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OBESITY, HYPERTENSION, HYPERURICEMIA AND DIABETES MELLITUS AMONG THE CREE AND INUIT OF NORTHERN QUÉBEC

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ABSTRACT

In the last thirty years, sociocultural and political changes have profoundly affected the way of life of the Cree and Inuit of Northern Québec. Their health status profile has also changed. This study presents the main results of a health survey performed among the Cree and Inuit in 1982-1984 by a multidisciplinary team. Obesity, arterial hypertension, hyperuricemia and diabetes mellitus while almost unknown in the past, have now been added to the list of Cree and Inuit health problems. Crees have the highest risk for obesity, hypertension and diabetes mellitus. Hyperuricemia for unknown reasons seems more prevalent among the Inuit. Our findings suggest that further in-depth studies of chronic conditions in these communities are needed.

The Cree and Inuit of Québec have gone through great political, economic, and socio-cultural changes in the second half of this century (1-3). The trend towards a sedentary way of life that began among the Cree in the 1940s has now become their basic way of life, even though they continue to go "into the bush" in relatively large numbers during the autumn and winter months. In 1981 some 7,500 Cree were spread throughout the James Bay region in eight distinct bands, each band based in a particular northern locality. Five of these communities are located on the east coast of James Bay and Hudson Bay, the other three are situated inland (Fig. 1). Villages vary from over 2,000 inhabitants, as in Chisasibi and Mistassini, to as few as 300 residents, as in Nemaska.

The main settlement in villages of the formerly nomadic Inuit took place in the 1950s, although a certain amount of migration to new localities is still taking place. For example, a new community, Umiujaq, was formed in 1986 near Lake Guillaume-Delisle, on the Hudson Bay coast north of Kuujjuarapik (Great Whale). In 1981, the Inuit population of northern Québec was 5,400, distributed throughout the 13 coastal villages that existed at that time, scattered along the coast of Hudson Bay, and Hudson Strait facing Baffin Island. The largest villages are Kuujjuak (1,068 inhabitants), Povungnituk (787), Kuujjuarapik (762) and Inukjuak (662). In addition to the Cree and the Inuit, some 20,000 non-native people live in this northern region. However, they are concentrated in the south, as the majority are employed in work related to the James Bay Hydroelectric Development projet, which has been underway since the 1970s.

Since 1978 health services have been administered by the Departments of Health and Social Services with regional offices based in Chisasibi for the Cree and in Kuujjuak for the Inuit. In each

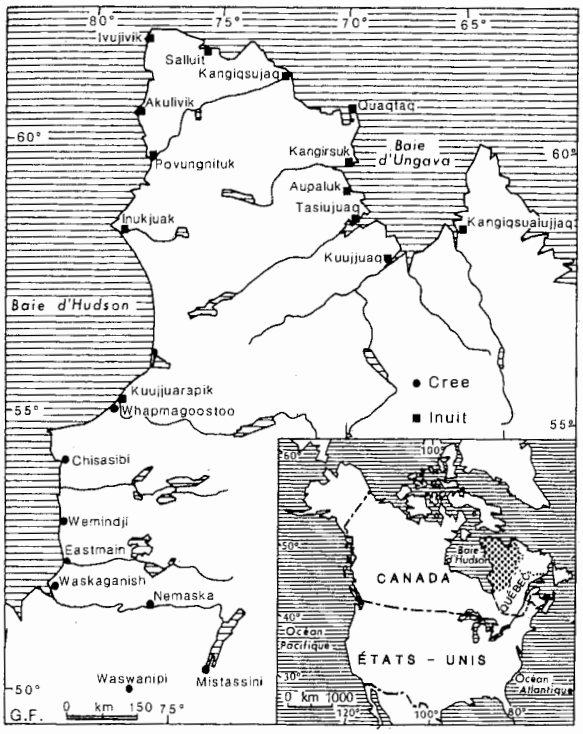

Fig. 1. Location of the Cree and Inuit of Northern Quebec.

village primary health care is provided by local nursing stations or health care centres. Second-line health care services are provided by three regional hospitals: in Kuujjuak and Povungnituk for the Inuit, and in Chisasibi and Mistassini for the Cree. In case of emergencies and if specialized care is needed, air evacuations are made to various hospitals in the south, particularly to Val d'Or, Montreal, and Québec City.

There have been many changes in daily life. Previously, traditional use of the land provided the base for a subsistence economy as well as for small-scale commercial production. Today, less than half the Aboriginal working population is occupied in traditional activities. However, a positive aspect of the James Bay Agreement was the insistence on the importance of developing local native economies (4). Nonetheless, salaried employment provides a growing part of net family income in the area. A formerly homogeneous population has now been divided between "traditional" and "modern" economic activities.

Not surprisingly, in some respects, the two Aboriginal populations are still in a process of change. Some of them refuse to cooperate with government programmes because (according to this group) any collaboration with white southerners is tantamount to upsetting, even rejecting, traditional values. There has also been a steady increase in levels of certain kinds of morbidity and mortality, such as those due to accidents and violence.

HEALTH AND ILLNESS

In correctly evaluating the health status of northern populations, two problems have to be taken into account. First, there is, typically, an inadequate system of information-gathering. Second, small population numbers accentuate the annual variability of demographic measurements. Despite these constraints, it is still possible to make important observations.

The Cree and Inuit have, demographically, very young populations. More than half of the Cree (51%) and 60% of the Inuit are younger than 20 years (compared to the Québec-wide figure of 32.5%). High birth rates, along with decreases in the still-high levels of infant mortality, have assured a continuing high population growth rate. Nevertheless, there has been some reduction in birth rates observed over the last several decades.

While infant mortality among the Inuit has decreased from 247 per thousand in 1946 to 46 per thousand in 1981 (6), the relative differences in infant mortality rates as compared to the national or Québec-wide rates remain much the same. In 1941 infant mortality among the Inuit was 4.5 times that of the national "norm", that of the general population, whereas in 1981 the comparative figure for the same population group was 4.9 times.

Between 1975 and 1982 infant mortality rates for the Cree were 27.4 per thousand in the coastal villages but 49.2 per thousand for Inlands. Similarly, a regional variation was noted for the Inuit for 1976-78 when infant mortality rates were almost twice as high on the Ungava coast as on the Hudson Bay littoral. In the case of both populations, relatively high levels of infant mortality are linked to post-natal mortality (28-365 days), during the period after hospital-based perinatal care. The main causes of infant mortality appear to be premature birth and their sequellae, pneumonia and meningitis (6).

Adjusted mortality rates for the Inuit during the 1973-79 period were 13.1 per 1,000, roughly double the Canada-wide rate (7). From 1971 to 1981, there appears to have been an increase in mortality in almost every age-group (6). Life-expectancy for the Inuit is about 60 years for both sexes taken together, a figure which was the norm for the Québec population some thirty years ago. The principal causes of death are diseases of the upper respiratory tract (23% of deaths), infectious and parasitic diseases (14%), accidents and poisonings (11%) (6). The proportion of deaths attributed to poorly or un-defined causes is higher than that for any other category (30%). Although we do not have exactly parallel information for the Cree, it is generally recognized that mortality rates are lower than those for the Inuit. In fact, life expectancy for the Cree is considerably higher : for the 1975-81 period the figures were 73.2 years for women and 69.8 for men. These figures were somewhat lower for villages in the Inland area (67.6 and 68.9, male and female respectively) (8). In general, the main causes of death are diseases of the circulatory system (23%), trauma and accidents (20%), diseases of the respiratory system (11%), and tumors (11%). Poorly-defined causes account for 21% of deaths among the Inuit of this region.

Hospitalization rates for the Inuit and the Cree are twice as high as for Québecers in general. Excluding births, six causes are implicated in 65% of all Inuit hospitalizations : respiratory problems (half of these are cases of pneumonia), accidents, digestive problems, nervous and sensory system malfunctions and infectious diseases (7). In the case of the Cree, hospitalization is typical for problems of the respiratory system (this is particularly true for male infants below 1 year of age and males 15 to 24 years of age). In addition, there is a considerable number of tumors among older men (45 to 64 years).

Although certain indicators show progress (for example, lower infant mortality rates) other diseases are on the increase. Respiratory infections are fewer but more serious than in the past. This health status profile gives some indication of the types of preventive health care programmes that need to be considered : for example, programmes for infants between 1 and 12 months of age. Not only is there a need to change the organization of health care delivery, but a better understanding of causative or predisposing factors with regard to prevalent illnesses might also contribute to improving health in general. Even though health services have played a role in this change, environmental factors seem to be equally important. As drinking water in the Cree villages is now usually provided by a closed-pipe distribution network, diarrhea is less of a problem than in the past, and certainly occurs less frequently than among the Inuit, who generally still have drinking water supplied through water trucks and in-house reservoirs.

Although housing is better, more spacious, and better heated than in the past, chronic bronchitis and emphysema appear to be increasingly frequent. Over 70% of young Cree and Inuit (20 to 24 years) smoke in comparison with fewer than 48% of Canadians of the same age-group (11, 12). It has been clearly shown that prevalence of respiratory illness is greater among children exposed (passively) to smoking environments (13).

Although there is a good deal of evidence of violence related to alcohol consumption, diseases related to chronic alcoholism, such as cirrhosis of the liver do not seem to be a major cause of death (14). While accidents and violence are a major problem, they appear to be less so than among Indian populations in Western Canada. However, alcohol and drug use, together with unemployment, are at the base of the rapid rise in social problems that has been observed over the past ten years.

With the increase in settlement and paid employment there is less and less emphasis placed on game and fish as a main element in the diet. The Cree and Inuit have tended to increase their use of commercial and processed foods available at local food stores. One of the results of this trend is the increasing consumption by Aboriginal peoples of carbohydrate and sweetened foods (15,17), in addition to a general lack of necessary vitamins (16,17). Consequently, it is not surprising that general levels of obesity, high blood pressure, hyperuricemia and diabetes mellitus have increased.

MATERIALS AND METHODS

A socio-environmental and epidemiological survey was carried out between October 1982 and March 1984 among the Inuit and between June

TABLE I. Study sample and the total population of the study region by age group and sex : a) Cree and b) Inuit.

a) CREE

TOTAL SAMPLE POPULATION = 2215 (all ages). RESPONSE RATE = 1655 (75%)
<15 y: 742; > 15 y: 913

AGE	TOTAL POPULATION (1985)		STUDY SAMPLE	
GROUP	*Males*	*Females*	*Males*	*Females*
15-24	*919 (37.5)*	*910 (37.0)*	*142 (33.0)*	*161 (33.3)*
25-34	*538 (21.9)*	*561 (22.8)*	*86 (20.0)*	*121 (25.0)*
35-44	*351 (14.3)*	*391 (15.9)*	*67 (15.6)*	*85 (17.6)*
45-54	*241 (9.8)*	*227 (9.2)*	*45 (10.4)*	*44 (9.1)*
55-64	*189 (7.7)*	*170 (6.9)*	*52 (12.0)*	*42 (8.6)*
65 +	*211 (8.6)*	*197 (8.0)*	*38 (8.8)*	*30 (6.2)*
	2449 (100%)	*2456 (100%)*	*430 (100%)*	*483 (100%)*

b) INUIT

TOTAL SAMPLE POPULATION = 2284 (all ages). RESPONSE RATE = 2068 (90.5%)
*< 15 y: 986; > 15 y: 1082**

AGE	*TOTAL POPULATION (1983)*		*STUDY SAMPLE*	
GROUP	*Males*	*Females*	*Males*	*Females*
15-24	*613 (38.4)*	*639 (40.8)*	*193 (38.8)*	*223 (38.1)*
25-34	*386 (24.2)*	*360 (22.9)*	*112 (22.5)*	*114 (19.5)*
35-44	*200 (12.5)*	*215 (13.7)*	*54 (10.8)*	*92 (15.7)*
45-54	*219 (13.7)*	*187 (11.9)*	*78 (15.7)*	*89 (15.2)*
55-64	*72 (4.5)*	*81 (5.2)*	*27 (5.4)*	*37 (6.3)*
65+	*106 (6.7)*	*85 (5.5)*	*33 (6.6)*	*30 (5.1)*
	1596 (100%)	*1567 (100%)*	*497 (100%)*	*585 (100%)*

**Kangirsuk, Quaqtaq, Salluit excluded.*

1983 and September 1984 among the Cree. Detailed descriptions of the survey and the sample design are given elsewhere (11,18,19), but it should be noted that a spatially based, random sample design was used within each of the Cree and Inuit localities; 35 to 45 households were selected in each of the 13 Inuit and 8 Cree villages. The only exceptions were at Aupaluk and Tasiujaq where all households were interviewed, because of the small size of these communities. Overall, there were 324 households in the Cree sample, 367 in the Inuit sample (Table I).

The survey questionnaire included questions on personal details such as smoking habit and history of specified illness. Height and weight were recorded. Following adult (15 years or over) subject consent, the survey doctor obtained blood samples. Frozen samples were sent by air to a laboratary in Montreal and results were available within two weeks of the air shipments. Blood

TABLE II. Overweight and obesity prevalence among the Cree (a) and Inuit (b) in Northern Québec, by age group and sex.

b) CREE	MALES				FEMALES			
	overweight		obesity		overweight		obesity	
Age group	No	%	No	%	No	%	No	%
15-19	12	9.4	1	1.0	21	15.5	9	4.4
20-29	38	29.9	11	11.2	55	40.7	51	24.8
30-39	37	29.1	32	32.6	30	22.2	58	28.3
40-49	18	14.1	27	27.5	21	15.5	51	24.8
50-59	12	9.4	14	14.2	5	3.7	24	11.7
60-64	10	7.8	13	13.2	3	2.2	12	5.8
TOTAL	127	(100%)	98	(100%)	135	(100%)	205	(100%)
b) INUIT								
Age group								
15-19	20	15.5	1	2.4	24	15.5	0	--
20-29	38	29.4	2	4.8	46	29.6	6	8.1
30-39	28	21.7	10	24.4	29	18.7	24	32.4
40-49	24	18.6	11	26.8	28	18.0	30	40.5
50-59	18	13.9	15	36.5	25	16.1	13	17.5
60-64	1	0.7	2	4.8	3	1.9	1	1.3
TOTAL	129	(100%)	41	(100%)	155	(100%)	74	(100%)

pressure was recorded using a Hawksley random-zero mercury sphygmomanometer with the subject sitting for at least 10 minutes. Blood pressure was recorded to the closest 2mm Hg and diastolic blood pressure was defined as the fifth phase of Korotkoff sounds.

a) Obesity

Body mass index (BMI) was used as a measure of obesity and calculated as weight (kg)/height (m2). Overweight was defined as a BMI of 24-29 in women and 25-29 in men; obesity was defined as a BMI of 30 in both sexes (20).

For the Cree, obesity is much more widespread among women than men, and is a very serious problem among women over thirty years of age. Among the Inuit, a tendency towards overweight exists but real obesity is still rare (Table II).

b) Hypertension (HTA)

Hypertension was defined using WHO criteria (21) as the mean of two readings of systolic blood pressure of at least 160 mm Hg or diastolic blood pressure of at least 95 mm Hg. People being treated for high blood pressure with diuretics or other antihypertensives - 8 Inuit (5 women, 3 men), 42 Cree (28 women, 14 men) - were also classified hypertensive regardless of their blood pressure values at the time of the survey.

Blood pressure levels were higher among the Cree than among the Inuit (Table III). Obese women had higher blood pressure than non-obese women. This difference was significant for Cree and Inuit women, while a similar, though not statistically significant, trend was seen in Cree men.

c) Plasma uric acid

Plasma uric acid levels are genetically determined

TABLE III. Prevalence of hypertension among the Cree and Inuit of Northern Québec.

	CREE MALES				INUIT MALES			
	borderline		*high*		*borderline*		*high*	
	No	*%*	*No*	*%*	*No.*	*%*	*No*	*%*
Age group								
15-24	*26*	*18.3*	*4*	*28*	*12*	*11.4*	*1*	*0.9*
25-34	*12*	*13.9*	*13*	*15.1*	*4*	*8.5*	*1*	*2.1*
35-44	*14*	*20.8*	*8*	*11.9*	*1*	*4.1*	*3*	*12.5*
45-54	*7*	*15.5*	*15*	*33.2*	*10*	*19.2*	*2*	*3.8*
55+69	*15*	*28.8*	*20*	*38.4*	*4*	*22.2*	*3*	*16.6*
TOTAL	*74*	*18.8*	*50 (+14)*	*16.9*	*31*	*12.6*	*10 (+3)*	*5.3*
	CREE FEMALES				*INUIT FEMALES*			
Age group								
15-24	*25*	*15.5*	*2*	*2.1*	*3*	*2.8*	*0*	*0*
25-34	*18*	*14.8*	*10*	*8.2*	*0*	*0*	*1*	*1.7*
35-44	*28*	*32.9*	*13*	*15.3*	*4*	*7.3*	*1*	*1.9*
45-54	*16*	*36.3*	*16*	*36.3*	*7*	*14.9*	*4*	*8.5*
55+69	*10*	*23.8*	*25*	*59.5*	*6*	*24.0*	*3*	*12.0*
TOTAL	*97*	*21.4*	*66 (+28)*	*22.1*	*20*	*6.8*	*9 (+5)*	*4.8*

but are influenced by multiple environmental factors. Hyperuricemia was defined as plasma uric acid levels > 7.0 mg/100 ml in men and 6.0 mg/100 ml in women (22). High plasma creatinine levels were defined arbitrarily as > 1.19mg/100 ml in men and 1.13 mg/100 ml in women.

Inuit men and women had a significantly higher prevalence of hyperuricemia than Cree men and women (Table IV).

Both glycemic status and body mass index were significantly associated with plasma uric acid among Cree women ($p = 0.009$) but only the body mass index in the case of Cree men and Inuit women ($p = 0.001$). Interaction between plasma uric acid levels and plasma creatinin was statistically significant for both Cree and Inuit women ($p = 0.001$) and for Cree men ($p = 0.001$) but not for Inuit men.

d) Diabetes mellitus

Since for practical and technical reasons fasting could not be assured, blood glucose measurements were performed any time during the day, regardless of meals time. The classification of random blood glucose values was therefore based on current random criteria for screening for diabetes mellitus. Diabetes mellitus is defined by WHO and the National Diabetes Data Group as a two hour plasma glucose concentration of 11.1 mmol/l (200 mg/dl) or more, two hours after a 75 g oral glucose blood (23,24).

The frequency distribution of blood glucose values was unimodal in both Cree and Inuit. Mean glucose values were higher among Cree females than among their male counterparts or among male and female Inuit. The Inuit showed significantly lower mean blood glucose values than the Cree. In both native populations blood glucose levels increased progressively with age.

In both populations diabetes was unlikely

TABLE IV. Proportion of hyperuricemia among Cree and Inuit in Northern Québec.

	TOTAL	*N*	*%*	*P. Value*	*TOTAL*	*N*	*%*	*P. Value*
Cree	*426*	*57*	*15.6*		*474*	*57*	*12.0*	
				= 0.005				*= 0.001*
Inuit	*229*	*67*	*24.9*		*274*	*60*	*21.9*	

among those below the age of 35. The diagnosis of diabetes was uncertain of 68% in female Crees (292/429) and 62.3% of male Crees (296/475). Percentages were lower among the Inuit: 45% for both males (103/229) and females (123/274). Sixty-two percent of the Cree sample and 45% of the Inuit sample showed suspiciously high blood glucose values. Finally, 4.42% of the female Cree (21/475) and 1.2% of the male (5/429) were in the likely diabetic category (blood glucose value > 11.1 mmol/l) compared with 0.43% among Inuit males /1/229) and 0.36% of Inuit females (1/274).

Thus, among the tested Cree, glucose abnormalities could be suspected in 67.8%, although uncertain (blood glucose value between 5 and 11.1 mmol/l) in 65%, and likely in 2.87% as compared with 45.5% suspected, 44.93% uncertain and 0.39% likely among Inuit.

Although significant differences were not seen, Cree females showed greater differences between the three random glucose values categories than other groups with respect to the other continuous variables examined - plasma cholesterol, and systolic and diastolic blood pressures. On the whole, there was a general trend which showed that increase in BMI parallels increase in blood glucose concentration.

DISCUSSION

As with many other minority populations, the Cree and Inuit of Québec have experienced major environmental changes over the past few years. Some of the effects of these changes are fairly well understood, either through direct analysis of the present situation or through application of general principles and understanding drawn from studies based on similar populations.

Higher-than-average hospitalization and mortality rates among the Cree and Inuit of northern Québec can be very probably related to life-style changes that have taken place in these communities. Obesity, high blood pressure, hyperuricemia and probably diabetes mellitus, particularly among the Cree, are likely to cause additional health problems in the future. Decreasing physical activity in the villages, compared to a more active life in the past which involved migration, hunting, and fishing, has resulted in a decrease in HDL cholesterol, the protecting agent with regard to heart disease. Other predisposing factors for disease, such as types of foods consumed, are probably also present, but these relationships are poorly understood in the context of northern Québec. Dufour (25) has noted, for example, that bottle-feeding might be a factor related to otitis in infants and children. Draper (26) has observed that the nutritional status of people in the Arctic is similar to that observed among urban people the lower socio-economic levels of the general population. While it has not yet been possible among the Cree and Inuit of northern Québec to draw such precise conclusions about dietary components, it would appear that findings from studies of other northern environments are applicable to the Aboriginal populations of Québec.

Furthermore, it appears that, with the disappearance of the old societal structures where roles were clearly defined, both the Inuit and the Cree are having difficulty in finding a suitable and satisfying place in contemporary society. For example, trained Cree and Inuit nurses with a sensivity toward local customs and attitudes are almost completely unavailable. Although Inuit have been trained as auxiliary nurses since 1977, such nurses are often assigned to non medical tasks such as that of interpreter. Philie and Foggin (27) have noted that non-native nurses are faced with tremenduous problems in attempting to adapt to their new environment in the North and are often not prepared adequately for the roles that are

thrust upon them in isolated outposts. Added to this are problems with recruiting professionals, multipication of inter-connecting but non-integrated organizations and branches of government, and difficulties with both spoken and written communication between nurse and patient (7). When the impact of life-style on health status is recognized it is obvious that trained nurses or other health professionals who are of the same culture as patients would make an enormous difference.

If it is possible to say that the health status at both ends of the age-spectrum, seniors and young children, has improved in recent years, it is equally imperative to note that the opposite is true for adolescents and young and middle-aged adults. In fact, the full impact of recent changes in the physical and social environment has not yet been measured. Changes due to the construction of a hydroelectric complex introduce many types of new environmental problems. Mercury pollution, of course, is an example of this. Mercury levels increase rapidly with the flooding of vegetation and soil, and this harmful mineral moves quickly into the food chain and is soon concentrated in fish (28). Much care needs to be taken, particularly in the case of pregnant women, with this as well as other environmental hazards, Other environmental risk factors include the contamination of drinking water due to unhealthy, or badly located, garbage disposal systems and hearing loss due to high-intensity noise from snowmobiles, motor boats and high-powered hunting rifles.

Although anthropologists have familiarized us with traditional societies, the changes that have taken place in recent years are going to require new models, particularly for populations living in permanent contact with non-native people from the "South". Berry and Kim (9) note that while problems of adaptation and acculturation are a definite source of added stress, the intensity of stress levels varies considerably from one locality to another, from one individual to another. The various health problems associated with environmental change must be studied in tandem with the social psychology of each community and must also be clearly situated within the historical context of each localized population group. Only with an overall multi-faceted approach can we even hope to truly understand the mechanisms at work in the man-environment relationship that so clearly impinge on a community's health status.

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