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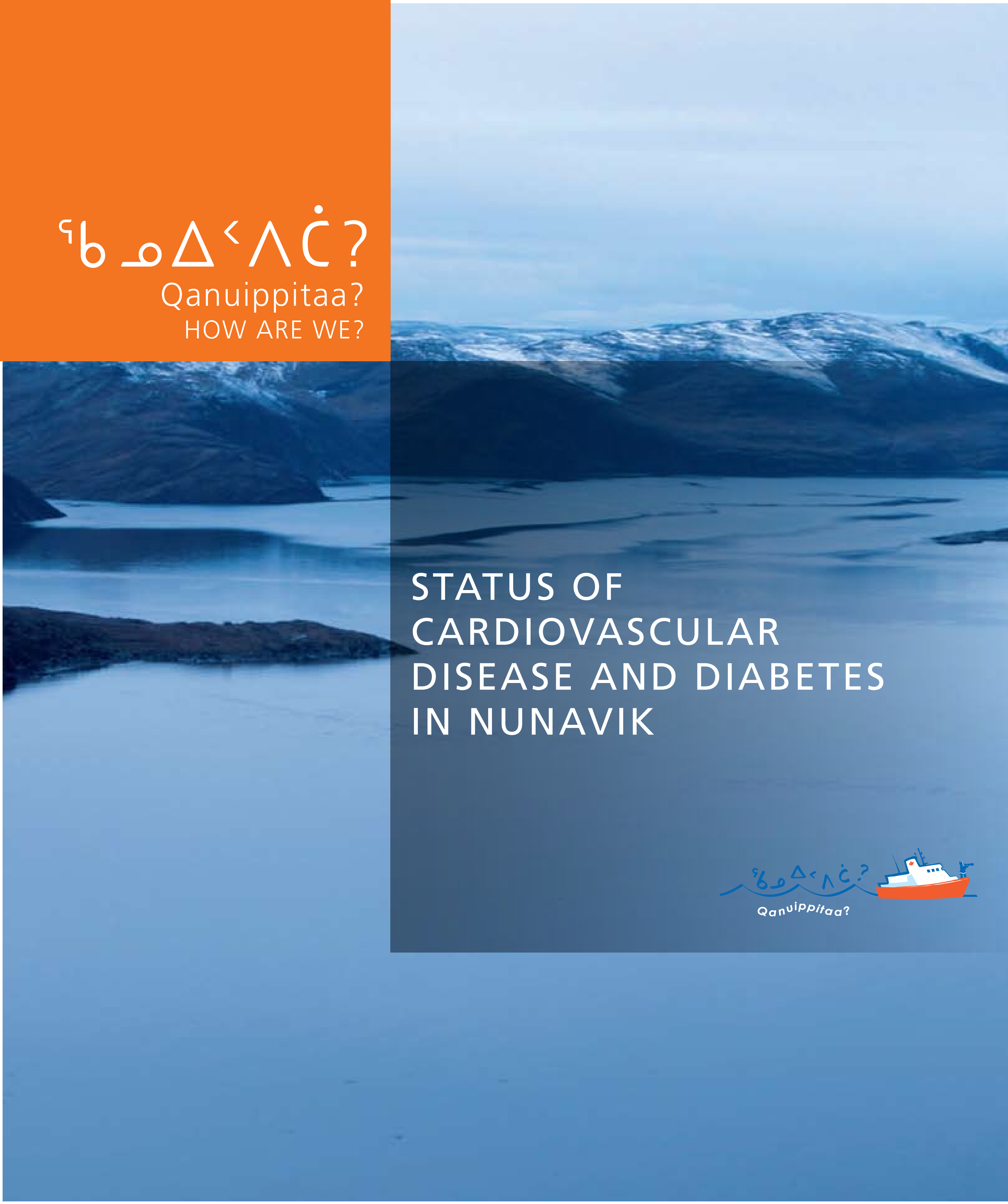

STATUS OF CARDIOVASCULAR DISEASE AND DIABETES IN NUNAVIK

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STATUS OF CARDIOVASCULAR DISEASE AND DIABETES IN NUNAVIK

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BACKGROUND OF THE NUNAVIK INUIT HEALTH SURVEY

The monitoring of population health and its determinants is essential for the development of effective health prevention and promotion programs. More specifically, monitoring must provide an overall picture of a population's health, verify health trends and how health indicators vary over distance and time, detect emerging problems, identify priority problems, and develop possible health programs and services that meet the needs of the population studied.

The extensive survey conducted by Santé Québec in Nunavik in 1992 provided information on the health status of the Nunavik population (Santé Québec, 1994). The survey showed that health patterns of the population were in transition and reflected important lifestyle changes. Effectively, the Inuit population has undergone profound sociocultural, economic, and environmental changes over the last few decades. The Inuit have changed their living habits as contact with more southerly regions of Quebec increased. A sedentary lifestyle, the switch to a cash-based domestic economy, the modernization of living conditions and the increasing availability and accessibility of goods and foodstuffs imported from southern regions have contributed to these changes. These observations suggest the need for periodic monitoring of health endpoints of Nunavik Inuit to prevent the negative impact of risk factor emergence and lifestyle changes on subsequent morbidity and mortality from major chronic diseases.

In 2003, the Nunavik Regional Board of Health and Social Services (NRBHSS) decided to organize an extensive health survey in Nunavik in order to verify the evolution of health status and risk factors in the population. The NRBHSS and the Ministère de la Santé et des Services sociaux (MSSS) du Québec entrusted the Institut national de santé publique du Québec (INSPQ) with planning, administering and coordinating the survey. The INSPQ prepared the survey in close collaboration with the Unité de recherche en santé publique (URSP) of the Centre hospitalier universitaire de Québec (CHUQ) for the scientific and logistical component of the survey. The Institut de la statistique du Québec (ISQ) participated in methodology development, in particular the survey design.

The general aim of the survey was to gather social and health information on a set of themes including various health indicators, physical measurements, and social, environmental and living conditions, thus permitting a thorough update of the health and well-being profile of the Inuit population of Nunavik. The survey was designed to permit a comparison of the 2004 trends with those observed in 1992. Data collected in 2004 also allowed researchers to compare the Inuit to other Quebecers.

Target population

The health survey was conducted among the Inuit population of Nunavik from August 27 to October 1, 2004. According to the 2001 Canadian census, the fourteen communities of Nunavik have a total of 9632 inhabitants, 91% of whom identified themselves as Inuit. The target population of the survey was permanent residents of Nunavik, excluding residents of collective dwellings and households in which there were no Inuit aged 18 years old or older.

Data collection

Data collection was performed on the Canadian Coast Guard Ship Amundsen, thanks to a grant obtained from the Canadian Foundation for Innovation (CFI) and the Network of Centres of Excellence of Canada (ArcticNet). The ship visited the fourteen villages of Nunavik, which are coastal villages. The study was based on self-administered and interviewer-completed questionnaires. The study also involved physical and biological measurements including clinical tests. The survey was approved by the Comité d'éthique de la recherche de l'Université Laval (CERUL) and the Comité d'éthique de santé publique du Québec (CESP). Participation was voluntary and participants were asked to give their written consent before completing interviews and clinical tests. A total of 677 private Inuit households were visited by interviewers who met the household respondents to complete the identification chart and the household questionnaire. A respondent was defined as an Inuit adult able to provide information regarding every member of the household. The identification chart allowed demographic information to be collected on every member of the household. The household questionnaire served to collect information on housing, environment, nutrition and certain health indicators especially regarding young children.

All individuals aged 15 or older belonging to the same household were invited to meet survey staff a few days later, on a Canadian Coast Guard ship, to respond to an interviewer-completed questionnaire (individual questionnaire) as well as a self-administered confidential questionnaire. Participants from 18 to 74 years of age were also asked to complete a food frequency questionnaire and a 24-hour dietary recall, and to participate in a clinical session. The individual questionnaire aimed to collect general health information on subjects such as health perceptions, women's health, living habits and social support. The confidential questionnaire dealt with more sensitive issues such as suicide, drugs, violence and sexuality. During the clinical session, participants were invited to answer a nurse-completed questionnaire regarding their health status. Then, participants had a blood sample taken and physical measurements were performed including a hearing test, anthropometric measurements, an oral glucose tolerance test (excluding diabetics) and toenail sampling. Women from 35 to 74 years of age were invited to have a bone densitometry test. Finally, participants aged 40 to 74 could have, after consenting, an arteriosclerosis screening test as well as a continuous measure of cardiac rhythm for a two-hour period.

Survey sampling and participation

The survey used a stratified random sampling of private Inuit households. The community was the only stratification variable used. This stratification allowed a standard representation of the target population. Among the 677 households visited by the interviewers, 521 agreed to participate in the survey. The household response rate is thus 77.8%. The individual response rates are obtained by multiplying the household participating rate by the individual collaboration rate since the household and individual instruments were administered in sequence. The collaboration rate corresponds to the proportion of eligible individuals who agreed to participate among the 521 participating households. In this survey, about two thirds of individuals accepted to participate for a response rate in the area of 50% for most of the collection instruments used in the survey. A total of 1056 individuals signed a consent form and had at least one test or completed one questionnaire. Among them, 1006 individuals answered the individual questionnaire, 969 answered the confidential questionnaire, 925 participated in the clinical session, 821 had a hearing test, 778 answered the food frequency questionnaire, 664 answered the 24-hour dietary recall, 282 had an arteriosclerosis test, 211 had a continuous measure of their cardiac rhythm for a two-hour period and 207 had a bone densitometry test. More details on the data processing are given in the Methodological Report.

INTRODUCTION[1]

Until the 1950s the Inuit were considered geographically isolated. Effectively, before the Second World War, the majority of the Inuit in Alaska, Canada, and Greenland lived mainly according to a traditional lifestyle, which was based on subsistence activities such as hunting and fishing (Duhaime, 1989 & 1991; Pars et al., 2001; Proulx, 1994). These activities involved vigorous physical activity and high dietary intake of marine mammals and fish. Studies conducted during the 1960s and 1970s suggested that the Inuit appeared to have been spared from the diabetes epidemic experienced by many North American Indian groups (Bjerregaard & Young, 1998; Mouratoff & Scott, 1967; Mouratoff & Scott, 1973; Sagild et al., 1966; Scott & Griffith, 1957).

Because of the rapid social transition subsequent to the improvement of communication and transportation with southern regions, and with the settlement of Inuit populations into permanent communities, a shift away from traditional lifestyles and diet was observed in these populations (Bjerregaard & Curtis, 2002; Blanchet et al., 2002; Hodgins, 1997; Kuhnlein & Receveur, 1996; Labbé, 1987; Nobmann et al., 1992; Pars et al., 2001). This abandonment of traditional lifestyles and diet has been associated with an increased prevalence of cardiovascular diseases (CVD) risk factors such as obesity, high blood pressure and elevated blood lipids (Adler et al., 1994; Bjerregaard & Young, 1998; Mouratoff & Scott, 1967; Mouratoff & Scott, 1973; Murphy et al., 1995; Sagild et al., 1966; Scott & Griffith, 1957).

However, despite the above-mentioned unfavourable observations, mortality and morbidity rates for Ischemic Heart Disease (IHD) are still lower in Inuit populations than in southern populations, probably reflecting protective lifestyle factors still in operation to some degree (Blanchet et al., 2000; Cote et al., 2004; Dewailly et al., 2003) and possibly a lower genetic susceptibility (Bjerregaard et al., 1997; Dewailly et al., 2001; Hegele et al., 1997a; Hegele et al., 1997b; Middaugh, 1990; Schraer et al., 1997). For instance, from 1987 to 1996, the mortality rate (per 100,000 person-years) from IHD was

[1] For ease of readability, the expression "Inuit" is used throughout the theme paper to define the population under study even though a small percentage of individuals surveyed identified themselves as non-Inuit. Refer to "Background of the Health Survey" for further details regarding the definition of the target population.

72.3 in Nunavik compared to 153.5 for Quebec as a whole. Furthermore, for the same period, the mortality rate from myocardial infarction was 24.2 in Nunavik, compared to 92.7 for Quebec (NRBHSS, 2003). Similar low rates have also been reported for the Inuit in Greenland, Alaska and the Northwest Territories (Bjerregaard & Young, 1998; Middaugh, 1990; Young et al., 1993). Nevertheless, recent mortality statistics and clinical observations suggest that ischemic heart disease and diabetes are on the increase in all these Inuit populations (Bjerregaard et al., 1997; Moffat & Young, 1994; Santé Québec, 1994; Schaeffer et al., 1996; Schraer et al., 1997; Adler et al., 1994; Bjerregaard et al., 2003; Cervenakova et al., 2002; Murphy et al., 1995).

In 1992, Santé Québec conducted a health survey among the Inuit population of Nunavik. The main conclusions of this study related to CVD and their risk factors were: 1) CVD risk factors seemed less prevalent in the Inuit population than among other Quebecers except for obesity and smoking (estimated at 19% and 73% respectively) (Blanchet et al., 1992); 2) the prevalence of hypertension was low in the Inuit population in general (Bjerregaard et al., 2003); 3) the lipid blood profile of the Inuit was better than that of Quebecers. Because the data did not permit a definitive conclusion on the prevalence of diabetes among the Inuit, researchers suggested a closer surveillance of diabetes in individuals aged 45 years and over.

Since the Inuit are exposed to potentially pro-oxidative (mercury, PCBs) and anti-oxidative (omega-3, selenium, polyphenols such as flavonoids) substances through their diet, a cross-sectional study was conducted in Salluit in 2001 to evaluate the oxidative status of 95 randomly selected participants. It was reported that insulin concentration was higher than the level found in 1992 (104 vs. 58.7 pmol/L in 1992), which was partially explained by the proportion of older women in the study. Also, among overweight participants, high blood glucose was found in high fish consumers possibly due to deleterious interactions between concomitant intakes of refined carbohydrates and omega-3 (Bélanger et al., 2004). However, even in obese participants, metabolic, oxidative and inflammatory markers were normal (Bélanger et al., 2006).

In light of other results on changes in eating habits, notably the reduction of highly nutritional, traditional food intake and the rising consumption of commercial foods high in refined carbohydrates, saturated and trans fatty acids, researchers stressed the need for better surveillance and prevention of CVD and related risk factors. Nunavik public health authorities had no general health information on the global health status of its population more recent than the 1992 survey; thus, an update was requested. Consequently, the main goal of this 2004 health study was to allow comparison with the cardiovascular health status of the Nunavik population measured in 1992 and to evaluate health promotion and prevention programs.

In relation to cardiovascular and diabetes conditions, the 2004 Nunavik Inuit Health Survey pursued the following objectives: 1) to determine the prevalence of CVD and diabetes as well as their risk factors; 2) to estimate the evolution of these health outcomes since 1992. This report presents the main results obtained during the survey.

METHODOLOGICAL ASPECTS

The data analyzed in this study was collected over a period of five weeks at the end of the summer of 2004. For this health survey, 925 subjects aged 18 to 74 were recruited for tests involving physical and biological measurements and to respond to a clinical questionnaire. The clinical questionnaire provided information on personal and family medical history (CVD, cancer and associated risk factors). During the clinical session, physiological and anthropometric measurements were taken, such as blood sampling (for lipid profile, insulin and glycaemia analyses), blood pressure, height, weight, hip circumference, etc. All interviews, clinical tests and anthropometric measurements were conducted according to standardized protocols.

LABORATORY ANALYSES

Anthropometric measurements (weight/height/hip) and blood pressure

Height was measured using a rigid square measuring tape with the participant standing barefoot on a hard surface up against a wall. Weight was measured on a beam scale. Waist size was measured after exhalation with the tape horizontal to where the abdomen curves in. If a subject's waist was not sufficiently defined, he or she was measured at roughly the location of the last floating rib. Hip circumference was measured by placing the measuring tape horizontal to the hips at the pubic symphysis and the most prominent part of the buttocks. The measures were recorded to the nearest centimetre. The mean of the four measurements was used for statistical analyses. Anthropometrical measurements were transformed into Body Mass Indices (BMI: kg/m^2) and into standardized Body Mass Indices (BMI_{std}: kg/m^2). A BMI_{std} value is based on the BMI corrected by the Cormic Index (Collins et al., 2000) and is used in our analysis because it better corresponds with the corpulence of the Inuit population (Charbonneau-Roberts et al., 2005). However, the BMI value was used for comparison with the 1992 health survey. We used international cutoffs to evaluate obesity in the population (BMI ≥ 30) (Kuczmarski & Flegal, 2000). Abdominal obesity was defined by the waist-to-hip ratio (W/H ≥ 1.00 in men, and W/H ≥ 0.85 in women).

Blood pressure was taken according to the Canadian Coalition for High Blood Pressure technique using mercury sphygmomanometers, 15-inch stethoscopes, and cuffs sized to the subjects' arms. Prior to having their blood pressure taken, subjects must have rested for five minutes and not eaten or smoked for at least thirty minutes. Each subject had three blood pressure readings. The mean blood pressure was calculated using the last two measurements.

Biological parameters

Nearly 60 ml of blood was taken from each participant. After centrifugation, all tubes were labelled and stored in -80°C freezers on the ship. They were then sent to the Centre Hospitalier de l'Université Laval (CHUL), where they were analyzed for total cholesterol, HDL cholesterol, LDL cholesterol, triacylglycerols (triglycerides), glucose and insulin. Other parameters, such as inflammation and oxidation are not reported in the present document since they were part of a companion research program conducted by Dr. Dewailly and his collaborators (Cohort study entitled, "The Inuit Health in Transition Study: the Nunavik Health Study"). Omega-3 blood concentrations will be reported in another theme paper from the Nunavik Inuit Health Survey 2004.

Biochemical analyses were performed using a Hitachi 917 autoanalyzer and reagents from Roche Diagnostics. Plasma analysis assessed fasting glucose levels (reference value: 3.6-5.8 mmol/L), total cholesterol, and triglycerides. HDL cholesterol was measured directly by selectively inhibiting reaction with other lipoproteins. LDL cholesterol was calculated using the Friedwald formula. Target values for individuals at high risk of cardiovascular disease are ≥ 6.2 mmol/L for total cholesterol, ≥ 5.0 for cholesterol/HDL ratio, ≤ 0.9 mmol/L for HDL cholesterol, ≥ 3.4 mmol/L for LDL cholesterol, and triglyceride values of ≥ 2.3 mmol/L.

Plasma insulin levels were measured using the Elecsys-2010 system from Roche. Reference values are 0-150 pmol/L for insulin.

Atherosclerosis

Atherosclerosis was measured by carotid ultrasound examination on a subgroup of subjects aged 40 to 74 years (n = 282). Carotid intima-media thickness (IMT) is the best assessment of sub-clinical atherosclerosis and was measured by a portable non-invasive ultrasound technique on twelve segments: two each of internal, external and common carotids, left and right sides. Carotid IMT was performed using a GE Logiq Book. Images were stored on disks and interpreted by Dr. Lonn at McMaster University.

Definitions of cardiovascular diseases and diabetes

In this study, cardiovascular diseases (CVD) were evaluated using two complementary methods: 1) a clinical questionnaire on self-reported CVD problems (reported to be diagnosed by a physician or a nurse); 2) by carotid ultrasonography to measure atherosclerosis, blood pressure, blood lipids and diabetes markers during the clinical session.

Diabetes was evaluated in the following ways: 1) self-reported diabetes was measured during the clinical questionnaire by asking the participants if a physician or a nurse ever told them that they were diabetic; 2) by blood analysis (blood collection during the clinical session). Participants were advised to fast for at least eight hours prior to blood sampling. Diabetes diagnosis was defined according to the Canadian Diabetes Association's cut-off levels. An Oral Glucose Tolerance Test (OGTT) 75g was also performed on a non representative sub-sample of solely non-diabetic, non-pregnant participants under fasting conditions (n = 166).

STATISTICAL ANALYSES

The analyses reported here are descriptive according to the categories of the various variables including socio-demographics, lifestyle habits and anthropometric variables. All data were weighted in order for estimations generated from the survey data to be representative of the entire population under study and not just the sample itself. Arithmetic means were calculated for normally distributed variables and geometric means were considered for variables with a log-normal distribution. Variance analysis allowed us to compare means or geometric means; the Chi-square test with a correction for design effect was used to compare proportions. Statistical analyses for comparisons have been conducted at a threshold of $\alpha = 0.05$.

Some comparisons have been made with results obtained during the 1992 Santé Québec survey where the questions asked are comparable. Given the sampling procedures in the different surveys, these comparisons include an adjustment in proportions or rates to take into account the change in the population's age structure. This adjustment is made on a five-year age-group basis using Statistics Canada 2001 census data for Nunavik as the reference population. However, only raw data is reported in the text and tables to avoid any possible confusion with adjusted proportions. Moreover, the comparisons with other surveys also included an adjustment for survey design (Aguirre-Torres, 1994).

The Nunavik territory has been divided into geographical sectors according to the proportion of Inuit living in each community according to the 2001 census. This distribution allowed for measurement of the influence of place of residence on lifestyle. The villages with a proportion of Inuit above 93% are Umiujaq, Akulivik, Ivujivik, Salluit, Kangiqsujuaq, Quaqtaq, Kangirsuk, Aupaluk, Tasiujaq and Kangiqsualujjuaq while the villages with a proportion of Inuit between 80% and 92% include Kuujjuarapik, Inukjuak, Puvirnituq and Kuujjuaq.

Accuracy of estimates

The data used in this study comes from a sample and is thus subject to a certain degree of error. The coefficient of variation (CV) has been used to quantify the accuracy of estimates and the Statistics Canada scale was used to qualify the accuracy of estimates. The presence of an "E" footnote next to an estimate indicates a marginal estimate (CV between 16.6% and 33.3%). Estimates with unreliable levels of accuracy (CV > 33.3%) are not presented and have been replaced by the letter "F".

Scope and limitations of the data

A very low response rate of 10% was observed for the Oral Glucose Tolerance Test (OGTT). This response rate does not permit application of sample weights since an insufficient proportion of the population is represented. Results of the test cannot therefore be inferred to the Nunavik population and should be used solely for information purposes.

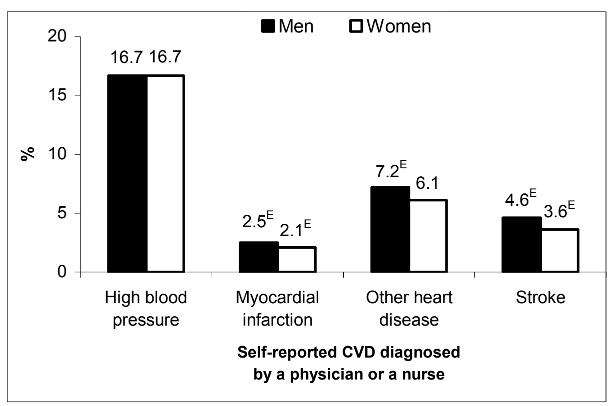
RESULTS

I. CARDIOVASCULAR DISEASE

Prevalence of self-reported cardiovascular disease

Figure 1 presents the frequencies of self-reported CVD. The main self-reported CVD was high blood pressure. Close to 17% of participants declared suffering from hypertension. Cerebrovascular disease appeared in the second position with a frequency of 4.1%, and other self-reported CVD are recorded with a frequency of 6.7%. For coronary heart disease (CHD) such as myocardial infraction, the self-reported frequency was low and was reported to be 2.3%^{E}. There was no difference in these various frequencies according to gender. Because of the low number of declared events, no conclusions could be drawn between parental history and self-reported CVD except for self-reported high blood pressure, which was positively associated with heredity. In the clinical questionnaire, 7.9% of participants reported having high cholesterol.

Figure 1
Frequencies of self-reported CDV diagnosed by a physician or a nurse, stratified by sex (%), population aged 18 to 74 years, Nunavik, 2004



E Interpret with caution.
Source: Nunavik Inuit Health Survey 2004.

Given the frequencies presented above, we could not perform conventional comparisons with the 1992 Santé Québec survey since the questions in the two surveys were not similar. However, self-reported prevalence of some CVD problems seems to have increased since 1992. For example, in 1992, only 5.2% of participants reported hypertension problems during the two weeks preceding the interview compared with 16.7% in 2004 who reported having suffered from hypertension in their lifetime.

Atherosclerosis

For atherosclerosis, among men, the arithmetic mean maximum carotid artery intimal-medial thickness (mmIMT) was 0.75 (geometric 0.71) mm (arithmetic mean CI at 95%: [0.71-0.79]), and among women, the arithmetic mmIMT was 0.65 (geometric 0.62) mm (arithmetic mean CI at 95%: [0.62-0.68]). Adjusted for age distribution, the mmIMT was significantly lower in women ($p < 0.0001$). Moreover, mmIMT increased significantly with age in the entire group ($p < 0.0001$) as well as in each gender ($p < 0.0001$). In our analysis, main determinants of atherosclerosis were age, sex, hypertension, BMI and diabetes (Table 1). But, IMT was not associated with total cholesterol, LDL or HDL cholesterol. For smoking habits, results showed an inverse relationship ($p < 0.001$) related to the fact that in this sample, smokers are mainly young people and non-smokers are older individuals. Since atherosclerosis was not measured in 1992, comparisons were not possible.

Table 1
Mean maximum carotid artery intimal-medial thickness (mm), arithmetic mean by sex according to various determinants, population aged 40 to 74 years, Nunavik, 2004

	Overall		Men		Women	
	Mean	SD	Mean	SD	Mean	SD
BMI						
15-24.9	0.65	0.02	0.68	0.04	0.62	0.02
25-29.9	0.74	0.03	0.78	0.04	0.69	0.04
30-49	0.71	0.02	0.79	0.03	0.64	0.02
Age group						
40-44 years	0.56	0.01	0.59	0.02	0.53	0.01
45-54 years	0.63	0.02	0.67	0.03	0.59	0.01
55-74 years	0.88	0.02	0.93	0.03	0.81	0.03
Fasting glucose						
Normal (< 6.1)	0.70	0.01	0.74	0.02	0.63	0.02
At risk (6.1-6.9)	0.63	0.05	0.73	0.07	0.51	0.04
Diabetes mellitus (≥ 7.0[a])	0.83	0.05	0.95	0.10	0.77	0.05

SD Standard deviation.

[a] Fasting glucose ≥ 7 plus people taking medication for diabetes.

Source: Nunavik Inuit Health Survey 2004.

Risk factor 1: blood pressure

High blood pressure (HBP) was evaluated during the clinical session. An individual was defined as having HBP if his/her measured blood pressure was at least 140/90 mmHg or if the respondent stated he/she was taking pills, following a diet or any other treatment for high blood pressure. The study revealed that HBP occurred among 17.3% of the population. We observed that the prevalence of HBP increased linearly with BMI ($p < 0.0001$) and age ($p < 0.0001$). The prevalence of HBP was higher among people with abdominal obesity (23.2%) compared to others (13.7%) but HBP was not related to gender ($p = 0.09$).

Self-reported HBP data from 1992 are not comparable with data from 2004 since the HBP estimates in 1992 come from the household questionnaire. However, blood pressure was taken in both surveys and can be compared. Results indicate that the prevalence of both abnormally high diastolic and systolic blood pressure seem to have increased significantly between 1992 and 2004. The prevalence of high systolic blood pressure (≥ 140 mmHg) was 8.9% in 2004, an increase of about 4% compared to the rate observed in 1992 (4.6%[E]; $p = 0.002$). A comparison of high diastolic blood pressure (≥ 90 mmHg) shows an increase of 3% between the two surveys (4.5%[E] vs. 7.6% in 2004; $p = 0.03$). The proportion of individuals with blood pressure levels of at least 140/90 mmHg varied from 6.0% in 1992 to 11.9% in 2004 ($p < 0.001$). Comparisons of means show a significant increase of systolic pressure (111.9 vs. 118.7 in 2004; $p < 0.001$) but no variations for diastolic pressure (73.1 vs. 74.0 in 2004; $p = 0.08$).

Risk factor 2: blood lipids

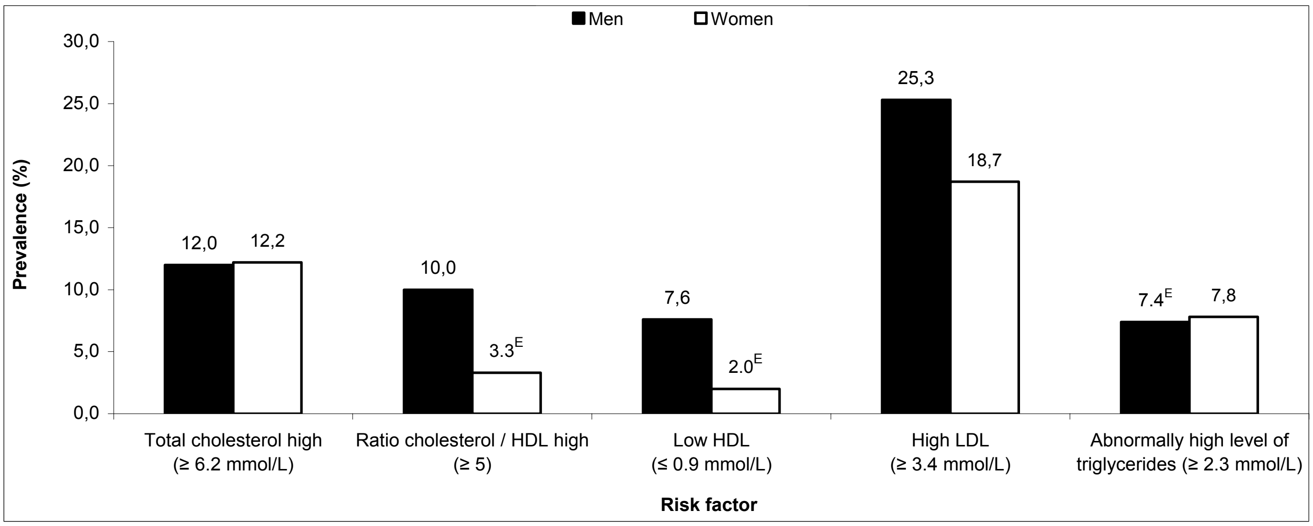
The prevalence of high total cholesterol (≥ 6.2 mmol/L) was 12.1% among adults. This prevalence was not associated with gender ($p = 0.90$) or obesity ($p = 0.34$). However, as presented in Table A1 (Appendix), the total cholesterol mean level was positively associated with age ($p < 0.001$). Similar positive associations were observed for other blood lipid mean concentrations, such as total cholesterol/HDL ratio ($p = 0.009$), HDL ($p < 0.001$), LDL ($p < 0.001$) and triglycerides ($p = 0.002$).

As presented in Figure 2 for gender, the prevalence of a high total cholesterol/HDL ratio (≥ 5.0) was significantly different between men and women (10.0% in men and 3.3%[E] in women, $p < 0.001$), and higher in obese people

(13.6% in obese vs. 3.9%[E] in non-obese, $p < 0.001$). The prevalence of low HDL (≤ 0.9 mmol/L) varied between genders (7.6% in men and only 2.0%[E] in women, $p = 0.01$) and by weight (9.8%[E] in obese vs. 2.3%[E] in non-obese people, $p < 0.001$) but not with age ($p = 0.49$). The prevalence of high LDL (≥ 3.4 mmol/L) was significantly different between genders (25.3% in men and 18.7% in women, $p < 0.01$), higher in obese people (36.5% in obese vs. 16.9% in non-obese, $p < 0.001$), and associated with age ($p < 0.001$). The prevalence of a high level of triglycerides (≥ 2.3 mmol/L) was higher in obese people (14.0% in obese vs. 3.3%[E] in non-obese, $p < 0.001$) but was not different between genders (7.4%[E] in men and 7.8% in women, $p = 0.83$). It was not different according to the standardized BMI.

Figure 2

Blood lipid profile by sex (prevalence of abnormal concentrations of each lipid parameter) (%), population aged 18 to 74 years, Nunavik, 2004



E Interpret with caution.

Source: Nunavik Inuit Health Survey 2004.

As blood lipid analytical methods were not similar in 1992 and 2004, comparisons between the two surveys are not possible. However, as suggested by results of the 1992 health survey, the blood lipid profile is still satisfactory.

Discussion on cardiovascular disease and risk factors

Cardiovascular results obtained during this health survey are in some way contradictory with satisfactory results observed in some risk factors (lipid profiles) and deteriorations in others (high blood pressure in general). Indeed, an increase of CVD prevalence triggered by an increase in the prevalence of some risk factors seemed to be verified, at least in the case of hypertension with an increase of nearly 6% since 1992 (from 6.0% to 11.9%).

Although it is difficult to compare self-reported conditions with those of surveys from other regions or countries, in general, self-reported CVD frequencies obtained here seem similar to those obtained in other Canadian Aboriginal populations for strokes (5%) and similar to Canadian Caucasians for myocardial infarctions (2%) (Anand et al., 2001).

In 1992, results showed that the blood lipid profiles of Inuit from Nunavik were healthier than those of Quebecers (Blanchet et al., 1992). However, with the expected increase in consumption of westernized food, researchers predicted a deterioration of the blood lipid profile. Twelve years later, there was no worsening of most of these CVD risk factors. Most of them were still low and others were unchanged. This is particularly good news as we are confident that these results are not due to selection bias (populations not comparable).

For atherosclerosis, given the current low mortality rate, lower mmIMT was expected in the Nunavik Inuit population compared to other Canadian Aboriginal populations who participated in a similar study (same equipment). This was clearly observed for both men and women aged 46-55 years [mmIMT mean (SD) in mm Inuit vs. other Aboriginal populations: Women 0.60 (0.01) vs. 0.71 (0.1); Men: 0.71 (0.03) vs. 0.78 (0.2)] (Anand et al., 2001). However, 12% of the population showed a mmIMT equal or higher than 1 mm. Available epidemiological studies indicate that increased IMT (at or above 1 mm) represents a high risk of myocardial infarction and/or cerebrovascular disease (Simon et al., 2002). In light of these results, we are reassured that the Nunavik Inuit are relatively well-protected against atherosclerosis. However, with the increase of risk factors such as the rates of smoking, glucose intolerance, obesity in general and abdominal obesity, we could expect an increase in the percentage of the population at risk for CVD events.

Whereas some modifiable factors such as blood lipid profiles showed the same satisfactory level since 1992, similar enthusiastic conclusions cannot be drawn for other modifiable factors such as tobacco smoking as detailed in another leaflet, and diabetes, obesity and insulin resistance as presented below.

II. Diabetes

Prevalence of diabetes

In the population as a whole, 5.5% of participants reported knowing they suffer from diabetes because a health worker told them they were diabetic. Through blood sampling, we found that only 2.4%[E] of the population had a fasting glucose of 7 mmol/L or higher. To this prevalence of newly screened diabetics, we added people who declared they take medication for diabetes (but have normal blood glucose due to treatment), which increased the prevalence to 4.8%. Given the detection of a significant agreement between the evaluation of diabetes by questionnaire and the measure based on blood glucose measurement (plus participants taking medication) (kappa = 0.73, CI 95%: 0.63-0.82), we decided to use the second, more objective measure to estimate the prevalence of diabetes.

The prevalence of diabetes is significantly higher in women (p = 0.004). We detected 3.4% of participants with impaired fasting glucose (glycaemia level between 6.1-6.9 mmol/L), and hyperinsulinemia under fasting conditions was detected in 12.7% of participants. The prevalence of hyperinsulinemia was higher in women (15.2%) than in men (10.2%). This proportion was significantly different (p = 0.03). None of the 27 pregnant women had a fasting glucose result above the 5.3 mmol/L level of concern. Among people who did the OGTT, 12.0% were diagnosed with diabetes (≥ 11 mmol/L) or showed pre-diabetes (7.8 to 11 mmol/L). These two categories, which are normally separate, have been collapsed because of the small number. These results are presented in Table 2.

Table 2
Prevalence of diabetes, glucose and insulin status by sex, population aged 18 to 74 years, Nunavik, 2004

Variables	Total	Men	Women
Diabetes (yes)[a]	4.8	3.0[E]	6.6
Fasting glucose			
Normal (< 6.1 mmol/L)	91.8	93.9	89.7
IFBG (6.1-6.9 mmol/L)	3.4	3.2[E]	3.7[E]
DM (≥ 7.0 mmol/L[a])	4.8	3.0[E]	6.6
OGTT[b]			
Normal (< 7.75 mmol/L)	88.0	91.6	84.3
IGT or DM (≥ 7.8 mmol/L)	12.0	8.4	15.7
Glycaemia			
Abnormally high (> 5.8 mmol/L)	7.7	6.4[E]	9.0
Hyperinsulinemia[c]			
(> 90 pmol/L)	12.7	10.2	15.2

DM Diabetes mellitus; IFBG Impaired fasting blood glucose; IGT Impaired glucose tolerance.

[a] Fasting glucose ≥ 7 plus people taking medication for diabetes, impaired fasting blood glucose (IFBG), impaired glucose tolerance (IGT).

[b] Non-weighted analysis.

[c] Restricted to participants who have not eaten for at least six hours.

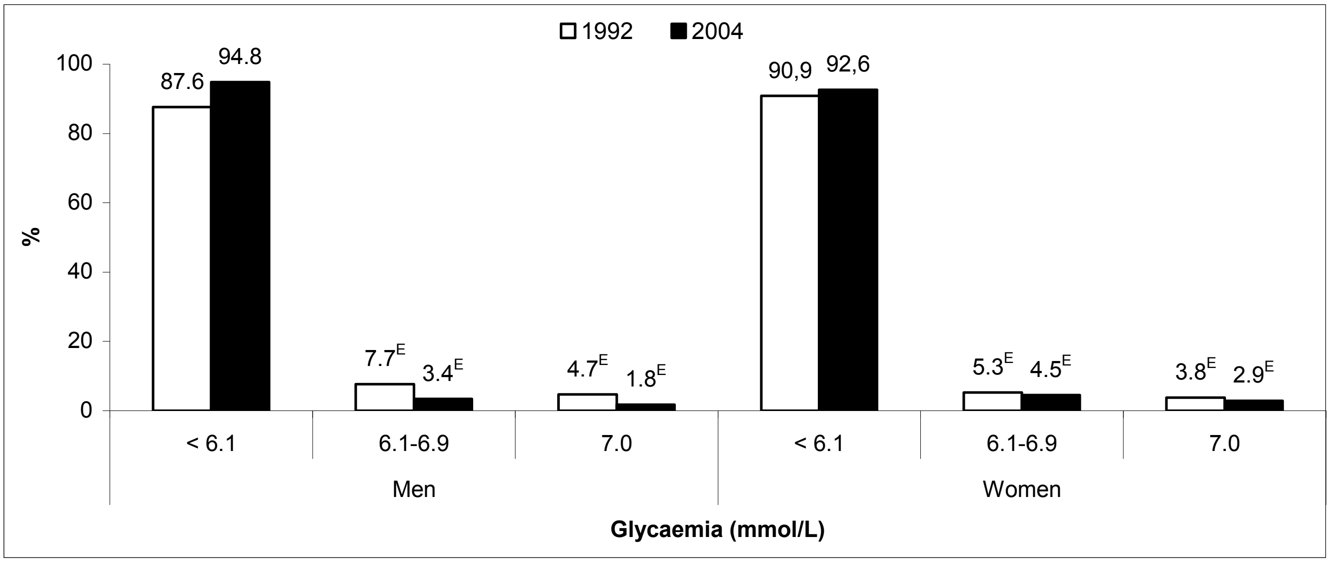
E Interpret with caution.

Source: Nunavik Inuit Health Survey 2004.

Evolution 1992-2004

Since 1992, glycaemia and insulinemia have significantly improved in the population (p < 0.001 adjusted for gender and age distribution). For glycaemia, levels significantly decreased in both genders (men: mean 5.3 (CI 95% [5.1-5.4]) in 1992 vs. mean 4.6 (CI 95% [4.5-4.7]) in 2004; women: mean 5.2 (CI 95% [5.0-5.3]) in 1992 vs. mean 4.6 (CI 95% [4.5-4.6]) in 2004). However, the situation varied according to different diabetes categories as seen in Figure 3. Indeed, in men, the proportion of those with a normal value for glycaemia had increased since 1992, with a decreasing trend observed for the

Figure 3
Comparison of glycaemia results stratified by sex (%), population aged 18 to 74 years, Nunavik, 1992 and 2004

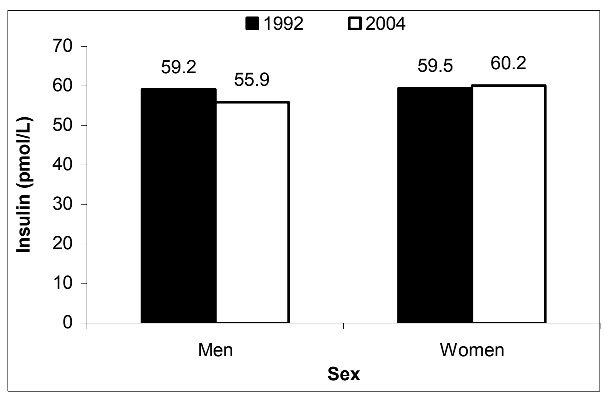


P-values: men p < 0.01; women p = 0.53.
E Interpret with caution.
Sources: Nunavik Inuit Health Survey 2004 and Santé Québec survey 1992.

proportion of those with impaired glucose tolerance (6.1-6.9 mmol/L) and with values compatible with diabetes although not significant. However, among women, none of the proportions changed significantly between 1992 and 2004.

Plasma insulin concentrations in 1992 and 2004 were respectively 59.2 and 55.9 pmol/L in men, with a non-significant decrease observed within that period (Figure 4). In women, insulin concentration increased from 59.5 to 60.2 pmol/L, and this difference was statistically significant. The prevalence of hyperinsulinemia has tended to decrease in the entire population (15.5% vs. 12.7%) since 1992, but the difference was not statistically significant (p = 0.17). This difference was attributable to the male population (16.5%[E] vs. 10.2%, p = 0.03) and was not seen among women (14.4% vs. 15.2%, p = 0.82).

Figure 4
Comparison of insulin concentration[a] under fasting conditions[b], means (pmol/L), stratified by sex, population aged 18 to 74 years, Nunavik, 1992 and 2004



[a] For statistical comparison, insulin levels were log-transformed. The graph presents normal values for reading convenience only.
[b] Restricted to participants who have not eaten for at least six hours.
P-values: men p = 0.15; women p = 0.009
Sources: Nunavik Inuit Health Survey 2004 and Santé Québec survey 1992.

Diabetes risk factors

Prevalence

No association was observed between diabetes and pulse (p =0.90), ethnic origin (p = 0.61), total personal income (p = 0.32) or geographical sectors (p = 0.34). However, diabetes was associated with level of education[2] (highest prevalence among people with the lowest level of education) and gender (higher in women) (p < 0.01). For insulinemia, an increase of the geometric mean was observed according to the BMI (p < 0.001).

The great majority of diabetics in this study were obese (64.8%) and an additional 23.4% of diabetics were overweight. In the Inuit population, the prevalence of obesity defined by the standardized BMI is 19.4% and abdominal obesity is 38.9%. This risk factor essentially affects women as 70.8% of them showed abdominal obesity compared to 9.9% among men. While fat mass is higher in women (means: 22.3 kg vs. 16.6 kg), we observed that fat-free mass is higher in men (57.6 kg vs. 43.5 kg). Moreover, we observed that the BMI increased with age (p < 0.001) in both genders. As for diabetes, the BMI was inversely associated with income (p < 0.0001) but no association was found with geographical sectors.

Evolution of diabetes risk factors

Abdominal obesity has changed in the population since 1992 (p < 0.0001) with an increase from 29.2% to 38.9%. This is mainly due to the proportion of women with abdominal obesity, which increased significantly by 31% between 1992 and 2004 (p < 0.0001). In men, the proportion of obesity did not change (p = 0.58) (Table 3). Similarly, population distribution throughout the BMI strata has also significantly changed (p < 0.0001). This situation seems to correspond to a shift in the overweight population to the status of obesity.

[2] In terms of the education variable, it is important to specify that the choice of answers for post-secondary training were not well adapted to the context of the survey's target population. The answers given for this category reveal that there was likely confusion during data collection between training that requires a post-secondary diploma and training that does not (e.g. driver's license, fishing license, etc). Therefore, the number of people with post-secondary education was likely overestimated.

Table 3
Comparison of weight indicators between health surveys (%), population aged 18 to 74 years, Nunavik, 1992 and 2004

	1992	2004	P-value
BMI (kg/m^2)[a]			
< 25	39.7	42.0	0.29
25-29.9	41.3	29.8	< 0.0001
30-49	19.0	28.3	< 0.0001
Abdominal obesity[b]			
Men	8.2[E]	9.9	0.58
Women [a]	54.2	70.8	< 0.0001

[a] Excluding pregnant women.
[b] Dimensionless.
E Interpret with caution.
Sources: Nunavik Inuit Health Survey 2004 and Santé Québec survey 1992.

Discussion on diabetes

In 1992, 8% of Inuit participants in the health survey reported they had diabetes and 2% glycaemia levels compatible with a diabetes diagnosis (Blanchet et al., 1992). Twelve years later, we found a similar prevalence of diabetes (2.4% according to fasting glucose measurement) for a global prevalence in Nunavik estimated at approximately 5%. This prevalence is comparable to values observed in the rest of Canada (4.8% in people aged 20 and over) (Centre for Chronic Disease Prevention and Control (CCDPC), 2002). However, in comparison with other Canadian populations, women have the highest prevalence of diabetes risk factors such as obesity and hyperinsulinemia. This implies that a particular effort should be made to adapt prevention programs to this group. Due to the small number of cases, an age-stratified analysis provided inconclusive results.

As observed in other Aboriginal populations (Anand et al., 2001), and according to the 1992 Santé Québec survey (Blanchet et al., 1992), diabetes and obesity were associated with low income and level of education. Anand and colleagues (2001) suggested that improving socioeconomic status might help to reduce these cardiovascular risk factors. Nevertheless, the prevalence of obesity and overweightedness in the Inuit enjoin urgent action. Indeed, 28% of Inuit participants are obese. This proportion is higher than that observed among the general Canadian population (14%) (Mongeau et al., 2005).

As mentioned earlier, the causes of the increase in diabetes and its related risk factors such as obesity are probably related to the epidemiologic transition that is occurring in Nunavik as it is everywhere in the Arctic. Given the magnitude of the socioeconomic changes in Nunavik and the increase in obesity in the last decade, a decrease in the prevalence of diabetes in Nunavik is not anticipated. Thus, we encourage maintaining and expanding prevention programs in order to reduce its main risk factors. Prompt action is needed as diabetes may induce microvascular and macrovascular complications.

KEY ISSUES

CARDIOVASCULAR DISEASES

- The main self-reported cardiovascular disease among Nunavik Inuit was high blood pressure. Close to 17% of participants declared suffering from hypertension.
- The main determinants of atherosclerosis were age, sex, hypertension, BMI and diabetes; atherosclerosis was not associated with total cholesterol, LDL or HDL cholesterol.
- The proportion of individuals with a blood pressure level of at least 140/90 mmHg increased from 6.0% in 1992 to 11.9% in 2004.
- As observed in 1992, the blood lipid profile in this population is still satisfactory.
- Since the 1992 Santé Québec survey, cardiovascular risk factors in the Nunavik Inuit population have remained at the same satisfactory level over time. Thus, we still observe that people from Nunavik are relatively well protected against these diseases and related risks.
- Nunavik Inuit are relatively well-protected against atherosclerosis. However, with the increase of risk factors such as rates of smoking, glucose intolerance, obesity in general and abdominal obesity in particular, we could expect an increase in the percentage of the population at risk for cardiovascular disease events.

DIABETES

- The global prevalence of diabetes in Nunavik is estimated at 5%. This prevalence is comparable to values observed in the rest of Canada (4.8% in people aged 20 and over).
- Inuit women showed high prevalence of diabetes risk factors such as abdominal obesity and hyperinsulinemia.
- The prevalence of obesity among the Inuit is 28%. This proportion is higher than that observed among the general Canadian population.

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APPENDIX

Table A1
Blood lipid concentration, arithmetic and geometric means according to age and sex, population aged 18 to 74 years, Nunavik, 2004

	Overall					
	18-24 years		25-44 years		45-74 years	
Total cholesterol (mmol/L)	4.32[a]	(0.06)	5.03	(0.04)	5.46	(0.06)
	4.24[b]	[4.13-4.36]	4.94	[4.85-5.02]	5.36	[5.24-5.49]
Cholesterol/HDL - Ratio	2.91	(0.05)	3.31	(0.05)	3.34	(0.08)
	2.83	[2.74-2.92]	3.16	[3.08-3.24]	3.15	[3.02-3.28]
HDL (mmol/L)	1.54	(0.02)	1.63	(0.02)	1.80	(0.04)
	1.50	[1.46-1.55]	1.56	[1.53-1.60]	1.70	[1.64-1.77]
LDL (mmol/L)	2.30	(0.05)	2.83	(0.04)	3.05	(0.06)
	2.21	[2.12-2.30]	2.70	[2.63-2.78]	2.91	[2.80-3.03]
Triglycerides (mmol/L)	1.04	(0.04)	1.25	(0.03)	1.33	(0.06)
	F	-	1.09[E]	[1.05-1.15]	1.15[E]	[1.07-1.23]
	Men					
	18-24 years		25-44 years		45-74 years	
Total cholesterol (mmol/L)	4.19	(0.08)	4.89	(0.06)	5.40	(0.10)
	4.13	[3.97-4.28]	4.80	[4.68-4.92]	5.30	[5.11-5.49]
Cholesterol/HDL - Ratio	3.05	(0.08)	3.56	(0.07)	3.68	(0.13)
	2.96	[2.82-3.10]	3.41	[3.28-3.54]	3.44	[3.22-3.67]
HDL (mmol/L)	1.43	(0.03)	1.45	(0.02)	1.62	(0.05)
	1.40	[1.34-1.45]	1.41	[1.37-1.46]	1.54	[1.45-1.64]
LDL (mmol/L)	2.30	(0.07)	2.86	(0.05)	3.16	(0.09)
	2.21	[2.08-2.34]	2.73	[2.62-2.83]	2.99	[2.82-3.17]
Triglycerides (mmol/L)	1.01	(0.05)	1.27	(0.05)	1.36	(0.08)
	F	-	1.11[E]	[1.05-1.19]	1.16[E]	[1.06-1.28]
	Women					
	18-24 years		25-44 years		45-74 years	
Total cholesterol (mmol/L)	4.45	(0.09)	5.17	(0.06)	5.51	(0.07)
	4.37	[4.22-4.53]	5.09	[4.98-5.20]	5.43	[5.29-5.58]
Cholesterol/HDL - Ratio	2.77	(0.06)	3.04	(0.05)	2.99	(0.08)
	2.70	[2.59-2.81]	2.92	[2.82-3.01]	2.87	[2.74-3.00]
HDL (mmol/L)	1.66	(0.03)	1.81	(0.03)	1.97	(0.05)
	1.62	[1.56-1.69]	1.75	[1.69-1.80]	1.89	[1.81-1.99]
LDL (mmol/L)	2.31	(0.07)	2.80	(0.05)	2.95	(0.06)
	2.21	[2.10-2.33]	2.67	[2.58-2.77]	2.83	[2.71-2.96]
Triglycerides (mmol/L)	1.06	(0.05)	1.23	(0.04)	1.29	(0.06)
	F		F		1.13[E]	[1.05-1.22]

[a] First line always refers to arithmetic $mean_a$ (standard deviation).
[b] Second line always refers to geometric $mean_g$ [95% CI].
E Interpret with caution.
F Unreliable estimate.
Source: Nunavik Inuit Health Survey 2004.

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Qanuippitaa?

HOW ARE WE?