CHRONIC DISEASES

LITERATURE REVIEW AND ANALYSIS OF THE
FIRST NATIONS AND INUIT REGIONAL HEALTH SURVEY
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Aboriginal Health
RESEARCH

Report Prepared for the
National Steering Committee
First Nations and Inuit Regional Health Survey

by

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Table of Contents

ABSTRACT

Background: Five chronic conditions (diabetes, cancer, heart disease, hypertension and arthritis/ rheumatism) are selected for the literature review with regard to the burden of illness, the health and social impact, co-morbidity, and health care needs. Data from the recently completed First Nations and Inuit Regional Health Survey (FNIRHS) are compared with the 1994 National Population Health Survey (NPHS) for the non-Aboriginal population and the 1991 Aboriginal Peoples Survey (APS) to detect temporal changes.

Results: Using the NPHS as comparison, the prevalence of all five conditions among First Nations exceeds that of all Canadians in all major age-sex groups. The FN/Canada ratio of age-adjusted prevalence for diabetes is 3.3 (M) and 5.3 (F); for heart problem is 3.0 (M) and 2.9 (F); for cancer is 2.0 (M) and 1.6 (F); for hypertension is 2.8 (M) and 2.5 (F); and arthritis/rheumatism is 1.7 (M) and 1.6 (F). The FINRHS tends to yield higher estimates than the APS of 1991. There is also some discrepancy from studies reported in the literature which tends to show a lower risk for cancer and heart disease among FN people. The limitations of self-reports in assessing disease burden must be recognized. Of particular interest is diabetes, which is extremely prevalent. Above the age of 45, a quarter of the FN population reports having diabetes.

Chronic diseases are associated with considerable disability in terms of activity limitation, needing help with personal care, and being house-bound. Individuals with chronic diseases are also more likely to report being in "poor" health and less likely to report "excellent'. There is a higher prevalence of all 5 chronic diseases among individuals with less education, who are widowed or having a past history of attending residential school. However, when age has been controlled for, the association disappears. In terms of concurrent health risk behaviours, those with chronic diseases are less likely to be current smokers; while this is encouraging, the prevalence of smoking is still too high (in the 50%+ range).

While a high proportion of respondents want more health care staff, chronic care facilities, home care, education on medications, prevention education, and mental health services, among individuals with chronic diseases, the proportion tend to be even higher (80%+).

Conclusion: The prevalence of chronic diseases in Aboriginal communities appears to be increasing and substantially higher than in the Canadian population. Diabetes continues to be a serious problem with respect to burden of disease, impact on quality of life, and utilization of health services. Providing services to address this "epidemic" will pose a significant challenge to the health care system. Failure to prevent it will result in substantial increase in health care costs.

1. INTRODUCTION

Over the past several decades Aboriginal people in Canada have undergone a health transition marked by a decline of infectious diseases and an increasing burden of chronic diseases and injuries in the population (Young 1988). There is no generally agreed definition of "chronic" diseases, apart from the fact that they are of insidious onset, long duration and not caused by microorganisms. However, some infectious diseases are also of insidious onset and long duration (e.g. tuberculosis) while the clinical presentation of some chronic diseases may be acute (e.g. myocardial infarction). Furthermore, some cancers and peptic ulcer have now been shown to be caused by viruses and bacteria. The division of diseases into "infectious" and "chronic" is therefore arbitrary but it does serve a purpose in that some chronic diseases are referred to as "diseases of modernization" or "Western diseases", and they are useful as indicators of the health transition of specific populations.

Since it is impossible to cover all chronic diseases, many important conditions such as digestive (eg. peptic ulcer, gallbladder disease), neurological (e.g. dementia), respiratory (e.g. chronic obstructive lung disease), and psychiatric (e.g. schizophrenia) illnesses have been excluded from this review. Five conditions are selected: heart diseases, hypertension, diabetes, cancer, and arthritis. The first three are considered to be relatively "new" diseases in Aboriginal communities but of public health concern because of the rapidly increasing burden of disease and adverse social impact. Cancer is rare, but many communities perceive themselves to be at high risk. Arthritis is very common, and there is some historical evidence to indicate that it is an "old" disease in the Aboriginal population.

2. METHODS

The source of data in this review includes the published literature as well as various mortality and morbidity databases. Only Canadian data are reviewed - the US Native American literature is vast, substantive reviews of which are already available (see, for example, Young 1994). The just completed First Nations and Inuit Regional Health Survey (FNIRHS) is analysed with regard to questions on past history of various chronic diseases. Comparison data from the non-Aboriginal population are obtained from the 1994 National Population Health Survey (NPHS). The Aboriginal People Survey (APS), conducted some 6 years earlier than the FNIRHS, provide a perspective on temporal changes. The questions on past health history are generally comparable.

This report is organized by disease category. Within each category, the discussion is divided into (1) Burden of Disease, providing estimates of incidence, prevalence and mortality, and the sources of Aboriginal data on which such estimates are based; (2) Risk Factors, reviewing data on the distribution of known risk factors for the disease in the Aboriginal population; and (3) Prevention and Control, discussing strategies for interventions (preventive, curative and rehabilitative) that have been attempted in the Aboriginal population. A final chapter considers the health and social impact of these diseases, comorbidity, temporal trends, and the implications for health care policy.

In addition to heart problems, hypertension, diabetes, cancer and arthritis/rheumatism, the FNIRHS also contains questions on asthma, tuberculosis, and “breathing problems”. These are not discussed in this review. Fig.1 ranks the crude prevalence of all self-reported conditions in the FNIRHS to indicate their relative importance.

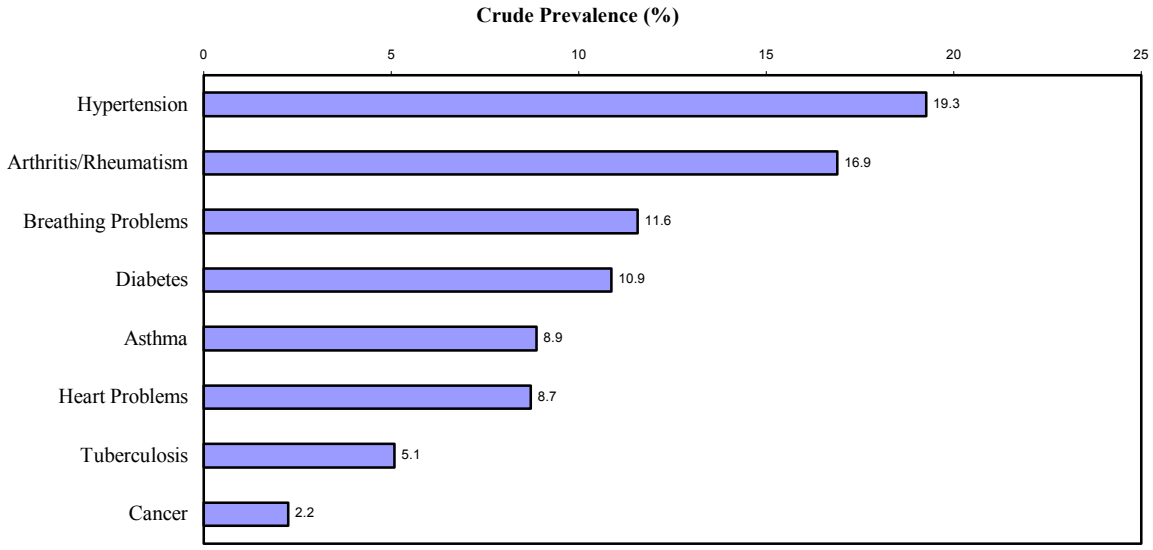

Fig.1 Crude prevalence of self-reported chronic conditions based on the First Nations and Inuit Regional Health Survey

The FNIRHS is a First Nation and Inuit controlled health interview survey conducted during 1997 in 9 regions (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec Nova- Scotia, New Brunswick, and Labrador). While each region designed its own survey questions, a set of national core questions were included in each regional survey. The present analysis focuses on these national core questions by merging the datasets from the 9 regional surveys. Individual, community and regional identifiers were removed from the total sample of 9,870 respondents. All individual records were appropriately weighted to represent the national population of on-reserve First Nation people and Labrador Inuit. [Note the Inuit in the Northwest Territories and northern Quebec are not part of the FNIRHS]. Two types of weights are used - expansion (or population) weights and analytic weights. The former consists of the record weights used to generate prevalence estimates for the national target population. An individual's analytic weight is obtained by dividing his or her expansion weight by the average expansion weight of all respondents in the sample. Analytic weights are used in various statistical procedures (e.g. cross-tabulations) within the sample. Separate sets of weights are calculated for the adults and children.

The presence of chronic diseases is derived from responses to the question: "Have you ever been told by a health care professional that you have high blood pressure, arthritis/ rheumatism, heart problems, cancer, diabetes? It should be noted that such self-reports may be diagnostically imprecise. For example, "heart problems" may represent a diversity of disease entities ranging from acute myocardial infarction to chest pains of musculoskeletal origin. The

use of self reports to indicate the presence of a specific disease has been the subject of much research [see the review by Harlow and Linet (1989)]. Traditionally the validity of such measures is established by comparison with medical record reviews and/or clinical and laboratory tests. Such methods are not feasible in large population surveys such as the FNIRHS and the APS. However, in a study comparing self-reports of diabetes, heart disease, stroke, hypertension and high cholesterol in the Manitoba Heart Health Survey with hospital and physician diagnoses as reported in claims submitted to the provincial health insurance plan for payment, a high degree of agreement was found for diabetes (kappa=0.72) and hypertension (0.59), but less so for the other conditions (0.4).

3. CARDIOVASCULAR DISEASES

3.1 Burden of Disease

Diseases of the circulatory system or cardiovascular diseases (CVD) comprise a heterogeneous group of diseases of the heart and blood vessels. Within the context of "diseases of modernization", it is primarily ischemic heart disease (IHD) that is of particular interest. However, data are often only available for the broader category of CVD as a whole or "diseases of the heart". In populations undergoing the health transition, it is well recognized that rheumatic heart disease, which has an infectious etiology, tends to decline, while IHD increases as a result of socioeconomic and lifestyle changes.

Among residents of First Nation communities in 7 provinces during 1976-83 and 1984-88, the female IHD and stroke mortality rate was higher than all Canadians, while among males, the stroke rate but not the IHD rate was higher (Mao et al 1986, Mao et al 1992). Regional studies in the 1970s and 1980s generally showed a deficit in cardiovascular diseases among Aboriginal people (Young 1983, Robinson 1988, Abu-Zeid et al 1978). The age-standardized hospitalization rate for all CVD among the James Bay Cree was 60% of the provincial rate for men, but 1.3 times higher for women (Robinson 1988). More recent data on mortality and hospital morbidity are not available.

The low incidence of IHD among the Inuit has been recognized for some time. Autopsies during the 1950s (Lederman et al 1962) indicate that cases of atherosclerosis, while not an important cause of death, were by no means absent. The age-standardized mortality rate for IHD in the Northwest Territories has remained consistently lower than the national rate, although the rate among Dene women approached that of all Canadians and exceeded that among the Inuit and non-Aboriginal people. Among residents of the Keewatin region, who are 90% Inuit, the hospitalization rate for all CVD during 1985-90 was only 54% and 73% of that of Canadian men and women respectively. The difference was especially pronounced among the elderly (Young, Moffatt et al. 1993). ECG surveys conducted in two NWT communities showed low rates of abnormalities, particularly ischemic changes. (Schaefer, Eaton et al 1980).

Analysis of the FNIRHS shows that 8% of respondents report having been told by a health professional to have "heart problem". Men over the age of 65 are more likely to report heart problems; at other ages, the prevalence is about the same in men and women. The

proportion of Aboriginal people reporting heart problems exceed the Canadian national population in all age-sex groups (Fig.2). When adjusted to the Canadian population age structure, the prevalence among Aboriginal people (13% in M and 11% in F) was three times that among the national population.

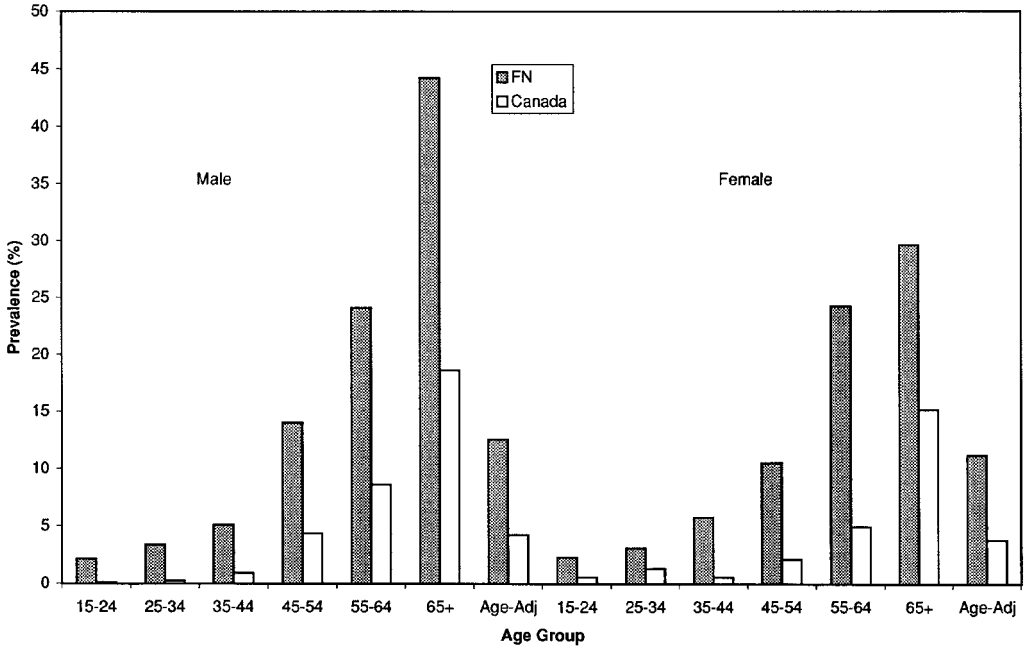

Fig. 2 Age-sex-specific and age-adjusted prevalence of self-reported "heart problem"

Source: FN refers to First Nations and Labrador Inuit data from the FNIRHS (1997); Canadian data are from the NPHS (1994)

3.2 Risk Factors

Many large-scale epidemiological studies have concluded that cigarette smoking, hypertension and elevated serum cholesterol levels are major independent risk factors for ischemic heart disease. Other risk factors include diabetes, physical inactivity, obesity, stress and personality characteristics. As the major risk factors are potentially modifiable, - IHD is largely a preventable disease. Hypertension, hypercholesterolemia, diabetes and obesity can also be considered as diseases in their own right with their own risk factors and complications. Because of the importance of diabetes among Aboriginal people, it is reviewed separately in Section 3.

Certain fatty acids in the diet referred to as the long-chain omega-3 fatty acids, such eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), have been found to be protective of IHD. Innis and Kuhnlein (1987) found substantial quantities of both EPA and DHA in land-based caribou in the Arctic. A study of the Tsimshian on Vancouver Island found that 50% of calories in the "traditional" diet were derived from salmon, rich in EPA and DHA (Bates et al 1985). They also had low levels of arachidonic acid (AA, an omega-6 fatty acid), which remained unchanged among those who had abandoned the traditional diet. Horrobin (1987)

suggested that the low AA levels among Inuit and Tsimshian may be due to a genetically determined enzymatic deficiency or reduced activity. As AA promotes thrombosis, its low level should reduce the risk of IHD.

Various genetic markers have been found to be associated with an atherogenic plasma lipid profile and increased risk of ischemic heart disease in some populations. Using plasma samples from the Keewatin survey, Hegele, Young and Connelly (1997) found that the frequency of several genes [*AGT* T235, *FABP2* T54, *PON* R192, and *APOE* B4] was higher among the Keewatin Inuit than in non-Inuit, whereas that of others [eg. *ACE* D] was lower These data suggest that the Inuit may well be genetically predisposed to be at high risk for ischemic heart disease. That their rate of IHD has actually been quite low could be the result of the protective effect of the traditional Inuit diet and lifestyle. The implications of the Inuit's increasing adoption of the "western" pattern of physical activity and diet are thus obvious. An alternative explanation is that these genetic markers have no association with ischemic heart disease in the Inuit and that other, as yet unmeasured, genomic variants may well determine disease susceptibility m this population.

Another study among the Keewatin Inuit which illustrates gene-environment interaction in disease susceptibility shows that they have a low prevalence of the V677 mutation in the enzyme methylenetetrahydrofolate reductase (MTHFR). Individuals homozygous for V677 have been shown to be at risk for IHD especially if the diet is deficient in folate. V677 occurs in only 6% of Keewatin Inuit, compared to 35% of whites; only 1.2% of Inuit are homozygous for V677, compared to 12% among white Canadians (Hegele, Tully, Young & Connelly 1997). The low frequency of this particular gene may be partially responsible for the lower risk of RID among Inuit.

Among the Dogrib in the NWT where IHD is still very rare, genotype-associated quantitative lipoprotein variation can still be demonstrated in the absence of disease. Fasting triglyceride levels in women varied significantly with the XnmI locus of the apolipoprotein A-I/C-III/A-IV gene cluster (Cole et al 1989). The extent to which observed lipoprotein gene frequency differences between Aboriginal and non-Aboriginal populations contributes to the differences in CVD frequency remains to be further investigated.

3.3 Hypertension

Data on self-reported history of hypertension are available from both the APS and the FNIRHS. The APS shows that Aboriginal people have a slightly lower crude prevalence of hypertension than all Canadians, and among Aboriginal people, on-reserve Indians have the highest, and Inuit the lowest, prevalence (Statistics Canada 1993). According to the FNIRHS, 18% of respondents reported having been diagnosed with high blood pressure. At each age-sex group, the prevalence is higher among FN than among all Canadians. When age-adjusted, the FN prevalence is 2.8 and 2.5 times higher than among Canadian men and women respectively (Fig. 3).

The APS, FNIRHS and NPHS are based on self-reports. Surveys involving actual blood pressure measurement have been conducted in several regional groups, e.g. in northwestern Ontario (McIntyre and Shah 1986) and northern Quebec (Thouez et al 1990). A survey of over

700 Ojibwa and Cree in northern Ontario and Manitoba in the 1980s showed higher mean diastolic blood pressure (BP) in all age-sex groups compared to Canadians nationally, while for systolic BP, the level was lower above the age of 45. Age, male sex, unemployment, body mass index, total cholesterol, positive family history, and single marital status were independent predictors of hypertensive status on multivariate analysis (Young 1991). In the Keewatin region of the NWT, the prevalence of hypertension (defined as diastolic BP≥90 or on treatment) among the Inuit was lower than among Manitobans in all age-sex groups except men aged 25-44 (Young, Moffatt et al 1993). In Igloolik, NWT, a survey of 400 subjects in 1969-70 showed a low mean BP but no rise with age (Hildes and Schaefer 1973). Later surveys showed an age-dependent increase in BP in both sexes in Inuvik, a large town, but not among males in remote Arctic Bay (Schaefer, Eaton et al 1980).

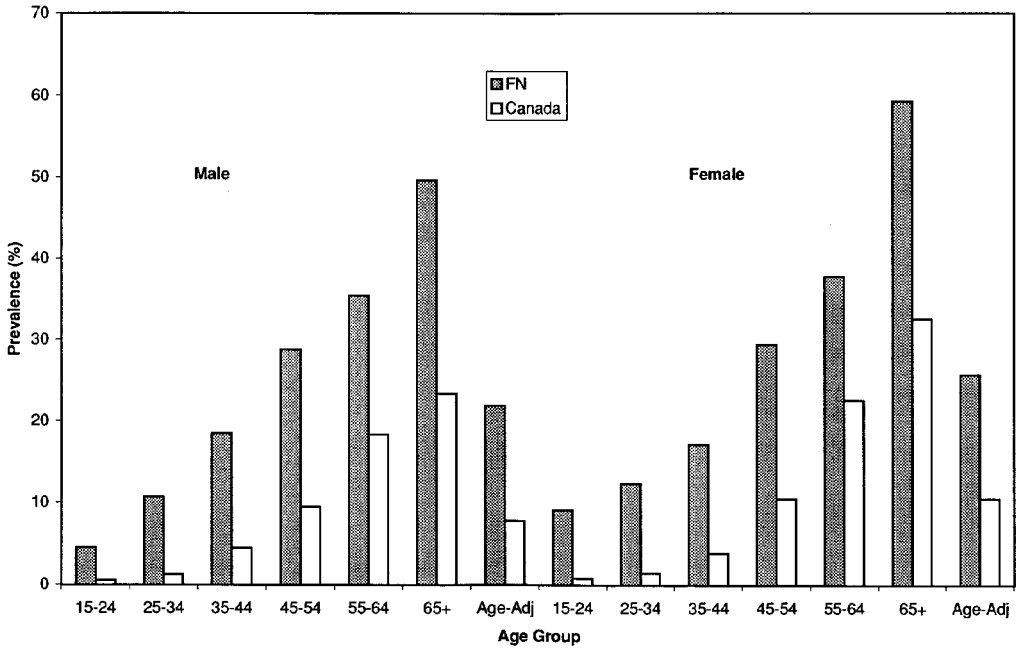

Fig.3 Age-sex-specific and age-adjusted prevalence of self-reported hypertension

Source: FN refers to First Nations and Labrador Inuit data from the FNIRHS (1997); Canadian data are from the NPHS (1994)

3.4 Serum Lipids

The level of various lipids (such as cholesterol and triglycerides) in the serum, which reflects dietary intake and genetic regulation of metabolic processes, has been identified as a strong risk factor for IHD. The Nutrition Canada Survey during the early 1970s (DNHW 1975) provided some data on serum cholesterol and triglycerides for 29 First Nations across the country and 4 Inuit communities in the NWT. Using the age-dependent criteria from the Framingham Study, which linked serum cholesterol level with long term disease risk, the proportion of people at "high" risk was lower among First Nations and Inuit than among Canadians in general, except

for First Nation men aged 55 and above. More recent data on a national level are not available. With the exception of Manitoba, the series of provincial heart health surveys conducted during the early 1990s, which analysed serum samples for lipids, excluded Indian reserves from the sampling.

Regional studies have also been conducted among the Nootka and Chilcotin in BC (Desai and Lee 1971), Yukon Dene (Desai and Lee 1974), Cree-Ojibwa (Reeder et al 1988) and the James Bay Cree (Thouez et al 1989). Among the Inuit in the Keewatin region, the mean total cholesterol was not different from Manitobans, although the level of triglycerides was lower and that of high-density-lipoprotein cholesterol (which has a protective effect) was higher than in Manitoba, except for women aged 25-44 (Young, Nikitin et al 1995). There is some evidence that cholesterol levels have increased over the years. In Arctic Bay, NWT, cholesterol levels were tracked over three surveys in 1976, 1978 and 1980 during which time an increasing prevalence of high risk status was observed (Verdier et al. 1987).

3.5 Prevention and Control

Primary prevention of CVD involves reducing the prevalence of risk factors through smoking cessation, cholesterol reduction, the detection and treatment of hypertension, maintenance of an ideal body weight, and regular physical activity. Few community trials have been attempted in Canadian Aboriginal communities [those with a diabetes focus are discussed in Section 3].

Health promotion programs must recognize the importance of cultural factors. Ethnographic studies of cultural knowledge of hypertension in some communities have provided important data on Aboriginal concepts of disease causation, manifestation and treatment. In an Ojibwa community in southern Manitoba, Garro (1988) found that the cultural model can be at odds with the prevalent biomedical view on the chronicity of the illness and the importance of "compliance" with treatment. Hypertension is conceived by the Ojibwa as episodic in nature, accompanied by perceptible symptoms, and treatment is only needed when symptoms are present.

4. DIABETES

4.1 Burden of Disease

Since the 1970s diabetes has been recognized as an emerging, serious health problem among many Aboriginal communities in North America (Young 1993). In Canada, Schaefer conducted studies on carbohydrate metabolism on Inuit patients in Edmonton during the 1960s and 1970s (Schaefer 1968, Schaefer, Crockford et al 1972). Population-based studies, however, began later.

While mortality does not accurately reflect the incidence of the disease, an increased risk of death from diabetes among residents of First Nations compared to Canadians nationally (2-fold among men and 4-fold among women) has been demonstrated (Mao et al 1986).

Various regionally based studies on the prevalence of diabetes in Canada has been conducted since the 1980s, among the Dogrib in the NWT (Szathmary and Holt 1983), the Cree-Ojibwa in northwestern Ontario (Young, McIntyre et al 1985, Young and Krahn 1988, Fox et al 1994, Harris et al 1997), the Mohawks in Kahnawake, Quebec (Montour and Macaulay 1985), the Oneida, Chippewa and Delaware in southwestern Ontario (Evers et al 1987), the Algonquins in Quebec (Delisle and Ekoe 1993, Delisle et al. 1995), the James Bay Cree (Brassard et al 1993), Okanagan in BC (Daniel et al 1995), and First Nations in Saskatchewan (Pioro et al 1996). It should be emphasized that the methodologies used in these studies varied widely, and that no single set of diagnostic criteria was uniformly adhered to. Some studies involved registries of diagnosed cases while others surveyed blood glucose levels. There are as yet no national diabetes registries, although a few regional, population-based registries have been established in some zones (e.g. the Sioux Lookout Zone).

The prevalence of diabetes is not uniform across the country - it varies according to language family, culture area, geographical location, and also degree of isolation (Young, Szathmary et al 1990). Such variation has also been demonstrated within regions, e.g. Saskatchewan (Pioro et al 1996).

Diabetes among Aboriginal people is predominantly non-insulin-dependent (NIDDM), or type 2, as distinct from the insulin-dependent type (IDDM) or type 1. While many type-2 patients are treated with insulin, few are truly insulin-dependent. However, a trend toward earlier onset of type-2 diabetes during the young teen years has been observed (Dean et al 1992, Dean 1998). While the FNIRHS contains a children's sample, the small number of cases makes the prevalence data unreliable.

Statistical data indicating time trends in diabetes prevalence are limited since few groups have been continuously monitored longitudinally for any length of time. The observation that diabetes was probably unknown or extremely rare among Aboriginal people prior to World War II seems to be correct, even allowing for changes in the availability of, and accessibility to, health services. In one report from Saskatchewan in the 1930s, no case of diabetes was detected in over 1,500 clinical examinations conducted as part of a tuberculosis survey (Chase 1937). A physician in Aklavik, NWT, noted the absence of glycosuria among the Dene (Urquhart 1935). Since the 1980s, an increase in prevalence has been documented in some regions, such as Saskatchewan (Pioro et al 1996) and northwestern Ontario (Fox et al 1994), where comparable surveys of cases were conducted a decade apart. In any community, the majority of existing cases have been diagnosed in the recent past, an indication that diabetes as a health problem is of relatively recent origin (Montour, Macaulay and Adelson 1989, Young, McIntyre et al 1985).

Health interview surveys, by asking respondents to report if they had ever been told by a health professional to have diabetes, provide another source of prevalence data. Both the Aboriginal Peoples Survey and the FNIRHSs contain questions on diabetes and its treatment (Fig.4).

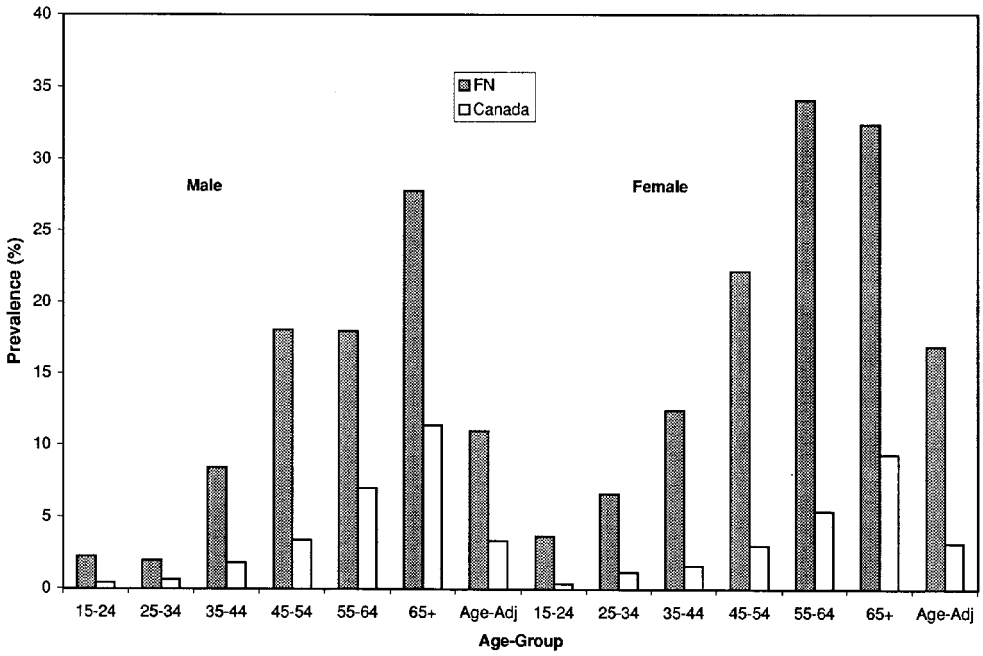

Fig. 4 Age-sex-specific and age-adjusted prevalence of self-reported diabetes

Source: FN refers to First Nations and Labrador Inuit data from the FNIRHS (1997); Canadian data from the NPHS (1994)

According to the FNIRHS, about 30% of women with diabetes reported that their diabetes was first diagnosed during pregnancy. The definition of gestational diabetes requires that the diabetes has its onset during pregnancy but disappears after the pregnancy. It is not possible to determine how many of the 30% of cases represent gestational diabetes and how many are cases that happen to be detected during pregnancy who will continue to be diabetic after the pregnancy. Accurate assessment of the extent of gestational diabetes requires all pregnancies to be screened with oral glucose tolerance tests.

4.2 Complications of Diabetes

Diabetes is associated with acute complications such as ketoacidosis which may be life-threatening. Such metabolic events, however, are generally associated with type 1 rather that type 2 diabetes. It is its association with various chronic, long-term complications which makes both types of diabetes an important public health problem. Such complications affect the circulatory system, eyes, kidneys, and nervous system and may result in premature mortality, disability and compromised quality of life. The development of complications actually proceeds even though the diabetes itself may not be clinically recognized, and indeed diabetes is often detected when a patient presents with a complication as an initial complaint.

Among Mohawks with diabetes, over 60% had at least one major complication. The risk of having such complications was 6 times that experienced by individuals without diabetes, even after adjusting for differences in age, sex, and die level of smoking, hypertension and obesity (Macaulay, Montour and Adelson 1988). Among the Cree-Ojibwa, the duration of illness and

coexisting hypertension were associated with the presence of complications, whereas the initial glucose level and weight status were not (Young, McIntyre et al 1985). Among the James Bay Cree (Brassard and Robinson 1995), factors associated with the presence of renal or retinal microvascular complications include: poor glycemic control reflected by a need of insulin therapy (odds ratio [OR] 2.7), elevated triglycerides (OR 4.5), duration of illness>5 years (OR 3.0).

Diabetes affects the structure and function of the kidneys which may eventually culminate in end stage renal disease (ESRD), requiring dialysis and renal transplantation. Aboriginal people are at an increased risk for ESRD, a substantial proportion of cases of which can be attributed to diabetes. Using data from the Canadian Renal Failure Registry, the overall risk of ESRD from all causes among Aboriginal people was 2.5 to 4 times higher, and the risk of ESRD due to diabetes specifically was at least 3 times higher than Canadians nationally (Young, Kaufert, McKenzie et al 1989). Similar excess risk of ESRD has been found among the Cree in Moose Factory Zone (Wilson et al 1992) and in Saskatchewan (Dyck and Tan 1994).

Disorders of the eyes associated with diabetes include retinopathy, cataract and glaucoma, all of which can lead to visual impairment and ultimately blindness. The major risk factor for diabetic retinopathy is hyperglycemia, and glycemic control can reduce the incidence and progression of retinopathy. Ross and Fick (1991) identified a high prevalence of serious and untreated diabetic retinopathy in both insulin-using and non-insulin-using Aboriginal diabetes patients in southern Alberta. They also have a high prevalence of both microalbuminuria and macroalbuminuria, indicative of eventual serious hypertension and renal failure.

Diabetes increases the susceptibility to infection. A study in Manitoba (Nicolle et al 1996) showed that Aboriginal women were hospitalized 5-20 times more frequently for acute pyelonephritis than nonaboriginal women, partially attributable to the greater frequency of pregnancy and diabetes. It also increases the risk of reactivation of tuberculosis (TB).

4.3 Obesity and Other Risk Factors

Diabetes is a chronic disease with a multifactorial etiology. To date, epidemiological evidence of varying consistency has implicated heredity, obesity, physical activity, diet, and metabolic factors as risk factors. The current wisdom is that genetic susceptibility is unmasked by rapid and unfavourable changes of environmental/lifestyle factors. There is increasing evidence to suggest that insulin resistance may be the key metabolic defect that leads to such related disorders as obesity, hypertension, diabetes, dyslipidemia and atherosclerosis.

The mode of inheritance of diabetes is complex. and has been likened to a "nightmare" by geneticists. Despite advances in molecular genetics, to date a diabetes gene has not been discovered, although a variety of mutations have been found to be associated with a minority (<5%) of cases of NIDDM. Maternal diabetes has been shown to be an important determinant of subsequent diabetes and obesity in the offspring. Among Algonquins in two Quebec communities, maternal history of diabetes is associated with higher serum triglyceride, BMI, SC skinfold, and fasting insulin, risk factors for diabetes, though not in plasma glucose level itself

(Ekoe et al 1996), an indication of the important role of the intrauterine environment during fetal development.

Among the potentially modifiable risk factors for diabetes established from various large scale epidemiological studies, obesity is considered the strongest. It is now recognized that the distribution of fat is as important as, or more important than, overall obesity as a risk factor of diabetes. Limited data do indicate that obesity among Aboriginal people is predominantly of the central type, characterized by a high waist-to-hip ratio (WHR). Among the Cree-Ojibwa, overall 38% of men had WHR greater than 0.99, compared to only 11 % among women. If this were taken as the cut-off point for "central" obesity, then among men with BMI of over 30, 75% were of the central type, while among men with BMI between 26 and 30, 46% were of the central type. Central obesity was much less evident among women, where only 18% of those with BMI over 30 and 13% of those with BMI between 26 and 30 could be considered as centrally obese (Young and Sevenhuysen 1989). The independent role of central fat. distribution in predicting diabetes or glucose intolerance has been demonstrated in the Dogribs in the NWT (Szathmary and Holt 1983) and the Oneida and Ojibwa in southwestern Ontario (Evers et al 1989). In Sandy Lake, ON, among adults under age 50, BMI, WHR and percent body fat (determined by bioelectrical impedance) are all associated with diabetes (Harris et al 1997). The FNIRHS did not involve anthropometry but asked respondents about their heights and weights. Self-reported data on heights and weights tend to be biased and they have not been used in this review.

The role of dietary factors such as total energy intake, specific nutrients, and the lack of fibre in diabetes has not been consistently demonstrated. Patterns of dietary change, particularly the substitution of modem for traditional food items, have been observed in many Aboriginal communities. Nationally, Aboriginal people who still obtain most of their meat and fish from hunting and fishing are in the minority (about 15%), according to the APS, although the proportion is considerably higher among the Inuit (Statistics Canada 1993). Among the Cree-Ojibwa, energy intake per unit body weight was lower among individuals with diabetes, reflecting their lower physical activity level (Young, Sevenhuysen, Ling and Moffatt 1990). Among the Dogribs, dietary differences between villages at different levels of acculturation were demonstrated but they had little influence on the plasma glucose levels (Szathmary et al 1987).

Lack of physical activity is an important risk factor for diabetes. Many Aboriginal People, particularly elders, recall times when most activities of daily living involved vigorous physical exertion. The decline in physical activity often accompanies the transition to a more sedentary lifestyle. The APS shows that 54% of Aboriginal adults nationally participate in leisure-time activity (Statistics Canada 1993). In the NWT, the 1985 Health Promotion Survey reported that Inuit and Indians were less likely than non-aboriginal people to exercise more than 15 minutes per day at least three times per week, the respective proportions being 43%, 38% and 51 % (Imrie and Warren 1988). However, the need to exercise may not be obvious to northerners who spend a significant portion of their time living "on the land'.

Why is diabetes so prevalent in many Aboriginal populations and why has there been an increase compared to half a century ago? It. was Neel who first proposed the "thrifty genotype" hypothesis in 1962 and subsequently revised it in 1982. There are critics of the thrifty gene theory, e.g. Szathmary (1990), who note that it assumes a nutritional environment in which

carbohydrate intake exceeds daily energy requirements. This was not the situation when the ancestors of modem Aboriginal people first occupied the continent, where the diet was one based predominantly on meat and fat. Survival advantage in a low carbohydrate, arctic/subarctic environment was provided by having an efficient formation of endogenous glucose through gluconeogenesis, efficient use of free fatty acids to provide for the energy needs of nonglucose dependent tissues, and the efficient use of ketone bodies as fuel. Under such conditions, selection should have favoured individuals in whom gluconeogenesis and free fatty acid release and use were enhanced. Ritenbaugh and Gooby (1989) also emphasized the physiologic consequences of the northern hunting lifestyle: low carbohydrate availability, intermittent lipid storage, protein sufficiency, and high energy demands for activity and body warmth. With the transition to agriculturally-based subsistence systems and modem industrial societies, genetically controlled modifications could have occurred in several enzymatically mediated pathways in lipid and glucose metabolism to "spare" glucose.

4.4 Prevention and Control

As the consequences of diabetes to the individual and the community are so serious, it is clear that the prevention of diabetes is the key to reducing the magnitude and extent of the problem. A variety of community-based diabetes prevention/health promotion projects have begun in a few locations across Canada, for example, in Kahnawake, QC (Macaulay et al 1997) and Sandy Lake, ON (Gittelsohn et al 1995). These projects, with intervention sites in schools, stores, and the community-at-large, demonstrated a high degree of community support and awareness, and preliminary data do indicate that they have resulted in measurable behavioural change.

With regard to blood glucose screening for diabetes in well individuals, national expert committees such as the Canadian Task Force on the Periodic Health Examination and the US Preventive Services Task Force do not recommend it in the general population, as there is insufficient evidence that such procedures improve the health outcomes of those screened, although it may be justified in high risk populations such as some Aboriginal communities. On the other hand, screening for diabetic complications in individuals with diagnosed diabetes, which involves periodic examination and tests of the eyes, renal, cardiovascular and peripheral nervous system, is a well established and important aspect of continuing care for diabetes.

The Clinical Practice Guidelines for the Treatment of Diabetes proposed by the Canadian Diabetes Advisory Board in 1992 (and currently being revised) contains a section on Aboriginal people. It emphasizes the need to view diabetes in the context of the profound social changes experienced by Aboriginal communities. It recognizes the importance of community involvement in developing and implementing treatment and education programs, programs which are compatible with and indeed incorporate traditional values and customs. It sees the Aboriginal diabetes worker, who may be a community health representative (CHR), as the foundation of community care.

Recent clinical practice appears to favour intensive pharmacologic therapy to maintain tight glycemic control in order to prevent microvascular complications. This often involved moving quickly towards the use of oral hypoglycemic agents and then insulin to achieve control.

Such practices will have enormous implications for Aboriginal people with diabetes. Data from the southern Alberta study indicate that over 80% of Aboriginal insulin-users have adequate endogenous production of insulin, compaired to 40% of non-aboriginal insulin users. The data further suggest that insulin may be a prominent risk factor for vascular complications in NIDDM patients who take insulin (Ross and Fick 1991).

Data from Australia and Hawaii indicate that reversion to traditional lifestyles can have beneficial effects on metabolic control in diabetes patients. This approach merits investigation in the Canadian setting, especially in northern, remote communities. Robinson et al (1995) compared Cree diabetes patients who spent 3 months in the bush and those who stayed in the village. Bush living was found to have only limited effects on a variety of indices (body weight, plasma glucose, glycated hemoglobin and blood pressure). While bush dwellers became more active, they also brought along large quantities of store-bought foods for sustenance.

Education is the cornerstone of diabetes treatment. Innovative education programs do exist and they can be found in scattered localities across the country, e.g. Kahnawake (Macaulay and Hanasaik 1988). Such programs have produced manuals, videos, posters, and board games, use the local media (community radio, TV, newspapers) extensively, and organize community events such as feasts, school visits, elder's teas, etc. According to the FNIRHSs, not all individuals with diabetes are benefitting from educational resources available in diabetes clinics or education centres. Young women with diabetes is the group with the lowest participation rate (Fig. 5). It is not known, however, if such women have received care at prenatal clinics if their diabetes is associated with pregnancy.

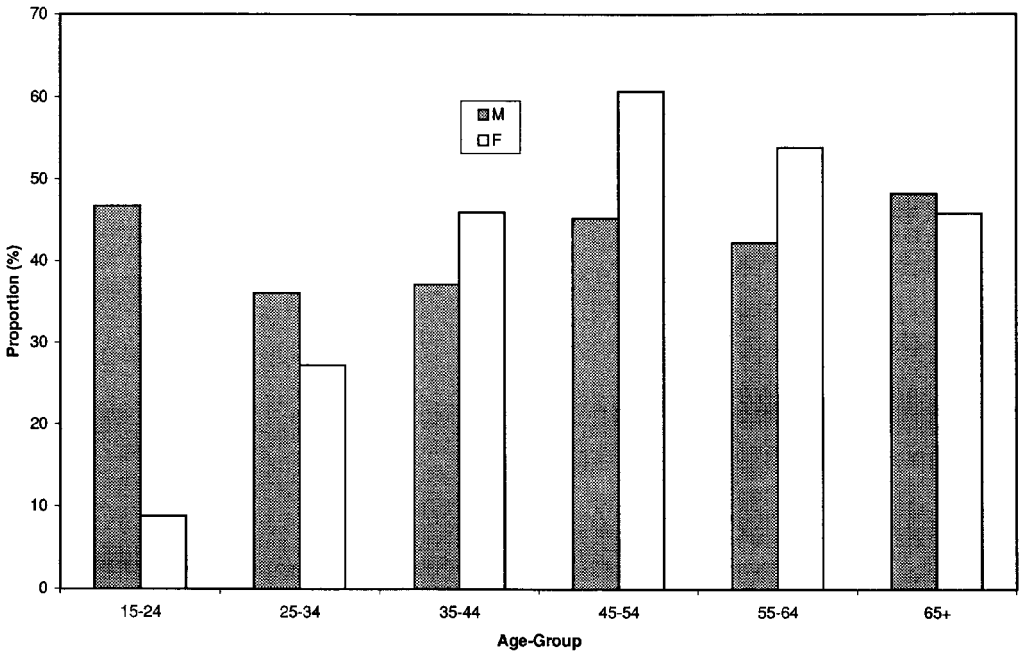

Fig. 5 Proportion of First Nations people with diabetes attending diabetes clinics or receiving diabetes education.

Source: FNIRHS (1997)

5. CANCER

5.1 Burden of Disease

While all Canadian provinces have had population-based cancer registries for some time, the number of cancer cases among Aboriginal people is not readily available. Statistics Canada does not report or collect cancer statistics by ethnic status. It is possible to determine cancer incidence/mortality for members of First Nations from some provincial registries through data linkage with the MSB or INAC population registry or based on residence on-reserve. A Canadian Inuit cancer registry, comprising cases from the NWT, Nunavik and Labrador, was established as part of an international, circumpolar review of cancer among Inuit (Gaudette et al 1996). This registry is not being maintained or updated, although the NWT registry is ongoing.

A survey of all Indian Health Service facilities during 1948-52 found an overall lower risk of cancer among First Nation people, with the exception of cancer of the cervix, compared to Canadians nationally (Warwick and Phillips 1954). In the 1970s, data from British Columbia (Gallagher and Elwood 1979), northwestern Ontario (Young and Frank 1983), and Manitoba (Young and Choi 1985) all showed a lower incidence when all cancer sites are combined. There are, however, a few sites in which Aboriginal people are at an increased risk: kidney in men and gallbladder and cervix in women. The risks of cancer of the breast, colon, lungs, and prostate are lower in the Aboriginal relative to the non-Aboriginal population, although they are still among the commonest cancers within the Aboriginal population. Geographical variation in overall cancer mortality is also evident.

The Inuit pattern has generally been different from that of First Nation people. Of particular interest is the extremely high risk of several cancers which are relatively rare in other populations: nasopharyngeal, salivary gland, and esophageal cancer (Gaudette et al, 1991,1993). These have been called "traditional" Inuit cancers. According to Schaefer and Hildes, between 1950-66 and 1974-80 in the central and western Arctic, there was a decline in the proportion of these traditional cancers relative to those cancers more commonly found in "modem" society such as lung, cervix, colon, and breast (Schaefer, Hildes et al 1975, Hildes and Schaefer 1984).

According to the FNIRHS, 1.5% of men and 2.8% of women reportedly suffer from some kind of cancer. It should be recognized that the burden of rare and highly lethal conditions such as cancer is not adequately conveyed by a one-time cross-sectional survey.

Time trend data are available only for a few groups. An overall increase in cancer from all sites combined was observed among the Inuit of both sexes in the Northwest Territories between 1970 and 1984 (Gaudette et al 1991) and Saskatchewan First Nations between 1967 and 1986 (Gillis et al 1991). Much of the increase in cancer incidence among these groups is accounted for by lung cancer, particularly among women. Since the early 1970s the lung cancer incidence has increased at least twofold in these populations.

An increasing trend in cancer of the cervix has also been reported. In Saskatchewan, the age-standardized mortality rate in First Nations rose by 52% between 1967-71 and 1982-86, while in the province there was a 43% decline. The relative risk increased from 2.3 in the first

period to 6.2 in the second period (Irvine et al 1991). In British Columbia, the relative risk of death from cervical cancer increased from 3.6 during 1953-62 to 4.7 during 1973-84 (Band et al 1992).

Cancer is an important health problem because of its impact on the quantity and quality of life of those who suffer from it and also of their families and communities. Only limited data on survival are available for Canadian Aboriginal people. In Saskatchewan, First Nations cancer patients experience an overall lower survival compared to the province as a whole. Survival was better among women than men, but decreased with age (Gillis et al 1991). The reasons for the lower survival are unclear, but may be related to differences in the stage of disease at diagnosis and access and use of available health services. For certain specific sites, for example, cervix, the survival experience of First Nations women is not significantly different from the provincial norm (Irvine et al 1991).

5.2 Risk Factors

Despite the large number of cancers, the recognized "causes" of cancer are limited. Tobacco, dietary factors, infectious agents, reproductive and sexual factors, occupation, alcohol, radiation, pollution, and drugs are all considered to be risk factors for various types of cancer. Some individuals may also be genetically predisposed to developing certain cancers. Smoking is clearly the most important risk factor. The high prevalence of smoking among Aboriginal people is well recognized (Longclaws et al 1980, Millar 1992, McIntyre and Shah 1986, Reading 1996).

Among dietary factors which have been implicated in the causation of cancer is animal fat for colorectal and breast cancer. On the other hand, vitamin A and its precursor the beta-carotenoids are protective for lung cancer, while fibre reduces the risk of colorectal cancer. The Aboriginal diet in the Arctic and Subarctic traditionally contains little leafy green vegetables rich in vitamin A Unfortunately, the modem store-bought diet which has replaced the Aboriginal diet hi many locations tends to be high in saturated fat but low in vitamin A and fibre content.

The link between the human papillomavirus (HPV) and cervical cancer is well established. Data on the prevalence of HPV among Canadian Aboriginal women are limited. One study from the inner city of Winnipeg found that the prevalence of HPV infection was not significantly different between Aboriginal and non-Aboriginal women, despite the high risk for cervical cancer and other behavioural risk factors among Aboriginal women (Young, McNicol et al 1997).

5.3 Prevention and Control

Screening plays an important role in the prevention and control of some types of cancer, for example cancer of the cervix and breast. Several studies from British Columbia have shown a lower coverage for Pap smear among Aboriginal women (Hislop et al 1992, 1996, Calam et al 1992). The Santé Québec surveys among the Inuit in Nunavik (Jetté 1994) and James Bay Cree (Davelluy et al 1994) found that the Inuit had higher Pap smear participation rate than Quebec women, whereas the Cree had a lower rate. The higher rate among the Inuit can be attributed to the existence of an organized program of tracking and recall. Among Cree women who stated

that they had never had a pap test, 83% said that no one had ever suggested the test. With regard to breast self-examination and examination by a health professional, both Aboriginal groups fared worse than the provincial population.

In interviews with BC Cancer Agency researchers (Deschamps et al 1992, Hislop et al 1996), Aboriginal women mentioned that they were not comfortable talking about Pap smears, even among family and friends. Many women reported having been screened because of pregnancy, and some confused the test with testing for sexually transmitted diseases, while others thought it was necessary for obtaining oral contraceptives. On the whole, they were embarrassed and uncomfortable both psychologically and physically, particularly with male physicians. Clearly, cultural factors must be taken into account in any program to promote cancer screening among Aboriginal people.

Various clinical procedures such as colposcopy and cervicography are used to improve the sensitivity of Pap smear screening. In the small hospital in Churchill in northern Manitoba, a colposcopy program staffed by visiting gynecologists and assisted by local family physicians was found to reduce travel costs and social dislocation of Inuit women from the Keewatin Region, NWT, who would have gone to Winnipeg for further investigations (Smith et al 1995)

6. ARTHRITIS AND RHEUMATISM

6.1 Burden of Disease

Among musculoskeletal disorders, the arthritides are of particular importance because of their contribution to long-term disability and pain and suffering, especially among the elderly. Only limited data are available for Canadian Aboriginal people, primarily from British Columbia (Gofton et al 1975, Hill 1977), Alberta (Russell et al 1977) and Inuit in the central Arctic (Oen et al 1986). Survey data need to be interpreted with caution due to the variability of clinical manifestations and the diagnostic criteria and laboratory tests used. In a comprehensive survey of chronic arthritis among children, Oen and Cheang (1996) found that ethnicity has little effect on the prevalence and incidence of the disease.

The Inuit have been found to suffer from osteoarthritis (the "wear-and-tear' variety especially common among the elderly) and rheumatoid arthritis to an extent not much different from the general North American population. On the other hand, they are at a much increased risk for the spondyloarthropathies (SPA), a group of related rheumatic disorders including ankylosing spondylitis, Reiter's syndrome, and a variety of other poorly classified and understood diseases (Oen et al 1986).

Surveys such as the FNIRHS do ask about "arthritis and rheumatism" but cannot distinguish the various diagnostic varieties. Most respondents who report having arthritis most likely suffer from osteoarthritis. As Fig.6 shows, First Nations people suffer from arthritis more than Canadians at all agesex group. The problem is more prevalent among women, and, as expected, increases with age.

6.2 Risk Factors

Interest in arthritis among Aboriginal people in North America is sparked by the known association between certain genetic markers and specific types of arthritis. A strong association between SPA and the histocompatibility antigen HLA-B27 is well established in a variety of populations. The prevalence of the HLA-B27 marker has been shown to be much higher among the Inuit than in European populations. Unlike diabetes and heart disease, the significance of arthritis as a marker of lifestyle change is unclear.

6.3 Prevention and Control

Intervention in arthritis and rheumatism is available mainly in the tertiary type or rehabilitation, the restoration of functional capacity and the reduction in disabilities. Rehabilitation requires more than individual treatment, but also environmental change, such as physically restructuring the home, public buildings and transportation to facilitate access, mobility and the performance of daily activities. The health care system must also ensure the proper design and distribution of prosthetic devices and physical aids. For most First Nations communities, rehabilitative services tend to be poorly developed.

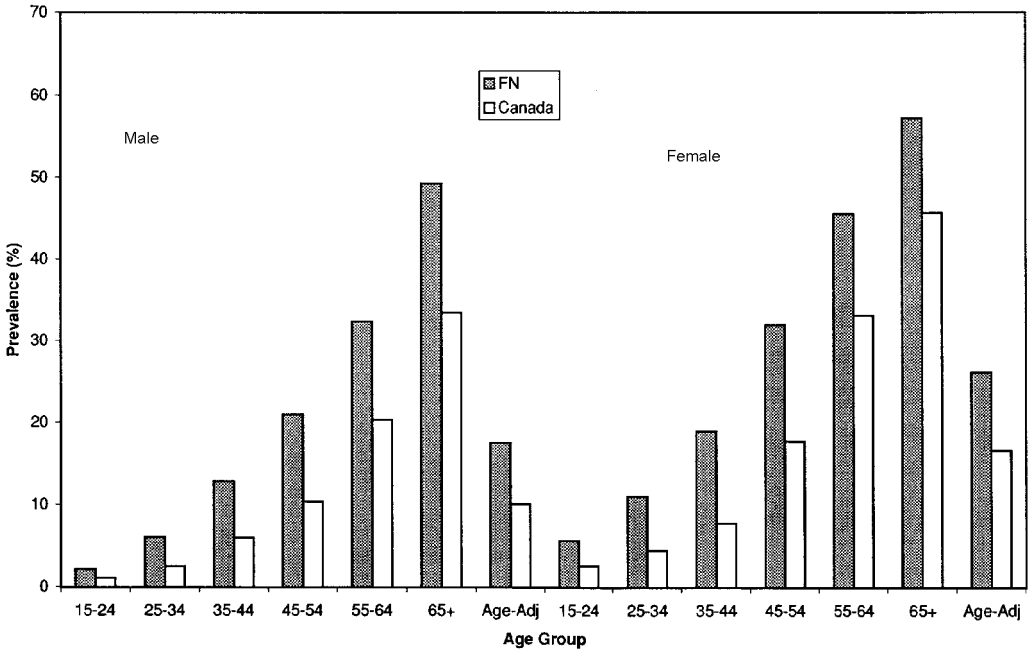

Fig.6 Age-sex-specific and age-adjusted prevalence of self-reported arthritis and rheumatisin

Source: FN refers to First Nations and Labrador Inuit data from the FNIRHS (1997); Canadian data are from the NPHS (1994)

7. SIGNIFICANCE AND IMPLICATIONS

Chronic diseases have assumed increasing importance as causes of mortality and morbidity among Canadian Aboriginal people. The FNIRHS provide useful self-reported data on the prevalence of chronic diseases. For all 5 diseases selected for analysis, the First Nation prevalence exceeds the Canadian one in all age-sex groups. For some diseases such as diabetes, it can be considered as being out of control.

7.1 Health and Social Impact

Surveys such as the FNIRHS provide a means to assess the health and social impact of chronic diseases. As shown in Fig.7, all the chronic diseases are associated with substantial disability as reflected in activity limitation and other indicators such as needing help with personal care, inability to take short trips, and being house-bound. Activity limitation is reported by 24% of individuals with hypertension, 28% among those with diabetes, 33% for arthritis, 36% for heart problem, and 38% for cancer. Individuals who suffer from a chronic disease also tend to view their health status as inferior. Fig.8 (and Appendix Table 1) shows that such individuals are more likely to report their overall health as "poor" and less likely to rate it as "excellent" compared to individuals without chronic diseases.

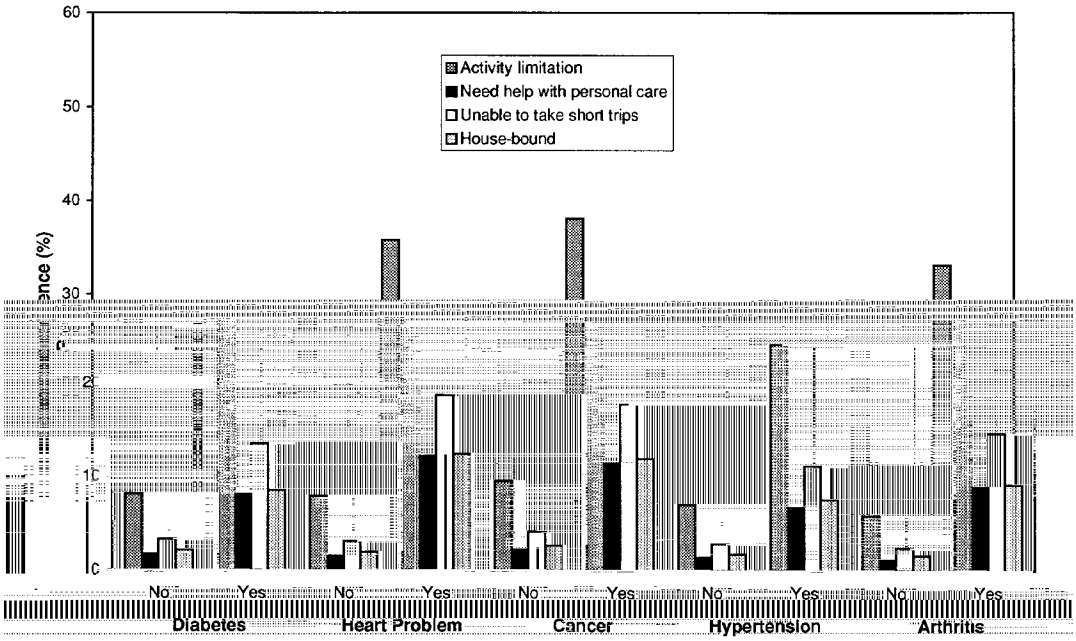

Fig. 7 Prevalence of disability among First Nations people with and without selected chronic diseases

Source: FNIRHS (1997)

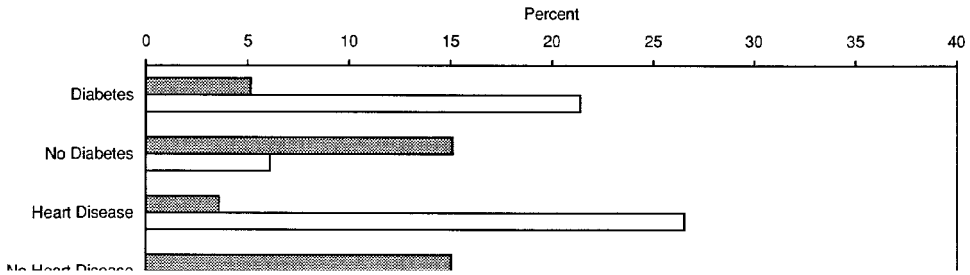

Fig.8 Comparison of self-rated health status between individuals with and without chronic diseases

Source: FNIRHS (1997)

7.2 Coexisting Diseases and Health Determinants

Chronic diseases have a tendency to co-occur or cluster in the same individuals. According to the FNIRHS, 26% of persons with diabetes also report having heart problem, and 50% report hypertension, a prevalence that is 3.9 and 3.3 times that of individuals without diabetes.

The co-occurrence of diabetes with other risk factors such as smoking compound the risk for cardiovascular complications. The FNIRHS indicates that those with chronic diseases are less likely to be current smokers than those without such diseases. There is thus some indication that health education regarding lifestyle changes is succeeding among Aboriginal people, at least among those who are afflicted with chronic diseases. Even so, the prevalence of smoking among Aboriginal people with chronic diseases is still too high (Fig. 9 and Appendix Table 2).

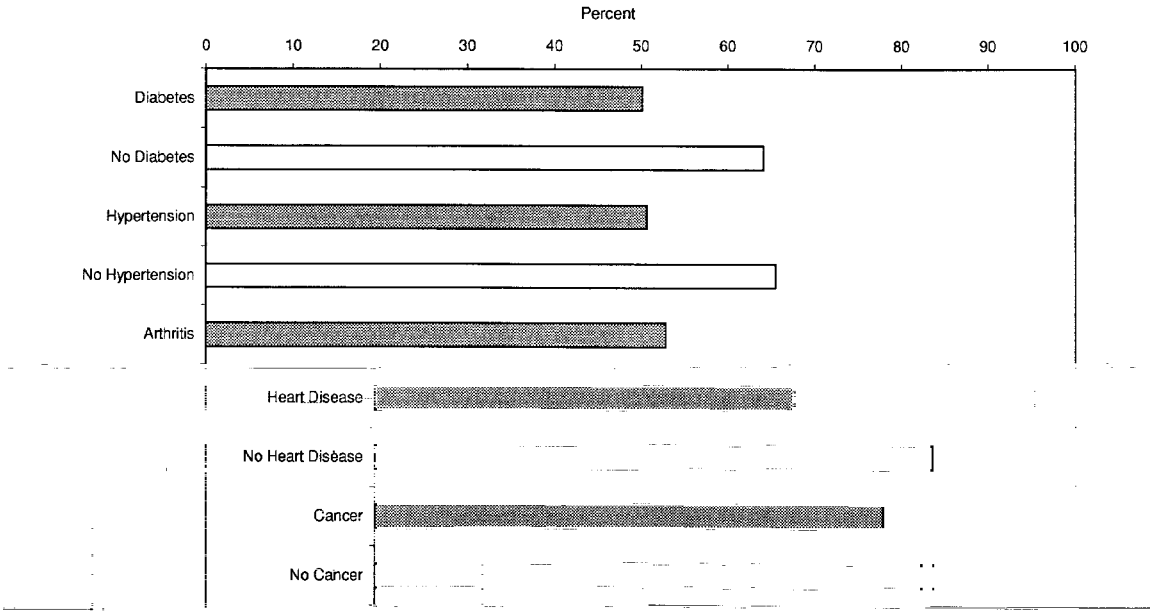

Fig. 9 Prevalence of smoking among individuals with and without chronic diseases

Source: FNIRHS (1997)

There is a higher prevalence of chronic diseases among individuals with less education, those who are widowed, and those who have attended residential schools in the past. However, it is unlikely that these health determinants are causally related to chronic diseases. The observed association (Fig.10) can be accounted for by confounding with age, as older people are more likely to have less education, to be widowed, and have gone to residential school. When age has been controlled for, the association of these health determinants with chronic diseases disappears. Appendix Table 3 shows that the age-adjusted relative risks (i.e. number of times a person who had gone to residential school, is not married, or have received secondary education is more likely to have hypertension, diabetes, etc) do not differ significantly from unity, indicating no excess risk.

7.3 Temporal Trends

A comparison of the FNIRHS with the APS provides a temporal perspective on the increase in the prevalence of chronic diseases among Aboriginal people, as the two surveys were conducted some 6 years apart and fix questions on self-reported disease are comparable. Fig. 11 shows that FNIRHS estimates are all higher than the APS ones. Note that the APS population has been adjusted to include only on-reserve First Nations people in 8 provinces and Labrador Inuit to correspond to the FNIRHS target population.

Such data indicate the importance and potential value of longitudinal surveys in tracking the growth in the burden of specific diseases over time.

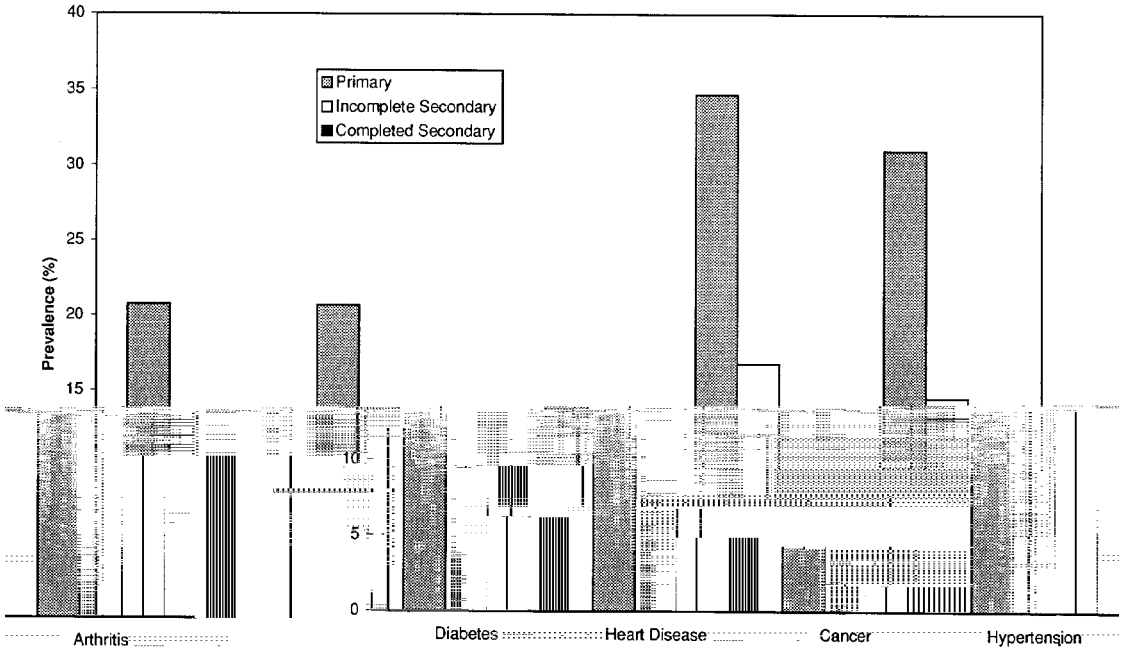

Fig. 10 Association between education and a history of chronic disease

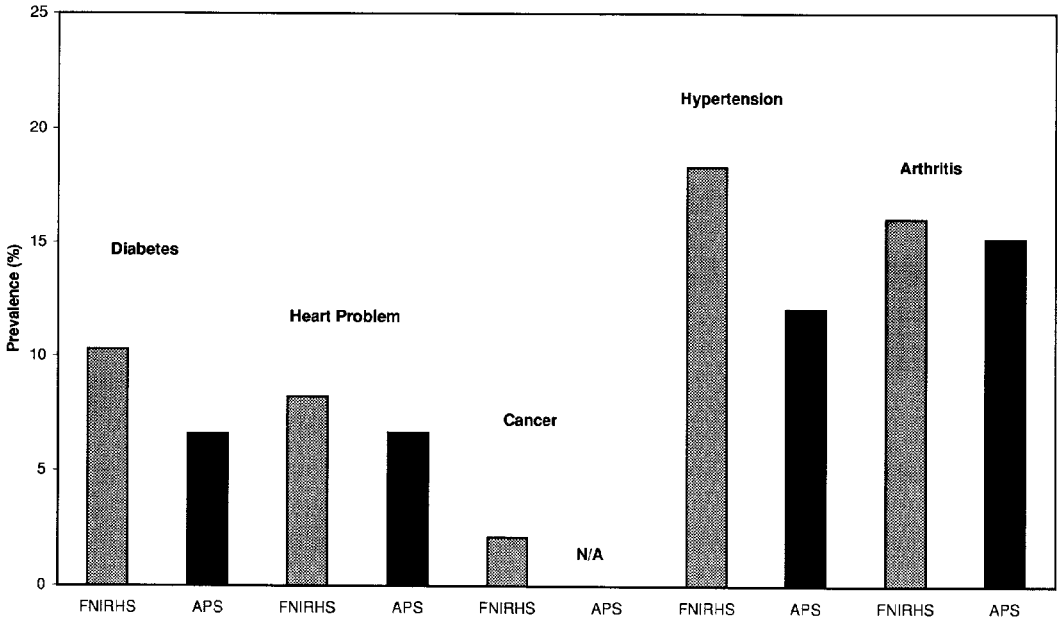

Fig.11 Comparison of prevalence estimates of chronic diseases by the FNIRHS and APS

7.4 Health Care Needs

Individuals with chronic diseases obviously have more health care needs than those without. Most respondents to the FNIRHS consider that their health care needs improvements, for example, more health care staff, chronic care facilities, home care, education on medications, prevention education and mental health services. For individuals with chronic diseases, the proportion reporting need for improvements in these areas is even higher, exceeding 80% in most cases. Clearly, the health care system needs to accommodate the increasing burden of illness in the population attributable to chronic diseases.

In terms of actual use of health services, according to the APS, over 90% of diabetic individuals report having seen a health professional in the past year, compared to only 75% among those without diabetes (Bobet 1997).

Health professionals who serve Aboriginal people with chronic diseases are confronted with the need to adapt their treatment plans and education programs to the culture and social environment of their patients. Furthermore, many Aboriginal communities are located in geographically remote areas with little or no access to specialized services often required for the optimal treatment of chronic diseases. It is difficult for many health professionals to appreciate fully the impact of these diseases and their treatment on individual patients and their families. The patients are expected to modify their lifestyle drastically and follow a complex regimen of rules relating to diet, physical activity, medications, self-monitoring and self-care, on a daily basis for the rest of their lives. It is no wonder that compliance with prescribed treatment plans is generally low. Research on cultural factors associated with chronic diseases in Aboriginal people (Garro 1988, 1995, Hagey 1984) has provided important data that could be used by health care providers in understanding Aboriginal concepts of disease causation and attitude towards treatment.

Surveys such as the FNIRHS play a useful role in identifying diseases of public health significance in the Aboriginal population, estimating their magnitude and extent, and investigating potential causes, associated factors, and health and social impact. Such data are critical to the rational planning of programs and services to prevent and control chronic diseases, and provide a baseline upon which future evaluation of such programs and services can be based.

8. Appendix Tables

Table 1

Comparison of self-rated health status between individuals with and without chronic diseases

	Diabetes		Hypertension		Arthritis/ Rheumatism		Heart Disease		Cancer	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
% rated "excellent" (95% confidence interval)	4.8 (3.4, 6.2)	14.8 (14.0, 15.6)	6.1 (4.9, 7.2)	15.6 (14.7, 16.4)	5.0 (3.8, 6.1)	15.5 (14.7, 16.4)	3.3 (2.1, 4.8)	14.8 (14.0, 15.6)	5.1 (2.4, 9.1)	13.9 (13.2, 14.7)
% rated "poor" (95% confidence interval)	20.0 (17.4, 22.5)	6.0 (5.4, 6.5)	17.5 (15.7, 19.4)	5.1 (4.6, 5.6)	20.4 (18.3, 22.5)	5.0 (4.5, 5.5)	24.1 (21.0, 27.2)	6.0 (5.4, 6.5)	23.2 (17.1, 65.5)	7.1 (6.6, 7.7)

Table 2

Prevalence of smoking among individuals with and without chronic diseases

	Diabetes		Hypertension		Arthritis/ Rheumatism		Heart Disease		Cancer	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
% current smoker (95% confidence interval)	50.1 (46.9, 53.3)	64.1 (63.0, 65.1)	50.6 (48.3, 53.0)	65.4 (64.3, 66.5)	52.8 (50.3, 55.4)	64.6 (63.5, 65.7)	48.2 (44.7, 51.8)	64.1 (63.0, 65.1)	58.4 (51.4, 65.5)	62.8 (61.8, 63.8)

Table 3

Age-specific prevalence and age-adjusted relative risk of chronic diseases according to history of attending residential school, marital status and education

	Residential School				Marital Status				Education			
	No	Yes	RR	RR-adj	Married	Not Marr.	RR	RR-adj	Primary	Secondary	RR	RR-adj
Hypertension												
15-24	7.3	3.8	0.5		8.2	6.2	0.8		4.9	7.0	1.4	
25-44	14.5	15.3	1.1	1.00	14.2	14.3	1.0	0.97	14.1	14.5	1.0	0.89
45-64	31.9	33.6	1.1	(0.87,	31.6	32.0	1.0	(0.86,	36.3	30.9	0.9	(0.75,
65+	57.0	53.9	0.9	1.15)	59.4	55.7	0.9	1.09)	56.1	55.2	1.0	1.04)
All ages	18.0	40.3	2.2		19.5	17.0	0.9		34.7	16.0	0.5	
Arthritis												
15-24	3.6	6.9	1.9		5.5	3.2	0.6		1.6	4.1	2.5	
25-44	11.7	10.6	0.9	1.06	12.1	10.9	0.9	0.94	10.6	11.7	1.1	1.09
45-64	29.9	33.6	1.1	(0.92,	30.5	31.9	1.0	(0.82,	34.7	29.8	0.9	(0.92,
65+	55.3	50.5	0.9	1.22)	51.8	55.1	1.1	1.06)	49.6	59.2	1.2	1.30)
All ages	15.0	23.6	1.6		17.5	14.4	0.8		31.0	13.7	0.4	
Heart Problem												
15-24	2.5	1.4	0.6		2.9	1.9	0.7		0.8	2.2	2.7	
25-44	3.7	5.8	1.6	1.07	4.2	4.2	1.0	0.94	4.3	4.2	1.0	0.80
45-64	17.6	15.3	0.9	(0.89,	16.1	17.6	1.1	(0.80,	21.0	15.8	0.8	(0.67,
65+	35.2	39.4	1.1	1.29)	39.5	33.9	0.9	1.11)	37.4	35.0	0.9	0.99)
All ages	7.6	13.4	1.8		8.8	7.6	0.9		20.7	6.4	0.3	
Cancer												
15-24	0.3	1.0	3.3		0.4	0.3	0.8		0	0.4	-	
25-44	1.5	0.9	0.6	1.12	1.6	1.4	0.9	0.99	0.4	1.5	3.9	0.99
45-64	4.6	5.8	1.3	(0.81,	4.6	5.3	1.1	(0.73,	4.9	4.6	0.9	(0.67,
65+	6.1	6.9	1.1	1.55)	6.8	6.1	0.9	1.34)	7.2	5.8	0.8	1.46)
All ages	1.9	3.5	1.8		2.4	1.9	0.8		4.3	1.8	0.4	
Diabetes												
15-24	2.6	6.6	2.5		2.9	3.0	1.0		4.9	3.0	0.6	
25-44	7.0	7.1	1.0	1.05	7.6	5.8	0.8	0.88	7.1	6.9	1.0	0.89
45-64	23.3	22.4	1.0	(0.89,	22.8	21.6	0.9	(0.77,	25.8	21.1	0.8	(0.73,
65+	30.3	29.6	1.0	1.23)	27.3	32.7	1.2	1.01)	28.7	32.8	1.1	1.08)
All ages	4.5	33.6	7.5		11.4	9.2	0.8		20.7	8.7	0.4	

8. BIBLIOGRAPHY

Abu-Zeid HA, Maini KK, Choi NW. Ethnic differences in mortality from ischemic heart disease: a study of migrant and native populations. J Chron Dis 1978;31:137-46.

Band PR, Gallagher RP, Threlfall WJ, Hislop TG, et al. Rate of death from cervical cancer among native Indian women in British Columbia. Can Med Assoc J 1992; 147:1802

Bates C, Van Dam C, Horrobin DF et al. Plasma essential fatty acids in pure and mixed race American Indians on and off a diet exceptionally rich in salmon. Prostaglandins Leukotrienes Med 1985; 17:77-84.

Bobet E. Diabetes among First Nations People: Information from the 1991 Aboriginal Peoples Survey carried out by Statistics Canada. Ottawa: Medical Services Branch, Health Canada, 1997.

Brassard P, Robinson E, Dumont C. Descriptive epidemiology of non-insulin-dependent diabetes mellitus in the James Bay Cree population of Quebec, Canada. Arctic Med Research 1993;52:47-54.

Brassard P, Robinson E. Factors associated with glycemia and microvascular complications among James Bay Cree Indian diabetics of Quebec. Arctic Med Research 1995;54:116-24.

Calam, B, Bass M, Deagle G. Pap smear screening rates: coverage on the southern Queen Charlotte Islands. Can Fam Physician 1992;38:1103-9.

Canadian Diabetes Advisory Board. Clinical practice guidelines for the treatment of diabetes mellitus. Can Med Assoc J 1992; 147:697-712.

Canadian Task Force on the Periodic Health Examination. The Canadian Guide to Clinical Preventive Health Care. Ottawa: Health Canada, 1994.

Chase LA. The trend of diabetes in Saskatchewan, 1905-1934. Can Med Assoc J 1937.,36:366-9.

Cole SA, Szathmary EJ, Ferrell RE. Gene and gene-product variation in the apolipoprotein A-I/C-III/A-IV cluster in the Dogrib Indians of the Northwest Territories. Am J Hum Genet 1989;44:835-43.

Daniel M, Gamble D, Henderson J, Burgess S. Diabetes prevalence, behavioural and anthropometric risk factors, and psychosocial constructs in three Aboriginal communities in central British Columbia. Chron Dis Can 1995;16:165-74.

Daveluy C, Lavellee, Clarkson M, Robinson E, eds. Sante Quebec: A Health Profile of the Cree. Report of the Sante Quebec Health Survey of the James Bay Cree 1991. Montreal: ministère de la Santé et des Services sociaux, 1994.

Dean W. NIDDM-Y in First Nation children in Canada. Clin Pediat 1998;37:89-96.

Dean HJ, Mundy RL, Moffatt M. Non-insulin-dependent diabetes mellitus in Indian children in Manitoba. Can Med Assoc J 1992; 147:52-57.

Dean HJ, Carson J. Insulin-dependent diabetes mellitus in an Inuit child. Can Med Assoc J 1989; 140: 527-8.

Delisle HF, Ekoe JM. Prevalence of non-insulin-dependent diabetes mellitus and impaired glucose tolerance in two Algonquin communities in Quebec. Can Med Assoc J 1993; 148:41-47.

Delisle HF, Rovard M, Ekoe JM. Prevalence estimates of diabetes and of other cardiovascular risk factors in the two largest Algonquin communities in Quebec. Diabetes Care 1995; IS: 1255-9.

Department of National Health and Welfare. Nutrition Canada: Eskimo Survey Report. Ottawa, 1975.

Department of National Health and Welfare. Nutrition Canada: Indian Survey Report. Ottawa, 1975.

Department of National Health and Welfare. Nutrition Canada: Anthropometry Report. Ottawa, 1980.

Desai ID, Lee M. Nutritional status of British Columbia Indians. III: Biochemical studies at Ahousat and Anahem Reserves. Can J Public Health 197 l;62:526-74.

Desai ID, Lee M. Nutritional status of Canadian Indians. I: Biochemical studies at Upper Liard and Ross River, the Yukon Territory. Can J Public Health 1974;65:369-74.

Deschamps M, Band M Flislop TG, et al. Barriers to cervical cytology screening in Native women in British Columbia. Cancer Detect Prev 1992;16:337-9.

Dyck RF, Tan I- Rates and outcomes of diabetic end-stage renal disease among registered Native People in Saskatchewan. Can Med Assoc J 1994; 150.203-208.

Eko6 JM, Thomas F, Balkati B, Eschwege E, Delisle H. Effect of maternal diabetes on the pattern of selected insulin resistance syndrome parameters in normal glucose tolerant subjects of two Algonquin Indian communities in Quebec. Diabetes Care 1996;19:822-6.

Evers S, McCracken F, Antone I, Deagle G. Prevalence of diabetes in Indians and Caucasians living in southwestern Ontario. Can J Public Health 1987;78:240-243.

Evers S, McCracken E, Antone 1, Deagle G. Body fat distribution and non-insulin dependent diabetes mellitus in North American Indians. Nutrition Research 1989;9:977-987.

Fox C, Harris SB, Whalen-Brough E. Diabetes among Native Canadians in northwestern Ontario: 10 years later. Chron Dis Canada 1994; 15:92-6.

Gallagher RB, Elwood JM. Cancer mortality among Chinese, Japanese, and Indians in British Columbia, 1964-1973. Nat Cancer Inst Monogr 1979;53:89-94.

Garro LC. Explaining high blood pressure: variation in knowledge about illness. Am Ethnologist 1988; 15:98-119.

Garro LC. Individual or societal responsibility? Explanations of diabetes in an Anishinaabe (Ojibway) community. Soc Sci Med 1995;40:37-46.

Gaudette LA, Dufour R, Freitag S, Miller AB. Cancer patterns in the Inuit population of Canada, 1970-1984. In: Postl BD,
Gilbert P et al, eds. Circumpolar Health 90. Winnipeg: University of Manitoba Press, 1991:443-6.

Gaudette LA, Gao RN, Freitag S, et al Cancer incidence by ethnic group m the Northwest Territories (NWT), 1969-1988. Health Reports 1993;5:23-32.

Gaudette LA, Freitag S, Dufour R, Baikie M et al. Cancer in circumpolar Inuit: background information for cancer patterns in Canadian Inuit. Acta Oncologica 1996;35:527-33.

Gillis DC, Irvine J, Tan L et al. Cancer incidence and survival of Saskatchewan northerners and registered Indians, 1967-1986. In: Postl BD, Gilbert P et al., eds. Circumpolar Health 90:Proceedings of the 8th International Congress on Circumpolar Health. Winnipeg: University of Manitoba Press, 1991: 447-5 1.

Gittelsohn J, Harris SB, Whitehead S, et al. Developing diabetes interventions in an Ojibwa-Cree community in northern Ontario. linking qualitative and quantitative data. Chron Dis Can 1995;16:157-64.

Gittelsohn J, Harris SB, Thorne-Lyrnan AL, Hanley AJ et al. Body image concepts differ by age and sex in an Ojibway-Cree community in Canada. J Nutr 1996; 126:2990-3000.

Gofton JP, Chalmers A, Price GE, Reeve CE. HL-A 27 and ankylosing spondylitis in BC Indians. J Rheumatol 1975;2:314-8.

Hagey R. The phenomenon, the explanations and the responses: Metaphors surrounding diabetes in urban Canadian Indians. Soc Sci Med 1984; 18:265-72.

Harlow SD, Linet MS. Agreement between questionnaire data and medical records: the evidence for accuracy of recall. Am J Epidemiol 1989; 129:233-48.

Harris SB, Gittelsohn J, Hanley A, Barnic A et al. The prevalence of NIDDM and associated risk factors in Native Canadians. Diabetes Care 1997;20:185-7.

Health and Welfare Canada.. Nutrition Canada: Anthropometry Report. Ottawa: HWC, 1980.

Hegele RA, Tully Q Young TK, Connelly PW. V677 mutation of methylenetetrahydrofolate reductase and cardiovascular disease in Canadian Inuit. Lancet 1997;349:1221.

Hegele RA, Young TK, Connelly P. Are Canadian Inuit at increased genetic risk for coronary heart disease? J Mol Med 1997;74:364-70.

Hildes JA, Schaefer 0. The changing picture of neoplastic disease in the western and central Canadian Arctic (1950-1980). Can Med Assoc J 1984; 130.25-33.

EM R. Juvenile arthritis in various racial groups in British Columbia. Arthritis Rheum 1977;20:162-4.

Hislop TG, Deschamps M, Band PR et al. Participation in the British Columbia cervical cytology screening program by Native Indian women. Can J Public Health 1992;83:344-5.

Hislop TG, Clarke HF, Deschamps M, Joseph R, et al. Cervical cytology screening: How can we improve rates among First Nations women in urban British Columbia? Can Fam Physician 1996;42:1701-8.

Horrobin DF. Low prevalence of coronary heart disease (CHD), psoriasis, asthma and rheumatoid arthritis in Eskimos: are they caused by high dietary intake of eicosapentaenoic acid (EPA), a genetic variation of essential fatty acide (EFA) metabolism or a combination of both? Med Hypotheses 1987;22:421-8.

Imrie R, Warren R. Health promotion survey in die Northwest Territories. Can J Public Health 1988;79:16-24.

Innis SM, Kuhnlein HV. The fatty acid composition of northern Canadian marine and terrestrial mammals. Acta Med Scand 1987;222:105-9.

Innis SM, Kuhnlein HV, Kinloch D. The composition of red cell membrane phospholipids in Canadian Inuit consuming a diet high in marine mammals. Lipids 1988;23:1064-8.

Irvine J, Gillis DC, Tan L, et al. Lung, breast, and cervical cancer incidence and survival in Saskatchewan northerners and registered Indians (1967-86). In Postl BD et al, eds. Circumpolar Health 90. Winnipeg: University of Manitoba Press, 1991: 452-6,

Jette M, ed. SantJ Quebec: A Health Profile of the Inuit. Report of the SantJ Quebec Health Survey among the Inuit of Nunavik, 1992. Vol 1. Health Determining Factors. Montreal: ministere de la Sant6 et des Services sociaux, 1994.

Lederman JM, Wallace AC, Hildes JA. Arteriosclerosis and neoplasms in Canadian Eskimos. In: Biological Aspect of Aging: Proceedings of the Fifth International Congress on Gerontology. New York: Columbia University Press, 1962: 201-7.

Longclaws L, Barnes GE, Grieve L, Durnoff P, Alcohol and drug use among the Brokenhead OJibwa. J Stud Alcohol 1980A1:21-36.

Macaulay AC, Hanusaik N, Delisle DD. Diabetes education program in the Mohawk community of Kahnawake, Quebec. Can Fam Physician 1988;34:1591-3.

Macaulay AC, Montour LT, Adelson N. Prevalence of diabetic and atherosclerotic complications among Mohawk Indians of Kahnawake, PQ. Can Med Assoc J 1988; 139:221-224.

Macaulay AC, Paradis 0, Powin L, et al. The Kahnawake Schools Diabetes Prevention Project: intervention, evaluation and baseline results of a diabetes primary prevention program with a Native community in Canada. Prev Med 1997;26:779-90.

Mahoney MC, Michalek AM. A meta-analysis of cancer incidence in United States and Canadian Native populations. Int J Epidemiol 1991;20:323-7.

Mao Y, Morrison H. Semenciw P, Wigle D. Mortality on Canadian Indian reserves 1977-1982. Can J Public Health 1986;77:263-8.

Mao Y, Moloughney BW, Semenciw M Morrison HI. Indian reserve and registered Indian mortality in Canada. Can J Public Health 1992;83:350-3.

McIntyre L, Shah CP. Prevalence of hypertension, obesity and smoking in three Indian communities in northwestern Ontario. Can Med Assoc J 1986;134: 345-9.

Millar WJ. Place of birth and ethnic status: factors associated with smoking prevalence among Canadians. Health Reports 1992A:7-24.

Montour LT, Macaulay AC. High prevalence rates of diabetes mellitus and hypertension in a North American Indian reservation getter]. Can Med Assoc J 1985; 132:1112.

Montour LT, Macaulay AC, Adelson N. Diabetes mellitus in Mohawks of Kahnawake, PQ. a clinical and epidemiologic description. Can Med Assoc J 1989; 141:549-552.

Nicolle LE, Friesen D, Harding OK, Roos LL. Hospitalization for acute pyelonephritis in Manitoba, Canada, during the period from 1989 to 1992; impact of diabetes, pregnancy, and aboriginal origin. Clin Infect Dis 1996;22:1051-6.

Oen K, Cheang M. Epidemiology of chronic arthritis in childhood. Sem Arthritis Rheum 1996;26:575-9 1.

Oen K, Postl B, Chalmers IM, et al. Rheumatic diseases in the Inuit population. Arthritis Rheum 1986;29:65-74.

Pioro UP, Dyck RF, Gillis DC. Diabetes prevalence rates among First Nations adults on Saskatchewan reserves in 1990 Comparison by tribal grouping, geography and with non-First Nation people. Can J Public Health 1996;87:325-8.

Reading J. Eating Smoke: A Review of Non-Traditional Uses of Tobacco Among Aboriginal People. Ottawa: Health Canada, 1996.

Reeder BA, Shah CP, Williams DA. Serum lipid distributions in Canadian Indians of northwestern Ontario. Can Fam Physician 1988;34:1535-9.

Ritenbaugh C, Goodby C. Beyond the thrifty gene: metabolic implications of prehistoric migation into the New World. Med Anthropol 1989; 11:227-36.

Robinson E. The health of the James Bay Cree. Can Fam Physician 1988; 34:1606-13.

Robinson EJ, Gebre Y, Pickering J, Petawabano B, Superville B, Lavallee C. Effect of bush living on Aboriginal Canadians of the Eastern James Bay region with noninsulin-dependent diabetes mellitus. Chron Dis Can 1995; 16:144-8.

Robinson JP, Young TK, Roos LL, Gelskey DE. Estimating the burden of disease: comparing administrative data and self-reports. Med Care 1997;35:932-47.

Ross SA, Fick GF. Insulin as a risk factor for diabetes complications. Diabetes 1991;4O(Suppl, I): 333A [abstract].

Russell AS, Davis P, Schlaut J. Prevalence of ankylosing spondylitis and HLA-B27 in a North American Indian population: a pilot study. Can Med Assoc J 1977; 116:148-9.

Schaefer 0. Glycosuria and diabetes mellitus in Canadian Eskimos. Can Med Assoc J 1968; 99:201-6.

Schaefer 0. Glucose tolerance testing in Canadian Eskimos: a preliminary report and hypothesis. Can Med Assoc J 1968; 99:252-62.

Schaefer 0, Crockford PM, Romanowski B. Normalization effect of preceding protein meals on---diabetic"oral glucose tolerance in Eskimos. Can Med Assoc J 1972; 107:733-8.

Schaefer 0, Eaton RD, Timmermans FJ, Hildes JA. Respiratory function impairment and cardiopulmonary consequences in long-time residents of the Canadian Arctic. Can Med Assoc J 1980; 123:997-1004.

Schaefer 0, Hildes JA, Medd LM, Cameron DG. The changing pattern of neoplastic disease in Canadian Eskimos. Can Med Assoc J 1975; 112:1399-1404.

Smith WL, Martin BD, Orr PH, G~ FB. Investigation and management of cervical intraepithelial neoplasia in Canadian Inuit: enhancing access to care. Arctic Med Res 1995;54(SuppI 1): 117-2 1.

Statistics Canada.. 1991 Aboriginal Peoples Survey: Language, Tradition, Health, Lifestyle and Social Issues. Ottawa: Statistics Canada, 1993. [Cat.No. 89-5331.

Szathmary EJ The effect of Ge genotype on fasting insulin level in Dogrib Indians. Hum Genet 1987;75:368-72.

Szathmary EJ Diabetes in Amerindian populations: the Dogrib studies. In: Armelagos G, Swedlund A, eds. Health and Disease of Populations in Transition. New York: Bergin and Garvey, 1990:75-103.

Szathmary EJ, Holt N. Hyperglycemia in Dogrib Indians of the NWT, Canada.. association with age and a centripetal distribution of body fat. Hwnan Biol 1983;55:493-515.

Szathmary EJ, Ritenbaugh C, Goodby CS. Dietary change and plasma glucose levels in an Amerindian population undergoing cultural transition. Soc Sci Med 1987;24:79 1-804.

Thouez JP, Eko6 JM, Foggin PM, et al. Obesity, hypertension, hyperuricernia and diabetes mellitus among the Cree and Inuit of northern Quebec. Arct Med Res 1990;49:180-8.

Urquhart JA. The most northerly practice in Canada. Can Med Assoc J 1935;33:193-6.

Verdier PC, Eaton RD, Cooper B. A study of the nutritional status of an Inuit population in the Canadian high Arctic. Part 1: Biochemical evaluation. Can J Public Health 1987;78:229-35.

Warwick OR Phillips; AJ. Cancer among Canadian Indians. Br J Cancer 1954;8:223-30.

Wilson R, Krefting LH, Sutcliffle P, VanBussel L. Incidence and prevalence of end-stage renal disease among Ontario's James Bay Cree. Can J Public Health 1992;83:143-146.

Young TK. Mortality pattern of isolated Indians in northwestern Ontario: a 10-year review. Public Health Rep 1983;98:467-75.

Young TK. Are subarctic Indians undergoing the epidemiologic transition. Soc Sci Med 1988; 26:659-7 1.

Young TK. Prevalence and correlates of hypertension in a subarctic Indian population. Prev Med 1991;20: 474-85.

Young TK. Diabetes mellitus among Native Americans in Canada and the United States: an epidemiological review. Am J Human Biol 1993;5:399-413.

Young TK. The Health of Native Americans: Toward a Biocultural Epidemiology. New York. Oxford University Press, 1994.

Young TK, Choi NW. Cancer risks among residents of Manitoba Indian reserves, 1970-1979. Can Med Assoc J 1985; 132:1269-72.

Young TK, Frank JW. Cancer surveillance in a remote Indian population in northwestern Ontario. Am J Public Health 1983;73:515-20.

Young TK, Kaufert JM, McKenzie X et.al. Excessive burden of end-stage renal disease among Canadian Indians: a national survey. Am J Public Health 1989;79:756-758.

Young TK, Krahn L Comparison of screening methods in a diabetes prevalence survey among northern Indians. Clin Invest Med 1988; 11: 380-385.

Young TK, McIntyre LL, Dooley J, Rodriguez J. Epidemiologic features of diabetes mellitus among Indians in northwestern Ontario and northeastern Manitoba. Can Med Assoc J 1985;132:793-797.

Young TK, McNicol P, Beauvais J. Factors associated with human papillomavirus infection detected by polymerase chain reaction among urban Canadian Aboriginal and non-Aboriginal women. Sex Trans Dis 1997;24:293-8.

Young TK, Moffatt MEK, O'Neil JD. An epidemiological perspective of cardiovascular diseases in an Arctic population. Am J Public Health 1993;83:881-7.

Young TK, Nikitin YP, Shubnikov EV, et al. Plasma lipids in two indigenous Arctic populations with low risk for cardiovascular diseases. Am J Human Biol 1995;7:223-6.

Young TK, Schrarer CD, Shubnikoff EV, Szathmary El, Nikitin JP. Prevalence of diagnosed diabetes in circumpolar indigenous populations. Internat J Epidemiol 1992;21:730-736.

Young TK, Sevenhuysen G. Obesity in northern Canadian Indians: patterns, determinants, and consequences. Am J Clin Nutr 1989;49:786-93.

Young TK, Sevenhuysen G, Ling N, Moffatt MEK, Determinants of plasma glucose levels and diabetes in a northern Canadian Indian population. Can Med Assoc J 1990; 142:821-830.

Young, TK, Szathmary W Carvers S, Wheatley B. Geographical distribution of diabetes among the Native population of Canada: a national survey. Soc Sci Med 1990-,31:129-139.