Sea for two samples with elevated PCBs. The proportion of coplanar PCBs to PCBs was within the range of values reported for Aroclor and Clophen mixtures. The 2,3,7,8-TCDD toxicity of the air samples was assessed in terms of the TEQ (dioxin toxic equivalents) contribution of mono-ortho PCBs (congeners 105, 114, 118, 156), non-ortho (coplanar) PCBs (congeners 77 and 126), and dioxin-like PCNs for which toxic equivalent factors have been determined. The results show a 13-67% TEQ contribution of PCNs in arctic air, and it is concluded that further investigation of this compound class is merited.

Harrison, J., Harrison, M., Rose-Morrow, R., & Shewelt, R. (2001). Home-Style Beef Jerky: Effect of Four Preparation Methods on Consumer Acceptability and Pathogen Inactivation. *Journal of Food Protection, 64*(8), 1194–1198.

Abstract:

The safety of homemade jerky continues to be questioned. Producing a safe product that retains acceptable quality attributes is important. Lethality of Salmonella, Escherichia coli O157:H7, and Listeria monocytogenes as well as consumer acceptability and sensory attributes of jerky prepared by four methods were examined. Preparation methods were drying marinated strips at 60°C (representing a traditional method), boiling strips in marinade or heating in an oven to 71°C prior to drying, and heating strips in an oven after drying to 71°C. A 60-member consumer panel rated overall acceptability. A 10-member descriptive panel evaluated quality attributes. Samples heated after drying and samples boiled in marinade prior to drying had slightly higher acceptability scores but were not statistically different from traditional samples. Although the four treatments were significantly different in color (P = 0.0001), saltiness (P = 0.0001), and texture (P = 0.0324), only texture appeared to influence overall consumer acceptability. Microbial challenge studies subjecting the pathogens to the four treatments showed a 5.8-, 3.9-, and 4.6-log reduction of E. coli O157:H7, L. monocytogenes, and Salmonella, respectively, even with traditional drying. Oven treatment of strips after drying was shown to have the potential to reduce pathogen populations further by approximately 2 logs. In conclusion,

a safer, yet acceptable home-dried beef jerky product can be produced by oven-heating jerky strips after drying.

Harvald, B., & Lynge, I. (2003). The Nordic Council for Arctic Medical Research. History, aims and achievements. *International Journal of Circumpolar Health, 62*(1), 94-109. Retrieved from, http://ijch.fi/.
Abstract:
The Organization of Nordic Council for Arctic Medical Research (NCAMR, or NoSAMF in Scandinavian languages) was initiated by the governmental Nordic Council in 1966. The new council was charged with the task of promoting arctic medical research in the Nordic countries. It began its duties in 1969. Originally the council covered Denmark, Finland, Norway and Sweden; Iceland joined as a member in 1977. During the first years the NCAMR held two to three conferences a year, the proceedings of which were communicated in the Nordic Council for Arctic Medical Research Reports series, distributed in about 1500 copies, free of charge. In 1971, 1981, 1987 and 1993, the NCAMR hosted the International Congress on Circumpolar Health and played a pivotal role in the establishment of the International Union for Circumpolar Health (IUCH) in 1986. Thereafter, the activities of the NCAMR developed a much more international character. Accident prevention, cold research, pollution, family health and, in later years, the health of indigenous peoples, became priorities, along with the establishment of international research networks. The NCAMR's report series soon developed into an established international journal under the title Arctic Medical Research. The inter-governmental financial support to the NCAMR was discontinued at the end of 1996. Thereafter, the secretariat operated under the auspices of the University of Oulu. The International Journal for Circumpolar Health, as it was named from 1997, continued to flourish, being published by the IUCH, the Nordic Society for Circumpolar Health and the University of Oulu.

Harvey-Berino, J., Hood, V., Rourke, J., Terrance, T., Dorwaldt, A., & Secker-Walker, R. (1997). Food preferences predict eating behavior of very young Mohawk children. Journal of the American Dietetic Association. *Journal of the American Dietetics Association, 97* (7), 750-753. doi: 10.1016/S0002-8223(97)00186-7.

Hauschild, A., & Dodds K. (1993). Epidemiology of Human Foodborne Botulism. In, *Clostridium botulinum, Ecology and Control in Foods.* (Chapter 4). New York: Marcel Dekker.

Hauschild, A.H., & Gauvreau, L. (1985). Food-borne botulism in Canada, 1971-84. *Canadian Medical Association Journal, 133*(11), 1141-6. Retrieved from, www.cmaj.ca.
Abstract:
Sixty-one outbreaks of food-borne botulism involving a total of 122 cases, of which 21 were fatal, were recorded from 1971 to 1984 in Canada. Most occurred in northern Quebec, the Northwest Territories or British Columbia. Of the 122 victims 113 were native people, mostly Inuit. Most of the outbreaks (59%) were caused by raw, parboiled or "fermented" meats from marine mammals; fermented salmon eggs or fish accounted

for 23% of the outbreaks. Three outbreaks were attributed to home-preserved foods, and one outbreak was attributed to a commercial product. The causative Clostridium botulinum type was determined in 58 of the outbreaks: the predominant type was E (in 52 outbreaks), followed by B (in 4) and A (in 2). Renewed educational efforts combined with a comprehensive immunization program would significantly improve the control of botulism in high-risk populations.

Healey, G., & Meadows, L. (2007). Inuit women's health in Nunavut, Canada: a review of the literature. *International Journal of Circumpolar Health, 66*(3), 199-214. Retrieved from, http://ijch.fi/.

Abstract:

OBJECTIVES: Inuit women face challenging health and wellness issues in Northern communities. Literature examining these contexts and the processes through which health is affected is virtually non-existent. The ojective of this review is to examine and consolidate the available literature on Inuit women's health issues from the last decade in order to identify priorities for future research. STUDY DESIGN: This study is a review of literature from the last decade. Inuit women's health issues that have been raised in the literature and in various reports are examined within a health-determinants framework. METHODS: Government reports and statistics, publications by Inuit organizations and publications available on MEDLINE were examined for this review. RESULTS: Inuit women's health is a crucial part of the health of their communities. Inuit women face serious health issues related to reproductive and sexual health, such as high rates of sexually transmitted infections and challenging circumstances surrounding childbirth. Wellness, suicide and stress are more significant issues for Inuit women compared with non-Inuit women. Food security and accessibility is an issue for all Northerners. Alcohol and substance abuse and exposure to violent situations endanger both the health and safety of Inuit women in many Northern communities. CONCLUSIONS: There exists an urgent need to better understand the mechanisms through which determinants of health affect Inuit women. As well as adding to the body of knowledge on health determinants in Canada, further examining these issues will provide valuable information for health policy decision-makers and program development in the North and facilitate the direction of resources to the necessary areas of health services provision in Nunavut.

Health Canada. (1998). *The Health and Environment Handbook for Health Professionals.* Retrieved from http://www.bvsde.paho.org/muwww/fulltext/saneam/health/health.html.

Health Canada. (1999). *Nutrient Value of Some common foods.* Retrieved from, http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/nvscf-vnqau_e.pdf

Health Canada. (2000). *A Statistical Profile on the Health of First Nations in Canada for the Year 2000 report.* Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/stats_profil_e.html

Health Canada. (2001). Two Outbreaks of Botulism Associated with Fermented Salmon Roe- British Columbia. *Canadian Communicable Disease Report, 28* (6). Retrieved from, http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/index-eng.php.

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Hegarty, M.P., Hegarty, E.E. & Wills, R.B.H. (2001). *Food Safety of Australian Plant Bushfoods*. Retrieved from, http://www.rirdc.gov.au/reports/NPP/01-28.pdf.

Heinitz, M., & Johnson, J. (1998). The incidence of Listeria spp., Salmonella spp., and Clostridium botulinum in smoked fish and shellfish. *Journal of Food Protection, 61*(3), 318-323.

Heinzl, L., & Grant, P. (2003). A process evaluation of a parenting group for parents with intellectual disabilities. *Evaluation and Program Planning, 26*, 263–274. doi:10.1016/S0149-7189(03)00030-2.
Abstract:
Parents who have intellectual disabilities are a unique population of adults who require specialized parenting programs. The purpose of the present research was to conduct a process evaluation of one such program. This group program is unique in that it is participant driven, and is focused on group learning. Prior to the evaluation, a brief evaluability assessment showed that the major service components of the program were providing a supportive and comfortable environment, teaching parenting skills, and crisis management. The evaluation was conducted using a qualitative, participant observation methodology and took place over a six-month period. The data were collected from facilitator debriefing forms, the evaluator’s detailed observations over an eleven-week period, and a small group interview with some of the parents. The results showed that the program components had been successfully implemented and that the participants found the services offered to be of great value.

Hemmelgarn, B., Klassen, R., Habbick, B., & Senthilselvan, A. (1993). Use of gastrointestinal and respiratory illness hospitalization rates as indicators of different social influences. *Canadian Journal of Public Health, 84*(2), 136-8. Retrieved from, http://www.cpha.ca/en/cjph.aspx.
Abstract:
The hospitalization rates for gastrointestinal and respiratory illnesses in children under five years of age were examined on two Indian reserves in Northern Saskatchewan. The gastrointestinal illness rate was used as an index of waterborne disease, and the respiratory rate as an index of general health and of local customs affecting hospitalizations. The reserve rates were compared with those for other Saskatchewan status Indians and for other Saskatchewan residents. The risk ratios between the reserves and other Indians, and between the reserves and other Saskatchewan residents, were increased for both gastrointestinal and respiratory illnesses. The risk ratio of gastrointestinal rate divided by respiratory rate was greater for either reserve than for other Indians or other Saskatchewan residents. Waterborne illnesses were an even greater problem on the two study reserves than on other reserves. Comparing hospitalization rates for different illness groups is a useful method to compare the effect of different social factors.

Hendriksen, N., Hansen, B., & Johansen, J. (2006). Occurrence and pathogenic potential of Bacillus cereus group bacteria in a sandy loam. *Antonie van Leeuwenhoek, 89*(2), 239-249. doi: 10.1007/s10482-005-9025-y.

Hermann, C. (1943). Cold Storage of Food. *Industrial and Engineering Chemistry Research, 35*(1), 29-38. Retrieved from, http://pubs.acs.org/journals/iecred/index.html.

Hermanson, M. (1991). Chronology and sources of anthropogenic trace metals in sediments from small, shallow Arctic lakes. *Environmental Science and Technology, 25*(12), 2059 – 2064. doi: 10.1021/es051100d.

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Hill, D., & Dubey, J. (2002). Toxoplasma gondii: transmission, diagnosis and prevention. *Clinical Microbiology and Infection, 8*(10), 634-640. doi: 10.1046/j.1469-0691.2002.00485.x.

Hill, R., & Hoover, S. (1997). Importance of dose-response model form in probabilistic risk assessment: A case study of health effects from methylmercury in fish. *Human and Ecological Risk Assessment, 3*(3), 465-481. doi:10.1111/j.1539-6924.1998.tb01107.x.

Himelbloom, B.H. (1998). Primer on food-borne pathogens for subsistence food handlers. *International Journal of Circumpolar health, 57*(Supp 1), 228-234.
Abstract:
Subsistence food preparations may lead to human illnesses caused by pathogenic bacteria and viruses. Little is known about the incidence of food-borne illnesses other than botulism in circumpolar indigenous populations. Lack of documentation for other pathogens may be related to the sparsely populated communities involved, limited laboratory analysis, and non-lethality to healthy individuals. This overview covers the major food-borne pathogens, their sources, transmission, growth parameters, and prevention. Examples of indigenous peoples' food preparations that may be susceptible to pathogenic bacterial growth and toxin formation are described.

Himelbloom, B., & Crapo, C. (1998). Factors Influencing the Microbial Quality of Cold-Smoked Salmon Strips. *Journal of Food Science, 63*(2), 356–358

Ho, L., Gittelsohn, J., Harris, S., & Ford, E. (2006). Development of an integrated diabetes prevention program with First Nations in Canada. *Health Promotion International, 21*(2), 88-97. Retrieved from, http://heapro.oxfordjournals.org/cgi/content/abstract/dak003v1.

Hoberg, E., Polley, L., Jenkins, E. J., Kutz, S. J., Veitch, A. M., & Elkin, B. T. (2008). Integrated approaches and empirical models for investigation of parasitic diseases in northern wildlife. *Emerging Infectious Diseases*, 14(1), 10-17. Retrieved from, http://wildlife1.usask.ca/IWAP/.

Hoekstra, P.F., Wong, C.S., O'Hara, T.M., Solomon, K.R., Mabury, S.A., & Muir, D.C.G. (2002). Enantiomer-Specific Accumulation of PCB Atropisomers in the Bowhead Whale. *Environmental Science and Technology, 36*(7), 1419-1425. doi: 10.1021/es015763g.

Abstract:
(Balaena mysticetus) Blubber (n = 40) and liver (n = 20) samples from the bowhead whale (Balaena mysticetus) were collected during the 1997-1998 Native (Inuit) subsistence harvests in Barrow, AK. Bowhead tissues and zooplankton were analyzed for polychlorinated biphenyl (PCB) concentrations and the enantiomeric fractions (EFs) of eight chiral PCB congeners (PCB-91, 95, 135, 136, 149, 174, 176, and 183) to quantify the enantiomer-specific accumulation of PCBs in this cetacean. PCB concentrations in bowhead blubber were low (mean ± 1 SE: 610 ± 54 ng g-1 lipid) relative to other cetaceans. The accumulation of several chiral PCBs (PCB-91, 135, 149, 174, 176, and 183) in bowhead blubber was enantiomer-specific relative to bowhead liver and zooplankton, suggesting that biotransformation processes within the bowhead whale are enantioselective. The EFs for PCB-95 and 149 were significantly correlated with body length in male and female whales, while EFs for PCB-91 correlated with length in males only. Despite evidence for enantioselective biotransformation, all three congeners bioaccumulated in the bowhead relative to PCB-153. Results suggest that enantioselective accumulation of PCB-91, 95, and 149 is influenced by PCB concentrations, age, and/or the modification of an uncharacterized stereoselective process (or processes) during sexual maturity.

Hoffman-Goetz, L., Shannon, C., & Clarke, J.N. (2003). Chronic disease coverage in Canadian aboriginal newspapers. *Journal of Health Communication, 8*(5), 475-88. Retrieved from, http://www.gwu.edu/~cih/journal/.

Abstract:
PURPOSE: To determine the volume and focus of articles on four chronic diseases in newspapers targeting First Nations, Métis, and Inuit in Canada. METHODS: From a sampling frame of 31 Aboriginal newspapers published in English from 1996-2000, 14 newspapers were randomly selected allowing for national and regional representation. Newspaper archives were searched at the National Library of Canada and articles selected if the disease terms cancer, cardiovascular disease, diabetes, or HIV/AIDS appeared in the headline, or in the first or last paragraph of the article. Articles were coded for inclusion of mobilizing information (local, distant, unrestricted, not specified, none) and content focus (scientific, human interest, commercial, other). Cancer articles were categorized by tumor site specificity. Data were analyzed by frequency, cross tabulations, and chi-square analysis. RESULTS: Of 400 chronic disease articles, there were significantly more articles on HIV/AIDS (167 or 41.8%) and diabetes (135 or 33.8%) and few articles on cancer (56 or 14%) and cardiovascular disease (30 articles or 7.5%) ($p<0.001$). Slightly more than one third (36.5%) of the articles contained

mobilizing information to enable readers to take further health action. Mobilizing information was virtually absent from cardiovascular (7/30 or 23%) and diabetes (29/135 or 21.5%) articles. Site specific cancer coverage differed significantly from chance ($p<0.001$) with 41% of the articles on breast cancer and no articles on lung or colorectal cancers. INTERPRETATION: Given the burden of tobacco-related cardiovascular disease and cancer in Canadian Aboriginal people, the lack of coverage and limited mobilizing information in ethnic newspapers are a missed opportunity for health promotion.

Holman, R., Curns, A., Cheek, J., Singleton, R., Anderson, L., & Pinner, R. (2003). Infectious disease hospitalizations among American Indian and Alaska native infants. *Pediatrics, 111*(2), E176-82. Retrieved from, http://pediatrics.aappublications.org/cgi/content/full/111/2/e176.

Holman, R., Curns, A., Singleton, R., Sejvar, J., Butler, J., Paisano, E. et al. (2006). Infectious disease hospitalizations among older American Indian and Alaska Native adults. *Public Health Report, 121*(6), 674-683.

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Holmes, A., & Deuel, H. (1920). Utilization of Kid, Rabbit, Horse, and Seal Meats as Food. *Industrial and Engineering Chemistry, 12*(10), 975 – 977. doi: 10.1021/ie50130a016.

Homer, R.A. (1996). Alexandrium the Dinoflagellate that Produces Shellfish Poisoning Toxins. *Alaska's Marine Resources, 8*(2), 1-20.

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Horowitz, B. (2003). Polar poisons: Did Botulism doom the Franklin expedition? *Clinical Toxicology, 41*(6), 841-847. doi: 10.1081/CLT-120025349.
Abstract:
In 1845 the Franklin expedition left London with 2 ships and 134 men on board in an attempt to find the route through the Northwest Passage. The ships were built with state-of-the-art technology for their day, but provisioned with supplies from the lowest bidder. After taking on fresh provisions in the Whalefish Islands, off the coast of Greenland, the entire crew was never heard from again. Graves found on remote Beechey Island indicate that three able-bodied seamen died during the first winter. A note written on a ship's log, later found in a cairn, indicate that the expedition's leader, Sir John Franklin, died during the second winter entrapped on the ice, by which time 24 men had also perished. The

remaining crew failed in their attempt to walk out of the Arctic by an overland route. In 1981 Owen Beattie, from the University of Alberta, exhumed the remains of the sailors from the three graves on Beechey Island. Elevated lead levels were found in all three sailors. While lead poisoning has been a leading theory of the cause of the crew's deaths, blamed on the crudely tinned provisions the ships carried with them from England, chronic lead exposure may only have weakened the crew, not necessarily killed them. One of three exhumed sailors also had in his intestine the spores of an unspecified Clostridium species. The theory put forth by this article is that Botulism, type E, which is endemic in the Arctic, may have been responsible for their deaths.

Horwitz, M.A., Pollard, R.A., Merson, M.H., & Martin, S.M. (1977). A large outbreak of foodborne salmonellosis on the Navajo Nation Indian Reservation, epidemiology and secondary transmission. *American Journal of Public Health, 67*(11), 1071-1076. Retrieved from, http://www.ajph.org/.

Howard, L., & Goodwin, R. (2004). *The Arctic Science and Technology Information System (ASTIS): Communicating Research Results to Canadian Inuit*. Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_contents

Abstract:

The Arctic Science and Technology Information System (ASTIS) is a database that describes publications and research projects about northern Canada. ASTIS is funded through contracts and donations, and can be searched for free from the Arctic Institute of North America's website. Although our coverage of research projects in the three territories (Yukon, N.W .T. and Nunavut) is close to comprehensive, our coverage of publications about the Canadian North is not. ASTIS has three projects that will improve our coverage of the parts of northern Canada where Inuit live: the Nunavut Environmental Database, the Nunavik Bibliography, and the Inuvialuit Settlement Region Database. Through ASTIS, people from all over the world can gain access to publications that describe northern environments and northern Canada's people: their cultural, social, economic and political conditions and aspirations. Inuit can use ASTIS to obtain information about northern research done by others, and to inform Inuit and others about research and publications funded or produced by Inuit.

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Ibelings, B., & Chorus, I. (2007). Accumulation of cyanobacterial toxins in freshwater "seafood" and its consequences for public health: A review. *Environmental Pollution, 150*(1), 177-192. doi:10.1016/j.envpol.2007.04.012.

Abstract:
This review summarizes and discusses the current understanding of human exposure to cyanobacterial toxins in "seafood" collected from freshwater and coastal areas. The review consists of three parts: (a) the existing literature on concentrations of cyanobacterial toxins in seafood is reviewed, and the likelihood of bioaccumulation discussed; (b) we derive cyanotoxin doses likely to occur through seafood consumption and propose guideline values for seafood and compare these to guidelines for drinking water; and (c) we discuss means to assess, control or mitigate the risks of exposure to cyanotoxins through seafood consumption. This is discussed in the context of two specific procedures, the food specific HACCP-approach and the water-specific Water Safety Plan approach by the WHO. Risks of exposure to cyanotoxins in food are sometimes underestimated. Risk assessments should acknowledge this and investigate the partitioning of exposure between drinking-water and food, which may vary depending on local circumstances.

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Iwata, H., Watanabe, M., Okajima, Y., Tanabe, S., Amano, M., Miyazaki, N., et al. (2004). Toxicokinetics of PCDD, PCDF, and Coplanar PCB Congeners in Baikal Seals, Pusa sibirica: Age-Related Accumulation, Maternal Transfer, and Hepatic Sequestration. *Environmental Science and Technology, 38*(13), 3505-3513. doi: 10.1021/es035461+.
Abstract:
To assess the toxicokinetic behavior and potential toxicity of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and coplanar polychlorinated biphenyls (PCBs) in Baikal seals, congener-specific levels and tissue distribution were evaluated in the liver and blubber, and the effects of biological factors including sex and growth were assessed. Total 2,3,7,8-TCDD toxic equivalents (TEQs) were in the range of 210-920 pgTEQ/g fat wt (180-800 pgTEQ/g wet wt) in the blubber and 290-7800 pgTEQ/g fat wt (10-570 pgTEQ/wet wt) in the liver. Non-ortho coplanar PCB126 was the most TEQ-contributed congener accounting for 37-59% of the total TEQs in the liver. From the unique congener profiles, weak metabolic properties of Baikal seals for 2,3,7,8-TCDF and 1,2,3,7,8-P5CDF are suggested. Concentrations of most congeners linearly increased with age in male seals, whereas in adult females the levels revealed an age-related decline. The increasing and declining rates were congener-specific. Maternal transfer rates of 5 representative congeners from adult female to pup through lactation, which was estimated from male-female differences in the body burden, was 1.1 ngTEQ/kg/day for the first pup and decreased with every lactational epoch. The liver-blubber distribution of 1,2,3,4,7,8-H6CDD, 1,2,3,6,7,8-H6CDD, PCB81, PCB126, and PCB169 was dependent on the hepatic total TEQ, indicating hepatic sequestration by induced cytochrome P450 (CYP). These results indicate that congener profile in Baikal seals is governed by complex factors including sex, tissue concentration, binding to CYP, and rates of absorption and metabolism/excretion.

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Jardine, C. (2003). Development of a Public Participation and Communication Protocol for Establishing Fish Consumption Advisories. *Risk Analysis, 23*(3), 461–471. doi:10.1111/1539-6924.00327.
Abstract:
Enabling people to make an informed choice on whether to change consumption behavior is ultimately the objective of any fish consumption advisory. This will occur only if people are aware of the advisory, know and understand the advisory information, and believe the information to be true. Interactive, meaningful communication and the opportunity to participate in the process to develop and review advisories are key to achieving these attributes. A case study was undertaken in a community in Alberta, Canada (where an existing advisory was under consideration for review) to determine public awareness, knowledge, compliance, communication effectiveness, information

needs, and desire for involvement related to the advisory. The information obtained from this case study was used to develop 14 guiding principles as a foundation for the incorporation of public participation and risk communication into the process of developing and reviewing fish consumption advisories.

Jaykus, L-A., Woolridge, M., Frank, J.M., Miraglia, M., McQuatters-Gollop, A., Clarke, R., & Friel, M. (2008). *Climate change and impact on food safety. FAO paper*. Retrieved from, http://www.fao.org/ag/agn/agns/files/HLC1_Climate_Change_and_Food_safety.pdf

Jellison, K.L., Distel, D.L., Hemond, H.F., & Schauer, D.B. (2007). Phylogenetic Analysis Implicates Birds as a Source of Cryptosporidium spp. Oocysts in Agricultural Watersheds. *Environmental Science and Technology, 41*(10), 3620-3625. doi: 10.1021/es0626842.
Abstract:
Cryptosporidium parvum and C. hominis are protozoan parasites responsible for cryptosporidiosis, an acute gastrointestinal illness that can be life-threatening for immunocompromised persons. Sources and genotypes of Cryptosporidium oocysts were investigated in two agricultural areas within the Wachusett Reservoir watershed, a drinking water source for Boston, Massachusetts. Two brooks (denoted Brook SF and Brook JF, respectively), each downgradient from a dairy farm, were chosen as sample sites. For one year, Brooks SF and JF were sampled monthly; oocysts were detected in 6 (50%) out of 12 samples from Brook JF, and no oocysts were detected in Brook SF. Oocyst genotypes from agricultural surface waters were compared to oocyst genotypes from Genbank, as well as fecal samples of cattle and birds, using phylogenetic analysis of a hypervariable region of the 18S rRNA gene by both neighbor-joining and parsimony methods. Results show extensive heterogeneity among Cryptosporidium spp. 18S rRNA sequences, and also suggest that birds are an oocyst source in this watershed. Principal components analysis showed oocyst presence correlating strongly with seasonal factors, and oocysts in surface waters were only detected in the summer through late fall, co-incident with the presence of migratory birds in this watershed. If birds are confirmed to be an important source of oocysts infectious to humans, the data suggest that protection of raw drinking water supplies in some agricultural areas may depend upon management and control of resident and migratory bird populations.

Jenkins, A., Gyorkos, T., Joseph, L., Culman, K., Ward, B., Pekeles, G., et al. (2004). Risk factors for hospitalization and infection in Canadian Inuit infants over the first year of life--a pilot study. *International Journal of Circumpolar Health, 63*(1), 61-70. Retrieved from, http://ijch.fi/.
Abstract:
OBJECTIVES: Inuit infants experience higher mortality and poorer health than other Canadian infants, and suffer disproportionately from bacterial and viral infections. A wide range of inter-related factors affect their health and susceptibility to infection. The objective of the study was to describe hospitalization and morbidity patterns in a cohort of 46 healthy Inuit infants from Iqaluit, Nunavut, over their first year of life. STUDY

DESIGN: Risk factors for hospitalization and infections were assessed using multiple linear regression. RESULTS: Infants experienced an average of four respiratory tract infections (RTIs) annually, which accounted for half of the hospitalizations in the cohort. Some interesting trends were evident from the assessment of risk factors using multiple linear regression. Adoption was associated with adverse health effects in addition to those that would be expected due to lack of breast-freeding alone; among infants who were not breast-fed, adopted infants had three more RTIs per year than non-adopted infants. CONCLUSION: The results of this pilot study provide support for undertaking larger epidemiological studies in order to clarify the role of these risk factors, so that future preventive efforts can be informed and effective.

Jimenez, M., Siller, J.H., Valdez, J.B., Carrillo, A., & Chaidez, C. (2007). Bidirectional *Salmonella enterica* serovar Typhimurium transfer between bare/glove hands and green bell pepper and its interruption. *International Journal of Environmental Health Research*, 17(5), 381-388.

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Joffraud, J., Cardinal, M., Cornet, J., Chasles, J., Léon, S., Gigout, F., et al. (2006). Effect of bacterial interactions on the spoilage of cold-smoked salmon. *International Journal of Food Microbiology, 112*(1), 51-61. Retrieved from, http://www.sciencedirect.com/science/journal/01681605.

Abstract:

Cold-smoked salmon is a lightly preserved fish product in which a mixed microbial flora develops during storage and where the interactive behaviour of micro-organisms may contribute to their growth and spoilage activity. The aim of this study was to assess the effect of the bacterial interactions between the main species contaminating the cold-smoked salmon on bacterial growth, chemical and sensory changes, and spoilage. First, Carnobacterium piscicola, Photobacterium phosphoreum, Lactobacillus sakei, Vibrio sp., Brochothrix thermosphacta and Serratia liquefaciens-like were inoculated as pure cultures on sterile cold-smoked salmon. All bacterial species grew well; Vibrio sp. was the fastest and L. sakei strains developed very rapidly as well with a high maximum cell density on cold-smoked salmon blocks (up to 10(9) cfu g(-1) after 10 days at 8 degrees C). Based on sensory analysis, Vibrio sp. was identified as non-spoilage bacteria, C. piscicola as very lightly and B. thermosphacta as lightly spoiling. L. sakei and S. liquefaciens-like were found to be the most spoiling bacteria. Secondly, C. piscicola and L. sakei, two species frequently occurring in the lactic flora of the product, were inoculated together and each of them in mixed cultures with respectively P. phosphoreum, Vibrio sp., B. thermosphacta, and S. liquefaciens-like. The growth of L. sakei was shown to strongly inhibit most of the co-inoculated strains i.e. P. phosphoreum, B. thermosphacta, S. liquefaciens-like and, to a lesser extent, Vibrio sp. The growth of C. piscicola seemed to be enhanced with B. thermosphacta and to develop earlier with P.

phosphoreum and Vibrio sp. Conversely, S. liquefaciens-like and P. phosphoreum were weakly inhibited by C. piscicola. The main observation resulting from the sensory evaluation was the delay in the appearance of the spoilage characteristics in the mixed cultures with L. sakei, in particular L. sakei/ S. liquefaciens-like. On the other hand, the spoilage activity of the non-spoiler strains Vibrio sp. or the moderate spoilage strains B. thermosphacta and C. piscicola was increased when they were associated together. It is concluded that the spoilage behaviour of micro-organisms in mixed culture is significantly different from pure culture and explain the difficulty to find robust quality indices for this product.

Johnsen, G., Wasteson, Y., Heir, E., Berget, O. I., & Herikstad, H. (2001). Escherichia coli O157:H7 in feces from cattle, sheep and pigs in the southwest part of Norway during 1998 and 1999. *International Journal of Food Microbiology, 65*,193-200. Retrieved from, http://www.sciencedirect.com/science/journal/01681605.
Abstract:
During a 2-year period from January 1998 to December 1999, intestinal content from 1541 cattle, 665 sheep and 1976 pigs were analysed for Escherichia coli O157:H7 using the immunomagnetic separation procedure. The animals originated from 848, 605 and 832 herds from the southwest part of Norway, respectively. E. coli O157:H7 was present in three samples from cattle from different herds, giving a herd prevalence of 0.35% and an animal prevalence of 0.19%. From pigs, E. coli O157:H7 was isolated from two pigs from different herds, giving a herd prevalence of 0.24% and an animal prevalence of 0.1%. A follow-up study revealed another positive testing pig from one of these herds. E. coli O157:H7 was not found from any of the 665 investigated sheep. By PCR analysis, all six E. coli O157:H7 isolates were shown to contain the genes encoding Shiga toxin 2 (stx2), the intimin protein (eae) and the H7 flagellum (fliC-H7). One of the cattle isolates also harboured the Shiga toxin 1 encoding (stx1) gene. The six isolates were differentiated into three pulse-field gel electrophoresis profiles. The results indicate that the occurrence of E. coli O157:H7 in cattle, sheep and pigs in the southwest part of Norway is low compared to other European countries.

Jones, M., Jenkerson, S., Middaugh, J., Benton, J., Sylvester, P., Klontz, K., et al. (1990). Foodborne hepatitis A - Alaska, Florida, North Carolina, Washington. *Morbidity and Mortality Weekly Report, 39*(14), 228-232. Retrieved from, http://www.cdc.gov/mmwR/.

Judd, N., Drew, C., Acharya, C., Mitchell, T., Donatuto, J., Burns, G., et al. (2005). Framing scientific analyses for risk management of environmental hazards by communities: case studies with seafood safety issues. *Environmental Health Persepectives, 113*(111), 1502-1508. doi: 10.1289/ehp.7655.

Judd, N., Griffith, W., & Faustman, E. (2004). Consideration of cultural and lifestyle factors in defining susceptible populations for environmental disease. *Toxicology, 198*(1-3), 121-133. doi:10.1016/j.tox.2004.01.023.

Juneja, V., Snyder, O., & Marmer, B. (1997). Potential for growth from spores of Bacillus cereus and Clostridium botulinum and vegetative cells of Staphylococcus aureus, Listeria monocytogenes, and Salmonella serotypes in cooked ground beef during cooling. *Journal of Food Protection, 60*(3), 272-275.
Abstract:
The ability of 16 foodborne pathogens, representative of 5 different species, to grow during cooling of previously sterilized cooked beef was studied to determine a safe cooling rate. Autoclaved ground beef samples (3 g) were inoculated with heat-shocked spores of Bacillus cereus (strain BH 86) or Clostridium botulinum (nonproteolytic type B strains CBW 25, 17B, and KAP B5 and type E strains Whitefish, Saratoga, and Alaska) or vegetative cells of Listeria monocytogenes (strains HO-VJ-S, V-7, and Scott A), Staphylococcus aureus (strains 196E, B121, and B124), or Salmonella serotypes (S. dublin, S. enteritidis, and S. typhimurium), vacuum-packaged, and cooked in a stirred water bath to an internal temperature of 60 degrees C in 1 h. In some experiments combinations of C. botulinum and B. cereus spores or S. aureus and salmonellae vegetative cells were used. Heated samples were cooled through the temperature range of 54.4 to 7.2 degrees C at rates varying from 6 to 21 h. Samples were removed at various times during cooling to determine if growth of the pathogens had occurred. No growth was observed with cooling periods of up to 21 h. This study with the model meat system (3 g autoclaved ground beef inoculated with selected pathogens and then pasteurized) indicated that cooling from 52.4 to 7.2 degrees C in up to 21 h would not pose a food safety hazard from growth of these pathogens.

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Kaplain, G., Tegtmeie, G., Sherman, G., Jones, S., Clark, T., Bender, P. et al. (1972). Echovirus Type-4 Meningitis and Related Febrile Illness-Epidemiologic Study of an outbreak in 2 Eskimo Communities in 1970. *American Journal of Epidemiology, 96* (1). Retrieved from, http://aje.oxfordjournals.org/.

Kapel, C., Measures, L., Moller, L., Forbes, L., & Gajadhar, A. (2003). Experimental Trichinella infection in seals. *International Journal for Parasitology, 33*(13), 1463-1470. doi:10.1016/S0020-7519(03)00202-9.
Abstract:
The susceptibility of seals to infection with Trichinella nativa and the cold tolerant characteristics of muscle larvae in seal meat were evaluated. Two grey seals, Halichoerus

grypus, were inoculated with 5,000 (100 larvae/kg) T. nativa larvae and two grey seals with 50,000 (1,000 larvae/kg). One seal from each dose group and two control seals were killed at 5 and 10 weeks post-inoculation (p.i.). At 5 weeks p.i., infection was established in both low and high dose seals with mean larval densities of 68 and 472 larvae per gram (lpg), respectively, using eight different muscles for analyses. At 10 weeks p.i., mean larval densities were 531 and 2,649 lpg, respectively, suggesting an extended persistence of intestinal worms. In seals with high larval density infections, the distribution of larvae in various muscles was uniform, but in one seal with a low larval density infection, predilection sites of larvae included muscle groups with a relative high blood flow, i.e. diaphragm, intercostal and rear flipper muscles. Trichinella-specific antibody levels, as measured by ELISA, increased during the 10 week experimental period. Infected seal muscle was stored at 5, −5 and −18 °C for 1, 4 and 8 weeks. Muscle larvae released from stored seal muscle by artificial digestion were inoculated into mice to assess viability and infectivity. Larvae from seal muscle 10 weeks p.i. tolerated −18 °C for 8 weeks but larvae from seal muscle 5 weeks p.i. tolerated only 1 week at −18 °C, supporting the hypothesis that freeze tolerance increases with the age of the host–parasite tissue complex. The expressed susceptibility to infection, extended production of larvae, antibody response and freeze tolerance of T. nativa in seals are new findings from the first experimental Trichinella infection in any marine mammal and suggest that pinnipeds (phocids, otariiids or walrus) may acquire Trichinella infection by scavenging even small amounts of infected tissue left by hunters or predators.

Keene W. E,. Sazie E., Kok J., Rice D. H., Hancock D. D., Balan V. K., et al. (1997). An outbreak of Escherichia coli O157:H7 infections traced to jerky made from deer meat. *Journal of the American Medical Association, 277*(15), 1229-1231. Retrieved from, http://jama.ama-assn.org/.

Abstract:

Objective.-To investigate a 1995 outbreak of Escherichia coliO157:H7 infections and to assess the safety of meat dehydration methods. Design.-Survey subsequent to routine surveillance report, environmental investigations, and laboratory experimentation. Setting.-Oregon community. Participants.-Members of an extended household and their social contacts with confirmed or presumptive E coli O157:H7 infections. Results.-A total of 6 confirmed and 5 presumptive cases were identified. Homemade venison jerky was implicated as the source of transmission. E coil O157:H7 with the same distinctive, pulsed-field gel electrophoresis pattern seen in the case isolates was recovered from leftover jerky, uncooked meat from the same deer, a saw used to dismember the carcass, and fragments of the deer hide. In a subsequent survey, E coil O157:H7 was recovered from 3 (9%) of 32 deer fecal pellets collected in nearby forest land. In the laboratory, inoculated venison was dried at several time and temperature combinations, ranging up to 10 hours at 62.8°C. Viable organisms were recovered under all conditions tested. Conclusions.-Deer can be colonized by E coliO157:H7 and can be a source of human infections. Conditions necessary to ensure the safety of dried meat deserve further review. Game should be handled with the same caution indicated for commercially slaughtered meat.

Kelso, D., & Kendziorek, M. (1991). Alaska's response to the Exxon Valdez oil spill. *Environmental Science and Technology, 25*(1), 16-23. doi: 10.1021/es00013a601.

Kempson, K., Palmer Keenan, D., Sadan, P., Ridlen, S., & Scotto Rosato, N. (2002). Food Management Practices Used by People with Limited Resources to Maintain Food Sufficiency as Reported by Nutrition Educators. *Journal of the American Dietitics Association, 102*(12), 1795-1799. Retrieved from, http://journals.elsevierhealth.com/periodicals/yjada.

Kendall, P.A., Elsbernd, A., Sinclair, K., Schroeder, M., Chen, G., Bergmann, V., et al. (2004). Observation versus self-report: validation of a consumer food behavior questionnaire. *Journal of Food Protection*, *67*(11), 2578-2586.

Kendall, P.A., Hillers, V.V., & Medeiros, L.C. (2006). Food safety guidance for older adults. *Clinical Infectious Diseases*, *42*(9), 1298-1304.

Kennedy, S. (1990). A Review of the 1988 European Seal Morbillivirus Epizootic. *Veterinary Record*, *127*(23), 563-567. Retrieved from, http://veterinaryrecord.bvapublications.com/.

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Kirby, A., Lévesque, L., Wabano, V., & Robertson-Wilson, J. (2007). Perceived community environment and physical activity involvement in a northern-rural Aboriginal community. *International Journal of Behavioral Nutrition and Physical Activity*, *4* (1), 63. doi:10.1186/1479-5868-4-63.

Kirk, R. (1986a). *Tradition & change on the Northwest Coast : the Makah, Nuu-chah-nulth, southern Kwakiutl, and Nuxalk / Ruth Kirk. Tradition and change on the Northwest.* Seattle: University of Washington Press.

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Kirk, J.L., St.Louis, V.L., & Sharp, M.J. (2006). Rapid Reduction and Reemission of Mercury Deposited into Snowpacks during Atmospheric Mercury Depletion Events at Churchill, Manitoba, Canada. *Environmental Science and Technology, 40*(24), 7590-7596. doi: 10.1021/es061299+.
Abstract:
Mercury (Hg) in some Arctic marine mammals has increased to levels that may be toxic to Northern peoples consuming them as traditional food. It has been suggested that sunlight-induced atmospheric reactions called springtime atmospheric Hg depletion events (AMDEs) result in the loading of ~150-300 tons of Hg to the Canadian Arctic

archipelago each spring and that AMDEs are the ultimate source of Hg to Arctic foodwebs. AMDEs result from the oxidation of gaseous elemental Hg0 (GEM) in Arctic atmospheres to reactive gaseous Hg (RGM) and particulate Hg (pHg), both of which fall out of the atmosphere to snowpacks. We studied the springtime cycling of Hg between air and snowpacks near Churchill, Manitoba, for 2 years to determine the net input of Hg to Hudson Bay from AMDEs. In 2004, we monitored atmospheric concentrations of GEM, pHg, and RGM while simultaneously measuring concentrations of total Hg (THg) in surface snow collected over the sea ice on Hudson Bay. During numerous springtime AMDEs, concentrations of THg in surface snow increased, often to over 60 ng/L, demonstrating that AMDEs resulted in deposition of oxidized Hg (Hg(II)) to snowpacks. However, immediately following AMDEs, average concentrations of THg in snow declined drastically from between 67.8 ± 97.7 ng/L during AMDEs to only 4.25 ± 1.85 ng/L four or more days following them. In 2003, we measured THg in surface snow collected daily over the sea ice and total gaseous Hg (TGM) concentrations in the interstitial airspaces of snowpacks. When concentrations of THg in the surface snow decreased, concentrations of TGM in interstitial airspaces of the snowpack increased sharply from between ~1.4-3.4 ng/m3 to between ~20-150 ng/m3, suggesting that there was a reduction of deposited Hg(II) to GEM, which then diffused out of snowpacks. At snowmelt in both 2003 and 2004, average concentrations of THg in meltwater collected over Hudson Bay were only 4.04 ± 2.01 ng/L. Using concentrations of THg in meltwater and snow water equivalent, we estimated a net springtime loading of only 2.1 ± 1.7 mg/ha of Hg to Hudson Bay from AMDEs, indicating that only a small portion of the Hg(II) deposited during AMDEs enters Hudson Bay each spring.

Knudson, K., Frink, L., Hoffman, B., & Price, T. (2004). Chemical characterization of Arctic soils: activity area analysis in contemporary Yup'ik fish camps using ICP-AES. *Journal of Archaeological Science, 31*(4), 443-456. doi:10.1016/j.jas.2003.09.011.

Abstract:

Despite the vital role of seasonal fish camps in hunter–gatherer subsistence activities in the Arctic, little archaeological or ethnographic research on fish camps has been conducted. This ethnoarchaeological study uses the chemical composition of soil samples collected at two modern fish camps in the Yukon–Kuskokwim Delta of western Alaska to elucidate chemical soil signatures associated with seasonal subsistence fish camps and the activities performed there. Concentrations of Al, Ba, Ca, Fe, K, Mg, Mn, P, Sr, Ti, and Zn were determined using an inductively coupled plasma-atomic emission spectrometer (ICP-AES). Both camps showed distinct anthropogenic soil signatures, even though one camp had a 30-year occupation history and one camp had only been occupied for 1 year. In addition, some activity areas within the camps have distinct anthropogenic signatures. In the future, this research can be used to identify ephemeral camps and their activities in the archaeological record.

Koch, A., Molbak, K., Homoe, P., Sorensen, P., Hjuler, T., Olesen, M., et al. (2003). Risk factors for acute respiratory tract infections in young greenlandic children. *American Journal of Epidemiology, 158*(4), 374-384. doi: 10.1093/aje/kwg143.

Abstract:

Acute respiratory infections cause considerable morbidity among Inuit children, but there is very little information on the risk factors for these infections in this population. To identify such factors, the authors performed a prospective community-based study of acute respiratory infections in an open cohort of 288 children aged 0-2 years in the town of Sisimiut, Greenland. Between July 1996 and August 1998, children were monitored weekly, and episodes of upper and lower respiratory tract infections were registered. Risk factor analyses were carried out using a multivariate Poisson regression model adjusted for age. Risk factors for upper respiratory tract infections included attending a child-care center (relative risk=1.7 compared with home care) and sharing a bedroom with adults (relative risk=2.5 for one adult and 3.1 for two adults). Risk factors for lower respiratory tract infections included being a boy (relative risk=1.5), attending a child-care center (relative risk=3.3), exposure to passive smoking (relative risk=2.1), and sharing a bedroom with children aged 0-5 years (relative risk=2.0 for two other children). Breastfeeding tended to be protective for lower respiratory tract infections. The population-attributable risk of lower respiratory tract infections associated with passive smoking and child-care centers was 47% and 48%, respectively. The incidence of acute respiratory infections among Inuit children may be reduced substantially through public health measures.

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Kuhnlein, H. (1989). Factors influencing use of traditional foods among the Nuxalk people. *Journal of the Canadian Dietetic Association, 50*(2), 102.
Abstract:
Understanding the traditional food systems of native Canadians and factors influencing the use of traditional cultural foods is essential for planning effective nutrition promotion programs with them. This article describes patterns of food use and factors influencing the traditional food system of the Nuxalk People of Bella Coola, British Columbia. The most frequently used fresh and processed foods are identified, and declining use of most traditional foods since 1910 is shown. Differential use of seafoods among three generations of Nuxalk women is defined, and the effects of availability, taste appreciation and harvest time on traditional animal and plant food use, identified. Of 70 food species in the traditional food system, 23 are still used by 90% of families. Current food use frequency correlates most highly with availability for seafoods, and with taste for plant foods. Frequency of use, environmental availability and taste appreciation of traditional native food resources are factors to be considered in planning community nutrition promotion programs with native people.

Kuhnlein, H. (1992). Change in the use of traditional foods by the Nuxalk native people of British Columbia. *Ecology of Food and Nutrition, 27,* 259-82.

Kuhnlein, H. (1995). Benefits and risks of traditional food for Indigenous Peoples: focus on dietary intakes of Arctic men. *Canadian Journal of Physiology and Pharmacology, 73*(6), 765-71. Retrieved from, http://pubs.nrc-cnrc.gc.ca/rp-ps/journalDetail.jsp?jcode=cjpp&lang=eng.

Summary: A variety of community and external pressures on Indigenous Peoples are leading to increased use of food that is available through industrialization and market economics; food in traditional food systems derived from local, natural environments is declining in use. This report focusses on dietary intake of Arctic men. While nutrient density of Arctic traditional food systems is superior to that of the composite of market food consumed in the North, the percentage of men's daily energy derived from market food is more than double that from traditional food in some communities. Older members of communities consume more traditional food than younger members; men consume more traditional food than do women. In addition to providing excellent nutrition and opportunities for physical exercise. Indigenous Peoples identify many sociocultural benefits to the harvest and use of traditional food. Evaluation of environmental accumulation of organochlorines in wildlife animal food species shows that risk of organochlorine consumption is higher in food systems containing sea mammals, and that tolerance levels for some organochlorines may be exceeded.

Kuhnlein, H. (2000). The joys and pains of sampling and analysis of traditional food of indigenous peoples. *Journal of Food Composition and Analysis, 13*(4), 649-658. doi:10.1006/jfca.1999.0857.

Abstract:
Traditional food of Indigenous Peoples' is defined as food that comes from the local environment and is culturally accepted. Usually, this food is part of the subsistence base of a specific cultural group, and may be wild animals, plants and/or insects, earth elements, or subsistence agricultural crops and animals. Since this food is often unfamiliar to the researcher, identification and sampling requires close collaboration with Indigenous People, and working with them in harvest, perhaps in local preservation techniques, and preparation for consumption. The many pleasures and benefits of this research include encountering unique food species, learning about "new" cultural food practices, uncovering new knowledge about nutrient composition, and potentially identifying excellent nutrient sources. Difficulties include the frustrations of making scientific collections in the human field setting (often in developing areas), getting replicate samples when food resources may be scarce, securing sufficient sample size, making judgments on simplifying preparation techniques, and ensuring adequate storage, transportation and shipping to avoid spoilage. Examples of these principles are represented from traditional food research with the Hopi Nation, Nuxalk Nation, James Bay Cree of Quebec, and the Canadian Inuit. (Au)

Kuhnlein, H. (2003). Micronutrient nutrition and traditional food systems of indigenous peoples. *Food, Nutrition and Agriculture, 32*, 33-39.

Abstract:
Indigenous peoples living in rural areas possess food resources that are usually not completely understood by the development and health sectors that provide services to

them. This means that the usual processes of nutrition assessment and identification of food-based strategies for micronutrient health promotion cannot take these resources into full consideration for planning. Indigenous peoples are often the most marginalized and disadvantaged for health care and other resources for well-being, and extreme poverty is often the result. Thus, most governments designate their indigenous peoples as those most in need of public health attention and food security. For these residents in rural developing areas, the "lifestyle and nutrition transition" experience means decreasing consumption of fish, wildlife, domestic animals and locally grown crops (rich sources of micronutrients) and increased consumption of industrially processed food. Poor micronutrient intake is a likely consequence, coincident with increasing obesity and other chronic diseases associated with increased caloric consumption in the form of simple carbohydrates and fat. A few micronutrient health promotion strategies using local food resources have demonstrated success and are presented here. These include the use of the gac fruit (Momordica cochinchinensis) in Viet Nam, the karat banana (Musa troglodytarum) in Micronesia and the Nuxalk food system in British Columbia, Canada. It is necessary to be aware of special considerations if successful food studies and health-promotion activities are to be carried out with indigenous peoples using their own local food. Tools for the evaluation of traditional food systems of indigenous peoples would be helpful. An FAO [Food and Agriculture Organization of the United Nations] collaboration found that for five case studies of indigenous peoples in Asia, 716 types of traditional food were reported, 93 of which required original scientific identification, and for approximately 147 of which there was not even the most basic nutrient data on file in the world literature. Techniques for understanding local food availability and use; scientific data for species; food harvest, storage and preparation practices; acceptability for vulnerable members of the population; and potential for increased food availability and consumption are necessary data. (Au)

Kuhnlein, H., & Chan, H. (2000). Environment and contaminants in traditional food systems of northern indigenous peoples. *Annual Review of Nutrition, 20,*595-626. doi:10.1146/annurev.nutr.20.1.595.

Abstract:

Traditional food resources of indigenous peoples are now ecognized as containing a variety of environmental ontaminants which reach food species through local or long-range transport avenues. In this chapter we review the published reports of contaminants contained in traditional food in northern North America and Europe as organochlorines, heavy metals, and radionuclides. Usually, multiple contaminants are contained in the same food species. Measurement of dietary exposure to these environmental contaminants is reviewed, as are major issues of risk assessment, evaluation, and management. The dilemma faced by indigenous peoples in weighing the multiple nutritional and socioeconomic benefits of traditional food use against risk of contaminants in ulturally important food resources is described.

Kuhnlein, H., & Receveur, O. (1996). Dietary change and traditional food systems of Indigenous Peoples. *Annual Review of Nutrition, 16,* 417-442. doi:10.1146/annurev.nu.16.070196.002221.

Kuhnlein, H., & Receveur, O. (2007a). Levels of Nutrients for Arctic Canadian Indigenous Adults and Children. *Journal of Nutrition, 137*, 1110-1114.

Kuhnlein, H., & Receveur, O. (2007b). Local cultural animal food contributes high levels of nutrients for Arctic Canadian Indigenous adults and children. *Journal of Nutrition, 137*(4), 1110-4.
Abstract:
Food systems of Canadian Arctic Indigenous Peoples contain many species of traditional animal and plant food, but the extent of use today is limited because purchased food displaces much of the traditional species from the diet. Frequency and 24-h dietary interviews of Arctic adults and children were used to investigate these trends. The most frequently consumed Arctic foods were derived from animals and fish. In adults these foods contributed 6-40% of daily energy of adults. Children ate much less, 0.4-15% of energy, and >40% of their total energy was contributed by "sweet" and "fat" food sources. Nevertheless, for adults and children, even a single portion of local animal or fish food resulted in increased ($P < 0.05$) levels of energy, protein, vitamin D, vitamin E, riboflavin, vitamin B-6, iron, zinc, copper, magnesium, manganese, phosphorus, and potassium; although children had similar results for these nutrients, they did not reach significance for energy, vitamin D, or manganese. Because market foods are the major source of energy in the Arctic, traditional animal-source foods are extremely important to ensure high dietary quality of both adults and children.

Kuhnlein, H., Appavoo, D., Soueida, N., & Rula Pierrot, P. (1994). Use and Nutrient Composition of Traditional Sahtu (Hareskin) Dene/Metis Foods. *Journal of Food Composition Analysis, 7*(3), 144-157. doi:10.1006/jfca.1994.1015.

Kuhnlein, H., Receveur, O., Muir, D., Chan, H., & Soueida, R. (1995). Arctic indigenous women consume greater than acceptable levels of organochlorines. *Journal of Nutrition, 125*(10), 2501-10.
Abstract:
Exposure to polychlorinated biphenyls and organochlorine pesticides through traditional food resources was examined for Arctic Indigenous women living in two cultural and environmental areas of the Canadian Arctic--one community representing Baffin Island Inuit in eastern Arctic and two communities representing Sahtú Dene/Métis in western Arctic. Polychlorinated biphenyls, toxaphene, chlorobenzenes, hexachlorocyclohexanes, dichlorodiphenyltrichloroethane, chlordane-related compounds and dieldrin were determined in local food resources as normally prepared and eaten. Quantified dietary recalls taken seasonally reflected normal consumption patterns of these food resources by women in three age groups: 20-40 y, 41-60 y and > or = 61 y. There was wide variation of intake of all organochlorine contaminants in both areas and among age groups for the Sahtú. Fifty percent of the intake recalls collected from the Baffin Inuit exceeded the acceptable daily intake for chlordane-related compounds and toxaphene, and a substantial percentage of the intake records for dieldrin and polychlorinated biphenyls exceeded the acceptable or tolerable daily intake levels. Primary contributing foods to organochlorine

contaminants intake for the Baffin Inuit were meat and blubber of ringed seal, blubber of walrus and mattak and blubber of narwal. Important foods contributing organochlorine contaminant to the Sahtú Dene/Métis were caribou, whitefish, inconnu, trout and duck. The superior nutritional benefits and potential health risks of traditional food items are reviewed, as are implications for monitoring organochlorine contaminant contents of food, clinical symptoms and food use.

Kuhnlein, H., Souida, R., & Receveur, O. (1996a). Dietary Nutrient Profiles of Canadian Baffin Island Inuit differ by Food Source, Season, and Age. *Journal of the American Dietetics Association, 96*(2), 155-162. Retrieved from, http://www.adajournal.org/.

Abstract:
Objective: To compare the effect of food source (traditional or market), season (six seasons), and age (five age groups) on dietary nutrient patterns of Inuit living in Baffin Island, Canada.
Design Twenty-four-hour recall interviews of all residents who had lived ≥3 years in this one community in each of six seasons. Foods that were recalled were divided by source.
Setting/subjects The study took place in the Inuit community of Qikiqtarjuaq, which harvests the highest quantity of wildlife per capita of all Baffin communities. Three hundred sixty-six residents contributed a total of 1,410 recalls: 401 from nonpregnant, nonlactating adult women, 74 from pregnant women, 301 from adult men, 451 from children aged 3 to 12 years, and 183 from teenagers aged 13 to 19 years. Participation was voluntary and averaged 65% to 75% of residents.
Main outcome measures Energy, total dry weight of food, and dietary nutrients (ie, carbohydrate, protein, total fat, saturated fat, polyunsaturated fat, vitamin A, iron, copper, zinc, calcium, phosphorus, magnesium, and sodium) were measured by food source, season, and age. Nutrient density (nutrient per 1,000 kcal) was calculated in traditional and market food sources. Selected nutrients were computed in total diets, and compared with Recommended Dietary Allowances (RDAs).
Statistical analyses performed Tests for normality of the distribution of nutrient intakes (ie, Shapiro-Wilk statistic) were performed followed by nonparametric analyses (ie, Wilcoxon paired-sample t test, Kruskal-Wallis analysis of variance, and adjustment for Bonferroni inequalities resulting from multiple comparisons).
Results Most nutrient intakes were significantly different by food source ($P<.05$). Traditional food contributed more protein, phosphorus, iron, zinc, copper, magnesium, and vitamin A for several age groups. Market food contributed greater amounts of dry weight, energy, fat, carbohydrate, calcium, and sodium for most age groups. Seasonal variation ($P<.05$) existed for nutrients coming from traditional and market food. Of the 10 nutrients assessed for nutrient density, all except calcium and sodium were present in greater amounts in traditional food than in market food ($P<.05$). Calcium and vitamin A intakes fell below 66.6% of the RDAs for more than 60% of the population.
Conclusions The comprehensive view of nutrient profiles, food source, and seasonality of Inuit diets will assist health professionals in developing nutrition promotion and education programs for all age groups of this population. Traditional food is an essential source of the total annual dietary nutrient intake of Inuit. Results indicated, however, that calcium and vitamin A intake must be improved.

Kuhnlein, H.V., Yeboah, F., Sedgemore, M., Sedgemore, S., & Chan, H.M. (1996b). Nutritional qualities of ooligan grease: A traditional food fat of British Columbia First Nations. *Journal of Food Composition and Analysis,* 9, 18–31. doi:10.1006/jfca.1996.0004.

Kuhnlein, H., Receveur, O., & Chan, H. (2001). Traditional food systems research with Canadian Indigenous Peoples. *International Journal of Circumpolar Health, 60*(2), 112-22. Retrieved from, http://ijch.fi/.

Abstract:
Traditional food systems research with Canadian Indigenous Peoples has revealed many aspects of benefits and risks of the use of this food. Traditions based in hunting, fishing and gathering contain a great variety of species of wildlife plants and animals that provide rich cultural and nutritional benefits. Dietary change for Indigenous Peoples in Canada has resulted in the use of traditional food to provide usually less than 30% of total dietary energy; however this portion of the total diet contributes significantly more of essential nutrients. It also results in exposure to organochlorine and heavy metal contaminants that exceed the tolerable intake levels for some areas. A successful research and education intervention program with one British Columbia community demonstrated that increasing traditional food use can improve health status for vitamin A, iron and folic acid. It is concluded that traditional food systems are rich with potential for research and public health education intervention programs for Indigenous Peoples.

Kuhnlein, H.V., Chan, H.M., Leggee, D., & Barthet, V. (2002). Macronutrient, mineral and fatty acid composition of Canadian Arctic traditional food. *Journal of Food Composition and Analysis, 15* (5), 545-566. doi:10.1006/jfca.2002.1066.

Abstract:
Traditional food resources of indigenous peoples provide a wealth of information on use of unique food species, and hrvest and preparation. Studying the nutrient contents of these food items presents several challenges; for example, adequate sampling to define variability, and conducting multiple nutrient analyses in limited sample portions. In this report, 236 independent samples of Canadian Arctic food species tissues are analyzed for macronutrients (protein, fat, moisture, ash, calculated energy), minerals (Ca, Fe, Cu, Zn, P, Mg, Na, Mn, K, Se) and fatty acids (SFA, MUFA,
n-3 PUFA and n-6 PUFA). Many new values are reported for the first time (particularly for Se, K, and PUFA), and ther values are compared to earlier reports on similar tissues from our laboratory. Samples were selected as food items reported being frequently used in recent randomly collected food intake survey data over a broad geographical range of Yukon First Nations and Inuit communities.

Kuhnlein, H., Receveur, O., Soueida, R., & Egeland, G. (2004). Arctic Indigenous Peoples Experience the Nutrition Transition with Changing Dietary Patterns and Obesity. *Journal of Nutrition, 134,* 1447-1453.

Kuhnlein, H., Barthet, V., Farren, A., Falahi, E., Leggee, D., Receveur, O. et al. (2006a). Vitamins A, D, and E in Canadian Arctic traditional food and adult diets [electronic resource]. *Journal of Food Composition and Analysis, 19*(6-7), 495-506. doi:10.1016/j.jfca.2005.02.007.

Kuhnlein, H., Chan, L.H.M., Peace, R., & Hindiroglou, N. (2006b). *Nutient benefits of traditional/country food consumed by Inuit.* Retrieved from, http://www.ainc-inac.gc.ca/ncp/pub/helt/helt18_e.html#rsk2

Kuhnlein, H., Erasmus, B., Creed-Kanashiro, H., Englberger, L., Okeke, C., Turner, N., et al. (2006c). Indigenous peoples' food systems for health: finding interventions that work. *Public Health Nutrition, 9*(8), 1013-1019. Retrieved from, http://journals.cambridge.org/action/displayJournal?jid=PHN.

Kuhnlein, H.V., Receveur, O., Soueida, R., & Berti, P.R. (2007). Unique patterns of dietary adequacy in three cultures of Canadian Arctic indigenous peoples. *Public Health and Nutrition, 5*, 1-12. doi:10.1017/S1368980007000353.
Abstract:
BACKGROUND: Information is needed on dietary adequacy of Arctic indigenous populations in Canada. Extensive work has been completed on composition of Arctic food and food use, and dietary reference intakes are available. OBJECTIVE: To complete the first comprehensive dietary adequacy assessment of three populations of adult Arctic indigenous people.Setting and subjectsDietary assessment interviews were conducted with randomly selected indigenous adults during two seasons in 44 representative communities of Yukon First Nations (n = 797), Dene/Métis, (n = 1007) and Inuit (n = 1525). METHODS: Twenty-four-hour recalls were used to derive adjusted distributions of usual nutrient intakes in four age/gender groups for assessment of dietary adequacy for carbohydrate, dietary fibre, protein, n-3 fatty acids, n-6 fatty acids, calcium, copper, iron, magnesium, manganese, phosphorus, selenium, zinc, vitamin A, riboflavin, folate, vitamin B6, vitamin C, vitamin D and vitamin E. RESULTS: Nutrients with high prevalence of adequacy for most age/gender groups in all three cultures were protein, carbohydrate, n-3 fatty acids, iron, copper, zinc, manganese, selenium, riboflavin and vitamin B6; some individuals exceeded the upper intake level for iron, zinc, selenium, vitamin A and vitamin D. Estimated average requirement nutrients of concern for adequacy were magnesium, folate, vitamin A, vitamin C and vitamin E; however, a few age/gender groups were exceptions. Prevalence of inadequacy for AI nutrients which may be undesirably high were fibre, n-6 fatty acids and calcium. Vitamin D was more adequate in Inuit women and men than for Yukon First Nations or Dene/Métis. CONCLUSIONS: Unique patterns of dietary adequacy exist among Arctic indigenous peoples. Local wildlife food sources and market food sources should be maximised for their nutrient contributions to Arctic diets.

Kurzel, R., & Cetrulo, C. (1981). Critical Review. The effect of environmental pollutants on human reproduction, including birth defects. *Environmental Science and Technology, 15*(6), 626-640. doi: 10.1021/es00088a001.

Kutz, S.J., Elkin, B., Gunn, A., & Dubey, J.P. (2000). Prevalence of Toxoplasma gondii antibodies in muskox (Ovibos moschatus) sera from northern Canada. *Journal of*

Parasitology, 86(4), 879-82. Retrieved from, http://digitalcommons.unl.edu/jrnlparasitology/.

Abstract:

Prevalence of antibodies to Toxoplasma gondii was determined in 203 muskoxen (Ovibos moschatus) from 3 geographically distinct areas of northern Canada (near the hamlets of Kugluktuk and Cambridge Bay, Nunavut and Holman, Northwest Territories) by the modified agglutination test (MAT). Antibodies were found in 13 (6.4%) of 203 animals with MAT titers of 1:25 in 2, 1:50 in 7, 1:200 in 2, 1:400 in 1, and 1:800 in 1. The 4 muskoxen with MAT titers > or =1:200 were adult females and were among 10 animals examined from a mainland population near Kugluktuk. The seroprevalence was lower in Victoria Island muskoxen collected near Cambridge Bay (4.6% of 151) and Holman (4.8% of 42). This is the first serologic survey for T. gondii infection in muskoxen.

Kutz, S., Elkin, B., Panayi, D., & Dubey, J.P. (2001). Prevalence of Toxoplasma gondii antibodies in barren-ground caribou (Rangifer tarandus groenlandicus) from the Canadian Arctic. *Journal of Parasitology, 87*(2), 439-42. Retrieved from, http://digitalcommons.unl.edu/jrnlparasitology/.

Abstract:

Prevalence of antibodies to Toxoplasma gondii was determined in 147 barren-ground caribou (Rangifer tarandus groenlandicus) from 5 herds in the Northwest Territories and Nunavut, northern Canada, by the modified agglutination test (MAT). In the mainland herds (Bluenose, Bathurst, and Beverly), antibodies were found in 43 (37%) of 117 caribou, and MAT titers were 1:25 in 10, 1:50 in 24, and 1:500 in 9. In the island herds, only 1 (4.3%) of 23 animals sampled from the North Baffin Island herd was positive (titer = 1:25) and no antibodies were detected in 7 caribou from the Dolphin and Union herd. The high prevalence of antibodies to T. gondii in the mainland caribou herds indicates that caribou meat may contain viable T. gondii. PMID: 11318582 [PubMed - indexed for MEDLINE]

Kutz, S.J., Hoberg, E.P., Nagy, J., Polley, L. and Elkin, B. (2004). “Emerging” parasitic infections in arctic ungulates. *Integrative and Comparative Biology, 44*(2), 109 – 118.

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Labelle, P., Dubey, J.P., Mikaelian, I., Blanchette, N., Lafond, R., St-Onge, S., et al. (2001). Seroprevalence of antibodies to Toxoplasma gondii in lynx (Lynx canadensis) and bobcats (Lynx rufus) from Quebec, Canada. *Journal of Parasitology, 87*(5), 1194-1196. Retrieved from, http://digitalcommons.unl.edu/jrnlparasitology/.

Abstract:

The seroprevalence of antibodies to Toxoplasma gondii was investigated in trapped lynx (Lynx canadensis) and bobcats (Lynx rufus) from Quebec, Canada. Forty-seven of 106

(44%) lynx and 4 of 10 (40%) bobcats had positive titers for T. gondii (greater than or equal to 25) by means of the modified agglutination test incorporating mercaptoethanol and formalin-fixed tachyzoites. Seroprevalence was significantly higher (P<0.0001) in adult lynx than in juvenile lynx. The presence of antibodies to T. gondii in lynx and bobcats suggests that this organism is widespread in the wild and that exposure to wild felids and game animals from Quebec may represent a potential source of infection for humans.

Labrèche, Y. (2005). *Appropriation et conservation des ressources alimentaires chez les Inuit de Kangiqsujuaq-Salluit, Québec arctique: Perspective ethno-archéologique.* (Ph.D. Dissertation, Université de Montréal, 2005).

Lambden, J., Receveur, O., Marshall, J., & Kuhnlein, H.V. (2006). Traditional and market food access in Arctic Canada is affected by economic factors. *International Journal of Circumpolar Health*, *65*(4), 331-340. Retrieved from, http://ijch.fi/.

Abstract:
This study aimed to evaluate the access that Indigenous women have to traditional and market foods in 44 communities across Arctic Canada. Study design. This secondary data analysis used a cross-sectional Survey of 1771 Yukon First Nat.ons, Dene/Wilis and Inuit women stratified by age. Methods. Socio-cultural questionnaires were used to investigate food access and chi-square testing was used to ascertain the distribution of subject responses by age and region. Results. There was considerable regional variation in the ability to afford adequate food, with between 40% and 70% saying they Could afford enough food. Similarly, regional variation was reflected in the percentage of the population who could afford, or had access to, hunting or fishing, equipment. Up to 50% of the responses indicated inadequate access to fishing and hunting equipment, and up to 46% of participants said they could not afford to go hunting or fishing Conclusions. Affordability of market food and accessibility to hunting and fishing in Arctic Canada were major barriers to Indigenous women's food security.

Lambden, J., Receveur, O., & Kuhnlein, H. (2007). Traditional food attributes must be included in studies of food security in the Canadian Arctic. *International Journal of Circumpolar Health, 66*(4), 308-319. Retrieved from, http://ijch.fi/.

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Lampe, J., Murphy, F., Furgal, C., & Craig, L. (2000). Country food nutrition and health: developing effective communication strategies in Labrador (Year 2). In: Kalhok S. (Ed.), *Synopsis of research conducted under the 2003–2004 Northern Contaminants Program* (pp. 271-280). Ottawa: Department of Indian Affairs and Northern Development.

Langeland, G, Hasselgard, T, Tangen, K, Skulberg, O., & Hjuelle, A. (1984). An Outbreak of Paralytic Shellfish Poisoning in Western Norway. *Sarsia, 69*(3-4), 185-193. Retrieved from, http://www.ifm.uib.no/sol/.

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Larcombe, L., Waruk, J., Schellenberg, J., & Ormond, M. (2007). Rapid emergence of methicillin-resistant Staphylococcus aureus MRSA) among children and adolescents in Northern Manitoba, 2003-2006. *Canadian Communicable Disease Report, 33*(2). Retrieved from, http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/index-eng.php.

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Lawn, J., & Harvey, D. (2001). *Change in Nutrition and Food Security in Two Inuit Communities, 1992 to 1997.* Ottawa: Dialogos Educational Consultants Inc. Retrieved from, http://www.ainc-inac.gc.ca/ps/nap/air/nutfoosec_e.pdf

Leclair, D., Forbes, L., Suppa, S., & Gajadhar, A. (2002). Infectivity of Trichinella larvae in aged walrus meat. *Parasitology Research, 93,* 507-599. Retrieved from, http://www.springerlink.com/content/thcbll2w9mqf1ulb/fulltext.pdf.

Leclair, D., Forbes, L.B., Suppa, S., & Gajadhar, A.A. (2003). Evaluation of a digestion assay and determination of sample size and tissue for the reliable detection of Trichinella larvae in walrus meat. *Journal of Veterinary Diagnostic Investigation, 15*(2), 188-191. Retrieved from, http://jvdi.org/.
Abstract:
A digestion assay was validated for the detection of Trichinella larvae in walrus (Odobenus rosmarus) meat, and appropriate samples for testing were determined using tissues from infected walruses harvested for food. Examination of muscles from 3 walruses showed that the tongue consistently contained approximately 2-6 times more larvae than the pectoral and intercostal muscles. Comparison of numbers of larvae in the root, body, and apex of the tongue from 3 walruses failed to identify a predilection site within the tongue, but the apex was considered an optimal tissue because of the high larval density within the tongue and the ease of collection. All 31 spiked samples weighing 50 g each and containing between 0.1 and 0.4 larvae per gram (lpg) were correctly identified as infected, indicating that the sensitivity of this procedure is adequate for diagnostic use. A sample size of 10 g consistently detected larvae in 2 walrus tongues containing > or = 0.3 lpg (n = 40), and until additional data are available, sample sizes from individual walrus tongues should be a minimum of 10 g. This study provides the preliminary data that were used for the development of a food safety

analytical protocol for the detection of Trichinella in walrus meat in arctic communities.

Leclair, D., Forbes, L.B., Suppa, S., Proulx, J.F., & Gajadhar, A.A. (2004). A preliminary investigation on the infectivity of *Trichinella* larvae in traditional preparations of walrus meat. *Parasitology Research*, 93(6), 507-509. doi: 10.1007/s00436-004-1179-4.

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Letcher, R.J., Norstrom, R.J., & Muir, D.C.G. (1998). Biotransformation versus Bioaccumulation: Sources of Methyl Sulfone PCB and 4,4'-DDE Metabolites in the Polar Bear Food Chain. *Environmental Science and Technology, 32*(11), 1656-1661. doi: 10.1021/es970886f.
Abstract:
In the polar bear food chain from the Canadian Arctic, methyl sulfone (MeSO2-) PCBs and 4,4'-DDE were below detection in arctic cod (<0.01 ng/g, lipid wt). Ringed seal blubber contained 3-MeSO2-4,4'-DDE (0.4 ng/g) and 14 3- and 4-MeSO2-PCB isomer pairs (MeSO2-PCB, ca. 13 ng/g) formed by the biotransformation of PCBs not chlorine substituted at the meta-para positions on one ring (m,p-PCBs). Bioaccumulation/formation efficiencies relative to CB153 (BFE-) from cod to seal were 0.001-0.086 for MeSO2-PCBs and 0.004 for 3-MeSO2-4,4'-DDE. Twelve MeSO2-PCB isomer pairs (MeSO2-PCBs, 432 ± 57 ng/g) and 3-MeSO2-4,4'-DDE (2.0 ± 0.7 ng/g) were identified in polar bear fat; BFE' values were 0.03-0.62 and 0.0001 for MeSO2-PCBs and 3-MeSO2-4,4'-DDE, respectively. Methyl sulfone formation is important but not the major route for m,p-PCB and 4,4'-DDE biotransformation in polar bear and ringed seal. Fifteen MeSO2-PCB congeners in the bear are likely bioaccumulated from seal relative to the completely bioaccumulated 3-/4-MeSO2-CB132. Strong evidence exists for the partial formation of seven MeSO2-PCBs in the bear. We conclude that MeSO2-PCBs have high biomagnification potential in food chains.

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Abstract:
To estimate the consumer risk of contracting Salmonella infection via shell eggs and to evaluate the effect of possible preventative measures, quantitative microbiological risk assessment is being developed in Finland. As a part of the risk assessment, a survey of 918 respondents was conducted to study how households purchase, store, handle, and use eggs. In addition, suitability of the Internet as a survey method was compared with a postal survey. Shell eggs were usually purchased once every 2 weeks (41% of all the respondents). Ninety-one percent of the respondents bought eggs in groceries and 93% stored eggs at chilled temperatures. The majority of the respondents (80%) only had eggs in their home for which the best-before date had not expired. Only 34% of the respondents said that they always washed their hands after breaking eggs. Consumption of well-cooked eggs accounted for 84%, consumption of soft-boiled eggs for 12%, and consumption of raw eggs for 4% of the total amount of eggs consumed. The elderly used eggs more frequently than the whole population, but the consumption of raw egg dishes decreased with age. The Internet survey was a rapid method for transmitting information, but its response rate was low (9%), and it did not appear to be a suitable tool for data collection in a general population. The results indicate that although the majority of the respondents had safe egg-handling practices, a substantial minority of the consumers had risk-prone behavior.

Lindstrom, M., Nevas, M., Hielm, S., Lahteenmaki, L., Peck, M.W., & Korkeala, H. (2003). Thermal inactivation of nonproteolytic Clostridium botulinum type E spores in model fish media and in vacuum-packaged hot-smoked fish products. *Applied and Environmental Microbiology, 69*(7), 4029-4036. DOI: 10.1128/AEM.69.7.4029-4036.2003.
Abstract:
Thermal inactivation of nonproteolytic Clostridium botulinum type E spores was investigated in rainbow trout and whitefish media at 75 to 93degreesC. Lysozyme was applied in the recovery of spores, yielding biphasic thermal destruction curves. Approximately 0.1% of the spores were permeable to lysozyme, showing an increased measured heat resistance. Decimal reduction times for the heat-resistant spore fraction in rainbow trout medium were 255, 98, and 4.2 min at 75, 85, and 93degreesC, respectively, and those in whitefish medium were 55 and 7.1 min at 81 and 90degreesC, respectively. The z values were 10.4degreesC in trout medium and 10.1degreesC in whitefish medium.

Commercial hot-smoking processes employed in five Finnish fish-smoking companies provided reduction in the numbers of spores of nonproteolytic C. botulinum of less than 10(3). An inoculated-pack study revealed that a time-temperature combination of 42 min at 85degreesC (fish surface temperature) with >70% relative humidity (RH) prevented growth from 106 spores in vacuum-packaged hot-smoked rainbow trout fillets and whole whitefish stored for 5 weeks at 8degreesC. In Finland it is recommended that hot-smoked fish be stored at or below 3degreesC, further extending product safety. However, heating whitefish for 44 min at 85degreesC with 10% RH resulted in growth and toxicity in 5 weeks at 8degreesC. Moist heat thus enhanced spore thermal inactivation and is essential to an effective process. The sensory qualities of safely processed and more lightly processed whitefish were similar, while differences between the sensory qualities of safely processed and lightly processes rainbow trout were observed.

Lockhart, W.L., Stern, G.A.,Wagemann, R., Hunt, R.V., Metner, D.A., DeLaronde, J. et al. (2005). Concentrations of mercury in tissues of beluga whales (Delphinapterus leucas) from several communities in the Canadian Arctic from 1981 to 2002. *Science of the Total Environment, 351-352*, 391-412. doi: 10.1016/j.scitotenv.2005.01.050.

Abstract:

Beluga whales have been hunted for food by Native People in the Canadian Arctic since prehistoric time. Here we report the results of analyses of total mercury in samples of liver, kidney, muscle and muktuk from collections over the period 1981-2002. We compare these results with human consumption guidelines and examine temporal and geographic variation. Liver has been analyzed more frequently than other organs and it has been used as the indicator organ. Mercury accumulates in the liver of the whales over time so that the whale ages are usually linked statistically to their levels of mercury in liver. Virtually all the samples of 566 animals analyzed contained mercury in liver at concentrations higher than the Canadian consumption guideline of 0.5 mu g g(-1) (wet weight) for fish. (There is no regulatory guideline for concentrations in marine mammals in Canada.) Samples from locations in the Mackenzie Delta in the western Canadian Arctic and from Pangnirtung in the eastern Canadian Arctic were obtained more often than from other location and these offered the best chances to determine whether levels have changed over time. Statistical outlier points were removed and the regressions of (In) mercury in liver on age were used to calculate the level of mercury in whales of age 13.1 years in order to compare age-adjusted levels at different locations. These age-adjusted levels and also the slopes of regressions suggested that levels have increased in the Mackenzie Delta over the sampling period although not in a simple linear fashion. Other locations had fewer collections, generally spread over fewer years. Some of them indicated differences between sampling times but we could not establish whether these differences were simply temporal variation or whether they were segments of a consistent trend. For example, the levels in whales from Arviat were considerably higher in 1999 than in 1984 but we have only two samples. Similarly, samples from Iqaluit in 1994 exceeded considerably those in 1993 and the interval seems too short to reflect any regional temporal trend and more likely represent an extreme case of year-to-year variation. Previous analyses of data from geographically distinct groups had suggested that whales in the western Canadian Arctic had higher levels of mercury than those from

the eastern Canadian Arctic. The present analysis suggests that such regional differences have diminished and are no longer statistically significant. No site has indicated significant decreases in more recent samples. The levels of total mercury in the most analyzed organs fell in the order of liver (highest levels), kidney, muscle and muktuk (lowest level). While muktuk had the lowest level of the organs most frequently analyzed, it is the preferred food item from these whales and it still exceeded the consumption guideline in most instances.

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Macaulay, A.C., Cargo, M., Bisset, S., Delormier, T., Lévesque, L., & Potvin, L. (2005). Kanien'kehá:ka (Mohawk) ways for the Primary Prevention of Type 2 diabetes: the Kahnawake Schools Diabetes Prevention Project. In, M. Ferreira, Lang G., & N. Durham (Eds.). *Indigenous Peoples and Diabetes: Community Empowerment and Wellness*. (pp. 407-434). North Carolina: Carolina Academic Press.

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Abstract:
INTRODUCTION: The Kivalliq region of Nunavut, Canada, had a 1996 population of 7,131, of which 87% were Inuit. An attempt was made to characterize patterns of mortality in the region. STUDY DESIGN: Descriptive regional mortality study, based on 10-year retrospective review of health records data. METHODS: All deaths and stillbirths of Kivalliq residents during the study period were identified. Available health records data were reviewed for each death, including medical charts, death certificates and coroner's reports where applicable. Age-standardized mortality rates, both overall and cause-specific, were calculated and compared to both Canadian national rates and territorial rates from the same time period. RESULTS: The infant mortality rate was 32.3/1,000 live births, five times Canada's rate. Leading causes of infant deaths were prematurity and Sudden Infant Death Syndrome (SIDS). The overall mortality rate was 1.8 times that of Canada, with leading causes of death being cancers (especially lung cancer), circulatory disease, respiratory disease, unintentional injury and suicide. CONCLUSIONS: Identified areas of concern included mortality due to premature birth, SIDS, unintentional injuries, suicides, respiratory disease and lung cancer. It is hoped that this study's results will assist territorial leaders, health workers and citizens in health planning activities.PMID: 15736627 [PubMed - indexed for MEDLINE]

Macaulay, A.C., Paradis, G., Potvin, L., Cross, E.J., Saad-Haddad, C., McComber, A., et al. (1997). The Kahnawake Schools Diabetes Prevention Project: intervention, evaluation, and baseline results of a diabetes primary prevention program with a native community in Canada. *Preventive Medicine, 26*(6), 779-90. Retrieved from, *http://www.ingentaconnect.com/ap/pm/1997/00000026/00000006/art00241*.

Abstract:
OBJECTIVES: Kahnawake Schools Diabetes Prevention Project is a 3-year community-based, primary prevention program for non-insulin-dependent diabetes mellitus in a Mohawk community near Montreal, Canada. Objectives are to improve healthy eating and encourage more physical activity among elementary school children. METHODS: Intervention incorporates behavior change theory, Native learning styles, the Ottawa Charter for Health Promotion, and a health promotion planning model. Evaluation uses a mixed longitudinal and cross-sectional design to measure obesity, fitness, eating habits, and physical activity of elementary school children in the experimental and comparison communities. Intermediate variables are self-efficacy and perceived parental support. Process evaluation provides feedback to the intervention. RESULTS: During 3 years, 63 distinct interventions that included a Health Education Program reinforced by school events, a new Community Advisory Board, a recreation path, and community-based activities promoting healthy lifestyles were implemented. Baseline consent rates were 87 and 71% in the experimental and comparison schools. As expected, anthropometric data increase with age. Between 9 and 10 years there are increased weight, height, BMI, and skinfold thicknesses; decreased fitness; and increased television watching. CONCLUSIONS: Implementing a Native community-based diabetes prevention program

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Abstract:
The role of green sea urchin Strongylocentrotus droebachiensis as a source of fecal particulate organic matter (POM) for the benthic nearshore ecosystems has been studied over a 3.5-month period. Three macroalgae were tested as food sources: Alaria esculenta, Laminaria longicruris and Ulvaria obscura. Urchins were fed ad libitum with either a single alga species or a mixture of all three algae. Consumption and defecation rates were determined as well as the feces/alga ratio in term of biomass and biochemical

composition. Consumption rate increased exponentially with urchin size and also varied with alga species. In the single alga trial, consumption rate was higher for both brown algae (Laminaria and Alaria) compared to Ulvaria. Urchins feeding on the mixture of algae maintained their total ingestion rate (sum of the three algae) at the same level to those feeding on a single alga diet. The mixed algae trial showed that urchins clearly preferred Laminaria (72% of total ingestion) over Alaria (22%) and Ulvaria (6%). The defecation rate was tightly correlated with the food consumption rate and thus increased with urchin size. On average, 75% of the ingested algal biomass was released as fecal POM. The percentage of food defecated changed with alga species, with the highest value for Alaria (81%) and the lowest for Laminaria (67%). The percentage of food defecated by urchins feeding on the mixture of algae was generally comparable to those feeding on single alga diet. Biochemical composition (in soluble carbohydrates, proteins and lipids) of urchin fecal POM reflected that of the algae content. From 40% to 80% of macronutrients in algal food persisted in fecal matter. This proportion varied with the alga species and macronutrient considered. This study shows that the green sea urchin plays a significant role in the production of POM within nearshore benthic ecosystems, and it is a potentially nutritious food source for detritivores.

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Abstract:
OBJECTIVES: To review the current status of health care access and utilization among Indigenous people in the North America, Australia and New Zealand. STUDY DESIGN: Literature review. METHODS: A systematic search and critical review of relevant studies using online searches of electronic databases (PubMed, PsychINFO, MEDLINE) that examined issues relating to health care utilization and access. RESULTS: Most studies found that health care access and utilization rates were found to be significantly lower among Indigenous populations. Factors such as rural location, communication and

socio-economic status were found to be barriers to health care services that disproportionately affected Indigenous communities compared with the general population. CONCLUSIONS: Inequalities in health care access and utilization among Indigenous populations may play an important role in understanding why disparities in the health status of Indigenous populations continue to exist despite public health interventions. Further research is needed to understand the factors that contribute to these inequalities and to develop specific interventions to increase access and utilization among Indigenous populations.

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Abstract:
In Nunavik, chlorine-treated water is delivered daily, by tank truck, to the houses, where it is stored in tanks. A large part of the Inuit population continues to depend on an untreated water supply, however. This traditional activity poses certain risks in a region with an abundant presence of migratory animals. Nunavik has also experienced significant climate warming since the beginning of the last decade. The main goal of this study, which took place in 2003 and 2004, was to evaluate drinking habits that may place Nunavik residents at an increased risk of gastroenteric diseases in the context of climate change. During the Amundsen cruise in fall 2004, we observed that raw water from the collection sites most frequently visited (brooks, lakes, rivers) was of good quality in most of the villages. Regular monitoring of these sites is necessary, however, and the public should be warned when the sites become contaminated. Of particular concern was the water from the individual storage containers, which was much more contaminated than the water at the collection sites. To develop or improve the climate change adaptation strategies in this area, we propose 1) establishing an appropriate environmental monitoring system, 2) improving wastewater disposal and municipal water systems, 3)

involving nursing staff in microbiological testing of the water at community sites, 4) raising public awareness of the risks related to raw water consumption, and 5) gathering strategic health information during the periods of the year when cases of gastroenteric diseases are most frequent, in order to establish whether there is a link between these disorders and water quality.

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McGrath-Hanna, N.K., Greene, D.M., Tavernier, R.J., & Bult-Ito, A. (2003). Diet and mental health in the Arctic: Is diet an important risk factor for mental health in

circumpolar peoples?--a review. *International Journal of Circumpolar Health, 62*(3), 228-41. http://ijch.fi/.
Abstract:
BACKGROUND: The people living in Arctic and Subarctic environments have adapted to cold temperatures, short growing seasons, and low precipitation, but their traditional ways are now changing due to increased contact with Western society. The rapid alteration of circumpolar cultures has led to generational changes in diet from traditional foods to the processed groceries common in modern stores. OBJECTIVES: Develop a link between changing traditional diets and mental health that may have substantial consequences for circumpolar peoples. METHODS: Review of English language literature pertaining to the northern circumpolar environments of the world that consist of the Arctic and Subarctic areas. Electronic resources such as ISI Web of Science and PubMed were utilized, using keywords such as arctic, circumpolar, diet, omega-3 fatty acids, mental health, seasonal affective disorder, and suicide. In addition, we used the cited references of obtained articles and the extensive University of Alaska Fairbanks library collections to identify additional publications that were not available from the electronic resources. The years covered were not restricted to any particular period, although 83% of the sources were published in the last 16 years. CONCLUSION: The change in traditional diets has already led to increased health problems, such as obesity, cardiovascular disease, and diabetes, while the mental health of circumpolar peoples has also declined substantially during the same time period. The decline in mental health is characterized by increased rates of depression, seasonal affective disorder, anxiety, and suicide, that now often occur at higher rates than in lower-latitude populations. Studies in non-circumpolar peoples have shown that diet can have profound effects on neuronal and brain development, function, and health. Therefore, we hypothesize that diet is an important risk factor for mental health in circumpolar peoples.

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McLaughlin, J.B., DePaola, A., Bopp, C.A., Martinek, K.A., Napolilli, N.P., Allison, C.G., et al. (2005). Outbreak of Vibrio parahaemolyticus gastroenteritis associated with Alaskan oysters. *New England Journal of Medicine, 353*(14), 1463-1470. Retrieved from, http://content.nejm.org/.
Abstract:
BACKGROUND Vibrio parahaemolyticus, the leading cause of seafood-associated gastroenteritis in the United States, typically is associated with the consumption of raw oysters gathered from warm-water estuaries. We describe a recognized outbreak of V. parahaemolyticus infection associated with the consumption of seafood from Alaska. METHODS After we received reports of the occurrence of gastroenteritis on a cruise ship, we conducted a retrospective cohort study among passengers, as well as active surveillance throughout Alaska to identify additional cases, and an environmental study to identify sources of V. parahaemolyticus and contributors to the outbreak. RESULTS Of 189 passengers, 132 (70 percent) were interviewed; 22 of the interviewees (17 percent) met our case definition of gastroenteritis. In our multiple logistic-regression analysis, consumption of raw oysters was the only significant predictor of illness; the attack rate among people who consumed oysters was 29 percent. Active surveillance identified a total of 62 patients with gastroenteritis. V. parahaemolyticus serotype O6: K18 was isolated from the majority of patients tested and from environmental samples of oysters. Patterns on pulsed-field gel electrophoresis were highly related across clinical and oyster isolates. All oysters associated with the outbreak were harvested when mean daily water temperatures exceeded 15.0 degrees C (the theorized threshold for the risk of V. parahaemolyticus illness from the consumption of raw oysters). Since 1997, mean water temperatures in July and August at the implicated oyster farm increased 0.21 degrees C per year (P< 0.001 by linear regression); 2004 was the only year during which mean daily temperatures in July and August at the shellfish farm did not drop below 15.0 degrees C. CONCLUSIONS This investigation extends by 1000 km the northernmost documented source of oysters that caused illness due to V. parahaemolyticus. Rising temperatures of ocean water seem to have contributed to one of the largest known outbreaks of V. parahaemolyticus in the United States.

McLaughlin, J.B., Gessner, B.D., & Bailey, A.M. (2005). Gastroenteritis outbreak among mountaineers climbing the west buttress route of Denali-denali National Park, Alaska, June 2002. *Wilderness & Environmental Medicine, 16*(2), 92-96. Retrieved from, http://www.wemjournal.org/wmsonline/?request=index-html.
Abstract:
Objective.-To determine the burden of and risk factors for diarrheal illness among mountaineers climbing Denali during the spring of 2002. Methods.-We conducted a retrospective cohort study of all willing and available climbers who returned to base camp from June 11 to 14, 2002. We used a questionnaire that addressed illness status, demographics, and potential risk factors for illness. A case of diarrhea was defined as self-reported diarrhea (loose stool) in a Denali climber who did not have diarrhea before arrival at base camp. Results.-Thirty-eight (29%) of the 132 climbers who were

interviewed reported experiencing diarrhea at some point on the mountain. Spending 8 or more days at the 17 200-foot high camp; being a member of a climbing party in which at least I other person also had diarrhea, especially if tent occupancy was 3 or more; and not receiving education about disease risk-reduction techniques among climbers who were on a guided expedition were associated with increased risk of illness. Conclusions.-To prevent infectious diarrheal outbreaks among mountaineers climbing Denali (and other highly trafficked alpine routes), we recommend that park staff provide climbers with detailed information related to minimizing disease risk and develop more effective strategies for preventing climbers from depositing fecal material directly into snow along the route, such as establishing and enforcing firmer penalties for noncompliance with existing human waste disposal regulations and requiring the use of personal stool-hauling devices.

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Abstract:

Issue addressed:The socio-economic disadvantage and ill-health experienced by Indigenous Australians has continued at alarming rates despite increased research into Indigenous health and the burdens faced by Indigenous peoples. Given the state of ill-health in Indigenous communities, there is increasing recognition of the need for greater understanding of Indigenous health needs and means by which to deal with them. Methods:This exploratory research study was designed to assess the meaning of Indigenous Australians' 'well-being' and 'spirituality', and the possible connection between these concepts. The study explored these concepts through a series of semi-structured interviews in an Indigenous community of north-eastern New South Wales. Results:The research participants consistently described well-being as an all-encompassing and holistic concept. Findings showed that spirituality still occupied a crucial role in Indigenous culture and well-being, despite the challenges to its existence since European invasion

McMahon, B.J. (2004). Viral hepatitis in the Arctic. *International Journal of Circumpolar Health, 63*(Suppl 2), 41-48. Retrieved from, http://ijch.fi/.

Abstract:

OBJECTIVES: Summarize research on viral hepatitis in indigenous populations in the Arctic. STUDY DESIGN: Literature review. METHODS: Medline search from 1966-2003. RESULTS: High prevalence rates of total hepatitis A antibody of > 50% and of hepatitis B of between 22% in Alaska and 42% in Greenland for total infection and between 3% in Canada and 12% in Siberia for chronic infection have been reported. Universal childhood vaccination with hepatitis A vaccine beginning at age 2 have stopped epidemics of HAV in Alaska and newborn hepatitis B immunization programs in Alaska and Canada have reduced new infections. However, in all Arctic countries several thousand persons chronically infected with HBV remain at risk for the development of cirrhosis and hepatocellular carcinoma. Prevalence rates of hepatitis C (HCV) reported are <1.4% in the Arctic. Hepatitis D virus, which co-infects with HBV, has been found in

40% of persons with HBV in Greenland. CONCLUSIONS: High rates of viral hepatitis A, B, C, and D are found in the Arctic. Effective vaccines against HAV, HBV and HDV can prevent transmission of these viruses. In addition, new antiviral therapies for HBV and HCV can be used effectively to treat many chronically infected patients.

McShane, K., & Smylie, J. (2006, March). The use of technology in urban Inuit health initiatives to bridge the gap between the north and the south. In N. Kaplan-Myrth and J. Smylie (eds.), Sharing what we know about living a good life. Indigenous Knowledge Translation Summit Report. Regina, SK: First Nations University of Canada. Retrieved June 3, 2008, from http://www.iphrc.ca/resources/Final_Summit_Report_Sept_30.pdf

McShane, K.E., Smylie, J.K., Hastings, P.D., & Martin, C.M. (2006). Guiding health promotion efforts with urban Inuit: a community-specific perspective on health information sources and dissemination strategies. *Canadian Journal of Public Health, 97*(4), 296-9. Retrieved from, http://www.cpha.ca/en/cjph.aspx.
Abstract:
OBJECTIVE: To develop a community-specific perspective of health information sources and dissemination strategies of urban Inuit to better guide health promotion efforts. METHODS: Through a collaborative partnership with the Tungasuvvingat Inuit Family Resource Centre, a series of key informant interviews and focus groups were conducted to gather information on specific sources of health information, strategies of health information dissemination, and overall themes in health information processes. FINDINGS: Distinct patterns of health information sources and dissemination strategies emerged from the data. Major themes included: the importance of visual learning, community Elders, and cultural interpreters; community cohesion; and the Inuit and non-Inuit distinction. The core sources of health information are family members and sources from within the Inuit community. The principal dissemination strategy for health information was direct communication, either through one-on-one interactions or in groups. CONCLUSION: This community-specific perspective of health information sources and dissemination strategies shows substantial differences from current mainstream models of health promotion and knowledge translation. Health promotion efforts need to acknowledge the distinct health information processes of this community, and should strive to integrate existing health information sources and strategies of dissemination with those of the community.

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Medeiros, L., Hillers, V., Kendall, P., & Mason, A. (2001). Evaluation of food safety education for consumers. *Journal of Nutrition Education and Behavior, 33,* S27-S34.

Meikle, N. (2007). How an isolated community took control of a TB outbreak: a nurse explains how community participation in health care helped an isolated Dene (aboriginal) community in Canada take control of a TB outbreak and the health of the community. [online] *Kai Tiaki: Nursing New Zealand*. Retrieved from, http://www.nzno.org.nz/Site/Professional/Kai_Tiaki/Default.aspx.

Messier, V., Levesque, B., Proulx, J., Ward, B., Libman, M., Couillard, M., et al. (2005). *Seroprevalence of zoonoses in nunavik: surveillance and risk factor assessment* [Poster]. Retrieved from, http://www.arcticnet-ulaval.ca/pdf/posters_2005/messier_et_%20al.pdf.

Messier , V., Lévesque, B., Proulx, J., Rochette, L., Serhir, B., Ward, B. et al. (2006). *Seroprevalence of zoonoses in Nunavik: What we have learned from the Qanuippitaa Health Survey.* Quebec City, Canada: Institut national de santé publique du Québec, Gouvernement du Québec. Retrieved from, http://arcticnet-ulaval.ca/pdf/talks2006/messier_valerie.pdf

Messier, V., Levesque, B., Proulx, J., Ward, B., Libman, M., Couillard, M. et al. (2007). *Zoonotic diseases, drinking water and gastroenteritis in Nunavik: a brief portrait*. Retrieved from, http://www.inspq.qc.ca/pdf/publications/resumes_nunavik/anglais/ZoonoticDiseasesDrinkingWaterAndGastroenteritisInNunavik.pdf.

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Midura, T., Nygaard, G., Wood, R., & Bodily, H. (1972). Clostridium botulinum Type F: Isolation from Venison Jerky. *Applied Microbiology, 24*(2), 165-167. Retrieved from, http://www.pubget.com/site/preload_results?search%5Bquick%5D=4561099.

Miewald, C. (1995). The nutritional impacts of European contact on the Omaha: A continuing legacy. *Great Plains Research: A journal of natural and social science*, Lincoln, Nebraska: University of Nebraska. Online. Retrieved from, http://

digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1178&context=greatplainsre searc

Mikhailovich, K., Morrison, P., & Arabena, K. (2007). Evaluating Australian Indigenous community health promotion initiatives: a selective review. *Rural & Remote Health. 7*(2), 746. Retrieved from, http://www.rrh.org.au/home/defaultnew.asp.
Abstract:
Effective health promotion interventions are critical to addressing the health needs of Indigenous people. We reviewed published and unpublished evaluation reports between 2000 and 2005 to identify practice issues pertinent to evaluators of Aboriginal and Torres Strait Islander health promotion initiatives. While the review of the literature was not systematic it was sufficiently comprehensive to provide a snapshot of evaluation practice currently in place within the Australian context. We found that published evaluation literature infrequently referred to the utilisation of guidelines for ethical research with Aboriginal and Torres Strait Islander peoples. The implications of this are that the importance and relevance of the guidelines for evaluative research are not being widely promoted or disseminated to evaluation practitioners and the role of the guidelines for improving evaluation practice remain unclear. While many innovative health promotion programs appear to have been highly regarded and well received by communities, the evaluation studies were not always able to report conclusively on the impact and health outcomes of these interventions or programs. This was due mainly to limitations in evaluation design that in some cases were insufficiently robust to measure the complex and multifaceted interventions described. To enhance rigour, evaluators of community health promotion initiatives could utilise mixed method approaches overtly informed by appropriate ethical guidelines, together with a broader range of qualitative methods aided by critical appraisal tools to assist in the design of evaluation studies. [References: 39]

Milburn, M. (2004). Indigenous Nutrition: Using Traditional Food Knowledge to Solve Contemporary Health Problems. *American Indian Quarterly, 48*(3&4), 411-434.
Abstract:
Indigenous populations are often disproportionately affected by changing diet and lifestyle patterns. Canada's Aboriginal people, for example, they have rates of diabetes some three times the national average and higher rates of other chronic diseases. A study of northern communities showed that 29% of young people and 60% of women were obese. Sandy Lake First Nation, an Ojibwa-Cree community in northern Ontario, has diabetes rate of 26%, the third highest rate in the world and some four to five times the national average. Traditional diet and lifestyle patterns provide protection against Western diseases, as rates of chronic, degenerative disease were historically very low in Indigenous populations. The interaction of changing lifestyle patterns with various genetic factors is considered the reason for the higher Aboriginal susceptibility to diet-related disease. This document talks about many studies looking at the effects of traditional indigenous food v.s. westernized foods on the health of indigenous people.

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Minuk, G.Y., & Uhanova, J. (2003). Viral hepatitis in the Canadian Inuit and First Nations populations. *Canadian Journal of Gastroenterology, 17,*707-712. Retrieved from, http://www.pulsus.com/journals/journalHome.jsp?HCtype=Consumer&jnlKy=2&/home.htm&.
Abstract:
OBJECTIVE: To review published prevalence data regarding hepatitis A (HAV), B (HBV) and C (HCV) in Canadian Inuit and First Nations populations. METHODS: PubMed database search and review of all papers describing data derived from seroepidemiological surveys. RESULTS: The prevalence of anti-HAV positivity in Canadian Inuit and First Nations populations reported to date is high (range 75% to 95%) and approximately three times that of non-Aboriginal Canadians residing in the same communities. Among the Canadian Inuit, the prevalence of HBV infection is approximately 5%, or 20 times that of non-Aboriginal Canadians, while the risk of exposure to HBV is 25%, or five times higher. Regarding the First Nations population, preliminary data suggest the prevalences of HBV infection (0.3% to 3%) and exposure (10% to 22%) are similar to rates in non-Aboriginals residing in the same regions and participating in similar high risk activities. Serological evidence of HCV infection (anti-HCV) is more common in the Canadian Inuit and First Nations (1% to 18%) than the remainder of the Canadian population (0.5% to 2%); however, viremia (HCV-RNA positivity) is less common (less than 5% versus 75% of anti-HCV positive individuals, respectively). CONCLUSIONS: Viral hepatitis is common in the Canadian Inuit and First Nations populations. In the absence of coexisting human immunodeficiency virus infection and alcohol abuse, the outcomes of HBV and HCV appear to be more benign than in non-Aboriginal Canadians.

Miskimmin, B., Muir, D., Schindler, D., Stern, G., & Grift, N. (1995). Chlorobornanes in Sediments and Fish 30 Years after Toxaphene Treatment of Lakes. *Environmental Science and Technology, 29*(10), 2490-2495. doi: 10.1021/es00010a006.

Moller, L., Petersen, E., Kapel, C., Melbye, M., & Koch, A. (2005). Outbreak of trichinellosis associated with consumption of game meat in West Greenland. *Veterinary Parasitology, 132*(1-2), 131-6.
Abstract:

The Inuit population of the Arctic has always been at risk of acquiring trichinellosis and severe outbreaks have been recorded in Alaska and Canada. In West Greenland, a number of large outbreaks took place during the 1940s and 1950s; they involved total 420 cases including 37 deaths. Since then only sporadic cases have been reported. Here, we describe an outbreak of infection with Trichinella spp. after consumption of infected meat presumably from walrus or polar bear caught in western Greenland. Six persons who had eaten of the walrus and polar bear meat were two males and four females, age range 6--47 years. Using ELISA and Western blot analysis (Trichinella-specific IgG antibodies against excreted/secreted antigen and synthetic tyvelose antigen, respectively) four of these persons were found to be sero-positive for Trichinella antibodies, with three of these having clinical symptoms compatible with trichinellosis. On re-test, 12--14 months later one of the two sero-negative persons had sero-converted, probably due to a new, unrelated infection. This study demonstrates that acquiring Trichinella from the consumption of marine mammals remains a possibility in Greenland, and that cases may go undetected. Trichinellosis in Greenland can be prevented by the implementation of public health measures.

Montville, R., Chen, Y., & Schaffner, D. (2002). Risk assessment of hand washing efficacy using literature and experimental data. *International Journal of Food Microbiology*, 73, 305-313.

Moorhead, A., Grunenwald, P., Dietz, V., & Schantz, P. (1999). Trichinellosis in the United States, 1991-1996: Declining but not gone. *American Journal of Tropical Medicine & Hygiene, 60*(1), 66-9. Retrieved from, http://www.ajtmh.org/.
Abstract:
Since the U.S. Public Health Service began recording statistics on trichinellosis in 1947, the number of cases reported by state health departments has decreased steadily. In the late 1940s, health departments reported an average of 400 cases and 10-15 deaths each year. From 1991 to 1996, the period covered in this report, three deaths in 230 cases were reported to the Centers for Disease Control and Prevention (an average of 38 cases per year), including 14 multiple case outbreaks from 31 states and Washington, DC. Information on the suspected food item was available for 134 (58%) of the 230 reported cases. Pork was implicated in 80 (60%) cases, bear meat in 31 (23%), walrus meat in 13 (10%), and cougar meat in 10 (7%). Sausage was the most frequently implicated pork product (i.e., 57 of the 64 cases for which the form of the pork product was identified). The proportion of trichinellosis cases attributable to consumption of commercial pork continued to decrease; this decrease was probably due to a combination of factors, including the continued reduction in the prevalence of Trichinella spiralis in domestic swine, the increased use of home freezers, and the practice of thoroughly cooking pork. As a proportion of all cases reported, those associated with wild game meat products has increased; however, the absolute numbers of such cases have remained similar at approximately 9-12 per year. The continued multiple case outbreaks and the identification of nonpork sources of infection indicate the need for further education and control measures.

Morgante, O., Wildinkso, D., Bruce, M., Burchak, E., & Richter, M. (1972). Outbreak of Hand-Foot-and-Mouth Disease Among Indian and Eskimo Children in a Hospital. *Journal of Infectious Diseases, 125*(6), 587. Retrieved from, http://www.journals.uchicago.edu/toc/jid/current.

Morrissey, C.A., Bendell-Young, L.I., & Elliott, J.E. (2005).Identifying Sources and Biomagnification of Persistent Organic Contaminants in Biota from Mountain Streams of Southwestern British Columbia, Canada. *Environmental Science and Technology, 39*(20), 8090-8098. doi: 10.1021/es050431n.
Abstract:
We assessed whether biota occupying mountain streams accumulate and biomagnify remotely derived organic pollutants originating from atmospheric inputs to snowpack and glacial runoff and from marine sources introduced by migrating anadromous salmon. Several persistent organic pollutants including polychlorinated biphenyls (PCBs), p,p'-dichloro-diphenyl-dichloroethylene, hexachlorobenzene, and trans-nonachlor were commonly detected in benthic invertebrates, salmon fry (Oncorhynchus spp.), and eggs of an aquatic passerine, the American dipper (Cinclus mexicanus) from the Chilliwack River watershed, British Columbia, Canada. Total PCBs and several organochlorines (OCs) biomagnified from benthic invertebrate composites to salmon fry to dipper eggs. Invertebrate samples generally did not differ significantly in contaminant burdens between the river main stem where salmon are more abundant and higher-elevation tributaries where the salmon density is lower. Concentrations of total OCs and total PCBs in dipper eggs were positively related to drainage basin area and collection year but not to elevation. No differences in PCB congener patterns existed between dipper egg samples from the Chilliwack watershed and other watersheds in southwestern British Columbia. However, principal component analysis revealed significant spatial differences in egg PCB congener patterns between the main Chilliwack River and the higher-elevation tributaries. This difference was primarily due to a greater occurrence of lower chlorinated PCB congeners (66 and 105) in dipper eggs collected from the tributaries and higher loadings of the more stable and persistent congeners (153, 138, 130, and 128) in eggs from the river main stem. The results suggest that atmospheric sources are the main contributor of contaminants detected in biota from the region and that biomagnification is a common pathway for accumulation in lotic predators such as the American dipper.

Morrison N.E., Receveur, O., Kuhnlein, H.V., Appavoo, D., Soueida, R. & Pierrot, P. (1995). Contemporary Sahtu Dene/Metis use of traditional and market food. *Ecology of Food and Nutrition, 34,*197-210. Retrieved from, http://www.tandf.co.uk/journals/titles/03670244.html.

Morrison, D.R. (2006). 1st Annual Interior of B.C. Indigenous Food Sovereignty Conference, Final Report. Retrieved from, http://www.fooddemocracy.org/docs/IFS_Conf06_Report.pdf

Mos. L., Jack, J., Cullon, D., Montour, L., Alleyne, C., & Ross, P.S. (2004). The importance of marine foods to a near-urban first nation community in coastal British Columbia, Canada: Toward a risk-benefit assessment. *Journal of*

Toxicology & Environmental Health, A, 67(8-10), 791-808. Retrieved from, http://www.tandf.co.uk/journals/titles/15287394.html.

Abstract:
There is increasing concern that some subsistence-oriented consumer groups may be exposed to elevated levels of persistent organic pollutants (POPs) through the consumption of certain traditional foods, including fish and other aquatic resources. Exposure to POPs has been associated with adverse health effects including immunotoxicity, endocrine disruption, and altered development in moderate to highly exposed humans and wildlife. The Sencoten (Saanich) First Nation consists of approximately 1900 people inhabiting communities in a near-urban setting in coastal British Columbia, Canada. A survey was conducted to document the relative importance of traditional foods in the diet of the Sencoten people, as a basis for the future assessment of exposure to, and risks associated with, environmental contaminants in such a diet. Salmon represented 42% of the total marine meals, but at least 24 other marine species were also consumed. Our study suggests that traditional marine foods remain very important to the social and economic well-being of the Sencoten, despite their proximity to an urban center. This information will be of value to those interested in nutritional, cultural, and health issues concerning subsistence-oriented First Nations peoples, and provides an important first step in risk assessment.

Motarjemi, Y. (2002). Impact of small scale fermentation technology oon food safety in developing countries. *International Journal of Food Microbiology, 75 (*3), 213-229.

Muckle, G., Ayotte, P., Dewailly, E., Jacobson, S.W., & Jacobson, J.L. (2001). Determinants of polychlorinated biphenyls and methylmercury exposure in Inuit women of childbearing age. *Environmental Health Perspectives, 109*(9), 957-963. Retrieved from, http://www.ehponline.org/.

Abstract:
The objectives of this study were to to identify maternal characteristics associated with traditional food consumption and to examine food items associated with polychlorinated biphenyls (PCBs) and mercury body burden in pregnant Inuit women from Northern Quebec. We interviewed women from three communities at mid-pregnancy and at 1 and 11 months postpartum. We measured PCBs, Hg, and selenium in maternal blood; Hg was also measured in maternal hair. The women reported eating significant amounts of fish, beluga muktuk/fat, seal meat, and seal fat. Although consumption of fish and seal was associated with lower socioeconomic status, consumption of beluga whale was uniform across strata. Fish and seal meat consumption was associated with increased Hg concentrations in hair. Traditional food intake during pregnancy was unrelated to PCB body burden, which is more a function of lifetime consumption. This study corroborated previous findings relating marine mammal and fish consumption to increased Hg and selenium body burden. Despite widespread knowledge regarding the presence of these contaminants in traditional foods, a large proportion of Inuit women increased their consumption of these foods during pregnancy, primarily because of pregnancy-related changes in food preferences and the belief that these foods are beneficial during pregnancy.

Muir, D., Backus, S., Derocher, A.E., Dietz, R., Evans, T.J., Gabrielsen, G.W., et al. (2006). Brominated Flame Retardants in Polar Bears (Ursus maritimus) from Alaska, the Canadian Arctic, East Greenland, and Svalbard. *Environmental Science and Technology*, *40*(2), 449-455. doi: 10.1021/es051707u.

Muir, D., Riget, F., Cleemann, M., Skaare, J., Kleivane, L., Nakata, H., et al. (2000). Circumpolar Trends of PCBs and Organochlorine Pesticides in the Arctic Marine Environment Inferred from Levels in Ringed Seals. *Environmental Science and Technology, 34*(12), 2431-2438. doi: 10.1021/es991245i.

Muir, D., Segstro, M., Hobson, K., Ford, C., Stewart, R., & Olpinski, S. (1995). Can seal eating explain elevated levels of PCBs and organochlorine pesticides in walrus blubber from Eastern Hudson Bay (Canada)? *Environmental Pollution, 90* (3), 335-348. DOI: 10.1016/0269-7491(95)00019-N.

Muir, D., Shearer, R., Van Oostdam, J., Donaldson, S., & Furgal, C. (2005). Contaminants in Canadian arctic biota and implications for human health: Conclusions and knowledge gaps. *Science of the Total Environment, 351-352*, 539-546. doi:10.1016/j.scitotenv.2005.08.030.
Abstract:
This paper summarizes the major findings of the special issue entitled “Contaminants in Canadian Arctic Biota and Implications for Human Health.” The individual papers and reviews in this special issue present a large amount of new information on contaminants in biota primarily from the Canadian arctic as well as from Alaska, Greenland and the European Arctic. Temporal and spatial trends are examined and potential biological effects on wildlife are assessed. The special issue also presents new and updated data on human exposure to and possible health effects of current levels of environmental contaminants in the Canadian Arctic. As part of the assessment of the human health implications, the unique structures and processes that have developed in the Canadian Arctic under the Northern Contaminants Program (NCP) of Indian and Northern Affairs Canada to build partnerships and manage and communicate the benefits and risks associated with contaminant exposure are discussed. Application of this information in international forums to reduce anthropogenic emissions of contaminants to the environment is also discussed.

Muller, N., Sager, H., Schuppers, M., & Gottstein, B. (2006). Methods for investigating Trichinella infections in domestic and wild animals. *Schweiz Arch Tierheilkd, 148*(9), 463-71.
Abstract:
Trichinellosis is an important parasitic zoonosis that is caused by the intracellular nematode Trichinella spp.. Infection of humans occurs through consumption of raw (or undercooked) meat containing infectious larvae. In Europe, meat from pork, horse, and wild boar have been identified as most important sources of Trichinella infections in humans. In Switzerland, both the domestic pig and wild boar population are considered free of Trichinella. Conversely, Swiss foxes, lynxs and recently a wolf were found to be

infected, the species identified in these animals was always referred to as Trichinella britovi. Although this species rarely infects pork and, compared to Trichinella spiralis, only causes reduced pathogenic effects in humans, the basic presence of Trichinella in Switzerland cannot be neglegted. This fact has gained increasing importance since the responsible authorities in the European Union (EU) are preparing regulations for the official Trichinella-control in meat in order to improve food safety for consumers. These regulations will be implemented as a consequence of the recent association of east European countries with the EU. This new legislation particularly takes into account, that in the past by far most cases of human trichinellosis in the EU were due to consumption of imported east European meat.Within the framework of the bilateral agreements of Switzerland with the EU, the Swiss veterinary public health authorities will have to comply with the foreseen EU regulations. Although diagnostic methods for the direct demonstation of Trichinella in pork meat are already routine practice in several Swiss abattoirs, the implementation of a meat control program for Trichinella for the entire slaughter pig population of the country would lead to an enormous increase in costs for the administration and will require an increased infrastructure in veterinary services. In order to find a reduced testing format for monitoring Trichinella infections in Swiss pork, an infection risk-oriented survey strategy is currently evaluated. In the present article, this minimized survey strategy is discussed regarding its compatibility with the EU regulations laying down rules for the official control of meat for Trichinella. PMID: 17024975 [PubMed - indexed for MEDLINE]

Muniesa, M., Jofre, J., Garcia-Aljaro, C., & Blanch, A.R. (2006). Occurrence of Escherichia coli O157:H7 and Other Enterohemorrhagic *Escherichia coli* in the Environment. *Environmental Science and Technology, 40*(23), 7141-7149. doi: 10.1021/es060927k.

Abstract:

Enterohemorrhagic Escherichia coli (EHEC) (O157 and other serotypes) are zoonotic pathogens linked with severe human illnesses. The main virulence factors of EHEC are the Shiga toxins, among others. Most of the genes coding for these toxins are bacteriophage-encoded. Although ruminants are recognized as their main natural reservoir, water has also been documented as a way of transmission of EHEC. E. coli O157:H7 and other EHEC may contaminate waters (recreational, drinking or irrigation waters) through feces from humans and other animals. Indeed, the occurrence of EHEC carrying the stx2 gene in raw municipal sewage and animal wastewater from several origins has been widely documented. However, the evaluation of the persistence of naturally occurring EHEC in the environment is still difficult due to methodological problems. Methods proposed for the detection and isolation of stx-encoding bacteria, ranging from the classic culture-based methods to molecular approaches, and their application in the environment, are discussed here. Most virulence factors associated with these strains are linked to either plasmids or phages, and consequently they are likely to be subject to horizontal gene transfer between species or serotypes. Moreover, the presence of infectious stx-phages isolated as free particles in the environment and their high persistence in water systems suggest that they may contribute to the spread of stx genes, as they are directly involved in the emergence of new pathogenic strains, which might have important health consequences.

Munroe, F.A., Dohoo, I.R., & McNab, W.B. (2000). Estimates of within-herd incidence rates of Mycobacterium bovis in Canadian cattle and cervids between 1985 and 1994. *Preventive Veterinary Medicine, 45*(3-4), 247-256. Retreived from, http://www.sciencedirect.com/science/journal/01675877.

Muscatello, J.R., Bennett, P.M., Himbeault, K.T., Belknap, A.M., & Janz, D.M. (2006). Larval Deformities Associated with Selenium Accumulation in Northern Pike (Esox lucius) Exposed to Metal Mining Effluent. *Environmental Science and Technology, 40*(20), 6506-6512. doi: 10.1021/es060661h.
Abstract:
The objective of this study was to investigate selenium toxicosis in larval northern pike (Esox lucius) originating from reproductively mature pike collected downstream of a uranium milling operation in northern Saskatchewan, Canada. Eggs were obtained from female pike collected from a reference site and three sites representing an exposure gradient (approximately 2, 10, and 15 km downstream of effluent discharge). Embryos were incubated following a two-way (crossover) analysis of variance experimental design that allowed discrimination between effects due to maternal transfer to eggs and effects due to site water exposure in the developing embryos. The major finding of this study was a significant increase in the frequencies of individual deformities (skeletal curvatures, craniofacial deformities, and fin deformities) and edema in fry originating from high and medium exposure site females (mean selenium concentrations of 48.23 and 31.28 g/g egg dry weight and 38.27 and 16.58 g/g muscle dry weight, respectively) compared to reference site females. Selenium concentrations resulting in a 20% increase in total deformities above background levels (EC20s) were 33.55 and 21.54 /g dry weight in eggs and muscle, respectively. Mathematical conversion of the egg- and muscle-derived relationships to whole body selenium levels resulted in similar EC20s of 15.56 and 17.72 g/g dry weight, respectively. These relationships between tissue selenium levels and larval deformities suggest that northern pike are within the same range of sensitivity to selenium as the majority of warm water (e.g., centrarchids and cyprinids) and cold water (e.g., salmonids) fish species studied to date.

Myers, H., & Furgal, C. (2006). Long-range transport of information: Are Arctic residents getting the message about contaminants? *Arctic, 59*(1), 47-60. Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_journal.
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

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Nabhan, G., & Kindscher, K. (2006). *Renewing the native food traditions of the Bison Nation.* Retrieved from, http://www.slowfoodusa.org/raft/Bison.pdf.

Nakano, T., Fediuk, K., Kassi, N., Egeland, G.M., & Kuhnlein, H.V. (2005). Dietary nutrients and anthropometry of Dene/Métis and Yukon children. *International Journal of Circumpolar Health, 64*(2), 147-56. Retrieved from, http://ijch.fi/.

Abstract:
OBJECTIVE: To describe nutrient intakes and anthropometry of 10-12-year-old Dene/Métis and Yukon children in the Canadian Arctic. STUDY DESIGN: 24 h-recall interviews (n = 222 interviews) were conducted on Canadian Dene/Métis and Yukon children in five communities during two seasons in 2000-2001; the children were measured for height and weight (n = 216). METHODS: Assessment of nutrient adequacy used Dietary Reference Intakes (DRIs) including cut-point procedures. Anthropometric measurements (height and weight) were assessed and body mass index (BMI) was compared to the 2000 CDC Growth Charts. RESULTS: Thirty-two percent of the children were above the 85th percentile of BMI-for-age. More than 50 percent of children were below the Estimated Average Requirement (EAR) for vitamins A and E, phosphorus and magnesium; mean intakes were below the Adequate Intake (AI) for vitamin D, calcium, dietary fiber, omega-6 fatty acids, and omega-3 fatty acids. Nutrients that were probably adequate for some gender/season groups were protein, carbohydrate, iron, copper, selenium, zinc, manganese, riboflavin and vitamins B6 and C. CONCLUSIONS: Excessive prevalence of overweight and inadequacy of some nutrients were observed among Dene/Métis and Yukon children, suggesting a necessity for dietary improvement. However, many nutrients were adequate, in some cases probably due to continued traditional food use. PMID: 15945284 [PubMed - indexed for MEDLINE]

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National Environmental Justice Advisory Council. (2004). *Ensuring risk reduction in communities with multiple stressors: environmental justice and cumulative* *risk/impacts.* Retrieved from, http://www.epa.gov/Compliance/resources/publications/ej/nejacmtg/nejac-cum-risk-reort-exec-summary.pdf.

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Abstract:
The purpose of this paper is to explore the health status of Canadian Aboriginals, along with their perceived community health problems and proposed solutions to these issues. Data are drawn from the 1991 Aboriginal Peoples Survey (APS), which is a weighted random sample of the Aboriginal population. Comparisons were made with respect to group identity (North American Indian, Métis and Inuit) and geographic location (reserve, urban, rural and North) and across a series of health status and health care use indicators. Analysis reveals that geographic location, as compared with Aboriginal identity, appears to have a large impact with respect to health status and use of physician services. On-reserve Aboriginals, for example, reported a lower likelihood of having seen a physician and were more likely to rank their health as fair or poor. Location also influenced perceived community health problems and solutions. Self-identified problems included drugs, cancer and arthritis, while corresponding solutions included education, counseling and service access. Although the problems and solutions were relatively consistent across space, they too varied in their importance. In general, the results tend to reinforce the determinants of health framework, suggesting that the provision of health services is insufficient to remove health disparities on its own. Instead, broader social-welfare provisions must be considered.

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New Mexico Department of Health. (2005). *New Mexico American Indian Health Status Report.* Retrieved from, http://www.health.state.nm.us/pdf/health_status_report_final.pdf

Nickels, S., Furgal, C., Buell, M. and Moquin, H. (2006): *Unikkaaqatigiit: Putting the human face on climate change — perspectives from Inuit in Canada*. Ottawa, Canada: Inuit Tapiriit Kanatami, the Nasivvik Centre for Inuit Health and Changing Environments at Université Laval and the Ajunnginiq Centre at the National Aboriginal Health Organization. Retrieved from, http://www.itk.ca/Climate-Change-Perspectives-From-Inuit-In-Canada

Nielsen, K.F., Sumarah, M.W., Frisvad, J.C., & Miller, J.D. (2006). Production of Metabolites from the Penicillium roqueforti Complex. *Journal of Agriculture and Food Chemistry*, *54*(10), 3756-3763. Retrieved from, http://pubs.acs.org/journals/jafcau/.

Abstract:
Penicillium roqueforti comprises three accepted species: P. carneum, which is associated with meat, cheese, and bread; P. paneum, associated primarily with bread and silage; and P. roqueforti, which is associated with various processed foods and silage. This paper reports the use of HPLC-MS and HPLC-NMR to investigate the metabolites of silage-derived strains from two areas where silage toxicoses are regularly observed (Scandinavia and eastern Canada). Only modest differences were seen between the metabolites produced by strains from Canada and Scandinavia; however, silage strains of P. paneum isolated from Quebec were poor producers of patulin. This paper reports for the first time the production of festuclavine from P. paneum. This may be important as a possible explanation for the ill thrift observed when this species is dominant in poorly ensiled materials fed to dairy cows.

Nielsen, O., Clavijo, A., Boughen JA. (2001). Serologic evidence of influenza A infection in marine mammals of arctic Canada. *Journal of Wildlife Diseases, 37* (4), 820-5. Retrieved from, http://www.jwildlifedis.org/.

Abstract:
A serologic survey of influenza A antibodies was undertaken on 1,611 blood samples from five species of marine mammals collected from Arctic Canada from 1984-98. Sampling was done in 24 locations throughout the Canadian Arctic encompassing Sachs Harbor (72 degrees N, 125 degrees W), Northwest Territories in the west to Loks Land (63 degrees N, 64 degrees W), Nunavut in the east, to Eureka (80 degrees N, 86 degrees W), Nunavut in the north to Sanikiluaq (56 degrees N, 79 degrees W), Nunavut in the south. A competitive ELISA using a monoclonal antibody (Mab) against influenza A nucleoprotein (NP) was used. Five of 418 (1.2%) belugas (Delphinapterus leucas) and 23 of 903 (2.5%) ringed seals (Phoca hispida) were serologically positive. None of the 210 walruses (Odobenus rosmarus rosmarus), 76 narwhals (Monodon monoceros) and four bowhead whales (Balaena mysticetus) had detectable antibodies to influenza A. Positive belugas were identified from communities on southeast Baffin Island while positive ringed seals came from communities in the eastern, western and high Arctic. Virus isolation attempts on lung tissue from a seropositive beluga were unsuccessful. We believe that influenza A infection in marine mammals is sporadic, the infection is probably self-limiting, and it may not be able to be maintained in these animals. Although the predominant hemagglutinin (H) type was not determined and therefore the

pathogenicity of the strains to humans is unknown, the hunting and consumption of marine mammals by the Inuit, may put them at risk for influenza A infection. PMID: 11763748 [PubMed - indexed for MEDLINE]

Nielsen, O., Cobb, D., Stewart, R.E.A., Ryan, A., Dunn, B., Raverty, S., et al. (2004). Results of a community based disease monitoring program of marine mammals in arctic Canada. *Oceans, 1,* 492-498.

Abstract:

It is the right of Canadian Inuit to hunt marine mammals for subsistence. Most of this food is consumed raw, yet it under goes no formal government inspection or certification. Hunters also encounter sick or abnormal animals and they are becoming increasingly concerned about the wholesomeness of the food that they eat. They are also concerned about epizootics that may severely limit the number of animals that are available for their use. As a result, the Department of Fisheries and Oceans Canada (DFO) has been asked by Inuit wildlife management groups to determine what possible disease threats are present in the marine mammal populations of Arctic Canada. Two separate DFO surveillance projects have been operational since the mid 1990 to address those concerns. The first uses tissue samples supplied from hunter-killed and presumably healthy animals while the second encourages hunters to submit tissue samples from animals that appear either sick or abnormal or that are found dead. Both programs rely on the cooperation of a number of specialists and the results of these investigations have provided a rare insight to the role that infectious diseases are having on the overall health of marine mammals in Arctic Canada. Specifically, serological evidence of significant viral and bacterial pathogens including distemper, influenza A, herpes and Brucellosis has been obtained from the apparently healthy animals while patterns of natural mortality are emerging from the systematic testing of the sick/abnormal submissions. Of special concern is the role that infectious diseases such as Brucellosis may be having on stocks of animals that are classed as endangered. Brucellosis in these animals may proceed as a steady decline in numbers over time while the introduction of a highly pathogenic viral disease such as distemper into a population of immunologically naive animals may be immediately catastrophic.

Nishi, J., Shury, T., & Elkin, B. (2006). Wildlife reservoirs for bovine tuberculosis (Mycobacterium bovis) in Canada: strategies for management and research. *Veterinary Microbiology, 112*, (2-4), 325-38. doi:10.1016/j.vetmic.2005.11.013.

Abstract:

In Canada, there are two known regional foci where wildlife populations are infected with bovine tuberculosis (Mycobacterium bovis) and considered to be disease reservoirs. Free-ranging populations of wood bison (Bison bison athabascae) in and around Wood Buffalo National Park (WBNP) and wapiti (Cervus elaphus manitobensis) in and around Riding Mountain National Park (RMNP) are infected with bovine tuberculosis. In this paper, we provide an overview of these diseased wild ungulate populations and the complexities of attempting to manage issues relating to bovine tuberculosis in and around protected areas. We do not describe the quantitative science and epidemiological data in detail from these case histories, but instead compare and contrast these two cases from a broader perspective. This is achieved by reviewing the context and process by which a diverse group of stakeholders engage and develop strategies to address the controversial problems that diseased wildlife populations often present. We suggest that understanding the factors that drive the strategic-level management processes is equally important for addressing a wildlife disease problem as the tactical-level issues, such as design and implementation of technically sound field research and management programs. Understanding the experiences within the WBNP and RMNP areas, particularly the strategies that have failed or succeeded, may prove useful to understanding and improving management approaches when wildlife are infected with M. bovis. Applying this understanding is consistent with the principles of adaptive management in which we learn from previous experiences to develop better strategies for the future.

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Norstrom, R., Simon, M., Muir, D., & Schweinsburg, R. (1988). Organochlorine contaminants in arctic marine food chains: identification, geographical distribution and temporal trends in polar bears. *Environmental Science and Technology, 22*(9), 1063-1071. doi: 10.1021/es00174a011.

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Nuxalk Food and Nutrition Program. (1984). *Nuxalk food and nutrition handbook : a practical guide to family foods and nutrition using native foods.* Richmond: Malibu Offset Printing.

Abstract:
Summary: Practical information on how to find and prepare foods native to the Nuxalk people of Bella Coola, British Columbia are offered in this handbook produced by the Nuxalk Food and Nutrition Program. The handbook emphasizes the nutritional benefits of native foods, as well as the contribution these foods make to the culture and lifestyle of the native people. The first section of the handbook describes a variety of native foods (fish, seafood, shellfish, berries, greens, roots, tea, tree foods, game), and traditional food preparation methods. Another section outlines the nutritional contribution of native foods and provides practical guidelines on keeping foods safe to eat, preserving foods, controlling food costs, losing weight, and choosing healthy snacks.
The final section outlines the objectives of the Nuxalk Food and Nutrition Program, and describes the following program activities: Nuxalk food use studies, native food availability studies, assessment of the nutritional quality of native foods, nutritional assessment of the Nuxalk people, and efforts to improve the nutritional status of the Nuxalk people. While the handbook specifically addresses the foods and nutrition of the Nuxalk people, information may be used in a number of ways with other native groups.

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Ogborn, M.R., Hamiwka, L., Orrbine, E., Newburg, D.S., Sharma, A., McLaine, P.N., et al. (1998). Renal function in Inuit survivors of epidemic hemolytic-uremic syndrome. *Pediatric Nephrology, 12*(6), 485-488. doi: 10.1007/s004670050493.

Abstract:
We undertook a case-control study to evaluate the renal health of survivors of hemolytic-uremic syndrome (HUS) from the 1991 Arctic epidemic of Escherichia coli O157:H7 gastroenteritis 4 years after the epidemic. Eighteen children who developed HUS during the 1991 epidemic and 18 age- and sex-matched controls from the same community who had uncomplicated gastroenteritis were compared in 1995 for height, weight, blood pressure, urinalysis, and glomerular filtration rate (GFR), measured using continuous subcutaneous infusion of non-radioactive iothalamate. HUS survivors did not differ from controls in height, weight, systolic (HUS 118 mmHg, control 117 mmHg) or diastolic (HUS 64 mmHg, control 62 mmHg) blood pressures. Hematuria was detected more frequently in HUS survivors (11/18 vs. 4/18, $P<0.05$), but no child had proteinuria. Mean GFR did not differ between the two groups (HUS 159 ml/min per 1.73 m(2), control 147 ml/min per 1.73m(2)). Survivors of post-enteritic HUS from the 1991 Arctic E. coli O157:H7 outbreak have excellent renal function 4 years after the epidemic.

O'Grady, K., & Krause, V. (1999). An outbreak of salmonellosis linked to a marine turtle. *Southeast Asian Journal of Tropical Medicine and Public Health, 30*(2), 324-327.
Abstract:
In September 1998, an outbreak of gastroenteritis occurred in a coastal Aboriginal community in the Northern Territory over a seven day period. An investigation was conducted by the Center for Disease Control, Territory Health Services. Thirty-six cases were detected and 17% (n=6) were hospitalized. Salmonella chester was isolated from eight of nine stool specimens. Sixty-two percent of cases interviewed (n=28) reported consumption of a green turtle (Chelonia mydas) within a median of 24 hours prior to onset of illness. Of the remainder, all but two were contacts of other cases. Salmonella chester was isolated from a section of partially cooked turtle meat. There are no previous published reports of salmonellosis associated with consumption of sea turtles despite them being a popular food source in coastal communities in the Pacific.

Okamoto, S.K., LeCroy, C.W., Tann, S.S., Rayle, A.D., Kulis, S., Dustman, P., et al. (2006). The implications of ecologically based assessment for primary prevention with indigenous youth populations. *Journal of Primary Prevention. 27*(2), 155-170. doi: 10.1007/s10935-005-0016-6.

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Olson, M., Roach, P., Stabler, M., & Chan, W. (1997). Giardiasis in ringed seals from the western arctic. *Journal of Wildlife Diseases, 33*(3), 646-8. Retrieved from, http://www.jwildlifedis.org/cgi/content/abstract/33/3/646.

O'Neil, J.D. (1995). Issues in health policy for indigenous peoples in Canada. *Australian Journal of Public Health, 19*(6), 559-66.

O’Neil, J.D. & Blanchard J. (2001). *Consideration for the development of public health surveillance in First Nations Communities.* Retrieved from, http://www.umanitoba.ca/centres/cahr/researchreports/Surveillancepaperfinal.pdf.

Ongerth, J., Johnson, R., Macdonald, S., Frost, F., & Stibbs, H. (1989). Backcountry Water Treatment to Prevent Giardiasis. *American Journal of Public Health, 79*(12), 1633-1637. Retrieved from, http://www.ajph.org/.
Abstract:
This study was conducted to provide current information on the effectiveness of water treatment chemicals and filters for control of Giardia cysts in areas where treated water is not available. Four filters and seven chemical treatments were evaluated for both clear and turbid water at 10°C. Three contact disinfection devices were also tested for cyst inactivation. Filters were tested with 1-liter volumes of water seeded with 3 x 104 cysts of G. lamblia produced in gerbils inoculated with in vitro cultured trophozoites; the

entire volume of filtrate was examined for cyst passage. Chemical treatments were evaluated at concentrations specified by the manufacturer and for contact times that might be expected of hikers (30 minutes) and campers (eight hours, i.e., overnight). Two of the four filter devices tested were 100 percent effective for Giardia cyst removal. Ofthe other two filters, one was 90 percent effective and the other considerably less effective. Among the seven disinfection treatments, the iodine-based chemicals were all significantly more effective than the chlorine-based chemicals. None of the chemical treatments achieved 99.9 percent cyst inactivation with only 30- minute contact. After an eight-hour contact each of the iodine but none of the chlorine preparations achieved at least 99.9 percent cyst inactivation. None of the contact disinfection devices provided appreciable cyst inactivation. Heating water to at least 70°C for 10 minutes was an acceptable alternative treatment.

Onishchenko, G.G. (2005). Problems of drinking water supply in Russia in the system of international actions on Water and health. Optimization of solution ways. *Gigiena i Sanitariya, 5*, 3-8.

Onishchenko, G.G., Maramovich, A. S., Golubinsky, E. P., Maslov, D. V., Vershkova, T. I., Urbanovich, L., et al. (2000a). Cholera in the far east of Russia: Communication 1. *Zhurnal Mikrobiologii Epidemiologii i Immunobiologii, 5*, 26-31.

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Oostdam, J., van Donaldson, S. G., Feeley, M., Arnold, D., Ayotte, P., Bondy, G., et al. (2005). Human health implications of environmental contaminants in Arctic Canada: a review. *Science of the Total Environment, 351/352*, 165-246. doi: 10.1016/S0048-9697(99)00036-4.

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Orr, P.H., Dong, V., Lorencz, B., Sinuff, N., Manuel, D., Bell, S., et al. (1994). Hemolytic uremic syndrome secondary to an outbreak of verotoxin-producing E. coli in the Canadian Arctic. *Arctic Medical Research, 53*(Suppl 2), 630-634.

Orr, P., Dong, V., Schroeder, M., & Ogborn, M. (1995). P1 Blood Group Antigen Expression and Epidemic Hemolytic Uremic Syndrome. *Pediatric Nephrology, 9*(5), 612-613. doi: 10.1007/BF00860953.
Abstract:
P1 blood group positivity has been postulated as a host factor which may provide protection against the development of post-enteropathic hemolytic uremic syndrome (HUS). In this study, blood group status in 20 Inuit survivors of Escherichia coil O157:H7-associated HUS was compared with age- and sex-matched controls from the same community who had experienced uncomplicated diarrheal illness due to the same pathogen. Of 20 HUS survivors, 6 were P1 antigen positive compared with 8 of the 20 controls (P = 0.7). We conclude that p1 antigen positivity was not protective against HUS in this population. Further studies of this condition to clarify the role of host factors in verotoxin-induced endothelial damage are indicated.

Orr, P., Lorencz, B., Brown, R., Kielly, R., Tan, B., Holton, D. et al. (1994). An Outbreak of Diarrhea Due to Verotoxin-producing *Escherichia coli* In the Canadian Northwest Territories. *Scandinavian Journal of Infectious Diseases, 26*(6), 675-684. DOI: 10.3109/00365549409008635.
Abstract:
In the summer of 1991 a large outbreak of Escherichia coil O157:H7 associated diarrhea occurred in 6 Inuit communities in the Canadian Northwest Territories. The total population of these communities is 5,292. Of the 521 individuals who developed diarrhea, 152 (29%) were positive for E. coli O157:H7 on stool culture or positive by verotoxin analysis. Median age was 6 years. The attack rate for children <1 year was 43% in the major affected community of Arviat. Hemolytic-uremic syndrome (HUS) developed in 22 cases, and 2 patients died. Asymptomatic stool carriage of verotoxin-producing E. coli (VTEC) 2-5 weeks after diarrheal illness was noted in 4/28 persons followed prospectively. Epidemic curves, case-control studies and phage type testing suggested person-to-person transmission, The original source of infection was not identified, though a food source was suspected. VTEC were detected in 6 food samples (minced beef and caribou) taken from retail outlets and homes. Primary prevention of infection through health education and promotion activities, as well as long-term follow-up of HUS survivors, are indicated in this population.

Outridge, P.M., Hobson, K.A., McNeely, R., & Dyke, A. (2002). A comparison of modern and preindustrial levels of mercury in the teeth of beluga in the Mackenzie Delta, Northwest Territories, and walrus at Igloolik, Nunavut, Canada. *Arctic, 55*(2), 123-132. Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_journal.
Abstract:
Mercury (Hg) concentrations were compared in modem and preindustrial teeth of belugas (Delphinapterus leucas) and walrus (Odobenus rosmarus rosmarus) at sites in the

Canadian Arctic so that the relative amounts of natural and anthropogenic Hg in modem animals could be estimated. Mercury levels in the teeth of Beaufort Sea belugas captured in the Mackenzie Delta, Northwest Territories, in 1993 were significantly ($p = 0.0001$) higher than those in archeological samples dated A.D. 1450-1650. In terms of geometric means, the Hg levels in modem animals were approximately four times as high as preindustrial levels in 10-year-old belugas, rising with age to 17 times as high in 30-year-olds. Because Hg levels in modem teeth were highly correlated with those in soft tissues, including muscle and muktuk, which are part of traditional human diets, it is likely that soft-tissue Hg has increased to a similar degree over the past few centuries. The increase was not due to dietary differences over time, as shown by analysis of stable-C and -N isotopes in the teeth, and was unlikely to be due to sex differences or to chemical diagenesis of historical samples. Industrially related Hg inputs to the Arctic Ocean and Canadian Arctic Archipelago may be the most likely explanation for the increase. If so, then 80-95% of the total Hg in modem Beaufort Sea belugas more than 10 years old may be attributed to anthropogenic activities. In contrast, tooth Hg concentrations in walrus at Igloolik, Nunavut, were no higher in the 1980s and 1990s than in the period A.D. 1200-1500, indicating an absence of industrial Hg in the species at this location.

Outridge, P., Hobson, K.A., & Savelle, J.M. (2005). Changes in mercury and cadmium concentrations and the feeding behaviour of beluga (Delphinapterus leucas) near Somerset Island, Canada, during the 20th century. *Science of the Total Environment, 350*(1-3), 106-118. doi:10.1016/j.scitotenv.2004.12.081.

Abstract:

Beluga (Delphinapterus leucas) continues to be an important food species for Arctic communities, despite concerns about its high mercury (Hg) content. We investigated whether Hg and cadmium (Cd) concentrations had changed during the 20th century in beluga near Somerset Island in the central Canadian Arctic, using well-preserved teeth collected from historical sites (dating to the late 19th century and 1926-1947) and during subsistence hunts in the late 1990s. Mercury concentrations in both historical and modem teeth were correlated with animal age, but 1990s beluga exhibited a significantly more rapid accumulation with age than late 19th century animals, indicating that Hg concentrations or bioavailability in their food chain had increased during the last century. The geometric mean tooth Hg concentration in modem 30 year old animals was 7.7 times higher than in the late 19th century, which corresponds to threefold higher concentrations in muktuk and muscle. Teeth from 1926 to 1947 were similar in Hg content to the late 19th century, suggesting that the increase had occurred sometime after the 1940s. In contrast, tooth Cd was not correlated with animal age and decreased during the last 100 years, indicating that anthropogenic Cd was negligible in this population. Late 19th century beluga displayed a greater range of prey selection (tooth delta(15)N values: 15.6-20.5 parts per thousand) than modem animals (delta(15)N: 17.2-21.1 parts per thousand). To prevent this difference from confounding the temporal Hg comparison, the Hg-age relationships discussed above were based on historical animals, which overlapped isotopically with the modem group. Toot h delta(13)C also changed to isotopically more depleted values in modem animals, with the most likely explanation being a significant shift to more pelagic-based feeding. Industrial Hg pollution is a plausible explanation for the recent Hg increase. However, without further investigation of the relationship

between the range exploitation of modem beluga and their possible exposure to regional marine food chains with (naturally) higher Hg contents than their historical counterparts, we cannot unequivocally conclude that the increase was anthropogenically driven.

Outridge, P.M., Wagemann, R. & McNeely, R. (2000). Teeth as biomonitors of soft tissue mercury concentrations in beluga, Delphinapterus leucas. *Environmental Toxicology and Chemistry, 19*(6), 1517-1522. DOI: 10.1897/1551-5028(2000)019<1517:TABOST>2.3.CO;2.

Ozeretskovskaya, N.N., Mikhailova, L.G., Sabgaida, T.P., & Dovgalev, A.S. (2005). New trends and clinical patterns of human trichinellosis in Russia at the beginning of the XXI century. *Veterinary Parisitology, 132*(1-2), 167-171. doi:10.1016/j.vetpar.2005.05.056.
Abstract
Official national statistics show a gradual decline in the incidence of trichinellosis in Russia from 971 cases in 1996 to 527 cases in 2002. Of the total 864 cases involved in 47 trichinellosis outbreaks during 1998–2002, only 35.8% were due to infected pork compared to 80% in 1995–1996. Other important sources were wild animals, such as bear (Ursus arctos) (39.5%), badger (Meles meles) (10.6%), and dog meat (11.9%). Children composed 15.9% of all cases. Overall, 81.0% of pork-cases occurred in the European part of the country, and 89.4% of bear-meat cases were from the Asian region where most of the badger and dog-meat cases also originated. The percent of clinically severe cases of disease derived from pork and from bear meat was 7.7% and 7.9%, respectively; the frequency of moderate cases from pork was significantly higher than from bear meat. Clinically severe cases from badger and dog meat were 1.1% and 1.9%, respectively, where the number of clinically moderate cases from badger meat was significantly larger than that from dog meat. A disturbing trend is the 52.3% of trichinellosis cases during 1998–2002 in Russia that were derived from wild animal meat, especially the clinically severe cases occurring among the aboriginal Siberian population. The contributing factors to the slow decline in trichinellosis incidence in Russia and to the increase in percentage of cases originating from wild animal meat are the distribution and consumption of veterinary-uncontrolled pork, poaching and distribution of wild animal meat, and the neglect of medical and civil regulations. These trends should be seriously evaluated by the institutions of health, education, and by the veterinary service.

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Paci, C.D.J., Dickson, C., Nickels, S., Chan, L., & Furgal, C. (2004). Food security of Northern Indigenous Peoples in a time of uncertainty. In *The Resilient North: Human responses to global change,* Yellowknife, NWT on September 15-18, 2004. Retrieved from, http:// www.nrf.is/Publications/The%20Resilient%20North/Plenary%204/3rd%20NRF_Plenary%204_PP_Paci%20et%20al.pdf

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Abstract:
OBJECTIVE: There is a large disparity in health status between the indigenous peoples of the US Associated Pacific compared to any population in the USA. The research process that has been supported by US academic institutions and federal agencies has been limited in its ability to address the disparate health issues and may be part of the problem. We define culturally competent research and review approaches to developing competency in cross-cultural research with indigenous Pacific Islander populations. DESIGN: This is a descriptive review of the investigators' experience in the Hawaii MEDTEP Center experience and of the experience of others conducting research with the indigenous people of the Pacific Islands. RESULTS: Culturally competent cross-cultural research with the indigenous peoples of the Pacific requires an understanding and application of indigenous peoples' paradigms of health, knowledge, science, and research. It is not sufficient to train more indigenous Pacific Islanders to do more Western-style research. Unraveling the complex health situation and determining the changes that need to be made is dependent on the dominant culture engaging the indigenous Pacific populations in a way that bridges cultural paradigms. CONCLUSION: Positively affecting the disparity of health in the indigenous populations of the Pacific is, in part, dependent on employing an indigenous-peoples-centered model of research. The model can have application to the study of indigenous peoples in other parts of the world.

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to build and expand on existing Arctic Council and International Union for Circumpolar Health (IUCH) human health research activities. The human health legacy of the IPY will be increased visibility of the human health concerns of Arctic communities, revitalization of cooperative Arctic human health research focused on those concerns, the development of health policies based on research findings, and the subsequent implementation of appropriate interventions, prevention and control measures at the community level.
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Peoples of the Arctic and sub-Arctic regions live in social and physical environments that differ substantially from those of their more southern-dwelling counterparts. The cold northern climate keeps people indoors, amplifying the effects of household crowding, smoking, and inadequate ventilation on person-to-person spread of infectious disease. The emergence of antimicrobial drug resistance among bacterial pathogens, the reemergence of tuberculosis, the entrance of HIV into Arctic communities, and the specter of pandemic influenza or the sudden emergence and introduction of new viral pathogens such as severe acute respiratory syndrome are of increasing concern to residents, governments, and public health authorities. The International Circumpolar Surveillance system is a network of hospital, public health agencies, and reference laboratories throughout the Arctic linked together to collect, compare, and share uniform laboratory and epidemiologic data on infectious diseases and assist in the formulation of prevention and control strategies.

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Fish from new reservoirs often have elevated concentrations of methylmercury (MeHg) that they primarily accumulate from food such as zooplankton. The objectives of this

research were (i) to determine the effect of reservoir creation on total mercury (THg) and MeHg in zooplankton and (ii) to examine how variations in community structure and water chemistry affect MeHg bioaccumulation by zooplankton. Beginning in June 1992, we measured concentrations of THg and MeHg in zooplankton from an experimental reservoir (L979) and an unmanipulated reference pond (L632). After flooding of L979 in June 1993, mean concentrations of MeHg in zooplankton increased from 32 to >300 ng g-1 dw and THg increased from 87 to >500 ng g-1 dw. Annual fluxes of MeHg through the zooplankton community increased 10-100× after impoundment. MeHg concentra tions in zooplankton, seston, and water were strongly correlated with each other (r > 0.92). Bioaccumulation factors relating MeHg in zooplankton to MeHg in water or seston did not change after impoundment, despite large changes in water chemistry and zooplankton community structure. Concentrations of Hg in zooplankton from Lake 632 did not change dramatically over the 4 years of study.

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(a) treating diseases if intervention will lessen morbidity and mortality (such as diabetes and hypertension) and (b) encouraging of dietary changes, cessation of smoking, exercise, reduction in alcohol consumption, and other healthy behavior.(author)

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Objective: To evaluate risk factors for childhood hemolytic-uremic syndrome (HUS) and gastroenteritis during an epidemic of Escherichia coli O157:H7 infection. Design: Case-control study. Setting: Remote Inuit community of Arviat in northern Canada. Participants: Of the 565 Arviat residents less than 15 years of age, 19 had HUS and 65 more had E. coli O157:H7 gastroenteritis. The 19 children with HUS were compared with 19 age- and gender-matched children with uncomplicated E. coli O157:H7 gastroenteritis, and both HUS and gastroenteritis patients were compared with 19 healthy control subjects. Interventions: Questionnaire administered face-to-face to parents of participants in the home. Main outcome measures: Rates of exposure to foods, travel, sources of water, and gastrointestinal illness in family members. Results: Patients with HUS and those with uncomplicated E. coli O157:H7 gastroenteritis differed only on measures of clinical severity. In the 7 days before the onset of gastrointestinal symptoms, children with HUS and those with uncomplicated gastroenteritis were more likely to have been exposed to a family member with diarrhea than were the healthy control subjects (odds ratio = 9 for HUS vs healthy control subjects; 95% confidence interval 2 to 43; p <0.01). Undercooked ground meat and foods traditionally consumed by the Inuit were not implicated as risk factors in E. coli O157:H7 infection. Conclusions: These findings emphasize the potential for extensive intrafamilial transmission of verotoxin-producing E. coli once infection is introduced into certain communities.

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PROBLEM/CONDITION: Trichinellosis is a parasitic disease caused by tissue-dwelling roundworms of the species Trichinella spiralis. The organism is acquired by eating Trichinella-infected meat products. The disease has variable clinical manifestations, ranging from asymptomatic to fatal. In the United States, trichinellosis has caused hundreds of preventable cases of illness and occasional deaths. The national trichinellosis surveillance system has documented a steady decline in the reported incidence of this disease, as well as a change in its epidemiology. REPORTING PERIOD COVERED: This report summarizes surveillance data for trichinellosis in the United States for 1997-2001. DESCRIPTION OF SYSTEM: Trichinellosis became a nationally reportable disease in 1966, but statistics have been kept on the disease since 1947. The national trichinellosis surveillance system is a passive system that relies on existing resources at

the local, state, and federal levels. Cases are diagnosed based on clinical history with laboratory confirmation. Cases are reported weekly to CDC through the National Electronic Telecommunications System for Surveillance (NETSS). Detailed data regarding signs and symptoms, diagnostic tests, and food consumption are gathered by using a supplementary standardized surveillance form and are reported to CDC by fax or mail. This information is compared with NETSS data several times a year by CDC staff. Discrepancies are reviewed with the state health departments. The purpose of the surveillance system is to determine the incidence of trichinellosis, to maintain awareness of the disease, to monitor epidemiologic changes, to identify outbreaks, to guide prevention efforts, and to measure the effectiveness of those efforts. RESULTS: Although trichinellosis was associated historically with eating Trichinella-infected pork from domesticated sources, wild game meat was the most common source of infection during 1997-2001. During this 5-year period, 72 cases were reported to CDC. Of these, 31 (43%) cases were associated with eating wild game: 29 with bear meat, one with cougar meat, and one with wild boar meat. In comparison, only 12 (17%) cases were associated with eating commercial pork products, including four cases traced to a foreign source. Nine (13%) cases were associated with eating noncommercial pork from home-raised or direct-from-farm swine where U.S. commercial pork production industry standards and Regulations do not apply. INTERPRETATIONS: The majority of the decline in reported trichinellosis cases is a result of improved observance of standards and regulations in the U.S. commercial pork industry, which has altered animal husbandry practices resulting in reduced Trichinella prevalence among swine. PUBLIC HEALTH ACTIONS: Because of the change in epidemiology of trichinellosis and the continued occurrence of cases among consumers of wild game meat and noncommercial pork, more targeted public education is needed to further reduce the incidence of this disease. PMID: 14532870 [PubMed - indexed for MEDLINE]

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Abstract

The Innu of northern Labrador, Canada have undergone profound transitions in recent decades with important implications for conservation, food and health policy. The change from permanent nomadic hunting, gathering and trapping in 'the country' (nutshimit) to sedentary village life (known as 'sedentarisation') has been associated with a marked decline in physical and mental health. The overarching response of the national government has been to emphasize village-based and institutional solutions. We show that changing the balance back to country-based activities would address both the primary causes of the crisis and improve the health and well-being of the Innu. Drawing on ethnographic fieldwork, interviews with Innu older people (Tshenut), empirical data on nutrition and activity, and comparative data from the experiences of other indigenous peoples, we identify pertinent biological and environmental transitions of significance to the current plight of the Innu. We show that nutrition and physical activity transitions have had major negative impacts on individual and community health. However, hunting and its associated social and cultural forms is still a viable option as part of a mixed livelihood and economy in the environmentally significant boreal forests and tundra of northern Labrador. Cultural continuity through Innu hunting activities is a means to decelerate, and possibly reverse, their decline. We suggest four new policy areas to help restore country-based activities: (i) a food policy for country food; (ii) an outpost programme; (iii) ecotourism; and (iv) an amended school calendar. Finally, we indicate the implications of our analysis for people in other countries.

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OBJECTIVE: To determine the number and nature of publications on Indigenous health in Australia, Canada, New Zealand and the United States) in 1987-1988, 1997-1998 and 2001-2003. DATA SOURCES: MEDLINE and PsychLit databases were searched using the following terms: Aborigines or Aboriginal; Torres Strait Islander; Maori; American Indian; North American Indian, or Indian, North American; Alaska/an Native; Native Hawaiian; Native American; American Samoan; Eskimos or Inuit; Eskimos or Aleut; Metis; Indigenous. STUDY SELECTION: Publications were included if they were concerned with the health of Indigenous people of the relevant countries. 1763 Indigenous health publications were selected. DATA EXTRACTION: Publications were classified as either: original research; reviews; program descriptions; discussion papers or commentaries; or case reports. Research publications were further classified as either measurement, descriptive, or intervention. Intervention studies were then classified as either experimental or non-experimental. DATA SYNTHESIS: The total number of publications was highest in 1997-1998 for most countries. The most common type of publication across all time periods for all countries was research publications. In Australia only, the number of research publications was slightly higher in 2001-2003 compared with other time periods. For each country and at each time, research was predominantly descriptive (75%-92%), with very little measurement (0-11%) and intervention research (0-18%). Overall, of the 1131 research publications, 983 were descriptive, 72 measurement and 76 intervention research. CONCLUSIONS: The dominance of descriptive research in Indigenous health is not ideal, and our findings

should be carefully considered by research organisations and researchers when developing research policies. PMID: 16719748 [PubMed - indexed for MEDLINE] Use in introduction

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Abstract:

Patterns of transmission of infectious diseases within and among populations are strongly affected by population structure, which can either facilitate or limit interactions among people from different groups. Results from several theoretical studies show that nonrandom mixing among subgroups can affect the time when an infectious disease is introduced to the population, the speed of propagation of the disease, and the severity of an epidemic. Because many of these models focus on the effects of population structure, they are functionally similar to models used to describe the genetic structure of a population. One major difference between genetic models and epidemic models is that genetic models, with a time scale of the order of generations, incorporate migrations (or permanent movement) among subgroups, whereas epidemic models, with a time scale of the order of days or weeks, must incorporate short-term mobility among subgroups. Such mobility can be included in models for epidemic spread by explicitly incorporating the process by which residents from different locations interact with one another. We present a derivation of a mobility model for epidemic processes and apply it to the spread of the 1918-1919 influenza epidemic among the Cree and Métis people associated with three Hudson's Bay Company posts in the central Canadian Subarctic. The model distinguishes mobility from population effects. Results indicate that social organization (population effects) and social responses to the epidemic were more important than movement patterns (mobility) in explaining the differential impact of this virgin soil epidemic on the three study communities.PMID: 9489237 [PubMed - indexed for MEDLINE]

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sugar in all forms has skyrocketed from a fraction to well above the Canadian average. There is ample evidence that this sudden shift in nutritional habits has led to new health problems for Northern Native infants and children as well as adults who live in a more critical environment and may also be particularly prone to certain metabolic hazards.

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OBJECTIVE: To provide health researchers and clinicians with background information and examples regarding Aboriginal health research challenges, in an effort to promote effective collaborative research with Aboriginal communities. METHODS: An interdisciplinary team of experienced Aboriginal-health researchers conducted a thematic analysis of their planning meetings regarding a community-based Aboriginal health research training project and of the text generated by the meetings and supplemented the analysis with a literature review. RESULTS: Four research challenges are identified and addressed: (1) contrasting frameworks of Western science and indigenous knowledge systems; (2) the impact of historic colonialist processes upon the interface between health science research and Aboriginal communities; (3) culturally relevant frameworks and processes for knowledge generation and knowledge transfer; and (4) Aboriginal leadership, governance, and participation. CONCLUSION: Culturally appropriate and community-controlled collaborative research can result in improved health outcomes in Aboriginal communities and contribute new insights and perspectives to the fields of public health and medicine in general. PMID: 15016333 [PubMed - indexed for MEDLINE]

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Abstract:
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Frozen meat, "stinking meat," powdered eggs, and storage caches were means of nutritional insurance among early historic Innu and Inuit of the Labrador–Quebec peninsula and among the Beothuk of the island of Newfoundland. This paper suggests that food storage was compatible with mobile societies in the form of strategically placed caches in a seasonally revisited landscape as well as in the form of transportable processed foods. The ethnohistoric evidence provides a reasonable analogy for understanding adaptation among prehistoric forager groups in the northeastern subarctic. Current models of adaptation are limited by a singular focus on food procurement; however, the storage of food resources is an equally critical component of subarctic cultural continuity and warrants greater consideration in the discussion of adaptation.

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The purpose of the study was to examine fruit and vegetable intake patterns among American Indian and Alaska Native adolescents and to assess psychosocial factors and health behaviors related to inadequate consumption. The study was conducted in nonurban schools from eight Indian Health Service Areas in the U.S.A total sample of 13,454 7th-through 12th-grade American-Indian and Alaska-Native youths living on or near reservations were given, in classroom settings, a revised version of the Minnesota Adolescent Health Survey. The health questionnaire assessed fruit and vegetable consumption
patterns and psychosocial variables and health-related behaviors. The results indicated that fruit and vegetable consumption was below the recommended amounts. Less than daily consumption of vegetables was reported by 30% of adolescents and less than daily consumption of fruits was reported by 20% of youths. Psychosocial and health behavior risk associated with inadequate intake included being overweight, low family connectedness, poor school achievement, poor perceived health status, and tobacco use. Our study shows that fruit and vegetable consumption is low among American-Indian and Alaska-Native youths. More attention needs to be placed on developing culturally appropriate interventions to promote healthy eating patterns and addressing factors related to inadequate intake.

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Abstract:
Mercury and many of its compounds behave exceptionally in the environment because of their volatility, capability for methylation, and subsequent biomagnification in contrast with most of the other heavy metals. Long-range atmospheric transport of elemental mercury, its transformation to more toxic methylmercury compounds, the ability of some to undergo photochemical reactions, and their bioaccumulation in the aquatic food chain have made it a subject of global research activities, even in polar regions. The first continuous high-time-resolution measure ments of total gaseous mercury in the Antarctic covering a 12-month period were carried out at the German Antarctic research station Neumayer (7039' S, 815' W) between January 2000 and February 2001. We recently reported that mercury depletion events (MDEs) occur in the Antarctic after polar sunrise, as was previously shown for Arctic sites. These events (MDEs) end suddenly during Antarctic summer. A possible explanation of this phenomenon is presented in this paper, showing that air masses originating from the sea-ice surface were a necessary prerequisite for the observations of depletion of atmospheric mercury at polar spring. Our extensive measurements at Neumayer of atmospheric mercury species during December 2000-February 2001 show that fast oxidation of gaseous elemental mercury leads to variable

Hg0 concentrations during Antarctic summer, accompanied by elevated concentrations, up to more than 300 pg/m3, of reactive gaseous mercury. For the first time in the Southern Hemisphere, atmospheric mercury species measurements were also performed onboard of a research vessel, indicating the existence of homogeneous background concentrations over the south Atlantic Ocean. These new findings contain evidence for an enhanced oxidizing potential of the Antarctic atmosphere over the continent that needs to be considered for the interpretation of dynamic transformations of mercury during summertime.

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Abstract:
One of the key public health challenges facing indigenous and other minority communities is how to develop and implement effective, acceptable, and sustainable strategies for the prevention of non-insulin-dependent diabetes mellitus (NIDDM). In this article, the authors describe how an ethnographic approach was used to contextualize the behavioral risk factors for NIDDM and applied to the development of a more meaningful and appropriate epidemiological risk factor survey instrument for an urban Aboriginal population in Australia. The overall research design comprised a mixture of qualitative and quantitative methods. The ethnographic study showed that the complex web of meanings that tie people to their family and community can and should be taken into account in any social epidemiology of health and illness if the findings are to have any effective and long-term potential to contribute to successful public health interventions targeting these behavioral risk factors.

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Abstract

Even though microbiological standards have been promulgated for many decades, their utility has sometimes been questioned, and this is one reason that performance standards associated with programs like HACCP in processing plants and now in other food industries have been espoused. The public has an increasing concern over food safety and perceives a zero tolerance policy (i.e. no pathogens in a sample of food) and strict enforcement with punitive consequences for failure to comply is the answer to making food safer. At present, there is no clear connection between government policy and a reduction in foodborne illness. Although national disease statistics may show gradual declines over long periods for some pathogens associated with food, other problems, including new pathogens, tend to emerge. International bodies and some governments, however, are increasingly considering adopting a risk-based approach to managing a food supply, with the potential for introducing the Acceptable Level of Protection (ALOP) and Food Safety Objectives (FSOs) concepts. These make it possible to see a connection between a goal for disease reduction and what industry must do to accomplish this with specific objectives through performance standards and microbiological testing. However, it may not be easy to apply this approach for all types of industries and pathogens and in developing countries.

Tomy, G.T., Muir, D.C.G., Stern, G.A., & Westmore, J.B. (2000). Levels of C10-C13 Polychloro-n-Alkanes in Marine Mammals from the Arctic and the St. Lawrence River Estuary. *Environmental Science and Technology, 34*(9), 1615-1619. doi: 10.1021/es990976f.

Abstract:

Marine mammals from various regions of the Arctic and the St. Lawrence River estuary were examined for the first time for levels of C10-C13 polychloro-n-alkanes (sPCAs). Respective mean total sPCA concentrations in the blubber of beluga whales (Delphinapterus leucas) from Saqqaq and Nuussuaq, western Greenland, were 0.23 ± 0.02 (n = 2) and 0.164 ± 0.06 g/g (n = 2), similar to that in beluga from the Mackenzie Delta in the western Canadian Arctic 0.21 ± 0.08 g/g (n = 3). sPCAs levels were higher in beluga blubber from the St. Lawrence River (0.37 to 1.4 g/g). Mean sPCA concentrations in the blubber samples from walruses (Odobenus rosmarus) (Thule, northwest Greenland) and ringed seal (Phoca hispida) (Eureka, southwest Ellesmere Island) were 0.43 ± 0.06 (n = 2) and 0.53 ± 0.2 g/g (n = 6), respectively. Relative to commercial sPCA formulations, samples from the Arctic marine mammals showed a predominance of the shorter chain length lower percent chlorinated PCA congeners, the more volatile components of industrial formulations. This observation is consistent with long-range atmospheric transport of sPCAs to this region. The profiles of the belugas from the St. Lawrence River estuary, however, had higher proportions of the less volatile sPCA congeners, implying that contamination to this region is probably from local sources.

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Abstract:
Caribou is an important source of protein in the diet of northern Canadians. It is also an important pathway for airbone environmental contaminants that concentrate in the lichen-->caribou-->human food chain. We present a method for estimating caribou consumption that is independent of questionnaires and dietary surveys. The method is based on direct, whole-body measurements of fallout radiocesium in northern caribou consumers and on measurements of the concentrations of radiocesium in the meat. From the 1989-90 surveys of five Arctic communities, we obtained the: following mean (90th percentile) intakes of caribou meat in grams per day: Baker Lake - males 65 (141), females 41 (88); Rae-Edzo - males 42 (103), females 31 (80); Old Crow - males 41 (108), females 23 (59); Fort McPherson - males 41 (77), females 32 (68); Aklavik - males 20 (47), females 15 (37). Compared with surveys carried out in the late 1960s, these values indicate a twofold to fourfold decrease in caribou consumption over a period of 20 years. A dietary survey questionnaire administered during the 1989-90 survey provided useful information on the consumption of various caribou organs, methods of meat preparation, and consumption of other traditional foods.

Trepka, M.J., Newman, F.L., Dixon, Z., & Huffman, F.G. (2007). Food safety practices among pregnant women and mothers in the women, infants, and children program, Miami, Florida. *Journal of Food Protection, 70*(5), 1230-1237.

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Tsuji, L., Manson, H., Wainman, B., Vanspronsen, E., Shecapio-Blacksmith, J., & Rabbitskin, T. (2007). Identifying potential receptors and routes of contaminant exposure in the traditional territory of the Ouje-Bougoumou Cree: Land use and a geographical information system [electronic resource]. *Environmental Monitoring and Assessment, 127*(1-3), 293-306. DOI: 10.1007/s10661-006-9280-z.

Abstract:
Great concern has been raised with respect to the 13 traplines that constitute the traditional territory of the Ouje-Bougoumou Cree located in the James Bay region of northern Quebec, Canada, with respect to mine wastes originating from three local mines. As a result, an “Integrative Risk Assessment” was initiated consisting of three interrelated components: a comprehensive human health study, an assessment of the existing ecological/environmental database, and a land use/potential sites of concern

study. In this paper, we document past and present land use in the traditional territory of the Ouje-Bougoumou Cree for 72 heads of households, including 13 tallymen, and use a Geographic Information System (GIS) to layer harvest/hunting and gathering/collecting data over known mining areas and potential sites of concern. In this way, potential receptors of contamination and routes of human exposure were identified. Areas of overlap with respect to land use activity and mining operations were relatively extensive for certain harvesting activities (e.g., beaver, Castor canadensis and various species of game birds), less so for fish harvesting (all species) and water collection, and relatively restrictive for large mammal harvesting and collection of firewood (and other collection activities). Potential receptors of contaminants associated with mining activity (e.g., fish and small mammals) and potential routes of exposure (e.g., ingestion of contaminated game and drinking of contaminated water) were identified.

Tsuji, L.J.S., Martin, I.D., Martin, E.S., LeBlanc, A., & Dumas, P. (2007). Spring-harvested game birds from the western James Bay region of northern Ontario, Canada: Organochlorine concentrations in breast muscle. *Environmental Monitoring and Assessment.* doi: 10.1007/s10661-007-0062-z .

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Ueno, D., Darling, C., Alaee, M., Pacepavicius, G., Teixeira, C., Campbell, L., et al. (2008). Hydroxylated Polybrominated Diphenyl Ethers (OH-PBDEs) in the Abiotic Environment: Surface Water and Precipitation from Ontario, Canada. *Environmental Science and Technology, 42*(5), 1657-1664. doi: 10.1021/es7021279.

Abstract:

Hydroxylated polybrominated diphenyl ethers (OH-PBDEs) have been identified as metabolites of PBDEs, and also as compounds of natural origin in the marine environment; however, there has only been very limited study of their presence in the

abiotic environment. In the present study, OH-PBDEs were determined in samples of surface water and precipitation (rain and snow) collected from sites in Ontario, Canada. OH-PBDEs were detected in all the samples analyzed, although half of the observed peaks did not correspond to any of the 18 authentic standards available. Fluxes of ΣOH-PBDEs ranged from 3.5 to 190 pg/m2 in snow and from 15 to 170 pg/m2/day in rain, and those were higher at three of the southern Ontario locations relative to a single northern remote site. Concentrations of ΣOH-PBDEs ranged from 2.2 to 70 pg/L in water and from <1 to 420 pg/g in particulate organic carbon (POC), and higher values were found near sewage treatment plant (STP) outfalls in Lake Ontario. Partition coefficients (log Koc) for OH-PBDEs ranged from 4.0 to 5.1. The results in this study suggest that OH-PBDEs are ubiquitous in the abiotic environment and most likely are produced through reaction of PBDEs with atmospheric OH radicals. As well, they may be present in surface waters near STPs due to oxidation of PBDEs and inflows from metabolism by humans and animals.

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University of Calgary. (2004). Proceedings from the 14th Inuit Studies Conference. The Arctic Institute of North America. Retrieved from http://www.arctic.ucalgary.ca/index.php?page=arctic_contents
Abstract:
Multicultural engagement for learning and understanding: In 1977 UNICEF reported that the most successful programs in addressing children's health were those that were locally based in the community and had solid grass-roots support (UNICEFWHO,1977).
In 1986 the International Union for Circumpolar Health was formed with four adhering bodies: American Society for Circumpolar Health, Canadian Society for Circumpolar Health, Nordic Council for Arctic Medical Research, and the Siberian Branch of the Russian Academy of Medical Sciences. Some of the names and structures have changed over the years and there is a fifth adhering body in the Greenlandic Society for Circumpolar Health (IUCH, 2005).
In 2003 the Canadian Center for Indigenous Peoples' Nutrition and Environment worked with the World Health Organization to produce "Indigenous Peoples & Participatory Health Research: Planning & Management / Preparing Research Agreements" (WHO, 2003). The Center for Alaska Native Health Research is focusing on the health issues of obesity, diabetes, and heart disease. The Alaska Native Science Research Partnerships for Health is focusing on traditional value transmission as a means to reduce teen substance abuse and suicide. Another international body that has a regional governmental focus is the Northern Forum.

University of Georgia, California Sea Grant, and Public Service Outreach. (2007). *Safe Oysters.org.* . Retrieved from, http://www.safeoysters.com/medical/prevention.html

Unnevehr, L., & Jensen, H. (1999). The economic implications of using HACCP as a food safety regulatory standard. *Food Policy, 24*(6), 625-635.

Usher, P., Baikie, M., Demmer, M., Nakashima, D., Stevenson, M.G., & Stiles, M. (1995). *Communicating about contaminants in country food: the experience in aboriginal communities.* Ottawa: Inuit Tapirisat of Canada

Uyeki, T.M., Zane, S.B., Bodnar, U.R., Fielding, K.L., Buxton, J.A., Miller, J.M., et al. (2003). Large summertime influenza A outbreak among tourists in Alaska and the Yukon Territory. *Clinical Infectious Diseases*, *36*(9), 1095-1102. Retrieved from, http://www.journals.uchicago.edu/toc/cid/current.
Abstract:
We investigated a large summertime outbreak of acute respiratory illness during May-September 1998 in Alaska and the Yukon Territory, Canada. Surveillance for acute

respiratory illness (ARI), influenza-like illness (ILI), and pneumonia conducted at 31 hospital, clinic, and cruise ship infirmary sites identified 5361 cases of ARI (including 2864 cases of ILI [53%] and 171 cases of pneumonia [3.2%]) occurring primarily in tourists and tourism workers (from 18 and 37 countries, respectively). Influenza A viruses were isolated from 41 of 210 patients with ILI at 8 of 14 land sites and 8 of 17 cruise ship infirmaries. Twenty-two influenza isolates were antigenically characterized, and all were influenza A/Sydney/05/97-like (H3N2) viruses. No other predominant pathogens were identified. We estimated that 133,000 cases of ARI might have occurred during this protracted outbreak, which was attributed primarily to influenza A/Sydney/05/97-like (H3N2) viruses. Modern travel patterns may facilitate similar outbreaks, indicating the need for increased awareness about influenza by health care providers and travelers and the desirability of year-round influenza surveillance in some regions.

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Van Caeseel, P., Macaulay, A., Orr, P., Aoki, F., & Martin, B. (2001). Rapid pharmacotherapeutic intervention for an influenza A outbreak in the Canadian Arctic : lessons from the Sanikiluaq experience. *International Journal of Circumpolar Health, 60*(4), 640-648. Retrieved from, http://ijch.fi/.

Abstract:
In January of 2000 an outbreak of influenza-like illness (ILI) was identified by Health Centre nursing staff in the remote island Inuit community of Sanikiluaq, Nunavut. A staged approach to an intervention strategy was adopted and an intervention team dispatched within 48 hours with diagnostic, prophylactic, and therapeutic capabilities and the intent to evaluate the response as well. The presence of influenza virus was determined on site in 3 out of thirteen initial cases of ILI using portable kit based rapid detection. This permitted the use of zanamivir (an inhaled neuraminidase inhibitor) for prophylaxis in 201, and for treatment in 12 persons. Amantadine was only used in 16 and 52 were ineligible for medical intervention, mostly because they fell outside of the window of opportunity or for maternal/reproductive reasons. The intervention strategy framework adopted was felt to be successful and is presented for consideration in future intervention initiatives. (Au)

Vancouver Coastal Health. (2002). Aboriginal Health Initiative Program (AHIP). Retrieved from, http://www.vch.ca/ahip/.

Summary: AHIP was launched in 2002 as a regional community based funding program to support and encourage Aboriginal communities to identify health promotion projects that are culturally meaningful to them. Successful projects have developed mechanisms to provide community input and ways to measure project outcomes. Some of the Health Promotion Projects include: Mental Wellness and Self-Esteem (can help prevent addictions), Chronic or Infectious Disease, Injury Prevention (wearing seat belts, preventing falls with our elders), Early Childhood (parenting programs, school readiness programs), Local Community Food Security: when aboriginal community members have

healthy, safe traditional foods that are easily accessible and sustainable. The traditional diets of Aboriginal people has changed over the years, and many do not have access to well balanced and healthy traditional foods. Finding ways to increase knowledge of our cultural teachings of traditional food sources will help support Local Food Security in our society today.

Van Oostdam, J., Gilman, J., Dewailly, E., Usher, P., Wheatley, B., Kuhnlein, H. et al. (1999). Human health implications of environmental contaminants in Arctic Canada: a review. *Science of the Total Environment, 1*(230), 1-82. DOI: 10.1016/S0048-9697(99)00036-4.

Abstract:

This paper assesses the impact on human health of exposure to current levels of environmental contaminants in the Canadian Arctic, and identifies the data gaps that need to be filled by future human health research and monitoring. The harvesting, sharing and consumption of traditional foods are an integral component to good health among Aboriginal people influencing both physical health and social well-being. Traditional foods are also an economic necessity in many communities. Consequently, the contamination of country food raises problems which go far beyond the usual confines of public health and cannot be resolved by health advisories or food substitutions alone. The primary exposure pathway for the contaminants considered in this paper is through the traditional northern diet. For the Inuit, the OCs of primary concern at this time from the point of view of exposure are chlordane, toxaphene, and PCBs. Consumers of traditional foods are exposed to an approximately seven-fold higher radiation dose than non-consumers of traditional foods due predominantly to the bioaccumulation of natural radionuclides in the food chain. Risk determination for contaminants in country food involves a consideration of the type and amounts of food consumed and the sociocultural, nutritional, economic, and spiritual benefits associated with country foods. Risk management options that minimize the extent to which nutritional and sociocultural aspects of Aboriginal societies are compromised must always be considered.

Van Oostdam, J., Donaldson, S., Feeley, M., Tremblay, N. Arnold, D., Ayotte, P., et al. (2003). Human Health – Canadian Arctic Contaminants Assessment Report II. Retrieved from, http://www.ainc-inac.gc.ca/ncp/pub/helt/helt2_e.html.

Van Oostdam, J., Donaldsson, S., Feeley, M., Arnold, D., Ayotte, P., Bondy, G., et al. (2005). Human health implications of environmental contaminants in Arctic Canada: A review. *Science of the Total Environment, 351*-352, 165-246. doi:10.1016/j.scitotenv.2005.03.034.

Abstract:

The objectives of this paper are to: assess the impact of exposure to current levels of environmental contaminants in the Canadian Arctic on human health; identify the data and knowledge gaps that need to be filled by future human health research and monitoring; examine how these issues have changed since our first assessment [Van Oostdam, J., Gilman, A., Dewailly, E., Usher, P., Wheatley, B., Kuhnlein, H. et al., 1999. Human health implications of environmental contaminants in Arctic Canada: a review. Sci Total Environ 230, 1-82]. The primary exposure pathway for contaminants for

various organochlorines (OCs) and toxic metals is through the traditional northern diet. Exposures tend to be higher in the eastern than the western Canadian Arctic. In recent dietary surveys among five Inuit regions, mean intakes by 20- to 40-year-old adults in Baffin, Kivalliq and Inuvialuit communities exceeded the provisional tolerable daily intakes (pTDIs) for the OCs, chlordane and toxaphene. The most recent findings in NWT and Nunavut indicate that almost half of the blood samples from Inuit mothers exceeded the level of concern value of 5 microg/L for PCBs, but none exceeded the action level of 100 microg/L. For Dene/Métis and Caucasians of the Northwest Territories exposure to OCs are mostly below this level of concern. Based on the exceedances of the pTDI and of various blood guidelines, mercury and to a lesser extent lead (from the use of lead shot in hunting game) are also concerns among Arctic peoples. The developing foetus is likely to be more sensitive to the effects of OCs and metals than adults, and is the age groups of greatest risk in the Arctic. Studies of infant development in Nunavik have linked deficits in immune function, an increase in childhood respiratory infections and birth weight to prenatal exposure to OCs. Balancing the risks and benefits of a diet of country foods is very difficult. The nutritional benefits of country food and its contribution to the total diet are substantial. Country food contributes significantly more protein, iron and zinc to the diets of consumers than southern/market foods. The increase in obesity, diabetes and cardiovascular disease has been linked to a shift away from a country food diet and a less active lifestyle. These foods are an integral component of good health among Aboriginal peoples. The social, cultural, spiritual, nutritional and economic benefits of these foods must be considered in concert with the risks of exposure to environmental contaminants through their exposure. Consequently, the contamination of country food raises problems which go far beyond the usual confines of public health and cannot be resolved simply by risk-based health advisories or food substitutions alone. All decisions should involve the community and consider many aspects of socio-cultural stability to arrive at a decision that will be the most protective and least detrimental to the communities.

Van Ravenswaay, E., & Hoehn, J. (1996). The Theoretical Benefits of Food Safety Policies: A Total Economic Value Framework. *American Journal of Agricultural Economics, 78*(5), 1291-1296. Retrieved from, http://www.aaea.org/fund/pubs/ajae/.

Verreault, J., Berger, U., & Gabrielsen, G.W. (2007). Trends of Perfluorinated Alkyl Substances in Herring Gull Eggs from Two Coastal Colonies in Northern Norway: 1983-2003. *Environmental Science and Technology, 41*(19), 6671-6677. doi: 10.1021/es070723j.

Abstract:
The present study reports on concentrations, patterns, and temporal trends (1983, 1993, and 2003) of 16 perfluorinated alkyl substances (PFAS) in whole eggs of herring gulls (Larus argentatus) from two geographically isolated colonies in northern Norway. Perfluorooctane sulfonate (PFOS) was the predominant PFAS in all eggs with mean concentrations up to 42 ng/g wet weight (ww) in samples from 2003. Perfluorohexane sulfonate (PFHxS) and perfluorodecane sulfonate (PFDcS) were found at concentra tions several orders of magnitude lower than PFOS. The general accumulation profile of perfluorocarboxylates (PFCAs) in herring gull eggs was characterized by high

proportions of odd and long carbon (C) chain length compounds in which perfluoroundecanoate (C11) and perfluorotridecanoate (C13) dominated with mean concentrations up to 4.2 and 2.8 ng/g ww, respectively. In both colonies PFOS concentrations in eggs showed a nearly 2-fold significant increase from 1983 to 1993, followed by a leveling off up to 2003. A comparable trend was found for PFHxS, whereas PFDcS was found to increase also between 1993 and 2003. PFCA concentrations showed marked significant increases during 1983-1993 associated with either a weak rise post-1993 (C8- to C11-PFCAs), although nonsignificant, or leveling off (C12- and C13-PFCAs). However, the composition of individual PFCAs (C8 to C15) to the summed concentrations of those eight PFCAs highly differed between the colonies and sampling years investigated. Present results suggest that direct and indirect local- and/or remote-sourced inputs (atmospheric and waterborne) of PFCAs have changed over the last two decades in these two coastal areas of Northern Norway.

Verreault, J., Gabrielsen, G.W., Chu, S., Muir, D.C.G., Andersen, M., Hamaed, A., et al. (2007). Flame Retardants and Methoxylated and Hydroxylated Polybrominated Diphenyl Ethers in Two Norwegian Arctic Top Predators: Glaucous Gulls and Polar Bears. *Environmental Science and Technology, 39*(16), 6021-6028. doi: 10.1021/es050738m.

Abstract:
The brominated flame retardants have been subject of a particular environmental focus in the Arctic. The present study investigated the congener patterns and levels of total hexabromocyclododecane (HBCD), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), as well as methoxylated (MeO) and hydroxylated (OH) PBDEs in plasma samples of glaucous gulls (Larus hyperboreus) and polar bears (Ursus maritimus) from the Norwegian Arctic. The analyses revealed the presence of total HBCD (0.07-1.24 ng/g wet wt) and brominated biphenyl 101 (<0.13-0.72 ng/g wet wt) in glaucous gull samples whereas these compounds were generally found at nondetectable or transient concentrations in polar bears. Sum () concentra tions of the 12 PBDEs monitored in glaucous gulls (range: 8.23-67.5 ng/g wet wt) surpassed largely those of polar bears (range: 2.65-9.72 ng/g wet wt). Two higher brominated PBDEs, BDE183 and BDE209, were detected, and thus bioaccumulated to a limited degree, in glaucous gulls with concentrations ranging from <0.03 to 0.43 ng/g wet wt and from <0.05 to 0.33 ng/g wet wt, respectively. In polar bear plasma, BDE183 was <0.04 ng/g wet wt for all animals, and BDE209 was only detected in 7% of the samples at concentrations up to 0.10 ng/g wet wt. Of the 15 MeO-PBDEs analyzed in plasma samples, 3-MeO-BDE47 was consistently dominant in glaucous gulls (MeO-PBDE: 0.30-4.30 ng/g wet wt) and polar bears (MeO-PBDE up to 0.17 ng/g wet wt), followed by 4'-MeO-BDE49 and 6-MeO-BDE47. The 3-OH-BDE47, 4'-OH-BDE49, and 6-OH-BDE47 congeners were also detected in glaucous gulls (OH-PBDE up to 1.05 ng/g wet wt), although in polar bears 4'-OH-BDE49 was the only congener quantifiable in 13% of the samples. The presence of MeO- and OH-PBDEs in plasma of both species suggests possible dietary uptake from naturally occurring sources (e.g., marine sponges and green algae), but also metabolically derived biotransformation of PBDEs such as BDE47 could be a contributing factor. Our findings suggest that there are dissimilar biochemical mechanisms involved in PCB and

PBDE metabolism and accumulation/elimination and/or OH-PBDE accumulation and retention in glaucous gulls and polar bears.

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Viallet, J., MacLean, J., Goresky, C., Staudt, M., Routhier, G. & Law, C. (1986). Arctic Trichinosis Presenting as Prolonged Diarrhea. *Gastroenterology,* 91(4), 938-946. Retreived from, http://www.gastrojournal.org/.

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Wagemann, R., & Kozlowska, H. (2004). Mercury distribution in the skin of beluga (Delphinapterus leucas) and narwhal (Monodon monoceros) from the Canadian Arctic and mercury burdens and excretion by moulting. *Science of the Total Environment, 351-52,* 333-343. doi:10.1016/j.scitotenv.2004.06.028.
Abstract:
Beluga and narwhal skin as a whole (in Inuktitut known as "muktuk") is considered to be a delicacy by native Canadian and Greenland people. Individual strata of the skin, and muscle from 27 beluga from the western, and 20 narwhal from the eastern Canadian Arctic, were analyzed for mercury and the thickness and density of each skin layer was measured. Mercury was not uniformly distributed in the skin, but increased outwardly with each layer. The concentration was only 0.29 and 0.16 mu g/g (wet wt) in the innermost layer (dermis) of belugas and narwhal respectively, and 1.5 and 1.4 mu g/g (wet wt) in the outermost layer (degenerative epidermis) of beluga and narwhal, respectively. There was a significant (alpha = 0.05) association between age and mercury concentration in each skin layer, the regression coefficients progressively increasing from the inner layer (dermis) to the outer layer: 0.011-0.063 mu g/g year(-1); 0.034 mu g/g year(-1) for skin as a whole; 0.054 mu g/g year 1 for muscle. The concentration of total mercury was 0.84 and 0.59 mu g/g (wet wt) in skin as a whole (muktuk) of beluga and narwhal respectively, and 0.12 and 0.03 mu g/g in blubber, respectively. The average, total mercury concentration in muscle tissue was 1.4 and 0.81 mu g/g wet wt, in beluga and narwhal respectively, exceeding (except for blubber) the Canadian Government's Guideline (0.5 mu g/g wet wt) for fish export and consumption. The skin surface area of an average-size beluga. and narwhal was estimated (6.10 and 6.50 in 2, respectively), as were excretions of mercury through moulting (13,861 and 6721 mu g year 1; 14 and 7 mg year) for belugas and narwhal, respectively. The whole-body mercury burden (699,300 mu g; 700 mg) for a 1000 kg beluga and its various tissues were estimated, as was the fraction of mercury excreted by moulting (2-0.42% of the whole-body burden). Annual mercury burden increments in beluga skin, muscle and the whole body were estimated (2750; 17,280; 40,00 mu g year, respectively), using regression coefficients of age on

mercury concentration. The annual gross mercury intake via food was estimated (131,400 mu g), of which 70% was excreted.

Wagemann, R., Trebacz, E., Boila, G., & Lockhart, W.L. (1998). Methylmercury and total mercury in tissues of arctic marine mammals. *Science of the Total Environment, 218* (1), 19-31. doi:10.1016/S0048-9697(98)00192-2.

Abstract:
Concentrations of methylmercury, total mercury and selenium in marine mammal tissues were determined in liver, muscle, skin (muktuk) and blubber of belugas, ringed seals and narwhal, using atomic absorption and capillary gas chromatography with ECD detection. Mean MeHg levels in the types of tissues analysed, except blubber, generally exceeded the Canadian Federal Consumption Guideline for mercury in fish (0.5 mu g/g wet wt.). A spatial trend of higher MeHg levels in western compared to eastern Arctic belugas and ringed seals was found which followed a similar trend observed for total mercury. Factors which could explain this trend are discussed. Robust linear regression of MeHg on total Hg and MeHg on age of animals was performed and a strong correlation between the two variables was found in each case. The ratio of MeHg to total mercury as indicated by the regression coefficients was close to one for muscle and skin (muktuk) while for liver it was < 1. The mean percentage of MeHg in the liver of marine mammals was 3-12% of the total Hg in this tissue depending on species and location. It is postulated that the formation and deposition of mercuric selenide in the liver is part of the demethylation process in this tissue. This is based on the relatively low fraction of MeHg in the liver not withstanding the fact that the predominant form of mercury taken up via food is MeHg. The long half-life for total mercury and the relatively short half-life for MeHg in this organ are in accord with this postulate as is the 1:1 stoichiometric relationship between mercury and selenium in the liver.

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Wainwright, R.B., Heyward, W.L., Middaugh, J.P., Hatheway, C.L., Harpster, A.P., & Bender, T.R. (1988). Food-borne botulism in Alaska, 1947-1985: Epidemiology and Clinical Findings. *Journal of Infectious Diseases, 157*(6), 1158-62. Retrieved from, http://www.journals.uchicago.edu/toc/jid/current.

Abstract:
We reviewed records of all food-borne outbreaks of botulism in Alaska from 1947 through 1985. Fifty-nine confirmed or suspected outbreaks with 156 cases were reported. All outbreaks occurred in Alaska Natives and were associated with eating traditional Alaska Native foods. Forty-four (75%) of the outbreaks were laboratory confirmed and involved 133 persons. The overall annual incidence of confirmed or suspected botulism was 8.6 cases per 100,000 population. Seventeen persons died, an overall case-fatality rate of 11%. Type E toxin accounted for 32 (73%) laboratory-confirmed outbreaks; type A, six (14%); and type B, five (11%). Forty-one cases demonstrated botulinal toxin in one or more specimens (serum, gastric contents, or stool). Of the 41 botulinal toxin-positive persons, 38 (93%) had at least three of the commonly recognized pentad of signs

or symptoms--nausea and vomiting, dysphagia, diplopia, dilated and fixed pupils, or dry mouth and throat--and 20 (49%) required respiratory assistance

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Walters, S.P., Gannon, V.P.J., & Field, K.G. (2007). Detection of Bacteroidales Fecal Indicators and the Zoonotic Pathogens E. coli O157:H7, Salmonella, and Campylobacter in River Water. *Environmental Science and Technology, 41*(6), 1856-1862. doi: 10.1021/es0620989.
Abstract:
Bacteroidales host-specific PCR offers a rapid method of diagnosing fecal pollution in water and identifying sources of input. To assess human health risks from exposure to fecal pathogens, however, Bacteroidales markers should be detectable when pathogens are present. To determine if Bacteroidales general, human-, ruminant-, and swine-specific markers correlate with certain fecal pathogens, we conducted a retrospective study on water samples for which the presence of E. coli O157:H7, Salmonella spp., and Campylobacter spp. had been determined. We found a positive relationship between detection of the Bacteroidales general fecal marker and presence of the pathogens. Detection of ruminant-specific markers predicted E. coli O157:H7 occurrence. There was a significant increase in the likelihood of detecting Salmonella when a ruminant marker was present, and Campylobacter spp. when human markers were present. For pathogens such as E. coli O157:H7 that are strongly associated with particular hosts, Bacteroidales host-specific markers can estimate the likelihood of pathogen occurrence, enabling more accurate health risk assessments.

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Abstract:
Model simulations of the fate of numerous hypothetical substances in the global environment can provide considerable insight into how an organic chemical's degradability and partitioning properties influence its absolute and relative Arctic enrichment behavior, as quantified by the Arctic Contamination Potential. For substances that degrade faster in water than in soil, but are quite persistent in the atmosphere, highest Arctic contamination is expected to occur if the substances have intermediate volatility and high hydrophobicity. Organic substances that are degradable in the atmosphere can still accumulate in the Arctic if they are soluble and highly persistent in water. These latter substances, which reach the Arctic in the ocean, also show the highest potential for relative enrichment in the Arctic, i.e., high amounts in northern high latitudes relative to

the amounts in the total global environment. Beyond a threshold persistence in surface media of the order of several months to a year, chemical degradability leads to further relative enrichment. This is because only chemicals that are sufficiently long-lived get transferred to polar regions and once there can persist longer than at lower latitudes. The model simulations can inform the search for new potential Arctic contaminants, and can highlight combinations of properties which should be avoided in high production volume chemicals with the potential for environmental release. Three categories of organic substances are singled out for troublesome combinations of persistence, distribution, and potential bioaccumulation characteristics, only one of which contains "classical" Arctic POPs. Examples of potential Arctic contaminants within each of these categories are named.

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Abstract:

Historically, infection with strains of methicillin-resistant Staphylococcus aureus (MRSA), which are usually multidrug-resistant, has been acquired by persons in hospitals, nursing homes, and other health care institutions. These infections are known as health care-associated MRSA infections. Community-associated MRSA (CA-MRSA) infection, which bears significant similarities to and differences from health care-associated MRSA infection, appears to be on the rise and has been described in several well-defined populations, such as children, incarcerated persons, Alaskan Natives, Native Americans, Pacific Islanders, sports participants, and military personnel. CA-MRSA infection has caused severe morbidity and death in otherwise healthy persons. Proven, reproducible strategies and programs for preventing the emergence and spread of CA-MRSA are lacking. Further surveillance and epidemiological and clinical studies on CA-MRSA infections are necessary for documenting the extent of the problem and for developing and evaluating effective prevention and control efforts.

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Abstract:
Canadian Aboriginal people encompass diverse cultural groups, whose daily food patterns vary in regard to the kinds and proportions of indigenous foods. Standard dietary methods of assessing food consumption sometimes require modification to be understandable and acceptable to Aboriginal communities. Depending upon the purpose of the research, food frequency methods, repeated 24-h recalls of individual food consumption, and (or) examination of food preferences and food health beliefs may be used. Consultation with Aboriginal community leaders in planning the research is essential, to ensure collaboration and support. Explaining the purpose and methods to community members requires assistance of a respected local Aboriginal person, fluent in the language. Extra time is required for becoming acquainted with local foods, for translation, and for training community members as interviewers. Examples of these principles are discussed from the author's experience in the Yukon, the Northwest Territories, and northern Alberta. PMID: 7585350 [PubMed - indexed for MEDLINE]

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Wein, E.E., & Sabry, J.H. (1987). Use of country foods by native Canadians in the taiga. *Arctic Medical Research Report, 45*(87), 75.
Abstract:
The hypothesis being tested is that even though there has been 200 years of acculturation of Native Canadians in the northern forests, these people still rely on country foods for a large proportion of their diet. The female head of 120 households from Fort Smith, Northwest Territories and Fort Chipewyan, Alberta were interviewed to establish, for each country food item and for each of four seasons, the number of times the foods were used. For the 60 country foods utilized, meats, especially moose, caribou, hare and waterfowl, were most highly prized but fish and berries also contributed to the diet. There was a wide range of country food intake. Wage oriented families had little; in a few families, 75-90% of the total food intake was country food. Aside from the quantitative aspects of the study, older respondents expressed a strong emotional attachment to maintaining country food in their diet; younger family members tended to reject country foods. It is unclear whether the families with high country food intake have a higher quality diet. This hypothesis needs to be tested to determine the validity of education programs that simply promote country food without addressing problems associated with the remainder of the diet. (Au)
ASTIS record 28398.

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Abstract:
This study examined food consumption patterns of native (Indian and Metis) Canadians living in a boreal forest area with good access to both store-bought and country foods (traditional foods from the land, such as wild animals, birds, fish and berries). Frequency of use by season of 48 country foods by 120 households was examined by interview with the female household head. Twenty-four-hour recalls of individual food consumption on four separate days over two seasons were obtained by interview with 178 persons (71 males, 107 females) age 13-86 years, and the mean values per person were used to represent their usual intakes. The mean reported household frequency of use (number of occasions per year) was as follows: all country foods 319, including large mammals 128, berries 63, fish 62, birds 32, and small mammals 27. The upper quintile of households used country food two and one-half times more often than the sample as a whole. Recalls of individual food consumption showed that country food was consumed on average 4.2 times per week and averaged 0.5 kg per week. Country meat, birds and fish accounted for one-third of the total consumption of meat, birds and fish. Young people consumed less country food than did their elders. Thus, country food constitutes an important part of the food supply, especially of meat and fish of many native people of this region.

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Abstract:
Lack of human exposure data is frequently reported as a critical gap in risk assessments of environmental pollutants, especially regarding "new" pollutants. The objectives of this study were to assess serum levels of the persistent 2,2',4,4',5,5'-hexachlorobiphenyl (CB-153), hydroxylated polychlorinated biphenyl metabolites (OH-PCBs), polybrominated diphenyl ethers (PBDEs), and hexabromocyclododecanes (HBCDDs) in a group of Swedish middle-aged and elderly women expected to be relatively highly exposed, and to evaluate the impact of potential determinants (e.g., fish intake, age) for the inter-individual variation, as well as to investigate the association between these pollutants and bone density. No associations were found between bone mineral density or biochemical

markers of bone metabolism and the analyzed environmental pollutants. Relatively high levels of CB-153 (median 260 ng/g fat) and 3OH-PCBs (median 1.7 ng/mL serum), and low concentrations of 6PBDEs (median 3.6 ng/g fat) were determined. Total level of HBCDDs in serum was quantified by gas chromatography with mass spectrometric detection (median 0.5 ng/g fat). HBCDD diastereomeric and enantiomeric patterns were determined by liquid chromatography with mass spectrometric detection. The dominating stereoisomer was (-)-HBCDD, but 1-3% of -HBCDD was also detected in the serum samples.

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Abstract:
BACKGROUND: Aboriginal women have been identified as having poorer pregnancy outcomes than other Canadian women, but information on risk factors and outcomes has been acquired mostly from retrospective databases. We compared prenatal risk factors and birth outcomes of First Nations and Métis women with those of other participants in a prospective study. METHODS: During the 12-month period from July 1994 to June 1995, we invited expectant mothers in all obstetric practices affiliated with a single teaching hospital in Edmonton to participate. Women were recruited at their first prenatal visit and followed through delivery. Sociodemographic and clinical data were obtained by means of a patient questionnaire, and microbiological data were collected at 3 points during gestation: in the first and second trimesters and during labour. Our primary outcomes of interest were low birth weight (birth weight less than 2500 g), prematurity (birth at less than 37 weeks' gestation) and macrosomia (birth weight greater than 4000 g). RESULTS: Of the 2047 women consecutively enrolled, 1811 completed the study through delivery. Aboriginal women accounted for 70 (3.9%) of the subjects who completed the study (45 First Nations women and 25 Métis women). Known risk factors for adverse pregnancy outcome were more common among Aboriginal than among non-Aboriginal women, including previous premature infant (21% v. 11%), smoking during the current pregnancy (41% v. 13%), presence of bacterial vaginosis in midgestation (33% v. 13%) and poor nutrition as measured by meal consumption. Although Aboriginal women were less likely than non-Aboriginal women to have babies of low birth weight (odds ratio [OR] 1.46, 95% confidence interval [CI] 0.52-4.15) or who were born prematurely (OR 1.45, 95% CI 0.57-3.72) and more likely to have babies with macrosomia (OR 2.04, 95% CI 1.03-4.03), these differences were lower and statistically nonsignificant after adjustment for smoking, cervicovaginal infection and income (adjusted OR for low birth weight 0.85, 95% CI 0.19-3.78; for prematurity 0.90, 95% CI 0.21-3.89; and for macrosomia 2.12, 95% CI 0.84-5.36). INTERPRETATION: After adjustment for potential confounding factors, we found no statistically significant relation between Aboriginal status and birth outcome. PMID: 15367460 [PubMed - indexed for MEDLINE]

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Abstract:
Methylmercury in aquatic ecosystems and bio-accumulated in aquatic biota, especially fish, is a major public health concern internationally. Precautionary efforts are currently underway internationally to reduce the anthropogenic release of mercury, which in turn, over time, will reduce human exposure. However, at the present time, it is important to address the issue of management of the risks of exposure as they exist now. Of particular concern are the impacts of methylmercury on indigenous populations which depend on fish as a subsistence food source, both in remote areas of developed countries, such as Canada, and in developing countries such as Brazil. Research into these impacts over the past two or three decades has shown that, other than in very severe pollution situations such as occurred in Minamata, Japan, the direct impacts on human health are difficult to prove. On the other hand, the indirect negative effects of methylmercury on health, mediated through the disruption of lifestyle and eating patterns and the associated socio-cultural and socio-economic consequences among the affected native populations, have, in many cases, been significant. These social factors have raised serious challenges in determining practical public health policies on the issue. Policy development relating to environmental contaminants has been presented, with the problem of assessing the role of the various factors which contribute to the impact on health as a result of socio-cultural disruption. These factors include changes in diet and lifestyle due to methylmercury in the environment and its real or perceived risk. The standard physical sciences risk assessment process, based on the lowest observed adverse effects level (LOAEL) or no observed adverse effects level (NOAEL) used in defining health policies may be seen as over-simplistic theoretical extrapolations when viewed in the context of the concerns of the social sciences. Both approaches, however, have relevance to health policies that address the risks posed by environmental methylmercury. Therefore, the standard physical sciences approach of the past three decades now needs to be linked with the social sciences approach, with its focus on the indirect impacts of exposure to methylmercury, to provide a comprehensive approach to public health policy development. With this objective in mind, this paper reviews methylmercury-related data from both physical and social sciences. It attempts to draw on the findings in both disciplines to provide suggestions for an integrated approach in policy development relating to human health and human exposure to methylmercury, especially among

indigenous peoples in remote areas and in developing countries. An integrated approach such as this may help to limit adverse health effects in the indigenous communities affected.

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Abstract:
The enantiomer ratios (ERs) of alpha-HCH and chlordane related compounds (CHLs) were examined in the polar bear food chain (arctic cod-ringed seal-polar bear), using chiral gas chromatography-mass spectrometry (GC-MS). The cod showed near-racemic mixtures (ER = 1) for most of the compounds. In contrast, ERs in ringed seal and polar bear were frequently nonracemic (ER 1), due to enantiomer-specific biotransformation. As (+)--HCH was transferred up the food chain, it became more abundant relative to (-)--HCH. For the CHLs, there was no uniform trend for the ER changes and the increasing trophic level. Apparent chiral biomagnification factors (BFs) were calculated and up to a 20-fold difference in the BF between enantiomers was found. Analysis of chiral BFs relative to CB-153 indicated that oxychlordane was formed by ringed seal and metabolized by polar bears. However, the ERs did not change significantly as a result of these biotransformations. Multivariate statistical methods revealed the clustering of sample categories and were used to investigate the relationships between the ERs, chemical residue concentrations, and biological data. ERs were important variables for the sample groupings and for the class separation of male/female seals and fat/liver tissues. The variance in the cytochrome P450 CYP2B protein content of bear liver could be explained by the variances in chemical residue data. In this analysis the ERs were of secondary importance. The ERs of some highly recalcitrant CHLs in polar bear adipose showed linear relationships with the age of the bears.

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Abstract:
Aboriginal peoples are the original inhabitants of Canada. These many diverse peoples have distinct languages, cultures, religious beliefs and political systems. The current dietary practices of Aboriginal peoples pose significant health risks. Interventions to improve the nutritional status of Aboriginal peoples must reflect the realities of how people make food choices and therefore should be informed by an understanding of contemporary patterns of food procurement, preparation and distribution. Most of the literature documenting the health of Aboriginal peoples is primarily epidemiologic, and there is limited discussion of the determinants that contribute to health status. The majority of studies examining dietary intake in Aboriginal communities do not aim to study the determinants of food intake per se even though many describe differences in food intake across sex, age groups, seasons and sometimes communities, and may describe factors that could have an effect on food consumption (e.g., employment status, level of education, household size, presence of a hunter/trapper/fisher, occupation, main source of income). For these reasons, there are many gaps in knowledge pertaining to the determinants of healthy eating in Aboriginal peoples that must be filled. Given the diversity of Aboriginal peoples, research to address the gaps should take place at both the national level and at a more local level. Research would be important for each of Inuit, Métis and First Nations.

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Abstract:
OBJECTIVE: To determine if research has adequately examined the health needs of the aboriginal population of Canada. DESIGN: Review. STUDY SELECTION: Medline search of journal articles published during 1992-2001. The search terms used were "Canada" and various synonyms and categories for Canadian aboriginal people. Each paper was categorised according to the aboriginal group, age-sex group, comparison group, geographic location, and type of research topic (health determinant, health status, or health care). RESULTS: Of 352 citations found, 254 were selected after elimination of those without abstracts, not containing data on Canada, or not focusing on health issues. The proportion of papers does not reflect the demographic composition of aboriginal people in Canada, with severe under-representation of Métis, urban aboriginal people, and First Nations people not living on reserves and over-representation of the Inuit. Children and women received less attention proportional to their share of the population. A few prolific research groups have generated a disproportionate amount of publications from a few communities and regions. 174 papers dealt with health determinants (for example, genetics, diet, and contaminants), 173 with health status, and 75 with health care. Injuries, which account for a third of all deaths, were studied in only 8 papers. None of the health care papers examined rehabilitation. CONCLUSION: Researchers have not adequately examined several important health needs of the aboriginal population. PMID: 12933728 [PubMed - indexed for MEDLINE]

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Appendix B2: List of Website References

Aboriginal Aquaculture Association (AAA)
December 2007 newsletter(copy)
http://www.aboriginalaquaculture.com/

Aboriginal Canada Portal
http://www.aboriginalcanada.gc.ca/
http://www.aboriginalcanada.gc.ca/acp/site.nsf/en/ao28005.html

Aboriginal Issues Press
University of Manitoba
http://www.umanitoba.ca/environment/aboriginal_issues_press/

Alaska Native Knowledge
www.nativeknowledge.org.

ArcticNet
http://www.arcticnet-ulaval.ca/index.php?fa=ArcticNet.showArcticNet.fr
http://www.arcticnet-ulaval.ca/

Arctic Peoples
Indigenous Peoples at the Arctic Council http://www.arcticpeoples.org/newsletter/

Canadian Nutrient File
Summary: You can look up detailed nutritional information for traditional foods. If you type in the term 'Native' you will see a list of almost 150 traditional foods used by Inuit, Métis and First Nations people in Canada including: Agutuk (native fish), Black crowberry, game meats, animal fats and Inconnu.
http://www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/index_e.html

Centre for Native Policy and Research
http://www.cnpr.ca/Home.aspx
The Centre is a non-partisan, social justice, progressive Aboriginal think tank focused on the social, economic, and environmental policy and research concerns of Aboriginal people in British Columbia and Canada.

Centre interuniversitaire d'études et de recherches autochtones
http://www.ciera.ulaval.ca/

Chiefs of Ontario
http://www.chiefs-of-ontario.org/

Cree Public Health
http://creepublichealth.org/front/category/traditional-knowledge/

First Nations Agricultural Association (BC)
http://www.fnala.com/about.htm

First Nations Agricultural Council Saskatchewan

http://www.agr.gc.ca/info/di/index_f.php?s1=grants-octrois&s2=qtr-tri&s3=gr-oc_07-08_q2&page=gr-oc_07-08_q2_43
http://announcements.usask.ca/news/archive/2002/05/mou_will_suppor.html
First Nations Development Institute
Native Agriculture and Food Systems Initiative (NAFSI)
http://www.firstnations.org/NativeAgDetails.asp

The Helicobacter Foundation.
http://www.helico.com/h_epidemiology.html

First Nations and Inuit Health Program Compendium
http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/2007_compendium/2_2_environ-milieu_e.html

Institute for Aboriginal Health-University of British Columbia
http://www.health-disciplines.ubc.ca/iah/research/canadian.php

Institut national de santé publique du Québec
http://www.inspq.qc.ca/pdf/publications/nunavik.asp

International Workshop on Arctic Parasitology (IWAP) 2000
http://wildlife1.usask.ca/IWAP/

Brent Patterson
Current Arctic Parasitology Research in Nunavut.
Department of Sustainable Development
Government of Nunavut
Box 316
Kugluktuk, Nunavut
X0E 0E0, Canada
http://wildlife1.usask.ca/IWAP/

Six Nations of the Grand River Territory
http://www.snhs.ca/hpnsProg.htm

The Sioux Lookout Meno Ya Win Health Centre (SLMHC)
http://www.slmhc.on.ca/services.htm

State of Alaska. Arctic Health: State of Alaska Health Topics.
http://www.arctichealth.org/healthtopics3.php?topic_id=75

Disease Agent	Transmission Route	Host(s)/ Source(s)	Symptoms in Humans	Prevention Methods
Parasites				
Name: *Anisakis* spp. Eg. *A. simplex* Other name(s): Herring worm Disease: Anisakiasis	Ingestion of raw or undercooked fish	Present in the gut and/or the flesh of many salt water fish including; herring , mackerel, whiting and blue whiting, salmon, pacific salmon, flounder, monkfish. Present in the stomach of whales and dolphins, copepods and other small invertebrates and squid [26]	Tingling or tickling of the throat Violent and sudden abdominal pain, nausea, vomiting Coughing up larvae. Symptoms similar to Crohn's disease.	Gut fish immediately after catching and distribute only gutted fish. Heat above 60^{o}C for one minute. Freeze at -20 ^{o}C for 60 hours. Immerse in 80% brine for 10 days. Kippering (cold smoking process) will **not** kill the worms. Larvae are resistant to salting. [26]
Name: *Cryptosporidium parvum* Disease: Cryptosporidiosis	Infectious dose: < 10 organisms Ingestion of contaminated food (prepared by contaminated person). Contact with contaminated animal or human fecal material. Ingestion of contaminated water or produce rinsed in contaminated water. [26, 15]	Herd animals: cows, goats, sheep, deer and elk. Also, humans, poultry, fish, small mammals, and reptiles. [26,15]	May involve none to all of the following: Profuse watery diarrhea, cramping, abdominal pains, weight loss, anorexia, flatulence and malaise, nausea, vomiting, fever and myalgias. Pulmonary and tracheal cryptosporidiosis in humans is associated with coughing. [26, 15]	Heating at 65°C for 30 minutes reduces infectivity. Boil water for 1 minute. Drying and ultraviolet light exposure. Freeze to -15^{o}C for 7 days Oocysts can survive for 2-6 months in a moist environment, and more than a year in cold water (5^{o}C) Resistant to routine chlorination. [26, 15]

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Name: *Echinococcus granulosis* Disease: Cystic hydatid disease or Hydatidosis	Ingestion of worm eggs present in contaminated animals, soil, plants, fruits or vegetables. Ingestion of contaminated meat. [10]	Definitive host: Canids: wolves, dogs, foxes. Incidental hosts: Cervids, moose, caribou and other herbivores with encysted larva. [10]	Asymptomatic until hydatid cysts in the liver and lungs cause pressure on tissues and organs. [10]	Wash hands regularly. Wash wild berries & plants before consumption. Wash produce before consuming. Wear gloves while skinning an animal. Proper disposal of infected organs. [6] [10]
Name: *Giardia lamblia* Disease: Giardiasis	Infectious Dose: < 10 cysts Ingestion of water or food contaminated with human or animal fecal material [17]	Water Humans Beavers, bears, dogs and cats (Beaver considered zoonotic reservoir for water-borne infections) [17]	May involve none to all of the following: sudden onset of diarrhea with foul-smelling, greasy-looking stool (no blood or mucus), abdominal cramps, bloating, fatigue and weight loss. Chronic infections can last months to years. [17]	Boil water for a minimum of 1 minute. Cysts remains infectious for prolonged periods in the environment. Chlorine in drinking water is insufficient to inactivate the cysts. [17]

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Name: *Toxocara* spp. Eg. *T. canis*, *T. cati* Disease: Toxacariasis	Ingestion of worm eggs present in contaminated animals, soil, plants, fruits or vegetables. Consumption of raw liver or organs from infected animals. [10]	Definitive host: Canids: wolves, dogs, foxes. Incidental host – various mammals containing encysted larvae. [10]	Visceral larval migrans – often asymptomatic or non-specific symptoms (fever, cough, eosinophillia) Affects the liver and lungs (hepatomegaly, pneumonitis Ocular larval migrans – inflammation of the eyes. [10]	Prevent children from eating dirt or putting unclean objects in their mouth. Regular handwashing. Treat dogs with antihelmintics. Proper dog feces disposal. Thorough cooking of liver and organs. [10]
Name: *Toxoplasma gondii* Disease: Toxoplasmosis	Consumption of raw, dried or undercooked infected meat Ingestion of contaminated water, food or soil particles Transplacental infection. [10]	Definitive hosts: felines: cats, cougars, lynx, bobcats Incidental hosts –seal, walrus, otter, caribou, ptarmigan, black bear, moose, bison, muskoxen, white-tailed deer. Unwashed fruits and vegetables from soil. [10, 2]	Adults –asymptomatic or unspecific symptoms: fever, sweats, malaise, lymphadenopathy. Immuno-compromised people can progress to encephalitis and pneumonia Fetus – chorioretinitis, blindness, psychomotor or mental retardation [10,2]	Use adequate protection when handling game animals. Wash hands after handling catches, meat and soil. Thorough cooking of meat. Freeze meat to –18^{o}C (0^{o}F) Proper disposal of cat feces. [10, 2]
Name: Trematodes (flukes) (many different species involved) Disease: Trematodiases	Consumption of snails Consumption of raw or undercooked crabs, crayfish, freshwater fish. Consumption of fruits from aquatic plants. [7]	Snails, crabs, crayfish, crustacea viz., frogs, tadpoles. Fresh water fish or tubers and fruits of water plants [7]	Depending on the dose of parasites. Virtually any tissue or organ of the body may be attacked. The symptoms depend on the resting place of the parasite. GI symptoms such as nausea, vomiting and diarrhea are among the most common symptoms encountered. [7]	Consume properly cooked foods. Do not eat or peel with teeth raw tubers, fruits and other edible parts of aquatic plants. Do not put water reeds/sarkandas in mouth. Do not consume untreated water from water bodies harbouring plants, snails.[7]

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Name: *Trichinella nativa* (mainly wild game) *Trichinella spiralis* (mainly swine) Disease: Trichinellosis [9]	Infectious dose: 1-4 larva(e) per gram of food. Consumption of raw or under-cooked meat [3]	Wild boar, horse, wolf, fox, walrus, bear, pig, and lynx. The tongue, masseter muscle, and diaphragm muscle are common concentration areas for larvae. [3]	Mild to severe depending on the number of larvae eaten. Malaise, nausea, diarrhea, and abdominal cramps. Can also cause muscle soreness and pain, edema of the upper eyelids, ocular pain, photophobia or pneumonitis when the larvae encapsulate in the body.	All wild game meat, pork and horse meat should be cooked to an internal temperature of at least 71ºC. Curing (salting), drying, smoking or microwaving the meat does **not** consistently kill infective worms. Most species of *Trichinella* present in wildlife (*T. nativa*) are resistant to freezing and, therefore, are not eliminated using the freezing guidelines developed for pork *Trichinella spiralis* is sensitive to freezing. Walrus meat sampling recommended. [3]. [10]
Bacteria				
Name: *Brucella* spp. Eg. *Brucella suis* Disease: Undulant fever	Contact with an infected animal or infected tissues (urine, blood, viscera). Consumption of undercooked or raw meat. Contaminated aerosols. [10,6]	Caribou, muskox, deer, elk, dog, coyote, bison (*B. abortus*), seal, walrus, beluga High-risk materials include; blood, urine, vaginal discharge and aborted fetuses. [10,6,14]	Intermittent fever, headache, weakness, profuse sweating, chills, arthralgia, localized suppurative infections. Subclinical infections are frequent. [14]	Practice good hygiene, wear gloves and a protective mask when handling viscera. Bacteria destroyed by moist heat (121 ºC for >15 min.), and dry heat (160 ºC to 170 ºC for >1 hour) Wash hands after handling Thorough cooking of game meat

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				Destroy any carcasses and aborted mateerials [10],[14]
Name: *Campylobacter* spp. Eg. *C. jejuni* Disease: Campylobacterosis	Infective dose: 400-500 bacteria Consumption of undercooked pork, chicken and raw clams. Consumption of contaminated food, water or unpasteurized milk. [12,26]	Intestinal tract of many mammals, particular problems associated with pigs, chicken, unpasteurized milk and raw clams Non-chlorinated water [12,26]	Diarrhea, abdominal pain, malaise, fever, nausea and vomiting. Complications include; reactive arthritis, febrile convulsions, meningitis and Guillain-Barré syndrome, haemolytic uremic syndrome. [12, 26]	Cook foods thoroughly Bacteria are sensitive to environmental stresses (e.g., 21% oxygen, drying, heating, disinfectants, acidic conditions) [12,26]
Name: *Clostridium botulinum* (type A, B, & E botulinum toxin) Disease: Botulism	Consumption of food item(s) contaminated with botulism toxin (a neurotoxin)	Outbreak sources – seal, whale (muktuk), salmon eggs, salmon heads, salmon, whitefish, herring, beaver tail. [Fermentation of these items – accounts for the main source] [24]	Nerve transmission failure beginning usually with the cranial nerves. Drooping eyes, double or impaired vision, dry mouth, sore throat, difficulty speaking, swallowing, dizziness (intoxication), paralysis descending to eventual respiratory arrest. Vomiting and diarrhea can also occur. [13,8, 22]	Toxin is destroyed after boiling for 10 minutes; moist heat 120°C (248°F) for at least 15 minutes. Spores survive smoking, cooking, and salting and grow best between 29°C to 35 °C (85 °F - to 95 °F) but can grow between 3 °C to 48 °C (38°F to 118 °F) Anaerobic conditions favour growth
Name: *Clostridium perfringens* Disease: Perfingens food poisoning	Ingestion of large numbers of vegetative cells in food. [26,16]	All food, particularily prepared food, that has been in the temperature range of 4°C (40°F) and 60°C (140°F) for more than two hours. Spores can be found in soil, dust,	Intense abdominal cramps and gassy diarrhea. Complications include; Necrotic enteritis, (pig-bel) often fatal infection and necrosis of the intestines with resulting	Do not leave food on the table or counter top, or warming in the oven, for more than two hours. Spores can survive normal cooking temperatures.

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		sewage and in the intestinal tracks of animals and humans. [16]	septicaemia. [26,16]	Grows only when exposed to little or no oxygen. Portion leftovers into small, shallow containers so they will cool rapidly. Reheat left overs at 74°C (165 °F) [26, 16]
Name: *Coxiella burnetii* Disease: Q fever	Exposure to infected animal or aerosols (birth fluids, milk, fur, manure). Insect bites [10]	Ruminants– goats, cattle, sheep. Ticks and arthropods Many mammals and birds are secondary hosts [10]	May involve none to all of the following: Influenza like symptoms; fever, chills, fatigue. Pneumonia; cough, chest pain. Hepatitis and other liver disorders. [10]	Use personal protection when handling animals. Prevent insect bites. Destroy infected carcasses and aborted material. [10]
Name: *Francisella tularensis* Disease: Tularemia	Handling and consumption of infected animals. Contact with contaminated water or aerosols including bedding. Bites by insects. Bites or scratches by infected animals. [10]	Main: Rodents and lagomorphs; muskrat, beaver, rabbit (infected animals may show white spots on the liver or other organs). Ticks, arthropods and flies. [10, 1]	May involve none to all of the following: Local skin ulcers, regional lymphnode inflammation, joint pain and swollen red eyes. Gastrointestinal or respiratory symptoms. Influenza like symptoms; fever, chills, fatigue. Pneumonia; cough, chest pain. [10,1]	Use protection when handling animals. Prevent contact with potentially contaminated water or animals. Thorough cooking of game meat. Do not consume animals that show white spots on the liver or other organs. Prevent insect bites Incinerate dead animals or bury one meter in depth. [10,1]
Name: *Helicobacter pylori*	Oral contact or ingestion of foods contaminated by human feces.	Humans Dogs and cats have a	Gastric ulcer, duodenal ulcer, stomach cancer, non-ulcer dyspepsia and/or gastritis.	Unknown

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	[27]	*Helicobacter* species (possible zoonosis) [27]	[27]	
Name: *Leptospira* spp. Eg. *L. interrogans* Disease: Leptospirosis	Contact with urine, tissues or feces from infected animals, or contaminated water. Ingestion or exposure of mucous membranes or broken skin to contaminated water. Ingestion of contaminated food. Inhalation of infected urine [10,19]	Main– rodents Secondary hosts – herbivores, dogs and insectivores. [10]	Liver, kidney and nervous system disorders, meningitis, hepatitis, liver failure, kidney damage, dengue or viral haemorrhagic fevers Influenza-like symptoms; fever, chills, fatigue. Pneumonia; cough, chest pain. [10,19]	Prevent contact with contaminated water and animals. Rodent control Use protection when handling animals. Protect wounds while in water. Do not consume untreated water. [10,19]
Name*:* *Mycobacterium tuberculosis* Disease: Tuberculosis	Direct contact with material coughed up by infected animals. Consuming undercooked contaminated meat. Inhaling bacteria from open wounds, droppings, or discharge from the nose and mouth of infected animals. [11]	Cattle, buffalo, muskox, and wood bison.	Young children may be asymptomatic or may have fever and nonproductive cough. Chest radiographs may show unilateral, patchy parenchymal infiltrates. Primary tuberculous pleurisy often accompanied with fever, cough, pleuritic chest pain and sometimes dyspnea. Chest radiographs show unilateral pleural effusion, often without identifiable parenchymal lesions. The bacteria usually affect the lung apex, the renal cortex and the metaphysis of long bones, but can cause skin and eye infections. In the animal: pale rounded	Prior infection, and especially prior infection giving rise to TB disease, provides a measure of protection against re-infection in immunocompetent people. Butcher infected animals carefully and do not cut into infected parts. Wash your hands, knives and clothes with hot soapy water after handling the animal. Lungs or other infected areas and lymph nodes should be handled with care, preferably with protective gloves. If the disease is wide-spread within the body, the animal should not be used for human

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			lumps can form in the lungs or on the lining of the ribcage, or in other organs including the liver, kidneys, spleen, windpipe and the associated lymph nodes. [11]	consumption. Thorough cooking will kill the bacteria. Freezing, smoking, drying and pickling will **not** kill the bacteria. Do not feed infected parts to dogs. [11]
Name: *Salmonella* spp. Eg. *S. enterica* Disease: Salmonellosis	Infectious dose: 15-20 bacteria. Consumption of raw meat and raw seafood. Ingestion of contaminated water or food. Present in the intestines of animals, pigs and poultry. Present in water and soil. [26]	Pig, poultry, oyster, bird and insect. Raw meat, poultry, eggs, milk and dairy products, fish, shrimp, frog legs, yeast, coconut. [26]	Acute symptoms: nausea, vomiting, abdominal cramps, diarrhea, fever and headache. Chronic consequences; arthritic symptoms may follow 3-4 weeks after onset of acute symptoms. [26]	Growth occurs between 6.5-47^{o}C (optimum 37^{o}C), pH must be above 4.5. Cooking will destroy the bacteria.
Name: *Shigella* spp. Eg. *S. boydii, S. dysenteriae, S. flexneri, S. sonnei.* Disease: Shigellosis Some strains produce an enterotoxin and Shiga toxin	Infectious dose: 10 to 200 organisms Consumption of food or water contaminated with fecal material. Also transmitted by flies. [26,3]	All prepared or handled food. Water Raw oysters [26]	Watery or bloody diarrhea, abdominal pain, cramps, fever, vomiting, tenesmus and malaise. Complications: Reiter's syndrome (*S. flexneri*), Hemolytic-uremic syndrome (*S. dysenteriae* type 1) infection. [3,26]	Shigellosis is a notifiable infectious disease. Growth is inhibited below pH 4.8 or above 9.3 and the presence of 5.2% salt. Optimal growth between 8-45^{o}C [3]
Name: *Staphylococcus aureus*	Toxin dose: < 1.0 microgram Consumption of food	Foods that require considerable handling during preparation and that are kept at slightly elevated	The amount of toxin consumed, and the health of the victim, affects the symptoms expressed.	The toxin is heat resistant, stable at boiling temperature, and tolerates high salt levels.

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Disease: Staphylococcal food poisoning Produces an entertoxin	contaminated by the toxin. [26]	temperatures after preparation. Meat and meat products; poultry and egg products; salads such as egg, tuna, chicken, potato and macaroni; bakery products such as cream-filled pastries, cream pies, and chocolate eclairs; milk and dairy products. The bacteria exist in air, dust, sewage, water, milk, environmental surfaces, humans and animals. [26]	Nausea, vomiting, retching, abdominal cramping and prostration. Severe cases: headache, muscle cramping, and transient changes in blood pressure and pulse rate may occur. [26]	Growth is optimal between pH 4-9, and temperatures between 21-37°C but will grow as low as 6.5 °C and as high as 50 °C. Keep food cold or hot until consumed.
Name: *Vibrio* spp. Eg. *V. cholerae*, *V. vulnificus*, *V. parahaemolyticus* Disease: Gastroenteritis [18]	Infectious dose: >100 organisms Through open wounds in water. Ingestion of raw or undercooked molluscan shellfish; oysters, clams, or mussels. [5, 29]	Oysters, clams, mussels and some fish. In the marine silt and sea water [18,29]	Watery diarrhea, abdominal pain, nausea, vomiting, fever, chills, septicaemia, hypo-tension and shock. Immuno-compromized people are susceptible, especially patients with liver disease. [5, 18,29]	Warm water and moderate salinity can increase the number of *V. vulnificus* organisms in shellfish. 85% of infections occur between May and October. Thoroughly cook all shellfish. Refrigerate shellfish from harvesting to consumption; a period of time at room temperature is generally necessary to allow multiplication of the bacteria. Avoid rinsing foods in seawater. [5,18,29]
Viruses and other				
Name: Hepatitis A virus Disease: Hepatitis	Infective dose: 10-100 virus particles Food or water contaminated with human feces.	Prepared foods	Fever, fatigue, loss of appetite, nausea, abdominal tenderness, jaundice, dark urine.	Killed by rapid boiling. Survives freezing, chilling and drying

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	[26]			Vaccine is available
Name: Hepatitis E virus: Disease: Hepatitis	Unknown infective dose Contaminated food or water with human feces. [26]	Generally associated with contaminated drinking water Possible zoonotic reservoir in pigs and rats. [18,26]	Indistinguishable from hepatitis A disease. Fever, fatigue, loss of appetite, nausea, abdominal tenderness, jaundice, dark urine. [26]	Excellent personal hygiene
Name: Norwalk virus, Norovirus Disease: Acute viral gastroenteritis	Consumption of food, or water contaminated by human feces. Ingestion of raw or insufficiently steamed clams and oysters [26]	Main host is humans Shellfish (clams and oysters) can also harbour viruses All other foods can be contaminated by humans during preparation. [26]	Abdominal cramps, diarrhea, nausea, vomiting, low-grade fever, headache.	Excelent personal hygiene Resistant to pH 5-10
Name: Paralytic shellfish poisoning (PSP) PSP toxins are produced by dinoflagellate algae of the genus *Alexandrium*, (Eg. *A. tamarense*). Bivalve shellfish, such as clams and mussels feed on this toxic algae. [28]	Consumption of shellfish or broth from cooked shellfish that contains the PSP toxins. Most commonly, saxitoxin, an alkaloid neurotoxin. [28]	All shellfish (filter-feeding molluscs) are potentially toxic. However, PSP is generally associated with mussels, clams, cockles, and scallops. [28]	Neurological including: tingling, burning, numbness, drowsiness, incoherent speech, and respiratory paralysis with possible death. Within 0.5 to 2 hours after ingestion of the shellfish, depending on the amount of toxin consumed. [28]	Do not consume shellfish during peak toxin season (during late spring and summer) Consult authorities for the history of PSP for the area. Avoid consuming the whole scallop. Water color during harvest is an unreliable indicator of PSP in the shellfish. [28]

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[5] Center for Disease Control and Prevention. 2005. *Vibrio vulnificus*. Retrieved March 19, 2007 from, http://www.cdc.gov/ncidod/dbmd/diseaseinfo/vibriovulnificus_t.htm

[6] Farber, J.M., Todd, E.C.D. 2000. Hunters, Trappers, and Fishers, and Scavengers of Dead Carcasses (Safe Handling of Foods, pg424)

[7] Government of India. CD AlertFood borne trematode (fluke)Infections: A neglected Health problem in India. November 2005 9(11) Retrieved March 19, 2007 from, http://nicd.nic.in/cdalert/November-05.pdf

[8] Himelbloom, B.H. (1998). Primer on food-bourne pathogens for subsistence food handlers. International Journal of Circumpolar health. 57(supp 1) 228-234.

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[13] Public Health Agency of Canada. (November 1 1996). Botulism reference service of Canada. Canada Communicable Disease Report Vol 22-21

[14] Public Health Agency of Canada. 2001. MSDS – Infectious Substances. Retrieved March 19, 2007 from, http://www.phac-aspc.gc.ca/msds-ftss/msds23e.html

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[15] Public Health Agency of Canada. 2002. MSDS – Infectious Substances – *Cryptosporidium parvum*. Retrieved March 19, 2007 from, http://www.phac-aspc.gc.ca/msds-ftss/msds48e.html

[16] Public Health Agency of Canada. 2002. Food Safety Facts on *Clostridium perfringens*. . Retrieved March 19, 2007 from, http://www.inspection.gc.ca/english/fssa/concen/cause/perfrine.shtml

[17] Public Health Agency of Canada. 2001. MSDS – Infectious Substances - *Giardia*. Retrieved March 19, 2007 from, http://www.phac-aspc.gc.ca/msds-ftss/msds71e.html

[18] Public Health Agency of Canada. 2007. Hepatitis E fact sheet. Retrieved March 19, 2007 from, http://www.phac-aspc.gc.ca/hcai-iamss/bbp-pts/hepatitis/hep_e_e.html

[19] Public Health Agency of Canada. 2004. Leptospirosis. Retrieved March 19, 2007 from,http://www.phac-aspc.gc.ca/tmp-pmv/info/leptospirosis_e.html

[20] Public Health Agency of Canada. 2001. MSDS – Infectious Substances – *Vibrio parahaemolyticus*. Retrieved March 19, 2007 from, http://www.phac-aspc.gc.ca/msds-ftss/msds165e.html

[21] Public Health Agency of Canada. 2007. The Canadian Tuberculosis Standard, 6th Edition. Retrieved March 19, 2007 from, http://www.phac-aspc.gc.ca/tbpc-latb/pubs/pdf/tbstand07_e.pdf

[22] Segal, M. 1992. Native food preparation fosters botulism – Alaskan Natives, dried fish. FDA Consumer. U.S. Government Printing Office, also copyright 2004 of the Gale group.

[23] Sobel J, Tucker N, Sulka A, McLaughlin J, Maslanka S. (2004). Foodborne botulism in the United States, 1990-2000. Emerg Infect Dis. 10(9), 1606-11. Retrieved March 19, 2007 from, http://www.cdc.gov/enterics/publications/436-McLaughlin2004.pdf

[24] State of Alaska. Department of Health & Social Services: Division of Public Health, Section of Epidemiology. Retrieved March 19, 2007 from, http://www.epi.hss.state.ak.us/pubs/botulism/bot_05.htm

[25] Tessaro SV, Forbes LB, Turcotte C. 1990. A survey of brucellosis and tuberculosis in bison in and around Wood Buffalo National Park, Canada Can Vet J. 31(3) 174-180.

[26] The Bad Bug Book. U.S. Food and Drug Administration. Retrieved March 19, 2007 from, http://vm.cfsan.fda.gov/~mow/intro.html

[27] The *Helicobacter* foundation. 2006. Retrieved March 19, 2007 from, http://www.helico.com/h_epidemiology.html

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[28] University of Alaska: Marine Advisory Program. 1996. Paralytic Shellfish Poisoning: The Alaska Problem. *Alaska's Marine Resources*.8(2)

[29] University of Georgia, California Sea Grant, and Public Service Outreach. 2007. Safe Oysters.org. . Retrieved March 19, 2007 from, http://www.safeoysters.com/medical/prevention.html

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Appendix D: Programs Targeting Aboriginal Populations

Amongst the many programs created for Native Canadians, very few relate to food safety outside of chemical contamination and none relates directly at improving food safety at home for the aboriginal populations. The programs that evolved in the context of food contamination by environmental pollutants are the only ones that examine traditional diets and study risk communications aimed at these most at risk populations.

1. Government or University Initiated Programs

1.1. Existing Food Safety Measures

1.1.1. Drinking Water Advisories

A document developed by the Drinking Water Advisory Group.
The purpose of this document is to provide guidance to Chief and Council to effectively address the underlying causes of the Drinking Water Advisories. The procedure provides an outline for the Chief and Council to address the issues, how to establish a Community Based Water Team, and how to foster communication between the government and the Chief and Council, encouraging proactive approaches to the issue.

Government of Canada. (2007). *Procedure for addressing drinking water advisories in first nation's communities south of 60°.* Retrieved from http://www.hc-sc.gc.ca/fnih-spni/alt_formats/fnihb-dgspni/pdf/pubs/water-eau/2007_water-qualit-eau_e.pdf

1.1.2. EAGLE Project

(Effects of contaminants on Aboriginals from the Great Lakes Environment)
The EAGLE project has many publications including: Contaminants in Human Tissues; Fish Consumption Guidelines; Health Project Survey; Fish Contaminants Program Risk Analysis; and Eating Patterns Survey.
Specific Reports:

- Contaminants in Wild Game – Technical Report May 2001 – Produced with Health Canada and Science Advisory committee as part of the EAGLE project: Samples were taken of local wild life and analysed for contaminants. Many samples were above Health Canada's recommendation levels but only in the liver and kidneys; it is recommended that these parts should not be eaten.

- Fish Consumption Guideline from May 2001: This study was conducted in partnership with the Assembly of First Nations, Chiefs of Ontario, Health Canada and First Nation Communities in Ontario. Ontario Ministry of Environment and Energy (OMEE) have published guidelines to inform people as to how much fish they can "safely" consume. This OMEE program does not sample fish which are representative of species caught and consumed by First Nations communities from their fishing locations. First Nations people need relevant, applicable consumption advice to better understand toxicological risks associated with their traditional food. The most exciting and well received format for the guidelines is a multimedia software package that allows adjustments in weight etc. for personal guidelines to fish consumption

Chiefs of Ontario. (2005). *Environment Department.* Retrieved from, http://www.chiefs-of-ontario.org/

Boucher, R., Davies, K., Hanley, S., & Holden, R. (2001). EAGLE Health Survey. Retrieved from, http://www.chiefs-of-ontario.org/environment/docs/EHS2.pdf.

1.1.3. Environmental Health Program

A community based program to improve First Nations' health through reduction of health risks, injuries or death. An Environmental Health Officer is assigned to the community to investigate potential environmental health related outbreaks, raise awareness of environmental health hazards, such as water, food and vector borne illnesses including health issues associated with indoor air quality, pest control, etc. Food safety is monitored here. Food safety services in First Nations communities are aimed at preventing the incidence of food-borne illnesses. Grocery stores, restaurants, cafeterias, public buildings and special events such as festivals, pow wows, rodeos and traditional games may be routinely inspected. Environmental Health Officers inspect food preparation and storage facilities on a yearly basis at a minimum. They will also inspect facilities on an "as requested" basis by the Chief and Council or through written agreement. Food safety activities in First Nations communities include training courses on safe food handling. This program is run by each province separately.

Health Canada. (2007b). *First Nations and Inuit Health Program Compendium. Government of Canada*. Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/2007_compendium/index_e.html.

1.1.4. International Circumpolar International Surveillance

This is a network of hospitals, public health agencies, and reference laboratories throughout the Arctic linked together to collect, compare, and share laboratory and epidemiologic data on infectious diseases and assist in the formulation of prevention and control strategies. The International Circumpolar Surveillance (ICS) Database (Health Canada) was established in 1999 to gather data for a better understanding of the epidemiology of infectious diseases in northern Aboriginal populations in order to improve prevention and control programs.

Health Canada. (2004). *Environmental and Workplace Health*. Retrieved from, http://www.hc-sc.gc.ca/ewh-semt/pubs/eval/inventory-repertoire/ics_e.html

1.1.5. Northwest Territories Traditional Food Fact Sheets Series

The Northwest Territories Department of Health and Social Services publishes fact sheets and information reports on foodborne diseases. They offer the information in many Native Canadian languages. They have published a report **Northwest Territories Traditional Food Fact Sheets Series** in June 2002. This report contains information to safely harvest, prepare, store, etc. traditional foods of Inuit and Dene/Metis.

NWT Health and Social Service. (2000). *Publications page*. Retrieved from, http://www.hlthss.gov.nt.ca/content/Publications/alphabetical_listing/publications_a_f.asp

1.1.6. A Program for the Prevention of Toxoplasmosis in Pregnant Women, in Nunavik (Québec).

A study revealed that some Inuit women were not immune (non-seropositive) to toxoplasmosis; this program was developed to educate these women on safe food handling during pregnancy. The program developed a protocol for protection, provides information to public and professional audiences, provides prenatal and postnatal health counselling for those that are not immune, and helps those who are pregnant and infected with *Toxoplasma gondii* to get receive treatment for the disease.

Proulx, J. (2002). *Protocole de prévention et de contrôle de la toxoplasmose congénitale au Nunavik.* Direction de la santé publique. Centre de santé Tulattavik de l'Ungava Centre de santé Inuulitsivik.

1.2. Programs Related to Food but not to Food Safety

1.2.1. Alaska Traditional Knowledge and Native Food Database

This organization has a project called, the Traditional Knowledge and Contaminants Project. The project was completed by the Institute of Social and Economic Research at the University of Alaska and the Alaska Native Science Commission in July 2000. The project's aim was to develop a database of community concerns and priorities, information on harvesting, nutrition value of traditional foods, cultural benefit of traditional foods, contaminants in traditional foods and the health effects of contaminants on animals and people. The Canadian Northern Contaminants Program was used as a model to learn how tribal organizations are involved in establishing research priorities and how they decide if the subsistence food is safe to eat. The project developed electronic links between the village organization, native regional organizations and governemnt agencies and scientists.

The Institute of Social and Economic Research, University of Alaska Anchorage. (2000). *Traditional Knowledge and Contaminant Program: Progress Report.* Retrieved from, www.nativeknowledge.org

1.2.2. Assembly of First Nations Annual General Assembly – Resolution #30

A review of literature by the Assembly of First Nations identified a research gap on the health effects of consuming traditional foods exposed to environmental contaminants. A study involving the University of British Columbia, the University of Montreal, the First Nations Inuit Health Branch (FNIHB), Health Canada and the Public Health Agency of Canada will document traditional and market food consumption, estimate exposure to contaminants and intake of nutrients of concern across communities. It will include documents of self-reported health status and lifestyle habits across communities and food related needs and concerns. The Assembly of First Nations has decided to participate in the study and provide technical support.

Assembly of First Nations. (2007). *Annual General Assembly Resolution*. Retrieved from, http://www.afn.ca/article.asp?id=3858.

1.2.3. Eating Well with Canada's Food Guide – First Nations, Inuit and Metis

An adaptation of the Canadian Food Guide for First Nations, Inuit and Métis. It includes some of the traditional foods such as wild game meat, seal and whale oil or ooligan grease. The bread, Bannock, has also been added. No information about food safety is provided.

Health Canada. (2007). *Eating well Canada's Food Guide – First Nations, Inuit and Métis.* Retrieved from, http://hc-sc.gc.ca/fn-an/alt_formats/fnihb-dgspni/pdf/pubs/fnim-pnim/2007_fnim-pnim_food-guide-aliment_e.pdf

1.2.4. First Nations Community Food Systems for Healthy Living

This is a program offered through the British Columbia First Nations Agricultural Association. It is funded through the B.C. government and implemented by the Ministry of Agriculture and Lands.The objective is to create awareness for locally grown fresh food, improve access to the food, and create jobs/farming land from underused land. The project has 3 components – training, food production, food processing of value added food.

This is a food security measure, which indirectly is providing food safety. The security of food means consumables of decreased quality or high risk can be avoided (Ross et al., 1989).

First Nations Agricultural Association. (2007). *First Nations Community Food Systems for Healthy Living – Guide to Applicants*. Retrieved from, http://www.fnala.com/CFSApplicaionGuidelines.pdf

Ross, P., Olpinski, S., & Curtis, M. (1989). Relationships between dietary practice and parasite zoonosis in Northern Quebec Inuit communities. *Etudies Inuit Studies, 13*(2), 33-47.

1.2.5. Food Mail Program

This program was started and paid for by the Government of Canada; it is managed by Indian and Northern Affairs Canada. This office provides the funding to Canada Post for the transport of food at reduced postal rates to 140 isolated Northern Communities. The objective is to provide fresh nutritious perishable food at a lower retail price through reduced postal costs to promote a healthier diet in these isolated communities. Also included in the shipments are non-perishable foods and essential non-food items. Food that has little nutritional value such as snack foods, alcohol, tobacco, convenience food are not subject to reduced postal rates. Food Mail has been in operation for more than 30 years.

A paper by Lawn & Harvey (2001) discusses the impact of the Food Mail program on two communities. In this paper, suveys were used on the people of the community; an increase in nutrition was observed as perishable food cost was lower but it was also noted that the increased cost of non perishable foods (inflation) affected the ability of the people to decrease the income spent on food.

This program can also be seen as a food safety measure through increased food security. When a traditional or market food supply is unavailable, people have eaten items that are not normally consumed, such as dog meat, diseased fish or road kill (Ross, et al, 1989; Kempson et al., 2002).

Indian and Nothern Affairs Canada. (2008). *Food mail program*. Retrieved from http://www.ainc-inac.gc.ca/ps/nap/air/nfc_e.html

Kempson, K., Palmer Keenan, D., Sadan, P., Ridlen, S., & Scotto Rosato, N. (2002). Food Management Practices Used by People with Limited Resources to Maintain Food Sufficiency as Reported by Nutrition Educators. *Journal of the American Dietitics Association, 102*(12), 1795-1799. Retrieved from, http://journals.elsevierhealth.com/periodicals/yjada.

Lawn, J., & Harvey, D. (2001). *Change in Nutrition and Food Security in Two Inuit Communities, 1992 to 1997.* Ottawa: Dialogos Educational Consultants Inc. Retrieved from, http://www.ainc-inac.gc.ca/ps/nap/air/nutfoosec_e.pdf

Ross, P., Olpinski, S., & Curtis, M. (1989). Relationships between dietary practice and parasite zoonosis in Northern Quebec Inuit communities. *Inuit Studies, 13*(2), 33-47.

1.2.6. Northern Contaminants Program

This program is directed by a management committee chaired by Indian and Northern Affairs and composed of all representatives of the Northern Communities. The objective is to work toward reducing and possibly eliminating the contaminants in traditional foods while providing information to assist individuals and communities in making informed decisions about their food. It began in 1991 in response to human concerns about exposure to contaminants. Phase one involved data collection about the contaminants.

Phase two involved communicating these data and collecting the traditional knowledge of the Inuit and monitoring the health of northern Aboriginals. The program was successful in communicating the risk associated with contaminants to the communities and is used as a model for other programs. Communication methods are discussed in the reports.

Indian and Northern Affairs Canada. (2008). *Northern Contaminants program last updates Jan 02 2008.* Retrieved from, http://www.ainc-inac.gc.ca/ncp/index_e.html

1.2.7. The American States Nutrient Database

A service of the United States Department of Agriculture, the database provides a complete breakdown of food, giving nutrient composition, energy concentration, etc. An additional 200 food items of traditional foods for American Indians and Alaska Natives were added based on a study conducted by Pamela Pehrsson. The data are intended for nutrition education and diet counselling, either by tribal health organizations or by federal and state health organizations. Navaho reservation, tribal health-care workers are already using the data for diet counselling in an effort to reduce the incidence of diabetes and obesity.

United States Department of Agriculture. (2005). *News and Events.* Retrieved from, http://www.ars.usda.gov/is/AR/archive/sep05/native0905.htm

United States Department of Agriculture. (2008). *Nutrient Data Laboratory*. Retrieved from, http://www.nal.usda.gov/fnic/foodcomp/search/

1.2.8. The Canadian Nutrient Database

This is a service similar to the American Nutrient Database. It also includes the nutrient composition of game meats, and some native breads such as bannock. It is not as comprehensive as the American Nutrient Database.

Health Canada. (1999). *Nutrient value of some common foods*. Retrieved from, http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/nvscf-vnqau_e.pdf

1.3. Other Programs

1.3.1. Aboriginal Head Start

The Head Start program began in the United States in 1965. In 1995, the Canadian government established Aboriginal Head Start to help enhance the child development and school readiness of Indian, Métis and Inuit children living in urban centres and large northern communities across Canada. A few years later, in October 1998, the program was expanded to include on-reserve First Nations.

Program available through Health Canada – First Nations and Inuit Health.

Aboriginal Head Start on Reserve (AHSOR) – An early childhood (preschool) intervention delivered until 6 years of age by Early Childhood Educators, community workers, administrators, parents, and community volunteers.
The goal is to provide the First Nations school children with a sense of themselves, a desire for learning, and opportunities to fully develop. The program also offers classes in traditional cooking and food preparation and also conducts community kitchens to involve parents and family. An objective is to involve and encourage involvement of the First Nations communities to play a major role in planning, developing, implementing, and evaluating the program.

The Head Start program is offered in all provinces. In British Columbia, First Nations Head Start Program (BCFNHS) issues newsletters. One of them "Using Traditional foods" discusses the addition of traditional foods into the meal menu and the food safety care involved. There is also mention of traditional preparation methods for cooking the meat. It suggests the involvement of local government authorities like the Environmental Health Officer for help with food safety (BCFHHS, 2003).

Head Start– Standards Guide states with relation to food safety:
"It is recommended that Aboriginal Head Start projects work in collaboration with community health professionals, nutritionists and Environmental Health Officials". It includes statements that pertain specifically to the handling of food to be served by the project. A food safety course is needed for those working in the kitchens.

British Columbia First Nations Head Start (BCFNHS). (2003). Using Traditional Foods. (BCFNHS Growing Together newsletter, Issue 5). Retrieved from, http://www.bcfnhs.org/downloads/newsletters/Nsl_4_Summer03_web.pdf

Health Canada. (2005). *Aboriginal Head Start on Reserve – Standards Guide*. Retrieved from http://www.hc-sc.gc.ca/fnih-spni/pubs/develop/2003_ahs-papa-ref-guide/sec4_hr_e.html#_66

Health Canada. (2007). *First Nations and Inuit Health Program Compendium*. Retrieved from http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/2007_compendium/index_e.html

Williams, L. (n.d.). *Aboriginal Head Start Program*. Published by National Indian & Inuit Community Health Representatives Organization (NIICHRO). Retrieved from http://www.niichro.com/Child/child4.html

<u>Reviews of the Head Start program</u>:

Bollella, M.C., Spark, A., Boccia, L., Nicklas, T., Pittman, B. & Williams, C. (1999). Nutrient intake of Head Start children: Home vs. school. *Journal of the American College of Nutrition, 18*(2), 108-114.

Authors report that the program has improved the nutrition of the preschool children.

Meal**s** served at the participating Head Start Centers include breakfast, lunch and snack. Each child is served at least two meals. Morning children eat breakfast and lunch at school, afternoon children eat lunch and a snack, and all-day children receive breakfast, lunch and snack. Children in the AM and PM groups consumed one-fourth or less of their total daily intake for energy, protein, carbohydrate, fat, zinc, vitamins E and B12, folate and sodium compared to the all-day children.

Groupe de Recherche et d'interventions psychosociales en Milieu Autochtone. (2002). *First Nations Heat Start on Reserve Program – 2001-2002 Annual Report Quebec Region.* Retrieved from, http://www.cssspnql.com/cssspnql/ui/kids/documents/finalreportheadstart.pdf

During the year 2001-2002, ten AHSOR sites mentioned having witnessed an accrued involvement and participation of parents, children and elders in the activities offered. Some communities underlined the realization and success of special activities often conducted in collaboration with other local organizations. Amongst the other accomplishments, researchers reported an accrued rate of activities, an accrued stability brought forward by the new premises, the delivery of activities aimed at enhancing parental skills, a better interconnection within local teams and finally, the development of promotional and awareness tools.

1.3.2. Air borne Disease – Tuberculosis (TB)

The purpose of this program is to reduce the incidence of tuberculosis in First Nations and Inuit Communities, through surveillance, community based research and control and prevention. Also, to detect, diagnose and prevent the spread of infections, provide treatment to those affected, promote awareness of the disease.

Health Canada. (2007). *First Nations and Inuit Health Program Compendium.* Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/2007_compendium/index_e.html

1.3.3. Alaska Native Knowledge Network

This was designed to serve as a resource for compiling and exchanging information related to Alaska native knowledge systems and ways of knowing. It has been established to assist Native people, government agencies, educators and the general public in gaining access to the knowledge base that Alaska Natives have acquired through cumulative experience over millennia. Some publications are free; most have a fee of 5-10 dollars. It produces a newsletter featuring important information. The website also links to Indigenous Knowledge Systems; another information network, http://www.uaf.edu/uaf/academics/departments.html

Alaska Native Knowledge Network. (2007). University of Alaska Fairbanks. Retrieved from, http://www.ankn.uaf.edu/

1.3.4. Building a Vibrant North

A NDP caucus initiative as part of their Northern Development Strategy. One part of the plan is “A Northern Healthy Food Initiative”, which includes garden projects in 27 remote communities, the promotion of traditional foods, food-processing training and two poultry-raising projects.

New Democratic Party, Caucus of Manitoba. (2007). *Building a vibrant north.* Retrieved from, http://ndpcaucus.mb.ca/newCaucus/?q=theNorth

1.3.5. Canadian Prenatal Nutrition Program

This program has a First Nations and Inuit component. It is delivered by the community health and social services providers. The objective is to improve adequacy of diet of prenatal and breastfeeding First Nations and Inuit women, to increase breastfeeding support, increase nutrition knowledge and access to information. Community kitchens are supported through this program in an effort to provide women with food preparation skills and knowledge.

Health Canada. (2007). *First Nations and Inuit Health Program Compendium*. Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/2007_compendium/index_e.html

1.3.6. Knowledge in Action Report

The Action Report reviews the communication structures, processes, methods and materials utilized under The Northern Contaminants program; the report has identified the following key elements:

1) A strategic yet balanced and flexible program design with a basis in sound science and responsible research;
2) Partnerships that form links across conventional boundaries;
3) Open communication networks that provide information to those who need it the most, and are able to listen to concerns and needs at various levels;
4) Ongoing processes of capacity-building using a variety of approaches; and
5) A commitment of resources to support these activities.

Arctic Institute of North America. (2004). Proceedings 14th Inuit Studies Conference 11-15 August 2004, University of Calgary. Calgary, Alberta, Canada. Retrieved from, http://www.arctic.ucalgary.ca/index.php?page=arctic_contents

1.3.7. Maternal Child Health Program

The program’s objective is to provide service and education about birthing, women’s health, nutrition, available care programs etc. to pregnant First Nations women and families with infants and young children. Programs available through Health Canada – First Nations and Inuit Health

Health Canada. (2007). *First Nations and Inuit Health Program Compendium*. Retrieved from, http://www.hc-sc.gc.ca/fnih-spni/pubs/gen/2007_compendium/index_e.html

1.3.8. Northwest Territories, Environmental and Natural Resources, Wildlife Division

The Northwest Territories: Department of Environmental and Natural Resources has a Wildlife division. The common diseases and parasites of the wildlife are listed on the website of the division. The conditions are listed by area of the carcass affected by pathogens (kidneys, lungs, skin...).

N.W.T. Department of Environmental and Natural Resources. (2008)**.** *Common Wildlife Diseases and Parasites in the NWT and Nunavut.* Retrieved from, http://www.nwtwildlife.com/Publications/diseasepamphletweb/tableofcontents.htm#Skin

1.3.9. Public Health Department of the Cree Board of Health and Social Services of James Bay (CBHSSJB)

This service was created in 2002 and is officially recognized by the Government of Québec. Its main duties are surveillance, promotion, prevention, protection, regulation, research and training relating to the health of the Cree (Iiyiyiu) population in the territory of Region 18 covered by the James Bay and Northern Québec Agreement. For public information. No food safety component. Reports publish specifically related to the Cree Community and Cree Territory of Eeyou Istchee.

Public Health Department of the Cree Board of Health and Social Services of James Bay (CBHSSJB). (2006). Waachiyaa. Retrieved from, http://creepublichealth.org/front/

1.3.10. Rural Health in Rural Hands

A Strategic Direction for Rural, Remote, Northern and Aboriginal Communities. This is a report published by The Ministerial Advisory Council on Rural Health in November 2002. The report discusses the problems and offers suggestions of relief for rural communities. This report is a first step toward building healthy rural communities and reducing the inequities in health status between rural and urban Canadians.
21 Council members from across the country representing a broad range of disciplines and experts started in 2001 to investigate the problem. The Council has articulated a vision and outlined seven broad strategic directions to address rural health challenges — building healthy communities; enhancing community infrastructure; fostering greater intersectional collaboration; expanding rural health research; creating a nationwide telehealth initiative; creating systemic and innovative approaches for health human resources; and promoting Aboriginal health.

Ministerial Advisory Council on Rural Health. (2002). *Rural Health in Rural Hands: A Strategic Direction for Rural, Remote, Northern and Aboriginal Communities.* Retrieved from, http://www.srpc.ca/librarydocs/rural_handsbr.pdf

1.3.11. State of Alaska. Division of Wildlife Conservation

This is a webpage from the State of Alaska, Wild Life Conservation Department. There is a section listing the common parasites and diseases of the wildlife. It explains the symptoms to look for in live animals and characteristics of carcasses; pictures are provided.

State of Alaska, Division of Wildlife Conservation. (2008). Wildlife Diseases & Parasites. Retrieved from, http://wildlife.alaska.gov/index.cfm?adfg=disease.main

1.3.12. University of Alaska

The University of Alaska has programs on Alaska Native and Rural Development designed to educate a new generation of community leaders for rural Alaska. The Programs available are;

- Earn a B.A. in Community Business & Economic Development
- Tribal and Local Government Administration
- Rural Health and Human Services Management
- Community Research and Indigenous Knowledge
- Land Resources and Environmental Management

University of Alaska. (2008). Departments. Retrieved from, http://www.uaf.edu/uaf/academics/departments.html

2: Aboriginal-Initiated Programs and Privately Funded Programs

2.1. An Existing Food Safety Measure

International Workshop on Arctic Parasitology

The first International Workshop on Arctic Parasitology (IWAP) was held in October, 2000 in Prince Albert National Park, Saskatchewan, and was hosted by Research Group for Arctic Parasitology. The main objective of the workshop was to review the state of knowledge, and research, which was addressed through an information exchange session and discussions on a variety of aspects of host-parasite-environment systems in the Arctic. These included the cultural and economic significance of wildlife resources for First Nations, host and geographic distributions, the effects of parasites on hosts, parasite epidemiology, the interactions between host migrations and parasitic infections, and global climate change and its possible influences on hosts and their parasites.

The workshop resulted in the identification of priorities for future research and additional issues, such as, the urgent need for selected baseline data as a foundation for long-term monitoring of the effects of natural and man-made changes in the arctic ecosystem on parasitic infections in wildlife. Also, the development of international research collaboration, which was achieved, based on the development of specific projects during the workshop, and the continuing contacts among participants after the IWAP concluded

Research Group for Arctic Parasitology. (2000). International Workshop on Arctic Parasitology (IWAP). Retrieved from, http://wildlife1.usask.ca/IWAP/

2.2. Aboriginal Initiated Programs Related to Food but not Food Safety

2.2.1. Brighter Futures

A program to strengthen family relationships and community connections. It offers a community kitchen to help people learn to cook nutritious meals on a budget. Not specific to Native Americans. Funded by a private group.

Brighter Futures Family Resource Society. (n.d.). Brighter Futures. Retrieved from, http://www.brighter-futures.ca/index.htm

2.2.2. U.S. Native Agriculture and Food Systems Initiative

First Nations Development Institute launched the Native Agriculture and Food Systems Inititive (NAFSI) in 2001 with primary support from W.K. Kellogg Foundation to provide Native communities the opportunity to better understand and perhaps influence the many issues and concerns related to food systems. The Initiative issues a newsletter informing of the programs that have been implemented by Native Americans.
Some programs that have been initiated are:
Time for Harvest: Renewing Native Food Systems Program: Foods and Folkways
Restoring Indigenous Foods and Cultural traditions in the Northern Plains

First Nations Development Institute. (2008). Native Agriculture & Food Systems Initiative. Retrieved from, http://www.firstnations.org/NativeAgriculture.asp

2.2.3. Greenhouse Alaska

The Alaska Department of Natural Resources has various resources available for the public to start their own greenhouse. The department does have a program to label food grown in Alaska, for marketing purposes, in order to increase the market for local food.

The Kenaitze Indian Tribe and the Louden Tribal Council have initiated a greenhouse for the production of fresh produce year round for their tribes (NAFSI, n.d.). Related to food safety through food security.

NAFSI. (n.d.). *Time for the Harvest: Renewing Native Food Systems.* Retrieved from, http://www.firstnations.org/publications/NAFSIFinalPR92903.pdf

2.2.4. Native American Community Board

Located in Lake Andes, South Dakota. This is an initiative to expand the access to native foods. The tribe will grow food and conduct workshops to instruct in the preparation of traditional food products, and preserving them.

Native American Community Board (NACB). Contact information:
P.O. BOX 572
LAKE ANDES, SD 57356
605-487-7072 or casetoyer@yahoo.com

2.2.5. Native American Women's Health Education Resource Centre

The Centre was formed in 1985 by Native Americans near the Yankton Sioux Reservation as part of the Native American Community Board. The Center has various information resources. No program directed at food safety specifically.
The Center has a program: Traditional Food Preservation Program where the Native people plant fruit trees. The purpose is to provide commerce and organic food. Te Center also has elders teaching how to make the traditional food products, how to identify indigenous plants, and for what purposes they can be used.

Chew, A. (2002). Traditional Food System Preservation Program gets underway. *Wicozanni Wowapi-Good Health Newsletter: 1*(2), Spring 2002

2.2.6. Six Nations of the Grand River Territory

The organization has a health promotion and nutrition service division. It also offers a canning and preserving class.

Six Nations Health Services. (2006). Health Promotion and Nutrition Service. Retrieved from, http://www.snhs.ca/hpnsProg.htm

2.3. Other Aboriginal Initiated Programs

2.3.1. Aboriginal Aquaculture Association

The Aboriginal Aquaculture Association (AAA) is an association founded by the British Columbia First Nations to create economic development and self-sufficiency in the community. The Association is non-profit and offers training, marketing assistance and environmental monitoring programs and provides a source of information for First Nations communities involved in the aquaculture sector. A program, called Aboriginal Certification of Environmental Sustainability (ACES), was started to ensure that Traditional First Nations values are respected in the management of the aquaculture industry in British Columbia. AAA website does not have a food safety component but does educate on fish diseases.

Aboriginal Aquaculture Association (AAA). (2005). Homepage. Retrieved from, http://www.aboriginalaquaculture.com/home.htm

2.3.2. Aboriginal Learning Knowledge Centre

Part of the Canadian Council of Learning. The centre works collaboratively with Aboriginal people and other learning professionals to build on the unique personal, social, cultural and historical contexts for Aboriginal learning. The centre aids the development of effective solutions to the many learning challenges faced by First Nations, Métis and Inuit. The centre provides information for educating adult aboriginals.

Canadian Council on Learning. (2008). *Aboriginal Leaning Knowledge Centre*. Retrieved from, http://search.ccl-cca.ca/CCL/AboutCCL/KnowledgeCentres/AboriginalLearning/AboriginalLearningHome/?Language=EN

2.3.3. ArcticNet

ArcticNet is a Canadian network of centres of excellence. It brings together scientists and managers in natural, human health and social sciences and Inuit organizations, northern communities, federal and provincial agencies and private sectors.

The goal is to study the impacts of climate change in the coastal Canadian Arctic and to contribute and disseminate knowledge that would be useful to develop strategies to adapt national policies and assessments of impact of the changing environment. It also aims to involve Northerners in the processes through exchange of knowledge.

The network offers links for high school and university students to become involved in awareness programs. It allows everyone to view current research and organizes conferences for students and graduates.

A food safety research component is not present.

ArcticNet. (2007). *Homepage*. Retrieved from, http://www.arcticnet-ulaval.ca/

2.3.4. Inuit Tapiriit Kanatami

Inuit Tapiriit Kanatami (ITK) is a Canadian Inuit Organization. The organization represents four Inuit regions – Nunatsiavut (Labrador), Nunavik (northern Quebec), Nunavut, and the Inuvialuit Settlement Region in the Northwest Territories.

The website provides information on issues to improve living conditions for Inuit economically and socially. They are seeking equity with other Canadians and seek to close the gap in living standards.

The website has no specific information on food safety, but informs about initiatives undertaken by Natives.

Inuit Tapiriit Kanatami (ITK). (2008). *About ITK*. Retrieved from, http://www.itk.ca/index.php

Appendix E : Traditional Foods of the First Nations People of Nuxalk Nation.

Fish and Seafood

English name	Local Name	Preparation
Herring roe	At	Herring can be eaten fresh, boiled, or coated with flour and fried. It is also canned either plain in a sauce or pickled. It is also frozen fresh. In the past, herring was smoked.
Sea cucumber	7lats	Some people used to pickle sea cucumber. Today few people use sea cucumber at all.
Abalone	Pixani	The abalone meat is removed from the shell, coated with flour and fried. Abalone is preserved either in jars or cans or by freezing.
Blue mussels	Smiks	Mussels are steamed open; the meat is then eaten or frozen.
Crab	K’inacw	Crab is cooked by steaming or dropping into boiling water, the shells are cracked and the meat removed. In the past, crabmeat was preserved by drying. Today crab is usually preserved by freezing or canning.
Ling cod	Nalm	The fillet can be frozen or eaten fresh. It can be dipped in flour and fried, or dipped in batter and deep fried. Some people like to smoke cod fillets before freezing them.
Pink salmon	Kap’ay, humps	In the past, pink salmon was dried in the smokehouse. Today, it is canned, dried, barbecued and made into ‘sluq’ or ‘knum’.
Chum (dog)	T’li	In the past, chum salmon was smoked and stored in the cedar boxes in the smokehouse. Today, chum salmon is preserved by canning, jarring, salting, smoking and as ‘sluq’.
Coho or silver salmon	Ways	Coho is canned, jarred, smoked, barbecued or salted

Appendix E (Continued): ***Traditional Foods of the First Nations People of Nuxalk Nation.***

English name	Local Name	Preparation
Sockeye salmon	Samlh	Sockeye are preserved by canning, jarring, barbecuing, and smoking and as 'sluq'. Fresh sockeye are usually cooked as steak. Another favorite way is to make a mulligan (or stew) with potatoes and vegetables.
Spring, chinook, king	Amlh	In the past, spring was preserved by drying. Today, spring salmon is salted or half smoked and then canned or frozen.
Seal	Ascw	When ooligan grease was scare, seal fat was used. Today seal meat and fat is frozen and usually cooked by boiling or baking.
Nukakals, flounder	Pays	Flounder is not usually preserved except by freezing. It is eaten fresh, and usually cooked by frying either whole or in fillets.
Steelhead	K'lat	Steelhead is usually preserved by freezing. There are still some people who smoke steelhead in early spring when other fish is not available.
Trout	Tutup	Trout are eaten fresh soon after they are caught.
Red cod, snapper	Lc7iixw	Fillets can be frozen, or eaten fresh. They can be dipped in flour and fried, or dipped in batter and deep fried. Some people like to smoke cod fillets before freezing.
Clams	Ts'ikwa,	In the past, clams were dried and smoked slightly. Eaten fresh they can be fried or cooked in chowder.
Sea urchin	Mtm	
Ooligan	Eulachon	Raw, smoked, dried meat and ooligan grease. They can be boiled, baked or dipped in flour and fried. Some people have cooked ooligans in sandwiches.

Appendix E(Continued): ***Traditional Foods of the First Nations People of Nuxalk Nation.***

Game

English name	Local name	Preparation
Moose	Skma	
Duck	Naxnx	In the past, ducks were jarred. Duck is now usually stored in plastic bags and frozen.
Grouse	Mucwmukwt, Takws	
Deer	Scwpanilh	Deer was dried and stored for later use. Meat was dried in strips, hung over a fire at the hunting camp, so it could be carried back to the village easily.
Mountain goat	Qwwaax, Yaki	In the past, mountain goat meat was dried at the hunting camp. Today, mountain goat is usually preserved by freezing.
Rabbit	Qax	Rabbit meat can be fried, deep fried, baked, steamed, or cooked in stew.

Wild Berries

English name	Local name	Preparation
Saskatoon berries	Sq’sk	Dried and soaked, jam or frozen for fruit salad. In the past, the berries were dried and then stored in cedar boxes.
Kinnikinnick berries	Milicw	Eaten fresh, frozen or as dry jam. Dried kinnikinnicks were cooked mixed with flour to make dumplings.
Bunchberries	P’xwlht	Bunchberries used to be dried on cedar racks outside. They were then soaked and mixed with other berries. Today, bunchberries are eaten with ooligan grease and a small quantity of sugar. They are also mixed with red huckleberries or made into dry jam with thimbleberries.

Appendix E (Continued): ***Traditional Foods of the First Nations People of Nuxalk Nation.***

English name	Local name	Preparation
Black Hawthorn berries	Q'ay	The berries were formerly mashed, strained, boiled and stored in cedar boxes. Now they are made into dry jam or jelly stored in cellars or freezers.
Crowberries		Mashed and strained and made into jam.
Wild strawberries (limited availability)	Qululuuxu	Fresh
Stink currants	Q'is	Currants were dried on cedar racks outside. Today, they are eaten fresh, frozen or as dry jam.
Wild black gooseberries	Atl'anulh	Dry jam or jelly.
Wild green gooseberries and leaves	Atl'anulh	Green berries were picked with their leaves to make a sauce. These berries were never dried.
Swamp gooseberries	Mnmntsa	Fresh or dried (infrequently used).
Wild blue currants	Ts'ipscili	Cooked briefly with water and consumed. They are not preserved.
Thimbleberries	Snutatiiqw	They used to be dried on cedar racks. Today, they are mixed with raspberries to make dry jam or eaten fresh with porridge.
Rose hips	Skupik	Previously eaten fresh, now dried for tea or used to make dry jam or jelly.
Wild raspberries	Qalhqa	Fresh, made into dry jam or dried in the sun.
Blackcap (black raspberries)	Usukw'ltlh	The berries were formerly dried and were either soaked in water and then eaten or mixed with ooligan grease and eaten. Today, people make jam or jelly and/or freeze to use in fruit salad.

Appendix E (Continued): ***Traditional Foods of the First Nations People of Nuxalk Nation.***

English name	Local name	Preparation
Salmonberries	Qaax	Fresh, dried or jam. The young shoots or stems are eaten fresh. Today, some children eat the stems dipped in sugar.
Red elderberries	K'ipt	Red elderberries were always cooked or dried; they were never eaten raw. Today, red elderberries are cooked in water with their stems on for about 20 minutes. They are eaten right off the stems or are jarred or made into dry jams.
Soapberries	Nuxwski	Made into a thick whip with added sugar, dried for tea and/or to make dry jam.
Watery blueberries	Snuqlxlayk	They used to be dried on cedar racks. Today, people make jam and jelly or freeze the berries.
Mountain bilberries (limited availability)	Sqaluts	Fresh, dried, jam.
Grey blueberries	Spuuxaltswa	The berries used to be dried. Today, people eat them fresh, frozen or use them in pies, dry jam and/or jelly. They are also used in fruit salad, pancakes and muffins.
Red huckleberries	Sqala	Fresh, dried, jam. They used to be dried on drying racks.
Bog blueberries		Fresh, dried, jam.
High bush cranberries	St'ls	High bush cranberries were stored in 10 gallon barrels filled with water and covered with ooligan grease. Now, high bush cranberries are preserved in jars.

Appendix E(Continued): ***Traditional Foods of the First Nations People of Nuxalk Nation.***

Greens, Roots and Other Plants

English name	Local name	Preparation
Lambsquarters	Ts'icts'ikmlhp	Fresh, used as a raw salad green or lightly steamed.
Fern rhizomes	Sqw'alm	Previously, the roots were steamed overnight in a pit. Today, they can be cooked in a pressure cooker. Once they are cooked, the roots are peeled. They are also eaten with ooligan grease or with ripened salmon eggs.
Fireweed	Ts'ayxlhp	Peeled fireweed shoots are used as fresh greens in early spring. The growing stem is snipped off 6-8 inches from the new tip, peeled and eaten.
Rice root (limited availability)	Ilk	Bulbs boiled, mashed, used with ooligan grease.
Cow-parsnip	Xwiq’	The inside tender stems are eaten raw or after being steamed lightly. In the past, they were eaten with ooligan grease. The stalks can also be preserved by freezing or pickling.
Labrador tea leaves	Pu7aas	Leaves are boiled for tea. The leaves can be picked any time because it is an evergreen. To store leaves it is better to collect them after the first frost.
Lupine roots	Q’akwtsnk	Cooked until tender.
Licorice fern root	K'tsaatsay	Eaten raw as a mouth “freshener”
Black cottonwood	Aq’miixalhp	Fresh, inner bark is consumed but not preserved.
Seaweed, laver	Lhaq's	Seaweed is used dry on top of stews, or it is boiled and eaten with the following: fish clams, fresh salmon eggs, or ripened salmon eggs. Dried seaweed can be kept for one year.

Appendix E (Continued): ***Traditional Foods of the First Nations People of Nuxalk Nation.***

English name	Local name	Preparation
Silverweed or cinquefoil	Uq’al	Roots cooked until tender are consumed with ripened salmon eggs, berries and ooligan grease.
Bracken rhizomes	Sacsakwmlhpnk	Rhizomes are cooked until tender.
Wild/pacific crabapple	P’c	Frozen to make dry jam or jelly.
Thimbleberry shoots	Sxtsi	The shoots or stems are eaten fresh after removing the leaves and outer skin.
Sheep sorrel	Yumyumalcwlhp	Eaten as a fresh salad green.
Springbank clover rhizomes	T'xwsus	Cooked until tender and can be added to stews.
Stinging nettle	Tsna	The nettles must be soaked in salt water and drained before steaming.

Source: Centres for Indigenous Peoples’ Nutrition and Environment Global Health Initiative. (2008). *Global Health Case Study- Nuxalk*. Retrieved from, http://www.mcgill.ca/cine/resources/data/nuxalk/

Appendix F: Traditional Foods of People of the Gwich'in Nation

Land Mammals

English name	Local name	Parts used (from most frequently to least frequently used)	Preparation
Moose	Dinjik	Meat, ribs, bone, heart, fat, bone marrow, head, kidney, liver, blood, brain	Meat is cooked, baked, boiled, roasted, fried, smoked or dried.
Beaver	Tsee'	Meat, tail and feet, liver	Meat is cooked, smoked or dried.
Porcupine	Ts'it	Meat	Meat is cooked, smoked or dried.
Rabbit/ Snowshoe Hare	Geh	Meat, head, liver, blood and brain	Cooked, boiled, smoked or dried.
Muskrat	Dzan	Meat, tail and brain	Meat is eaten raw, cooked, smoked or dried.
Dall Sheep	Divu	Meat	Meat is cooked, smoked or dried.
Caribou - barren land	Chuu choo vadzaih	Meat, ribs, bone, bone marrow, heart, tongue, head, fat, kidney, stomach, liver, brain and blood	Meat is eaten raw, cooked, smoked, dried, fried, boiled or baked. Bone is used in a soup. Bone marrow and fat are eaten raw. Heart is eaten cooked or raw. Ribs are cooked and liver is baked.
Caribou - woodland	Dachan vadzaih	Meat, ribs, bone marrow, bone, tongue, fat, head, heart, kidney, liver, stomach, blood, brain	Meat is eaten cooked, smoked, dried, fried, boiled or baked. Bone is used in soup. Bone marrow and fat are eaten raw. Heart and ribs are cooked.
Bear black and grizzly	Shoh	Meat	Meat is cooked, smoked or dried.

Appendix F (Continued): ***Traditonal Foods of People of the Gwich'in Nation.***

Fish, Seafood and Sea Mammals

English Name	**Local Name**	**Parts Used (from most frequently to least frequently used)**	**Preparation**
broad whitefish/lake whitefish/round whitefish	Luk dagau/ Luk zheu	Flesh, eggs, fish-pipe and head	The flesh is smoked, baked, fried or dried. The eggs are baked.
Cisco lake herring	Treeluk	Flesh, head, eggs and fish-pipe	The flesh is cooked or dried.
Beluga whale	Ehvyak	Muktuk, blubber and flesh	Muktuk is eaten raw. Flesh is cooked, smoked or dried.
Loche/burbot	Chehluk	Flesh, liver, eggs, head, fish-pipe	Flesh is dried or baked. Liver is baked.
Arctic char/ Arctic salmon	Dhik'u	Flesh, fish-pipe, eggs, head	Flesh is cooked, boiled, smoked or dried.
Lake trout	Vit	Flesh, eggs, head, fish-pipe	Flesh is eaten raw, cooked, boiled or dried.
Inconnu, connie/coney	Shryuh	Flesh, head, fish-pipe, eggs	Flesh is cooked, baked, smoked or dried.
Walleye		Flesh	Cooked or dried.
Arctic grayling/bluefish	Shriijaa	Flesh, head	Cooked or dried.

Birds

English name	**Local name**	**Parts used (from most frequently to least frequently used)**	**Preparation**
Pintail	Naak'oh jidigau	Meat, gizzard, kidney, heart and liver	Meat is eaten cooked, smoked or dried.
Whistling duck/widgeon		Meat, gizzard, kidney, heart, liver and eggs	Meat is eaten cooked, smoked or dried.
Mallard	Meet'au	Meat, gizzard, heart, liver, kidney, eggs	Meat is eaten cooked or boiled.

Appendix F (Continued): ***Traditonal Foods of People of the Gwich'in Nation.***

Birds

English name	Local name	Parts used (from most frequently to least frequently used)	Preparation
Canvasback		Meat, gizzard, kidney, heart, liver and eggs	Meat is eaten cooked.
Canada goose	Kheh	Meat, gizzard, fat, heart, kidney, liver and eggs	Meat is eaten cooked, boiled, smoked or dried.
Snow goose/wavies	Googeh	Meat, gizzard, heart, kidney, liver and eggs	Meat is eaten cooked.
Squaw duck/oldsquaw	A'aalak	Meat and kidney	Meat is eaten cooked.
Spruce partridge/grouse	Daih	Meat, kidney, gizzard and heart	Meat is eaten cooked.
Black duck/surf scoter/white-winged scoter	Deetree'aa, Njaa,	Meat, gizzard, heart, kidney, liver and eggs	Meat is eaten cooked or baked.
Fish duck/red breasted merganser/common merganser		Meat, gizzard, kidney, liver and heart	Meat is eaten cooked.
Trumpeter swan/whistling swan/tundra swan		Meat, gizzard, kidney, heart, liver and eggs	Meat is eaten cooked.
Rock ptarmigan/willow ptarmigan	Daagoo	Meat, gizzard, kidney, heart and liver	Meat is eaten cooked.

Plants and Berries

English name	Local name	Parts used (from most frequently to least frequently used)	Preparation
Crowberry/blackberry	Dineech'uh,	Berries	Raw
Labrador tea	Lidu	Unknown	Tea

Appendix F (Continued): ***Traditonal Foods of People of the Gwich'in Nation.***

Plants and Berries

English name	Local name	Parts used (from most frequently to least frequently used)	Preparation
Wild rhubarb	tsu'gyuu	Stalks	Cooked and eaten as fruit.
Wild raspberries	ts'au nakal'	Berries	Not obtained/Unknown
Black currants	Deetr'ee jak	Fruit	Not obtained/Unknown
Green gooseberries/Canada gooseberries		Berries	Not obtained/Unknown
Red currrants	Nee'yuu	Berries	Not obtained/Unknown
Rose Hips	Nichih	Fruit	Not obtained/Unknown
Cloudberries	Nakal'	Berries	Not obtained/Unknown
High blueberries (blue)	Jak naalyuu	Berries	Not obtained/Unknown
Low blueberries (grey)	Jak zheu	Berries	Not obtained/Unknown
Low bush cranberries/high bush cranberries/bog cranberries	Natl'at	Berries	Eaten raw or used to make jam.

Source: Centres for Indigenous Peoples' Nutrition and Environment Global Health Initiative. (2007). *Global Health Case Study- . – Gwich'in*. Retrieved from, http://www.mcgill.ca/cine/resources/data/gwichin/