Anthropometric correlates and underlying risk factors for type 2 diabetes mellitus among Inuit

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ABSTRACT

Type 2 diabetes mellitus (DM) is an emerging problem among Inuit of Circumpolar Countries. However, Canadian Inuit health surveillance data are limited. Data from the Nunavik Health Survey were used to evaluate the prevalence of overweight and obesity using the observed body mass index (BMIob) and the standardized BMI adjusted for sitting height (BMIstd). Also, data from Pangnirtung, Nunavut in the Baffin Region pilot health screening were used to evaluate anthropometric correlates of indices of insulin resistance. Obesity among the Nunavik study population (29.8%) is more prevalent than among general Canadians (23.1%), but the prevalence rates are more comparable when using BMIstd (21.5%). In Pangnirtung, anthropometric measures BMIob, BMIstd, waist circumference and percent body fat were associated with indices of insulin resistance/sensitivity ($p \leq 0.05$). BMIstd showed similar results to BMIob and does not better predict the indices of insulin resistance/sensitivity.

RÉSUMÉ

Le diabète de type 2 émerge parmi les Inuit des pays circumpolaires. Par contre, les données concernant leur état présent de santé sont très limitées. Les données de l'enquête de santé du Nunavik ont servi à évaluer leur taux d'obésité en utilisant l'index de masse corporelle observé (IMCob) et l'index de masse corporelle standardisé (IMCstd) en ajustant l'IMCob à une mesure de taille assise. Aussi, des données sur l'enquête de santé pilote de Pangnirtung, Nunavut de l'île de Baffin ont permis d'évaluer les associations entre des mesures corporelles et des indices de résistance à l'insuline. Le taux d'obésité parmi la population de recherche du Nunavik est plus marqué (29.8%) que parmi un groupe représentatif de la population canadienne (23.1%), mais en utilisant l'IMCstd, le taux d'obésité était comparable (21.5%). À Pangnirtung, les mesures corporelles comme l'IMCob, l'IMCstd, la circonférence de taille et le pourcentage de gras corporel étaient associés aux indices de résistance/sensibilité à l'insuline ($p<0.05$). Les résultats de l'IMCstd étaient comparables à ceux de l'IMCob et ne sont pas supérieurs pour prédire les indices de résistance/sensibilité à l'insuline.

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CONTRIBUTION OF AUTHORS

The manuscripts presented were accomplished through collaborative efforts among the co-authors. Their specific roles are described below.

The first manuscript entitled, *"Body mass index may overestimate the prevalence of overweight and obesity among the Inuit"* was authored by G. Charbonneau-Roberts, H. Saudny-Unterberger, H.V. Kuhnlein, and G.M. Egeland. This topic was first presented as part of Dr. Egeland's presentation at the Circumpolar Health: Population in Transition Research Day, University of Toronto, Feb. 27, 2004. Dr. Egeland encouraged Ms. Charbonneau-Roberts to complete a thorough literature review on the topic in a manuscript format. The article has now been published in the International Journal of Circumpolar Health. The manuscript was written by Ms. Charbonneau-Roberts and edited by the co-authors.

The second manuscript entitled, "Comparisons of obesity measures among Inuit of Nunavik" was authored by G. Charbonneau-Roberts, and G.M. Egeland. Field work was conducted by G. Charbonneau-Roberts and the nurses hired for the Nunavik Health Survey. Ms. G. Charbonneau-Roberts designed and built the sitting height table as no suitable device was available. She also trained research staff in its use. The investigators leading the Nunavik Health Survey agreed to incorporate it into their survey and G. Charbonneau-Roberts worked for 5 weeks on the Amundsen in the fall of 2004 together with the other research staff in collecting data on nearly 1,000 Inuit. The analyses were conducted and the manuscript was written by Ms. Charbonneau-Roberts and edited by the co-author.

The third manuscript entitled, "Anthropometric correlates of indices of insulin resistance among Inuit" was authored by G. Charbonneau-Roberts, T.K. Young, and G.M. Egeland. Ms. G. Charbonneau-Roberts was the manager for the field study. Her responsibilities included training community research assistants, overseeing other graduate students working on the project, ensuring quality control procedures for the laboratory specimen handling preparation and

shipping, training of staff in appropriate specimen preparation, and in chart auditing to ensure completeness of data. Ms. G. Charbonneau-Roberts also took a leadership role in the preparation for the field work. Field work was conducted by G. Charbonneau-Roberts, with the guidance and oversight of Dr. Egeland and assistance of D. Denomme and S. Bird. The manuscript was written by the Ms. Charbonneau-Roberts and edited by the co-authors.

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1. Introduction

1.1 Brief overview

Health promotion and intervention programs are important for the well-being of northern communities. However, health promotion programs cannot be appropriately designed in the absence of surveillance data on the health status of a population. In 2004, a health survey among Inuit of Nunavik was conducted to obtain health data, assess changes in health status since a 1992 health survey, and to help develop appropriate health programs based upon the findings. For Inuit residing in Nunavut, health surveillance data are limited. Available data are from the Central Arctic and over 10 years old. Therefore, a community pilot health screening in the Baffin Region was conducted to facilitate health screenings in other Nunavut communities. The health screenings were designed to be linked to research and health promotion efforts. This project is based upon the Centre for Indigenous Peoples' Nutrition and Environment's mandate which seeks to respond to health concerns of Indigenous Peoples through participatory research and education.

The thesis includes findings from the Nunavik study population and the Baffin Region community study population. More specifically, the thesis consists of an overview of the literature as it pertains to type 2 diabetes mellitus (DM) among Inuit; a published article on the appropriateness of body mass index (BMI) (kg/m^2) to assess obesity among Inuit; a manuscript for publication describing the level of obesity among the Nunavik study population; a third manuscript regarding the association of anthropometric measures and indices of insulin resistance among the Baffin Region study population; and lastly, overall conclusions.

1.2 Rationale

There is evidence that type 2 DM is an emerging problem among Inuit of Circumpolar Countries (Young et al. 2000; Bjerregaard 2003; Naylor et al. 2003). However, Canadian Inuit data are limited and the scope and full extent of the diabetes problem is unknown. While there is a need to evaluate the determinants of diabetic risk factors within an Inuit context, few studies have focused on this specific issue. For example, widely used BMI may overestimate the prevalence of overweight and obesity in Inuit populations due to their shorter legs and higher sitting heights compared to other populations (Charbonneau-Roberts et al. 2005). Therefore, BMI and other determinants commonly used may not be as predictive of type 2 DM risk among Inuit. Further, early detection of insulin resistance and the implementation of Inuit specific intervention programs to improve insulin sensitivity may lower the risk of developing type 2 DM (Gutt et al. 2000; Vaccaro et al. 2004) and help prevent the diabetes epidemic experienced in First Nations and American Indian communities (Montour et al. 1985; Brassard et al. 1993a; Brassard et al. 1993b).

1.3 Purpose and specific objectives

The purpose of the thesis is to evaluate differences in the prevalence of overweight and obesity using BMI and BMI adjusted for sitting height; and to evaluate the association of anthropometric measures with risk factors for type 2 DM among Inuit.

The thesis includes three primary objectives:

1) to provide a descriptive overview of the anthropometric characteristics of Inuit of Nunavik;
2) to compare the prevalence of overweight and obesity using BMI and BMI adjusted for sitting height among men and women; and

3) to evaluate the anthropometric correlates of indices of insulin resistance using the homeostasis model assessment index (IR_{HOMA}) (Matthews et al. 1985), the quantitative insulin sensitivity check index (QUICKI) (Katz et al. 2000), and the insulin sensitivity index developed by Gutt et al. ($ISI_{0,120}$) (Gutt et al. 2000).

2. Literature review

2.1. Type 2 diabetes mellitus

2.1.1. Prevalence of type 2 diabetes mellitus among Inuit

Type 2 DM has historically been rare among Inuit (Scott et al. 1957; Sagild et al. 1966; Mouratoff et al. 1967). However, the emergence of obesity and chronic diseases such as type 2 DM among Aboriginal populations in the Circumpolar North has become an area of public health concern (Young et al. 2000; Bjerregaard 2003; Naylor et al. 2003). Among Alaskan Eskimo/Inuit adults 35 years and above, the prevalence of diabetes increased from between 0.8 and 1.4 per 1000 in 1957 (Scott et al. 1957) to 21.9 per 1000 in 1993 (Schraer et al. 1997). Among Greenlanders, the prevalence of type 2 DM increased from 0.5 per 1000 in 1962 (Sagild et al. 1966) to 108 per 1000 among men and 88 per 1000 among women in 2001 (Bjerregaard 2003). In 1987, the prevalence of diagnosed diabetes among Inuit of the Northwest Territories (NWT) was 3.6 per 1000, a rate below that of the United States general population prevalence of 23.5/1000 and well below the high prevalence among North American Indians (Young et al. 1992). While southern First Nations in Canada were suffering from exponential increases in type 2 DM 30-40 years ago, Inuit were spared the diabetes epidemic perhaps due to a slower rate of dietary transition and acculturation.

2.1.2. Type 2 diabetes mellitus: An overview

According to the Canadian Diabetes Association, "diabetes mellitus is a metabolic disorder characterized by the presence of hyperglycemia due to defective insulin secretion, insulin action, or both" (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003b). Type 2 DM which accounts for approximately 90-95% of all diabetic cases (American Diabetes Association 2004) "may range from predominant insulin resistance with

relative insulin deficiency to a predominant secretory defect with insulin resistance" (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003b). Rarely, type 2 DM will originate from an immune-mediated loss of pancreatic beta cells, also known as latent autoimmune diabetes in adults (LADA) (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003b). Pre-diabetes has been defined as impaired fasting glucose (IFG) together with impaired glucose tolerance (IGT), and while the condition does not always progress to clinically-diagnosed type 2 DM, the diagnosis is considered an important step toward the prevention of diabetes and cardiovascular diseases (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003b).

Further, type 2 DM, insulin resistance, and IGT are often expressions of a much broader underlying condition known as the metabolic syndrome (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003b). The metabolic syndrome is a cluster of risk factors (obesity, hypertension, dyslipidemia, microalbuminuria, dysglycemia, and insulin resistance) (World Health Organization 1999) which increases the risk of developing diabetes and cardiovascular diseases (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003b). Causes of insulin resistance include both non-modifiable factors such as age and genetics (family background, family history) and modifiable factors such as a sedentary lifestyle, a poor diet (Schulze et al. 2005) and excess weight.

2.1.3. Traditional Inuit lifestyle and consequences of acculturation

Traditionally, Inuit consumed animals from the land such as caribou, fish and sea mammals, and fowl as well as their eggs (Arima 1984). Plant food was mostly consumed in the form of berries, seaweeds, roots and from stomach contents of herbivores and birds (Arima 1984).

Today, dietary transition continues to occur among Inuit with youth and young adults consuming more saturated fats and less polyunsaturated fats than that of the Elders (Egeland GM et al. 2003; Kuhnlein et al. 2004). Dietary transition has and is occurring throughout the world and its implications for changing the pattern of chronic diseases are being examined. For example, where fish consumption has traditionally been high and saturated fat intake very low, an increased intake of animal protein and fat among Japanese school children has been associated with type 2 DM (Kitagawa et al. 1998). Also, in Western Alaska, daily seal oil or salmon consumption was associated with a reduced prevalence of IGT (Adler et al. 1994). Dietary change coincides with other important lifestyle changes, such as decreases in physical activity associated with modern transportation and household conveniences and sedentary jobs. Younger and older Inuit men and women are now more obese than the general Canadian population (Kuhnlein et al. 2000). Also, anecdotal reports from communities suggest that Inuit are becoming heavier. Obesity, as a consequence of dietary changes and declines in physical activity, is a good indicator for patterns of health and disease (Schaefer 1981; Trowell et al. 1981; Rode A et al. 1994). Among Inuit, the increased prevalence of obesity has paralleled the increasing prevalence of diabetes (Murphy et al. 1992; Ebbesson et al. 1998; Jorgensen et al. 2002). These changes in diet, activity, and obesity may result in an emerging type 2 DM epidemic among Inuit, as has been observed among First Nation communities such as the Cree and Mohawk (Montour et al. 1985; Brassard et al. 1993a; Brassard et al. 1993b).

2.2 Anthropometric indicators of obesity

2.2.1 Manuscript I:

Body Mass Index May Overestimate the Prevalence of Overweight and Obesity Among the Inuit

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Abstract

Body mass index (BMI) is a widely used body weight classification system but has known limitations, and may need to be adjusted for sitting height in order to be useful as an indicator of health risks in special populations. Data confirm that Inuit and Far East Asians have shorter legs and relatively higher sitting heights compared with all other populations. Using standing height alone to calculate the BMI may overestimate the number of individuals that are overweight and obese, and at risk for type 2 diabetes mellitus and cardiovascular disease among the Inuit. Measuring sitting height allows for the calculation of a sitting height-to-standing height ratio (SH/S) which can be used to correct the observed BMI. Incorporating sitting height measurements into health research could help formulate Inuit-specific screening guidelines. *(Int J Circumpolar Health 2005;64(2):163-169.)*

Keywords: Inuit, sitting height, body mass index, obesity, risk factors

The article belongs to the series of papers "Populations in transition", the Circumpolar Health Symposium, Toronto February 2004

Introduction

Body mass index (BMI) has become a widely used tool for identifying overweight and obese individuals (Norgan 1995; Health Canada 2003). BMI is an index of weight to height (kg/m^2), and while it is not a direct measure of body fat, or lean tissue, it is the most commonly used indicator of health risks associated with overweight (type 2 diabetes mellitus, insulin resistance and cardiovascular disease) and underweight (osteoporosis, infertility) (Health Canada 2003). According to Canadian guidelines for body weight classification in adults, a BMI between 25 and 29.9 places individuals at increased risk of developing health problems compared with those in the normal range of 18.5 – 24.9 (Health Canada 2003). As the BMI increases from 30 to 40, or above, the risk of developing health problems changes from high to extremely high (World Health Organization 2000; Health Canada 2003).

Despite its usefulness as a body weight classification system, BMI has several limitations (Health Canada 2003), and may not be an equally good indicator of risk in individuals, or populations, who have very long, or short legs relative to torso length (Garn et al. 1986). BMI will tend to underestimate obesity among those with long legs and overestimate obesity among those with short legs relative to torso length. Empirically, the limitations of BMI have been demonstrated in research studies. For example, BMI underestimated obesity among the tallest, and overestimated obesity among the shortest men and women in a subset of normal, healthy adults from the NHANES III survey (Bagust et al. 2000). Differences in leg lengths are reported to increase (Norgan 1994b; Bagust et al. 2000), or decrease BMI values by as much as five, or even ten units (kg/m^2) (Collins et al. 2000). Other groups, or individuals, for whom the BMI may have certain limitations include young adults who have not reached full growth, adults who are very muscular, over 65 years of age, or belong to certain ethnic, or racial groups (Health Canada 2003). To circumvent some of these difficulties, alternate anthropometric measurements have been suggested. Among them is a

standardized BMI, which makes use of a sitting height measurement to correct the observed BMI by applying a correction factor based on a linear regression model (Norgan 1995; Collins et al. 2000).

The purpose of the current review paper is to explore the evidence for the extent to which sitting height may be a useful additional anthropometric indicator to include in research and whether it could help refine screening guidelines for Inuit adult populations.

Sitting height methodology

To measure sitting height, an anthropometer is placed against a wall or the edge of a sitting tool (box, chair or table), and the individual sits on this sitting tool as tall and as straight as possible, either with the forearms and hands extended forward, horizontally, and with the palms facing each other (U.S Coast Guard) (Figure 2.2.1), or with the hands resting on the thighs (Martin et al. 1988). Sitting height is then measured as the distance from the highest point on the head to the base of the sitting surface. No gold standard for sitting height measurements exists, but recommendations suggest that the back of the knees be in close contact with the edge of the sitting tool (Martin et al. 1988), or in contact with the edge (Torres et al. 2003), that the thighs and lower legs be at a 90 degree angle (Martin et al. 1988), and that the feet be supported by an adjustable shelf, although eliminating the latter has given results that are in close agreement (Martin et al. 1988).

Another option is to measure sitting height using a standard chair, or box, and then to subtract the height of the chair, or box, from the distance measured from the highest point on the individual's head to the floor (Martin et al. 1988). The sitting height measurement could also be taken with an anthropometer placed directly on the chair, or box. In both cases, sitting height may not be as accurate since the chair may not be a completely flat surface, the individuals'

knees may not be in close contact with the edge of the chair, and thighs and lower legs may not necessarily be at a 90 degree angle. Using a combination of standing height and sitting height, leg length can be calculated by subtracting the sitting height from the standing height (Martin et al. 1988).

Finally, a sitting height table equipped with a sliding anthropometer adjustable for thigh length and an adjustable foot support may be used (Figure 2.2.1). Unfortunately, sitting height tables can be expensive, distributors are limited, and not all models are portable, which is a disadvantage for fieldwork. Whichever tool is used, a sitting height to standing height ratio (SH/S) can be used to correct the observed BMI from the population under study to obtain a standardized BMI (Norgan 1995).

Inuit specific context

The emergence of obesity and chronic diseases, such as type 2 diabetes mellitus (DM), among Aboriginal populations in the Circumpolar North has become an area of public health concern (Young et al. 2000; Bjerregaard 2003; Naylor et al. 2003). The prevalence of obesity among the Inuit, as measured by BMI, is now comparable to, and in some cases greater than, that of the general Canadian population (Kuhnlein et al. 2000) and the North American population (Young 1996a). The prevalences of obesity and central fat patterning were noted to be particularly high among women (Young 1996a).

In the early 1980s, a sample of Siberian Yupik Eskimo women was compared with a white and black reference population from the U.S. Health Examination Survey. Yupik women were shorter, with shorter leg lengths, but had sitting heights, body weights and tricep skinfold thicknesses similar to those of the reference population (Johnston et al. 1982). Furthermore, BMI values and SH/S ratios among the Yupik were higher compared with the reference population, particularly for males (Johnston et al. 1982). Other anthropological

data also showed that Inuit leg lengths were shorter (Szathmary 1984) and that the SH/S ratio for men (0.541) and women (0.540) were higher compared with the average Canadian ratios (Demirjian 1980). Inuit of Greenland were also found to have a higher sitting height ratio than their Danish counterparts. When height for age among the Inuit of Greenland was compared to that of Europeans, the Inuit were found to be shorter, although their weight for height was higher (Becker-Christensen 2003).

SH/S ratios have been established for some populations, and to date, they are the highest among Far East Asians (0.55 in Japanese, 0.54 in Chinese and Koreans, and slightly less in Thai and Vietnamese) (Pheasant 1986) and the Inuit (0.54) (Demirjian 1980), compared with Europeans whose average ratio is 0.52 (Norgan 1995). However, it is important to discuss that, among Asian Indians, the health risks at any given level of obesity are higher compared to those among Caucasians (Banerji et al. 1999; Misra 2002; Vikram et al. 2003). Plausible explanations for these differences in risk for any given BMI are that Asian populations have higher percentages of body fat, and lower levels of lean body mass for every level of BMI compared to Caucasians (Banerji et al. 1999; Misra 2002; Vikram et al. 2003). These observations have led to the lowering of BMI cut-off points for Asian populations for identifying at-risk individuals (WHO expert consultation 2004).

However, when Canadian Inuit were compared with a white Canadian population, high BMI (kg/m2) was associated with fewer metabolic consequences than among the Canadian population (Young 1996b). At each level of BMI, the Inuit had lower mean triglyceride and higher mean HDL-cholesterol values compared with a white Canadian population, and a high BMI had little effect on glucose and insulin levels (Young 1996a), suggesting that BMI does not have the same degree of health-related implications among the Inuit. When making cross-cultural comparisons, underlying differences in the SH/S ratio could contribute to differences in the BMI's predictive value for chronic disease risk factors.

However, one cannot rule out potential metabolic differences due to genetics, dietary factors, or other factors associated with recent and ongoing acculturation (Young 1996a). We note, for example, that similar contradictions in type 2 diabetes mellitus risk factors were observed between Greenlandic Inuit and a Danish comparison group across categories of waist circumference (Jorgensen et al. 2003), suggesting that a standardized BMI alone would likely not fully account for differences observed in risk factors between Inuit and other populations. Future research is needed to clarify the interplay of anthropometric and other determinants of health risks among the Inuit.

The usefulness of sitting height measurements

Using a population's SH/S ratio to standardize the observed BMI would most likely better represent the Inuit's risk for chronic disease and prevalence of chronic energy deficiency. Among selected African groups and Australian Aborigines who have low SH/S ratios (i.e. proportionately longer legs), BMI alone would likely lead to an underestimation of overweight and obesity and an overestimation of the prevalence of chronic energy deficiency (Norgan 1995). For example, among Australian Aborigines, the long legs relative to torso length underestimated their observed BMI values by approximately 2 kg/m^2 (Norgan 1994a). The data illustrate that uniform BMI cut-off values are not valid across all populations, and that body proportions may have to be accounted for when BMI is used to assess nutritional status (Norgan 1994a) and risk of chronic disease.

The SH/S ratio can also be influenced by secular trends in anthropometric indices within populations (Dangour 2003). Sitting height measurements have been used to track secular changes in body proportions. Among a population from Southeast England, secular changes were related to a greater increase in lower- rather than upper-body growth (Dangour et al. 2002). Also, researchers in Holland concluded that the secular trend of increased standing height was due to increased leg length (Gerver et al. 1994). Among the Inuit of Greenland, a

secular trend in height was also due to an increase in leg length observed among boys and girls between 1964 and 1997 (Becker-Christensen 2003). On the other hand, among Amerindian adults, no secular changes were observed in leg length (Dangour 2003).

Furthermore, sitting height has been used to measure growth velocity among children (Becker-Christensen 2003), and to assess scoliosis (Mose). Traditionally, weight for height measures are used to assess stunting in children's growth patterns. However, its suitability should be questioned among children from various ethnic groups. Sitting height rather than arm span has also been shown to be a better choice for estimating pulmonary function in children with limb deformities (Torres et al. 2003).

In addition, sitting height measurements remain important in the design and layout of work stations among Navy personnel and other trades with limited spaces (U.S Coast Guard). Sitting height is a relatively simple measure and is feasible to determine in most situations. Inter-observer variations will, of course, always be present, as with standing height and other measurements, but they can be minimized by providing proper training.

Comparing BMI to the predictive value of other measures of obesity

It is important to recognize that a normal range BMI does not dismiss health risks (Ruderman et al. 1998; Vikram et al. 2003), just as a high BMI does not necessarily indicate a high health risk. BMI, in combination with other measures, is useful, because of its convenience and simplicity. Other commonly used measurements of obesity, such as bioelectrical impedance, skinfold thickness, waist circumference and waist-to-hip ratio, have been compared to BMI for their predictive value of risk factors for chronic diseases.

Bioelectrical impedance analysis (BIA) combines the impedance value with anthropomorphic data to provide body compartment measures (i.e. body fat %), but does not specify the location of body fat. It often replaces reference models, such as hydrodensitometry and dual energy x-ray absorptiometry (DEXA), because of its simplicity, speed, portability, affordability, non-invasiveness and, to some extent, acceptable results (Hainer et al. 1995; Utter et al. 1999; Cable et al. 2001; Tyrrell et al. 2001; Lintsi et al. 2004). While the epidemiological evidence strongly supports the association between upper-body obesity, in particular visceral obesity, and the development of obesity-related complications (Lemieux et al. 1994), the association between peripheral obesity and obesity-related complications is not as strong (Arner 1997). Further, because the accuracy of BIA depends on the use of an appropriate prediction equation, it has been suggested that an equation be validated for each type of BIA analyzer and for each population (Tyrrell et al. 2001). With measurements to differentiate ethnic-specific body builds, such as sitting height, or leg length, it may be possible to improve the prediction equation used to estimate body fat, making the results more population-specific (Deurenberg et al. 2002).

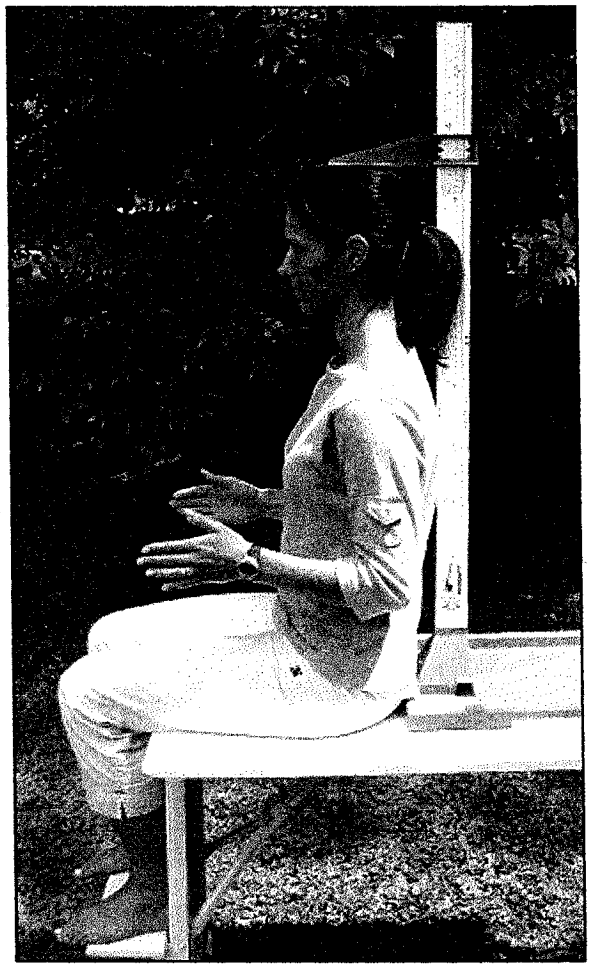
Skinfold thickness is a tool used to measure subcutaneous fat and, again with the use of prediction equations, estimates total body fat (Wagner et al. 1999). This method is inexpensive, relatively simple and very portable, but has several known limitations. For example, it requires a high degree of technical skill for consistent measurements of site locations, and there are considerable inter-observer variations in measurements (Wagner et al. 1999). Further, the measurements do not always correlate well with body fat, especially among the obese (Gray et al. 1990; Wagner et al. 1999) and older individuals (Wagner et al. 1999), in whom the fat tends to reside well below the epidermis. Also, prediction equations have not been derived for all populations, restricting its use (Wagner et al. 1999).

As for waist circumference, computed tomography demonstrated that waist circumference, or the abdominal sagittal diameter, were the preferred anthropometric correlates of the amount of abdominal visceral adipose tissue when compared to the waist-to-hip ratio (Pouliot et al. 1994). In a study by Clasey and colleagues, results from 76 Caucasian adults concluded that, in both men and women, waist circumference and abdominal sagittal diameter were the most predictive anthropometric measures of total abdominal fat ($r = 0.87$ to 0.93) and abdominal visceral fat ($r = 0.84$ to 0.93) and that the waist-to-hip ratio was the least predictive (Clasey et al. 1999). Further, waist circumference values above about 100 cm, or abdominal sagittal diameters above 25 cm, were associated with disturbances in lipoprotein metabolism and plasma insulin glucose homeostasis in both genders (Pouliot et al. 1994). Among Australian Aborigines, waist circumference was the best body size measurement in predicting diabetes (Wang et al. 2004). Waist circumference is a simple, convenient and reliable anthropometric index for determining the extent of abdominal obesity and the risk for related metabolic complications (Pouliot et al. 1994). The World Health Organization recommends that waist circumference be used within populations with a predisposition to central obesity and related risk for developing the metabolic syndrome, and that it be used to refine public health action levels in conjunction with BMI (WHO expert consultation 2004).

Conclusion

We recommend that sitting height be routinely incorporated into future cross-sectional and longitudinal health research evaluating the anthropometric determinants of health risks in populations with heterogeneous body proportions, or with body proportions that differ from those upon which standards are based. This will facilitate a better understanding of the interplay of risk factors related to diabetes and cardiovascular disease among the Inuit, and may help in the development of appropriate screening guidelines and prevention efforts.

Figure 2.2.1 - Sitting height table.



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2.3 Relationship between anthropometric indicators and indices of insulin sensitivity

2.3.1 Derived indices of insulin action based upon fasting and oral glucose tolerance test data

Decreased insulin sensitivity is a common defect underlying type 2 DM and IGT (Gutt et al. 2000), and may be involved in the development of the metabolic syndrome (Vaccaro et al. 2004). Early detection of insulin resistance and the implementation of interventions may reduce the development of such diseases (Gutt et al. 2000; Vaccaro et al. 2004).

The gold standard for measuring the tissue insulin sensitivity as described by DeFronzo is the euglycemic hyperinsulinemic clamp, while that for measuring the response of β–cell to glucose is the hyperglycemic clamp technique (DeFronzo et al. 1979). Given that these gold standards are invasive, time-consuming and costly, simple methods have been developed to provide estimates of insulin action. Several studies of insulin action may be used and examples based on fasting values include: fasting insulin (Laakso 1993), the homeostasis model assessment for insulin resistance (IR_{HOMA}) and for β-cell secretion ($Secr_{HOMA}$) (Matthews et al. 1985), and the quantitative insulin sensitivity check index (QUICKI) (Katz et al. 2000). Studies of insulin action using different data include an insulin sensitivity index (ISI) based on oral glucose tolerance test (OGTT) and estimated metabolic clearance rate data (Gutt et al. 2000), and another ISI based on insulin release and peripheral sensitivity to the OGTT (Cederholm et al. 1990). Other methods include the first and second phase insulin secretions (Stumvoll et al. 2001), the whole-body insulin sensitivity index utilizing glucose and insulin from both fasting and OGTT states (Matsuda et al. 1999), and the weighted combination of fasting insulin and triglycerides (McAuley et al. 2001). According to Laakso, one of the simplest and most consistent markers of insulin resistance was fasting insulin, especially among individuals with abnormal glucose tolerance (Laakso 1993). In a more recent study, the use of fasting insulin or IR_{HOMA} performed as well as QUICKI to

measure insulin resistance and even to identify individuals with the metabolic syndrome (Vaccaro et al. 2004).

Obesity is known to be a major risk factor for insulin resistance (Jones et al. 2000) and type 2 DM (Health Canada 2003). Measures of obesity commonly used include BMI, waist circumference and body composition, and each relate to insulin sensitivity. Determining which anthropometric measure best relates to insulin sensitivity may prove useful in designing diabetes prevention and screening guidelines among differing populations.

2.3.2 Body mass index and indices of insulin sensitivity

According to Cervenakova, BMI is inversely correlated with indices of insulin sensitivity, of which the correlation coefficient was highest with Matsuda's insulin sensitivity index (ISI), followed by Cenderholm and Stumvoll's ISI (Cervenakova et al. 2002). Further, the indices of insulin secretion (area under the curve for insulin ($AUC_{insulin}$) and $Secr_{HOMA}$) were positively associated with BMI (Cervenakova et al. 2002). The correlations described between indices of insulin sensitivity and of insulin secretion with BMI clearly show that obesity is an important factor linked with insulin resistance (Berglund et al. 1996; Jones et al. 2000; Cervenakova et al. 2002). The weakest correlations of BMI were found with IR_{HOMA} and $Secr_{HOMA}$, representing only the steady state of glucose metabolism during fasting. Further, $Secr_{HOMA}$ seems to be more useful in diabetic subjects rather than in healthy subjects due to the short distances of different β-cell function lines at normal glucose concentrations (Matthews et al. 1985) and because younger normal subjects follow a sigmoid reaction curve rather than the linear β-cell response curve applied in this model (Hosker et al. 1984). Nevertheless, other indices such as differing ISI, as measures of insulin sensitivity, and $AUC_{insulin}$, as a measure of insulin secretion, are all closely correlated to BMI and reflect the active changes in glucose metabolism which occurs after the ingestion of glucose (Cervenakova et al. 2002). Limitations of these highly correlated indices are that cut-off values have not been established

for healthy subjects, subjects with IGT, or diabetic subjects (Cervenakova et al. 2002).

2.3.3 Waist circumference and indices of insulin sensitivity

Waist circumference is an independent predictor of insulin sensitivity and the decline in insulin action seen in the elderly has been attributed to increased abdominal fat rather than age per se (Bryhni et al. 2003). Among offspring of diabetic patients in Taiwan, only waist circumference predicted insulin resistance in analyses comparing several abdominal obesity measures (Kuo et al. 2002). However, using IR_{HOMA} and $ISI_{0,120}$ among Chinese hypertensive patients, BMI was more strongly associated with insulin sensitivity than sagittal abdominal diameter or waist circumference (Hwu et al. 2003).

2.3.4 Body composition and indices of insulin sensitivity

Among offspring of diabetic patients in Taiwan, both BMI and percent body fat derived from bioelectrical impedance analysis (BIA) were shown to be good predictors of insulin resistance (Kuo et al. 2002). Among women in another study, when peripheral obesity and abdominal obesity were compared, the latter accounted for close to 80% of the variance in insulin sensitivity compared to 44% in peripheral obesity, and therefore had a significantly stronger relationship with insulin sensitivity (Carey et al. 1996). Further, in an evaluation of the association between adipose tissue compartments and insulin resistance in overweight and obese men, intraperitoneal adipose tissue best predicted insulin resistance (Chan et al. 2004).

2.3.5 Underlying mechanisms of insulin resistance linked to obesity

Insulin sensitivity is affected by nonesterified fatty acids (NEFA) and various adipocytokines secreted by adipocytes. Adipocytokines, defined as cell-

to-cell signaling proteins secreted by adipose tissue, have been shown to be regulators of insulin sensitivity. More specifically, recent studies have found that the adipocytokines adiponectin and interleukin 6 (IL-6) are both closely linked to insulin sensitivity, and may explain the relationship between insulin resistance and obesity. For example, several studies have shown that obesity related insulin resistance is associated with IL-6 and adiponectin (Kern et al. 2001; Weyer et al. 2001; Klover et al. 2005). Prospective studies have also shown that if patients had higher levels of IL-6 and lower levels of adiponectin, their risk for developing type 2 DM increased (Pickup et al. 1997; Pradhan et al. 2001; Spranger et al. 2003). The peptide hormone leptin produced by adipose cells has also been indirectly linked to insulin sensitivity by altering body weight (Kellerer et al. 2001; Fernandez-Galaz et al. 2002).

3. Manuscript II:

Comparisons of obesity measures among Inuit of Nunavik

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3.1 Abstract

There is evidence that type 2 diabetes mellitus (DM) is an emerging problem among Inuit of Circumpolar Countries but few studies have focused on correlates of diabetic risk factors within an Inuit context. For example, widely used body mass index (BMI) may overestimate the prevalence of overweight and obesity in Inuit populations due to their proportionally shorter legs and higher sitting heights compared to other populations. The aims of the study were to provide a descriptive overview of the anthropometric results of Inuit of Nunavik randomly selected for a health survey, and to compare the prevalence of overweight and obesity using the observed BMI (BMIob) and the standardized BMI adjusted for sitting height (BMIstd). Results indicated that 28.4% of men and 30.9% of women were obese when using the BMIob, compared to 19.6% for men and 21.9% for women when using the BMIstd. As for waist circumference (WC), 18.8% of men and 53% of women were above the World Health Organization (WHO) cut-off values indicative of increased risk of obesity related health complications. Using %BF, 24.6% of men and 22.2% of women were obese. There was good agreement between BMI and %BF obesity groupings, whereas WC showed poorer agreement with BMI and %BF. In conclusion, BMIstd along with WC may provide a more appropriate comparison for obesity patterns between populations. Secular trends were also observed where Inuit seem to be undergoing positive secular changes in height.

3.2 Introduction

There is evidence that type 2 diabetes mellitus (DM) is an emerging problem among Inuit of Circumpolar Countries (Young et al. 2000; Bjerregaard 2003; Naylor et al. 2003). While there is a need to evaluate the correlates of diabetic risk factors within an Inuit context, few studies have focused on this specific issue. For example, the widely used observed body mass index (BMIob) may overestimate the prevalence of overweight and obesity in Inuit populations due to their shorter legs and higher sitting heights compared to other populations (Demirjian 1980; Szathmary 1984). Therefore, BMIob and other measures commonly used may not be as predictive of type 2 DM risk among Inuit (Charbonneau-Roberts et al. 2005). Using a standardized BMI (BMIstd) adjusted for sitting height has been recommended for Inuit and may help in the development of appropriate screening guidelines and prevention efforts (Charbonneau-Roberts et al. 2005).

The aims of the study were to provide a descriptive overview of the anthropometric results of the Inuit of Nunavik randomly selected for a health screening, and to compare the prevalence of overweight and obesity using BMIob and BMIstd adjusted for sitting height.

3.3 Subjects and methods

3.3.1 Participant population

The Nunavik data were collected aboard the CCGS Amundsen Research Icebreaker late August to early October, 2004. Anthropometric data were obtained from 800 Nunavik Inuit (Northern Quebec), aged 18-74 years, residing in randomly selected households from 14 communities for the Nunavik Health Survey (Figure 3.1). A randomly selected sub-sample of 500 participants was obtained for the thesis data analysis from the Institut national de santé publique

du Québec (INSPQ) database. The sample size was further reduced by eliminating the non-Inuit. The total sample was 489 Inuit, of whom 220 were men and 269 were women, and 3.7% had incomplete data on either height, weight, sitting height, waist circumference or percent body fat (%BF).

3.3.2 Ethical approvals

Approvals for the Nunavik Health Survey were obtained from the Ethics Committees of Laval University and McGill University (Appendix 8.1). All other appropriate regional reviews were also obtained as well as an informed consent from each participant (Appendix 8.2).

3.3.3 Anthropometric measurements

The anthropometric data collected included weight, height, and sitting height. **Weight and body fat composition** were measured using a Tanita leg-to-leg bioelectrical impedance scale where a clothing reference weight of 0.5 kg was entered for each participant, and automatically subtracted to provide weight. **Height** was measured using a leveled height rod equipped with a horizontal head board. The participants were asked to remove their shoes and stand as tall and as straight as possible with the head level, the shoulders and upper arms relaxed. The vertical distance between the standing surface and the top of the head was measured to the nearest millimeter (0.1 cm). **Sitting height (SH)** was measured using a sitting height table equipped with a sliding anthropometer adjustable for thigh length and an adjustable foot support (Charbonneau-Roberts et al. 2005). Two measurements were taken to the nearest millimeter (0.1 cm). If a large variation (more than 1 cm) was detected between the two measurements, the body position was rechecked and measurements were taken until two measurements were within 1 cm. **Waist circumference (WC)** was measured over light clothing at the point midway between the iliac crest and the costal margin (lower rib). The measurement was taken to the nearest millimeter

(0.1cm). Also, if the standing height, sitting height or waist circumference measures fell between two millimeters, the even millimeter was recorded.

3.3.4 Cormic index adjustments

When sitting height to stature (SH/S) ratios, also known as relative sitting heights, were examined as to how they related to BMI in 158 study populations taken from 46 papers and representing 18 000 men and women, it was found that for every 0.01 unit difference in SH/S ratio, the difference in BMI was 0.90 kg/m^2 (Norgan 1994b). Therefore, the commonly used BMIob was standardized using a Cormic index for men and women developed from their relative sitting heights. Cormic index adjustments are based upon techniques developed by Norgan (Norgan 1994b; Norgan 1994c; Norgan 1995) and modified by Collins et al. (Collins et al. 2000). The BMIstd was calculated using the formula from Collins et al. (Collins et al. 2000) which provide separate SH/S ratio *beta* coefficients and intercepts for predicting BMI for men (*beta*=0.78, α=-18.43) and women (*beta*=1.19, α=-40.34), based on linear regression techniques and equations first published by Norgan (Norgan 1994c; Norgan 1994b). Variations in the SH/S ratio between or even within populations may account for a 5 kg/m^2 unit difference in BMI, therefore individual rather than population BMIes were calculated (Norgan 1994b). The SH/S ratio *beta* coefficient from the linear regression analyses was then used to predict the BMI at a SH/S ratio of 0.52 (Norgan 1994b), which is the mean SH/S ratio among European study populations that have been used to develop BMI cut-off points related to elevated mortality rates (Norgan 1995).

$BMI_{std} = BMI_{0.52} + (BMI_{ob}-BMI_{es})$, where:

> $BMI_{0.52}$ is the BMI at an estimated SH/S ratio of 0.52. For men, $BMI_{0.52}$ = 0.78(52.0)-18.43 = 22.13 and for women, $BMI_{0.52}$ = 1.19(52.0)-40.34 = 21.54, where 0.78 and 1.19 are the *beta* coefficients for men and women, respectively, and -18.43 and

-40.34 represent the intercept (constant) for the men and women, respectively;

BMI_{ob} is the observed BMI as calculated by measured weight divided by standing height in meters squared (kg/m^2);

BMI_{es} is the BMI at the calculated individual SH/S ratio. For example, if the SH/S for one man is 0.530, use 53 percent in the formula BMI_{es} = 0.78(53.0)-18.43 = 22.91, and if the SH/S ratio for one women is 0.533, use 53.3 percent in the formula BMI_{es} = 1.19(53.3)-40.34 = 23.17.

Further, since the values used in the formula described by Norgan et al. were based on diverse ethnic groups but not specifically on Inuit, Inuit-specific intercept and beta coefficient values were obtained from linear regressions of SH/S ratios on BMIob and used in the Norgan et al. formula (Norgan 1994c). The beta coefficient for men was 0.60 (SE=0.27), which is compatible with the published range of 0.47 to 1.1 (Norgan 1994c). For women, the beta coefficient was 0.70 (SE=0.28), which is slightly below the published range of 0.76 to 1.6 (Norgan 1994c).

The formulas based on the Nunavik population are as follows:

For men, $BMI_{0.52}$ = 0.60(52.0)-5.32 = 25.88 and for women, $BMI_{0.52}$ = 0.70(52.0)-10.66 = 25.74, where 0.60 and 0.70 are the beta coefficients for men and women, respectively, and -5.32 and -10.66 represent the intercept (constant) for men and women, respectively. The same formulas were used to calculate the BMI_{es} using the calculated individual SH/S ratios expressed as percentages instead of the European standard of 52.0. In these analyses, Inuit derived mean BMI_{std} and the percent obese

was slightly higher than what was obtained using the already published intercept and beta coefficient values (Collins et al. 2000).

3.3.5 Statistical analysis

Analyses were run separately for men and women except when specified. Descriptive statistics were used to provide an overview of the anthropometry among Inuit from Nunavik. Linear regressions were used to evaluate trends in height and sitting height by age in years, while figures use age groupings for the presentation of the data. Residual plots were used to evaluate deviations from linearity. Further, the analysis of agreement between anthropometric obesity measures, for men and women combined, was evaluated using the percent agreement and the *kappa* statistic. The proportion of agreement between obesity measures can be misleading because it is heavily influenced by the proportion of people with the obesity characteristics being compared. Therefore, the *kappa* statistic and the 95% confidence interval (CI) were used to adjust for the amount of agreement expected by chance alone (Fisher et al. 1993). The *kappa* statistic gives values between 0 and 1, where values nearest to one indicates a perfect agreement and where a value equal to zero indicates agreement totally due to chance (Fisher et al. 1993). Statistical significance was set at $p \leq 0.05$. Statistical analyses were performed using SPSS version 13.0 for Windows (SPSS, 2004).

3.4 Results

The ages ranged from 18 to 73 years of age with a mean age of 37 years (14 SD) (Table 3.1). The majority of participants were women (55%). The mean standing height for men was 166.0 cm (6.0 SD), and for women, the mean standing height was 154.1 cm (5.0 SD). The mean sitting height for men and women was 88.9 cm (3.5 SD) and 83.2 cm (3.2 SD), respectively. The mean sitting height to stature ratio was 0.536 (0.012 SD) and 0.540 (0.013 SD), for men and women, respectively. The mean weight for men was 75.2 kg (16.5 SD),

and the mean weight was 65.6 kg (15.2 SD) for women. As for BMIob, the mean for men was 27.1 kg/m^2 (5.0 SD), and the mean BMIob for women was 27.6 kg/m^2 (6.1 SD). The mean BMIstd adjusted to the individual Cormic Index for men was 25.8 kg/m^2 (5.0 SD), and for women, 25.2 kg/m^2 (6.1 SD). The mean WC for men was 91.6 cm (SD=12.8), and 91.3 cm (SD=14.2) for women. A total of 18.8% of the men had a WC > 102 cm and 53% of the women had a WC > 88 cm: representing World Health Organization (WHO) WC cut-off values indicative of increased risk of obesity related health complications (World Health Organization 2000). The mean %BF for men was 21.4% (SD=8.1), and the mean %BF for women was 32.0% (SD=9.5). When %BF was classified according to age-specific body fat ranges based on a BMI ≥30 (Gallagher et al. 2000), 24.6% of men and 22.2% of women were considered obese.

The categories of BMI (kg/m^2) included underweight (<18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese classes I, II and III (30-34.9; 35-39.9; ≥40 kg/m^2). The total percentage of obese men and women according to the BMIob was 28.4% and 30.9%, respectively (Table 3.2, Figures 3.2 and 3.3). After applying the Cormic index, the total percentage of obese men and women according to BMIstd was 19.6% and 21.5%, respectively.

There was overall good agreement in the obesity measures where the percent agreement ranged from 76.4% to 90.5% (Table 3.3). However, when the amount of agreement was assessed through the *kappa* statistic, the amount of agreement between WC and the other obesity measures was low (BMIob and WC *kappa*=0.59, 95% CI=0.52-0.66; %BF and WC *kappa*=0.46, 95% CI=0.37-0.55; BMIstd and WC *kappa*=0.48, 95% CI=0.43-0.53), whereas greater agreement was observed between BMIstd, BMIob and %BF obesity measures (Table 3.3).

For both genders, height and sitting height were inversely related to age (Table 3.4). However, no significant trends were observed for SH/S by age.

Supplementary figures show, by age and gender, the mean standing height, sitting height, and the sitting height to stature (SH/S) ratio by age group (Figures 3.4-3.6).

3.5 Discussion

As Inuit are undergoing a nutrition transition (Kuhnlein et al. 2004), changes in body proportions, such as increased height and leg length, may be occurring. When compared to the Nutrition Canada survey of 1972, the mean SH/S ratios of the 2004 Nunavik Inuit show a slight decrease among Inuit men and little change among women, but both genders were still above the Canadian average of the 1970s (Demirjian 1980). Reasons for this lower SH/S ratio among men compared to past Inuit data could be due to the different Inuit groups sampled for the Nutrition Canada survey, (Nutrition Canada 1975) or due to the decreasing SH/S ratio observed among younger Inuit, although the latter was shown to be non-significant in the Nunavik data. Significant decreases were observed in overall height and sitting height with increasing age. It is difficult to conclude if these changes are true differences versus differences due to the aging process, but it would be expected that sitting height, rather than leg length, would decrease with age (Diacinti et al. 1995). Further, as secular trends have been shown to increase lower-body rather than upper-body growth, the significant age-related change in total height among the younger individuals of this study population suggest positive secular change (Tanner et al. 1982; Dangour et al. 2002). This positive secular trend was also observed in Greenland (Becker-Christensen 2003).

It is alarming that compared to the general Canadian population, there is a greater prevalence of obese Inuit adults (Tjepkema et al. 2005). Obesity, defined by a BMI greater than or equal to 30, has been linked to health problems such as type 2 DM, insulin resistance and cardiovascular disease (Health Canada 2003). However, when BMIob was adjusted for SH/S ratios using both the published

formula (Collins et al. 2000) and one modified from linear regression analyses based on the Nunavik study population, the prevalence of obesity among Inuit was reduced and was more comparable to the Canadian population (Tjepkema et al. 2005). Based on previous observations among differing populations, using a population's SH/S ratio to standardize the observed BMI may better represent a population's obesity patterns and the subsequent risk for chronic disease (Charbonneau-Roberts et al. 2005). Further, it has been observed in the past that high BMIob among Canadian Inuit was associated with fewer metabolic consequences than among a white Canadian population (Young 1996b). However, it is important to recognize that BMI (whether BMIob or BMIstd) does not account for central obesity, and therefore should be combined with WC among populations where WC measures are homogenously high (WHO expert consultation 2004). According to WC, this study population had a tendency for central fat patterning, increasing their risk for obesity related health complications (Pouliot et al. 1994; World Health Organization 2000; Wang et al. 2004). Also, low percent agreement between WC and other measures of obesity further emphasizes the importance of combining WC and BMI measures of obesity to characterize risk in Inuit populations. Obesity measured by %BF remains difficult to assess as no accepted ranges currently exist. International attempts involving three ethnic groups have been made but it appears that a single set of standards cannot be easily developed (Gallagher et al. 2000). Nevertheless, using combined age-specific ranges developed from African American and Caucasians from the United Kingdom (Gallagher et al. 2000), approximately a quarter of this study population were considered obese. While some may consider the amount of agreement found between all the obesity measures to be relatively good (*kappa* 0.46-0.74), the importance of central adiposity in chronic disease progression warrants that multiple measures are needed to assess the degree of obesity in research and health surveillance.

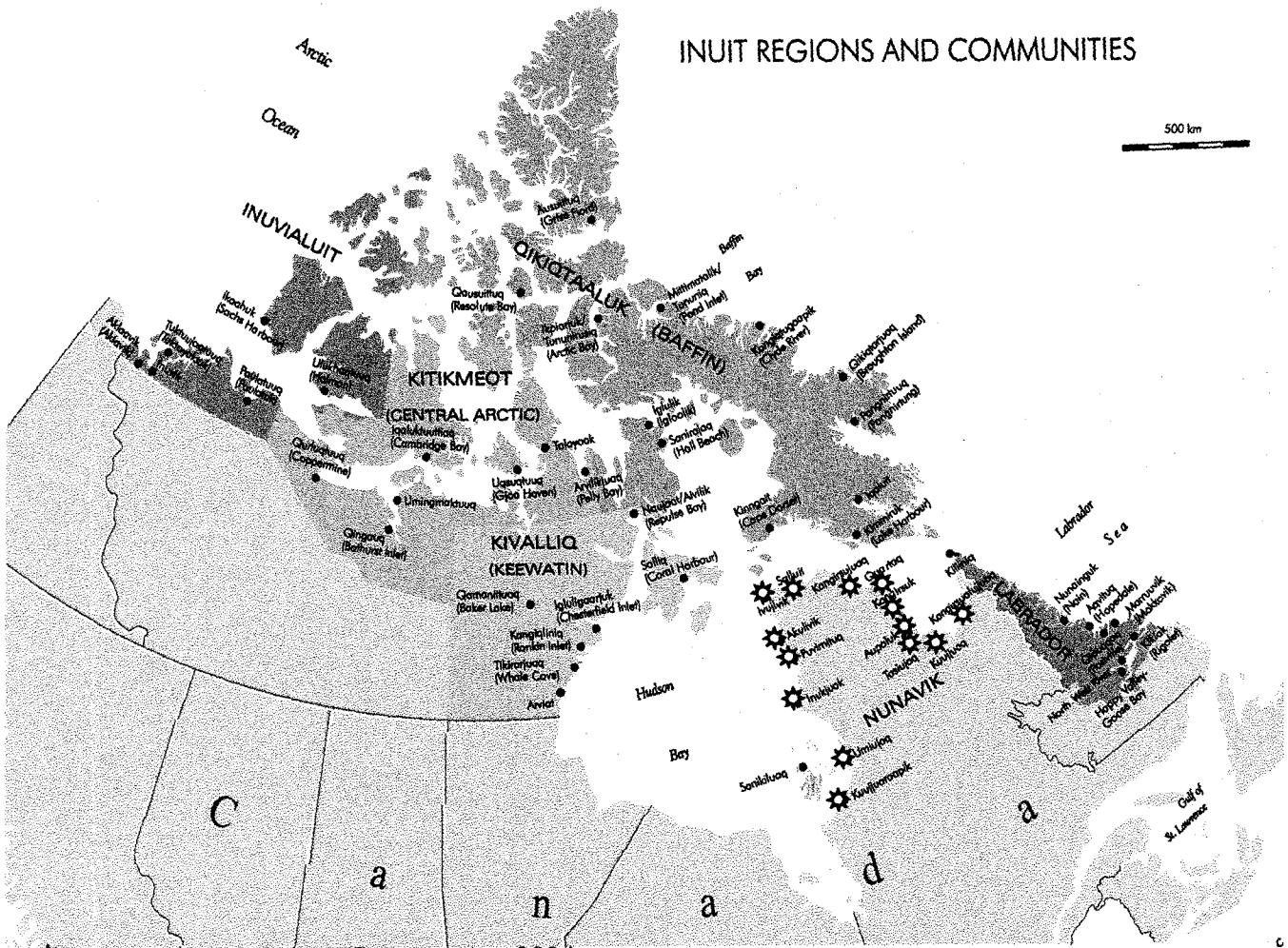
There are some limitations to this study. First of all, because the anthropometric measurements were taken as part of a larger Health Survey,

measurements may not be precise. More specifically, the pressure applied on the lumbar region for proper sitting height measurements may not have been as emphasized as within a more focused study. Secondly, the actual weight of the clothing could have differed from the reference weight used, however, under the study constraints of clinic rooms available on the ship, a reference clothing weight estimate was the most appropriate.

3.6 Conclusion

In conclusion, using the widely used BMIob, Inuit are heavier than the general population of Canadians, suggesting that they are at increased risk for obesity-related chronic diseases. However, it appears that BMIstd adjusted for sitting height may provide a more appropriate comparison for obesity patterns between Inuit and other populations. Further, the relatively low agreement between WC and all other measures suggest that WC is important to characterize risk among Inuit. Further work is needed to help interpret %BF. Secular trends were also observed where Inuit seem to be undergoing positive secular changes in height, but age was inversely related to sitting height which is most likely explained by the aging process.

Figure 3.1- Nunavik communities screened during the Health Survey.



✡ *Nunavik Health Survey Communities, 2004*
Source: Inuit Tapiriit Kanatami, 1997

Table 3.1 - Nunavik Inuit random sample population characteristics.

	Men n=220		Women n=269	
	Mean (SD)	(Min-Max)	Mean (SD)	(Min-Max)
Age, years	37 (14)	18-72	38 (14.3)	18-73
Height, cm	166.0 (6.0)	151.0-188.0	154.1 (5.0)	142.0-172.0
Sitting height, cm	88.9 (3.5)	77.3-97.8	83.2 (3.2)	73.0-91.2
Weight, kg	75.2 (16.5)	45.0-167.0	65.6 (15.2)	39.5-118.0
BMIob, kg/m^2	27.1 (5.0)	17.5-41.0	27.6 (6.1)	17.5-48.0
SH/S ratio	0.536 (0.012)	0.499-0.563	0.540 (0.013)	0.491-0.574
BMIstd, kg/m^2	25.8 (5.0)	15.9-39.8	25.2 (6.1)	14.5-44.2
Waist, cm	91.6 (12.8)	(66.0-131.0)	91.3 (14.2)	(66.0-136.0)
Body fat, %	21.4 (8.1)	(4.0-46.0)	32.0 (9.5)	(6.0-52.0)

Table 3.2 - The effect of adjusting the BMI to a relative sitting height among Nunavik Inuit on the distribution of the BMI values.

	Men				Women			
	Observed		Standardized		Observed		Standardized	
BMI kg/m^2	n	%	n	%	n	%	n	%
<18.5	2	0.9	3	1.4	5	1.9	26	10.0
18.5-24.9	86	40.8	105	50.2	99	37.8	116	44.4
25-29.9	63	29.9	60	28.7	77	29.4	56	24.1
≥30	61	28.4	41	19.6	81	30.9	56	21.5
Total	211	100.0	209	100.0	262	100.0	261	100.0

Table 3.3 – Agreement between anthropometric obesity measures.

Obesity Measures	% Agreement	Kappa	(95% CI*)
BMIob, kg/m^2 and waist, cm	81.5	0.59	(0.52, 0.66)
Body fat, % and waist, cm	76.4	0.46	(0.37, 0.55)
Body fat, % and BMIob, kg/m^2	89.6	0.74	(0.65, 0.83)
BMIstd, kg/m^2 and waist, cm	78.0	0.48	(0.43, 0.53)
BMIstd, kg/m^2 and body fat, %	90.5	0.73	(0.63, 0.83)

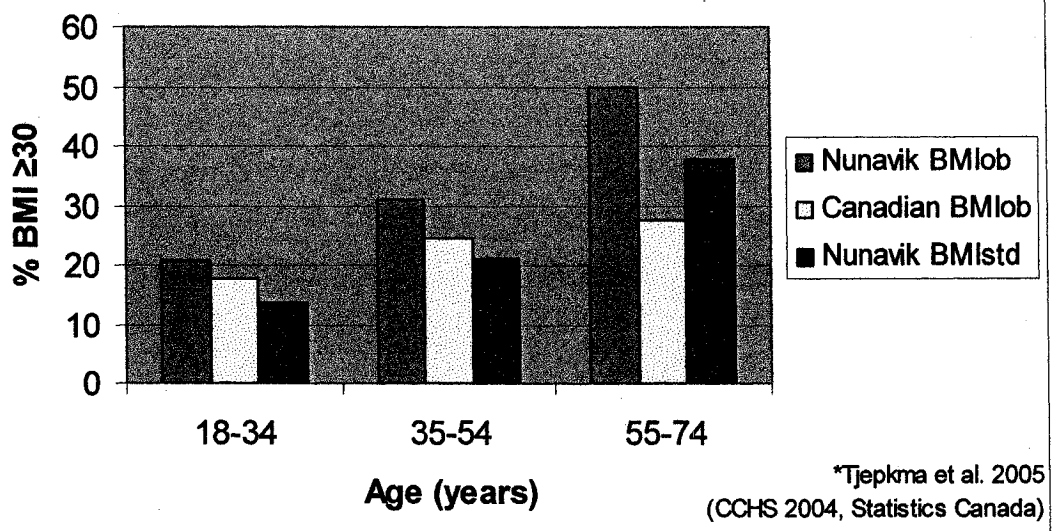
* CI= Confidence interval

Table 3.4 – *Beta* coefficients (SE) for age (years) in linear regression analyses conducted separately for each anthropometric dependent variables.

	Men		Women	
	Intercept	*Beta* (SE)	Intercept	*Beta* (SE)
Weight, kg	66.5	0.243 (0.081)**	64.2	0.037 (0.066)
Height, cm	169.4	-0.094 (0.028)***	159.6	-1.146 (0.020)***
Sitting height, cm	90.2	-0.036 (0.017)*	86.1	-0.079 (0.013)***
SH/S ratio	0.532	0.000 (0.000)	0.540	0.000 (0.000)

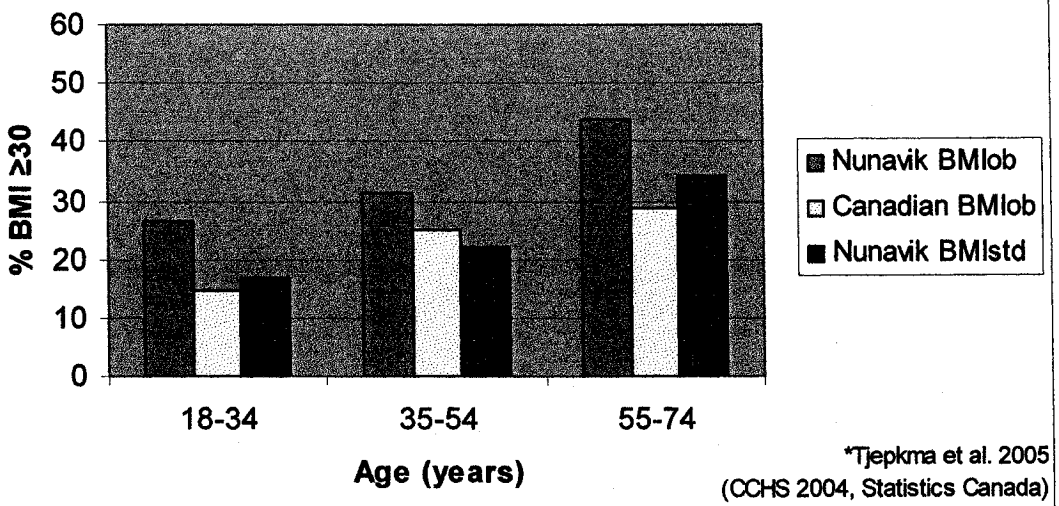
*Significant at $p \leq 0.05$, ** significant at $p \leq 0.01$, ***significant at $p \leq 0.001$

Figure 3.2 - Inuit Men's BMIs ≥30, by Age, Compared to Canadian Population*.



*Tjepkma et al. 2005
(CCHS 2004, Statistics Canada)

Figure 3.3 - Inuit Women's BMIs ≥30, by Age, Compared to Canadian Population*.



*Tjepkma et al. 2005 (CCHS 2004, Statistics Canada)

Figure 3.4 - Height Trends, by Age and Gender, among Inuit.

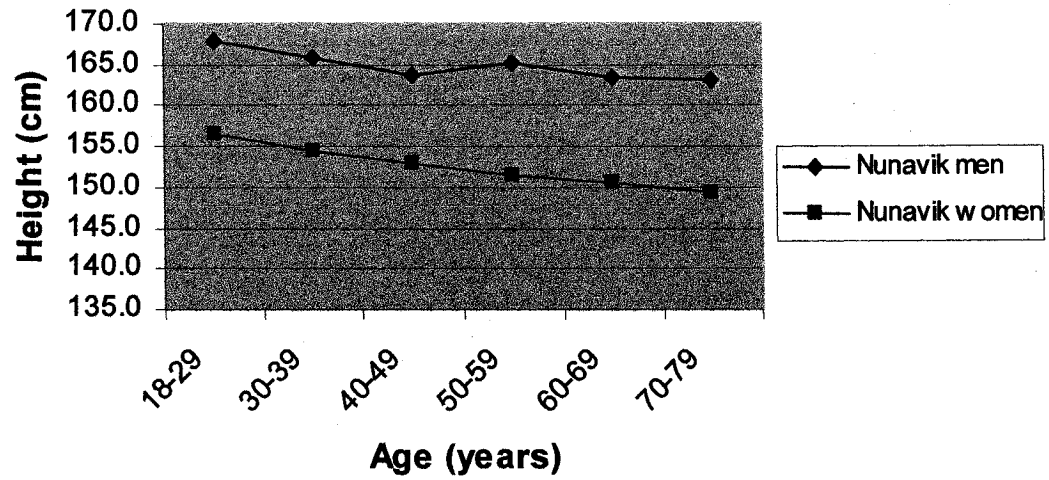


Figure 3.5 - Sitting Height Trends, by Age and Gender, among Inuit.

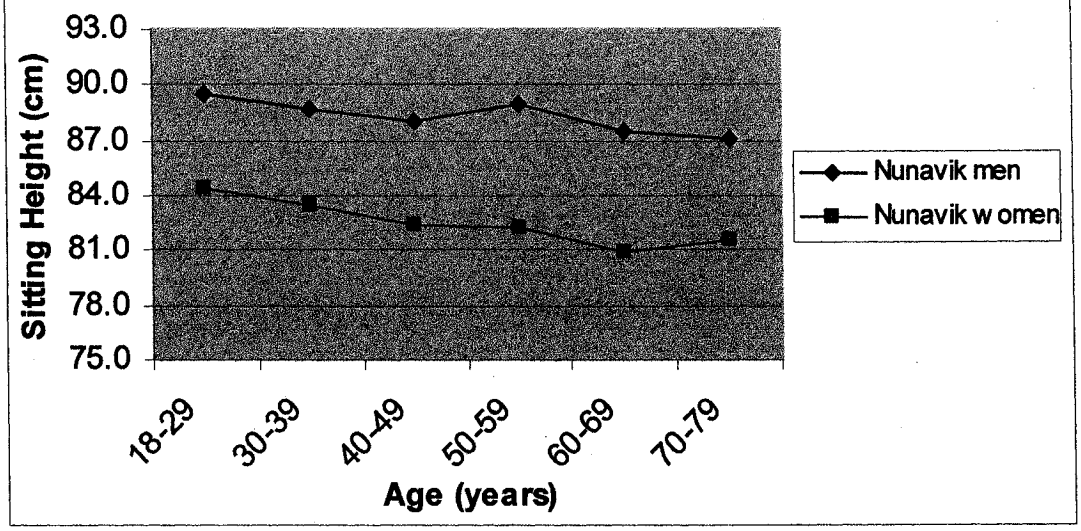
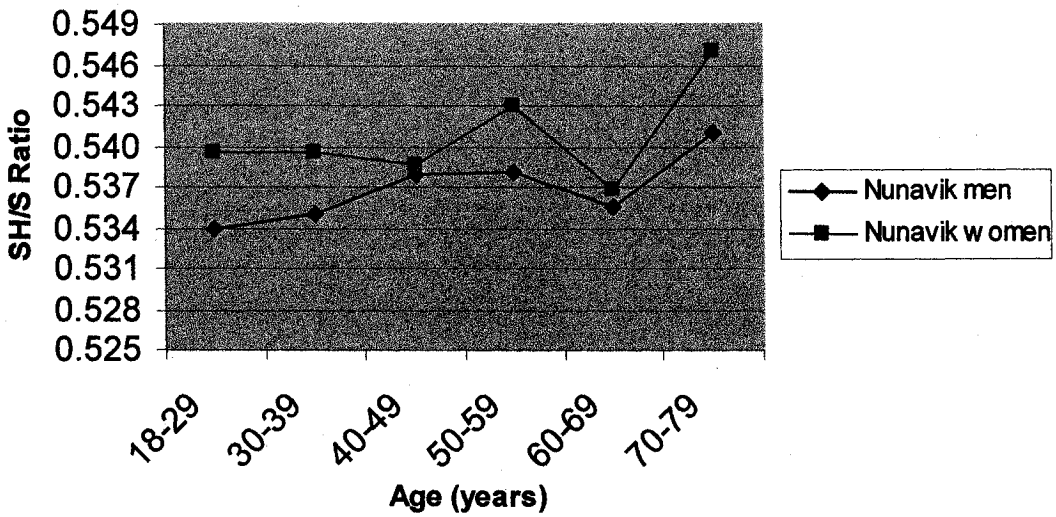


Figure 3.6 - Sitting Height to Stature (SH/S) Ratio Trends, by Age and Gender, among Inuit.



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4. Bridge

As the Nunavik thesis data were limited to anthropometric measurements, the association between Inuit's obesity patterns and risk factors for type 2 DM could not be evaluated. Therefore, as obesity has been linked to insulin resistance and insulin resistance has been linked to type 2 DM, data from a Baffin Region pilot health screening was used to evaluate the anthropometric correlates of indices of insulin resistance. Diabetes in remote communities presents a health care challenge as services are not easily accessible. Early detection of the correlates of diabetic risk factors within an Inuit context will help in the development of appropriate screening guidelines and prevention efforts.

5. Manuscript III:

Anthropometric correlates of indices of insulin resistance among Inuit

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5.1 Abstract

Obesity is known to be a major risk factor for insulin resistance. As Inuit are undergoing a dietary transition involving lifestyle changes, the rates of obesity and of obesity-related chronic diseases including type 2 diabetes mellitus (DM) are increasing. The aims of the study were to evaluate the anthropometric correlates of indices of insulin resistance using the homeostasis model assessment index (IR_{HOMA}), the quantitative insulin sensitivity check index (QUICKI), and the insulin sensitivity index ($ISI_{0,120}$). Data were collected as part of a pilot health screening in Pangnirtung, Nunavut of the Baffin Region among adults 18 years of age and above. Results for women indicated that in age-adjusted linear regression analyses, observed BMI (BMIob), sitting height adjusted BMI (BMIstd), waist circumference (WC) and percent body fat (%BF) predicted IR_{HOMA}, QUICKI and $ISI_{0,120}$ ($p<0.05$). For men, BMIstd and %BF predicted IR_{HOMA}, BMIob, BMIstd and %BF predicted QUICKI, and WC and %BF predicted $ISI_{0,120}$ ($p<0.05$). BMIstd showed similar results to BMIob and did not better predict the indices of insulin resistance/sensitivity. In general, the present study suggests that increasing rates of obesity among Inuit will have health consequences and that anthropometry is an effective tool to indirectly assess insulin resistance/sensitivity.

5.2 Introduction

Early detection of insulin resistance and the implementation of interventions to improve insulin sensitivity may reduce the development of type 2 diabetes mellitus (DM) (Gutt et al. 2000; Vaccaro et al. 2004). Obesity is known to be a major risk factor for insulin resistance (Jones et al. 2000). Measures of obesity commonly used include body mass index (BMI), waist circumference (WC) and body fat percentage (%BF) and each relate to insulin sensitivity (Cervenakova et al. 2002; Bryhni et al. 2003; Ehtisham et al. 2005). Further, because Inuit tend to have a longer torso relative to the total height compared with other populations, sitting height adjusted BMI has been recommended when evaluating the anthropometric correlates of health risks and when comparing obesity rates between populations (Charbonneau-Roberts et al. 2005).

Among Inuit, the role of obesity-related measurements in predicting health risks is especially not well understood. For example, in Greenland, the central fat patterning of Inuit was not as predictive of metabolic syndrome risk factors compared to a Danish study population (Jorgensen et al. 2003). Also, when Canadian Inuit were compared to a general North American population, the central fat patterning of Inuit did not have an independent effect on fasting and 2-hour glucose, or on triglycerides, total cholesterol, LDL and HDL cholesterol (Young 1996a). Central fat patterning of Inuit may have been helpful in surviving the harsh arctic environment (Young 1996a). However, as Inuit are undergoing a dietary transition which also involves decreases in physical activity due to modern day conveniences and sedentary jobs, the rates of obesity and of obesity-related chronic diseases including type 2 DM are increasing (Murphy et al. 1992; Ebbesson et al. 1998; Jorgensen et al. 2002). Therefore, an evaluation of the extent to which anthropometric measures relate to indices of insulin sensitivity may prove useful in designing Inuit-specific diabetes screening guidelines and health promotion programs.

The aims of the study were to evaluate the anthropometric correlates of indices of insulin resistance using the homeostasis model assessment index (IR_{HOMA}) (Matthews et al. 1985), the quantitative insulin sensitivity check index (QUICKI) (Katz et al. 2000), and the insulin sensitivity index developed by Gutt et al. ($ISI_{0,120}$) (Gutt et al. 2000), and to compare the results of the different insulin sensitivity indices used.

5.3 Subjects and methods

5.3.1 Participant population

A pilot health screening in Pangnirtung, Nunavut from the South Baffin coastal region was conducted during the month of May, 2005, among adults 18 years of age and above. The specifics regarding recruitment to the health screening were worked out in detail with the community steering committee. As part of a volunteer and not a randomly selected sample, all Inuit adults in the community were eligible to participate. Volunteers were recruited through community radio announcements, pamphlets and three information sessions where bilingual community research assistants explained the screening and its importance to community members.

5.3.2 Ethical approvals and participatory processes

Approvals for the Pangnirtung health screening were obtained from the McGill Ethics Review Committee, the Nunavut Research Institute, and the community (Appendix 8.3). A Pangnirtung, Nunavut-Centre for Indigenous Peoples' Nutrition and Environment (CINE) research agreement was also developed with the Hamlet Council (Appendix 8.4). The methodology followed reflected the participatory process developed by the World Health Organization (WHO) and Dr. Harriet Kuhnlein from CINE (World Health Organization et al.

2003). Comments and feedback were also requested of the Inuit Tapiriit Kanatami (ITK), which is a member of the CINE Governing Board, the Government of Nunavut Health and Social Services Department and the Nunavut Tunngavik Incorporated. A community steering committee guided all aspects of the field work and ensured appropriate and accurate translations of consent forms and questionnaires into Inuktitut. Informed consent was obtained from each participant (Appendix 8.5).

5.3.3 Sample size

There were a total of 52 Inuit participants in the pilot health screening. Four reported being diagnosed with type 2 DM (which was confirmed by medications being taken) and were excluded from the analysis. A total of 48 participants were included in the analysis. Capillary blood tests were conducted for individuals who were both obese and over 50 years of age as a precautionary measure using a One UltraSoft Touch. If the capillary blood test was ≥7 mmol/L, only fasting blood samples were collected. One individual was found to have a capillary blood value was ≥7 mmol/L and therefore only fasting samples were collected. Another individual did not return for the 2-hour blood collection. Therefore, a total of 46 participants completed both the fasting and the 2-hour blood tests. One individual had a fasting insulin of <14 pmol/L and therefore no insulin sensitivity indexes could be calculated.

5.3.4 Anthropometric measurements

The anthropometric data collected included weight, height, sitting height, waist circumference, and body fat composition. **Weight and body fat composition** were measured using a Tanita leg-to-leg bioelectrical impedance scale where a clothing reference weight of 0.5 kg was entered for each participant, and automatically subtracted to provide weight. **Height** was measured using a leveled height rod equipped with a horizontal head board. The

participants were asked to remove their shoes and stand as tall and as straight as possible with the head level, the shoulders and upper arms relaxed. The vertical distance between the standing surface and the top of the head was measured to the nearest millimeter (0.1 cm). **Sitting height (SH)** was measured using a sitting height table equipped with a sliding anthropometer adjustable for thigh length and an adjustable foot support (Charbonneau-Roberts et al. 2005). Two measurements were taken to the nearest millimeter (0.1 cm). If a large variation (more than 1 cm) was detected between the two measurements, the body position was rechecked and measurements were taken until two measurements were within 1 cm. **Waist circumference** was measured at the point midway between the iliac crest and the costal margin (lower rib). The measurement was taken to the nearest millimeter (0.1cm). Also, if standing height, sitting height or waist circumference measures fell between two millimeters, the even millimeter was recorded.

5.3.5 Sitting height adjusted body mass index

When sitting height to stature (SH/S) ratios, also known as relative sitting heights, were examined as to how they related to BMI in 158 study populations taken from 46 papers and representing 18 000 men and women, it was found that for every 0.01 unit difference in SH/S ratio, the difference in BMI was 0.90 kg/m^2 (Norgan 1994b). Therefore, the commonly used BMIob was standardized using a Cormic index for men and women developed from their relative sitting heights. Cormic index adjustments are based upon techniques developed by Norgan (Norgan 1994b; Norgan 1994c; Norgan 1995) and modified by Collins et al. (Collins et al. 2000). The BMIstd was calculated using the formula from Collins et al. (Collins et al. 2000) which provide separate SH/S ratio *beta* coefficients and intercepts for predicting BMI for men (*beta*=0.78, α=-18.43) and women (*beta*=1.19, α=-40.34), based on linear regression techniques and equations first published by Norgan (Norgan 1994c; Norgan 1994b). Variations in the SH/S ratio between or even within populations may account for a 5 kg/m^2 unit difference in

BMI, therefore individual rather than population BMIes were calculated (Norgan 1994b). The SH/S ratio *beta* coefficient from the linear regression analyses was then used to predict the BMI at a SH/S ratio of 0.52 (Norgan 1994b), which is the mean SH/S ratio among European study populations that have been used to develop BMI cut-off points related to elevated mortality rates (Norgan 1995).

$BMI_{std} = BMI_{0.52} + (BMI_{ob}-BMI_{es})$, where:

$BMI_{0.52}$ is the BMI at an estimated SH/S ratio of 0.52. For men, $BMI_{0.52}$ = 0.78(52.0)-18.43 = 22.13 and for women, $BMI_{0.52}$ = 1.19(52.0)-40.34 = 21.54, where 0.78 and 1.19 are the *beta* coefficients for men and women, respectively, and -18.43 and -40.34 represent the intercept (constant) for the men and women, respectively;

BMI_{ob} is the observed BMI as calculated by measured weight divided by standing height in meters squared (kg/m^2);

BMI_{es} is the BMI at the calculated individual SH/S ratio. For example, if the SH/S for one man is 0.530, use 53 percent in the formula BMI_{es} = 0.78(53.0)-18.43 = 22.91, and if the SH/S ratio for one women is 0.533, use 53.3 percent in the formula BMI_{es} = 1.19(53.3)-40.34 = 23.17.

5.3.6 Laboratory measurements

Clinical and laboratory measurements included fasting and 2-hour glucose and insulin. A standard 75-gram oral glucose tolerance test (OGTT) was performed in the morning after an overnight fast of 8 hours.

MDS Laboratories was used for all laboratory analyses without information regarding clinical histories of the patients attending the health screening (MDS Laboratories). Venous blood samples were placed on ice and after a 20 minute period to allow for clotting, samples were centrifuged for 10 minutes using a Fisher Centrific Model 228 Benchtop centrifuge. The plasma was decanted into storage tubes that were stored in a -20^0 freezer at the Arctic College and shipped in batches with ice packs to the MDS laboratory within 3-7 days. Glucose profiles were done on a Vitros 950 analyzer and examined using a glucose oxidase color technique. Insulin profiles were done on a Immulite 2000 (test ref-out) analyzer and measured by the chemiluminescent immunometric assay.

5.3.7 Derived indices of insulin action

Indices of insulin action based upon fasting and oral glucose tolerance test data were used. For indices based on fasting insulin and glucose values, QUICKI and IR_{HOMA} were selected for the analyses as they are widely used, and are recognized as a means for assessing insulin sensitivity in population based studies (Katz et al. 2000; Monzillo et al. 2003). The rationale behind the choice of insulin sensitivity indices, which utilize information from the oral glucose tolerance test (OGTT), was based on results from recent findings assessing all indices to date in which Gutt et al.'s insulin sensitivity index at 0 and 120 minutes ($ISI_{0,120}$) was found to be the most predictive for type 2 DM in a large multiethnic cohort (Hanley et al. 2003). Calculations for each of the indexes used are described below:

Quantitative insulin sensitivity check index (QUICKI) (Katz et al. 2000)

QUICKI $= 1/[\log_{10}$ fasting glucose (mg/dl) $+ \log_{10}$ fasting insulin (μIU/ml)], where from insulin pmol/l to insulin μIU/ml, divide by 6.945.

Homeostasis model assessment insulin resistance index (IR_{HOMA}) (Matthews et al. 1985)

IR_{HOMA}= Fasting insulin (mU/l) x fasting plasma glucose (mmol/l) / 22.5), where insulin pmol/l is converted to insulin mU/l by dividing by 6.945.

Insulin sensitivity index developed by Gutt et al. ($ISI_{0,120}$) (Gutt et al. 2000)

$ISI_{0,120}$= (m/MPG) / log10 MSI, where

m= (75000 mg + (fasting glucose (mg/L) - 2-h glucose (mg/L)) x 0.19 x body wt kg)/120,

MPG is the mean plasma glucose value (mmol/l),

MSI is the mean serum insulin value (μIU/ml).

Conversions: insulin pmol/l is converted to insulin mU/l by dividing by 6.945, and glucose mmol/l is converted to glucose mg/l by multiplying by 180 (Cervenakova et al. 2002)

5.3.8 Statistical analysis

Descriptive statistics were used to provide an overview of the anthropometric data and the blood sample results among Inuit. Independent student t-tests were used to detect differences in glucose, insulin and the insulin sensitivity/resistance indices between the normal weight and the obese group. Linear regressions, both univariate and multivariate, were used to evaluate the anthropometric determinants of insulin resistance using derived indices of insulin action examined as continuous variables. Age-adjusted linear regressions were conducted separately for men and women. Outliers were assessed using the standard procedure of multiplying the interquartile range by 1.5 and were found only among four women for $ISI_{0,120}$ and QUICKI. Outliers were not excluded from the data presented as these values were physiologically possible. However, models were conducted with and without the outliers to evaluate consistency in the results. Models relating BMIob, BMIstd, %BF or WC were highly correlated and therefore were not included in one analysis. Correlations between independent variables and between insulin sensitivity indices were assessed using Pearson correlations. For selected variables that had slightly skewed

distributions, Spearman correlations were also conducted but as no differences were found between Spearman and Pearson *r*, Pearson *r* is presented for all variables. The significance was set at $p \leq 0.05$. All statistical analysis was performed using SPSS version 13.0 for Windows (SPSS, 2004).

5.4 Results

The ages ranged from 19 to 77 years of age with a mean age of 45 years (SD=17) (Table 5.1). The majority of participants were women (77.1%). The mean WC was 91.6 cm (SD=15.6) for men, and 103.5 cm (SD=14.0) for women. A total of 36.4% of the men had a WC > 102 cm and 86.1% of the women had a WC > 88 cm: representing World Health Organization (WHO) WC cut-off values indicative of increased risk of obesity related health complications (World Health Organization 2000). As for BMIob, the mean for men was 26.4 kg/m^2 (SD=4.9), and the mean BMIob for women was 32.0 kg/m^2 (SD=6.1). Using the sitting height adjusted BMIstd, the mean for men was 25.1 kg/m^2 (SD=5.2), and the mean for women was 28.6 kg/m^2 (SD=6.0). The percentage of obese using the BMIob was 27.3% for men and 67.6% for women; whereas the percentage of obese using the BMIstd remained the same for men and decreased to 43.2% for women. The mean %BF for men was 22.1% (SD=9.5), and for women was 40.3% (SD=7.8). When %BF was classified according to age-specific body fat ranges based on a BMI ≥30 (Gallagher et al. 2000), 27.3% of the men and 64.9% the women were considered obese.

Participants were classified as having normal glucose tolerance (NGT), impaired fasting glucose (IFG), impaired glucose tolerance (IGT), both IFG and IGT or type 2 (DM) according to the Canadian Diabetes Association (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2003a). Results indicated that out of 48 participants, two had isolated IFG and two others had isolated IGT. No new diabetic cases were found. Using the clinical cut-off values from the MDS laboratories of up to 210 pmol/l for fasting insulin and

between 70-770 pmol/l for 2-hour insulin, one participant had elevated fasting insulin and one had elevated 2-hour insulin. Eight had a 2-hour insulin value <70 pmol/l.

Fasting and 2-hour glucose values were similar between obese (BMIob ≥30) and non-obese (BMIob <30) individuals (Table 5.2). Among women, the mean fasting and 2-hour insulin levels were significantly higher in the obese BMI group than in the normal weight group, and fasting insulin was significantly higher in the high WC group. According to the IR_{HOMA}, QUICKI and $ISI_{0,120}$ values, insulin sensitivity was significantly lower among the obese BMI and the high WC groups than among the normal weight and normal WC groups. Among eleven men, similar differences were observed in the $ISI_{0,120}$ between the obese and the non-obese, and in IR_{HOMA} and QUICKI between WC groups, but they were not significant. When using the BMIstd to define the obese group, results among women were similar to results using the BMIob. As the same men were characterized as obese using BMIstd, no separate presentation is provided.

Among women, strong positive correlations were observed between BMIob and WC (r=0.95), BMIstd and WC (r=0.94), BMIstd and BMIob (r=0.98), %BF and WC (r=0.94), %BF and BMIob (r=0.90), and %BF and BMIstd (r=0.90) (Table 5.3). Among men, strong positive correlations were observed between WC and age (r=0.81), BMIob and age (r=0.73), BMIob and WC (r=0.92), BMIstd and age (r=0.74), BMIstd and WC (r=0.93), BMIstd and BMIob (r=0.98), %BF and age (r=0.89), %BF and WC (r=0.95), %BF and BMIob (r=0.93), and lastly, %BF and BMIstd (r=0.92).

In age-adjusted linear regression analyses, all four anthropometric independent variables predicted IR_{HOMA}, QUICKI and $ISI_{0,120}$ in women (Table 5.4). For men, BMIstd and %BF predicted IR_{HOMA}, BMIob, BMIstd and %BF predicted QUICKI, and WC and %BF predicted $ISI_{0,120}$. Correlations between the

different insulin sensitivity indices were strong (IR_{HOMA} and QUICKI, r=-0.91; IR_{HOMA} and $ISI_{0,120}$, r=-0.71; and $ISI_{0,120}$ and QUICKI, r=0.78).

5.5 Discussion

Based simply on the BMI and the WC, this population of volunteers for the health screening is at risk for developing obesity-related complications such as type 2 DM (Lemieux et al. 1994; Health Canada 2003). Based on BMIob, over a quarter of the men and sixty-eight percent of the women were considered obese according to the Canadian guidelines for body weight classification in adults (Health Canada 2003). However, the BMIstd decreased the percent of obese women to forty-three percent. As for WC, over a third of the men and the majority of the women had values above the WHO recommended levels (World Health Organization 2000). However, for Inuit there are possible adaptations to central fat patterning for survival in the arctic. Inuit may favor intra-abdominal deposition to provide more heat production, whereas subcutaneous fat provides insulation (Shephard 1991). Bioelectrical impedance analysis (BIA), which measures the body's percentage of fat, does not specify the type or location of body fat. Further, BIA has only recently been used among Inuit and needs to be validated using appropriate prediction equations. Until then, BIA instruments are only useful for within population comparisons. Measuring the type of fat through abdominal ultrasounds on a subgroup of a population may also prove to be useful.

In the current study population, no differences were observed in fasting and 2-hour glucose values in the obese compared to the normal weight group. A similar trend was observed among the Keewatin Inuit of the Northwest Territories, where increasing BMI had no effect on fasting or 2-hour glucose values, indicating that the body's glucose disposal was not impaired (Young 1996a). When compared to Inuit from Greenland, the Pangnirtung health screening volunteers had similar fasting glucose values and 2-hour glucose

values (given the range of the standard deviations), but had lower fasting and 2-hour insulin values (Jorgensen et al. 2003). However, comparison of insulin values between laboratories is problematic given that techniques are not yet standardized and produce variable results. When Inuit from Greenland were compared to their Danish counterparts, 2-hour glucose and insulin values among Inuit were lower at any given level of waist circumference (Jorgensen et al. 2003). Insulin values and indices of insulin resistance in the current population were shown to be higher among the obese compared to the normal weight group.

From the results, it is clear that obesity among women assessed through BMIob and BMIstd was linked to indices of insulin resistance, and that WC, BMIob, BMIstd and %BF are predictors of insulin sensitivity. For men, similar results were observed but %BF seemed to be a better predictor of insulin sensitivity.

In this study, the indices used based on fasting insulin and glucose values (IR_{HOMA} and QUICKI) showed a significantly high correlation with each other in both genders. This is not surprising as QUICKI is similar to IR_{HOMA} except that it is also based on taking the logarithm and the reciprocal of the glucose-insulin product to compensate for skewed fasting insulin values (Katz et al. 2000). However, QUICKI has been shown to have a significantly better correlation than IR_{HOMA} with the insulin sensitivity clamp (SI_{Clamp}) (Katz et al. 2000).

There are some limitations to this study. First of all, the volunteer recruitment may have led to self-selected overweight individuals as previous work among Inuit have found a lower prevalence of obesity among Inuit women (approximately 27%) (Ebbesson et al. 1998; Jorgensen et al. 2002). The data, however, are still useful for within-population comparisons and for assessing how obesity relates to indices of insulin sensitivity. Also, differences in results observed between men and women participants are likely due to the small

number of men and perhaps to other factors such as differences in physical activity levels as men tend to be more active than women (Craig et al. 2004) and physical activity has been linked to improved insulin sensitivity (Duncan et al. 2003).

A larger sample size with greater heterogeneity in anthropometric measures is needed to further evaluate the anthropometric correlates of insulin sensitivity. Also, the use of an additional post-load blood sample at 30 minutes would help assess glucose metabolism (Stumvoll et al. 2000).

5.6 Conclusion

As in the Nunavik analyses (manuscript II), when BMI was adjusted for sitting height, the prevalence of obesity was diminished in the Pangnirtung pilot volunteer community screening. Nonetheless, the prevalence of obesity remained high among those that self-selected to be screened. Despite the high prevalence of obesity, few had abnormalities in either IFG, IGT, or insulin. However, the obesity was associated with central fat patterning and with relative measures of insulin resistance, and therefore, cannot be considered harmless. The data indicate a need for ongoing health surveillance, research and health promotion. As the volunteer study population was relatively homogeneous, a larger more heterogeneous and preferably randomly selected study population is needed to explore the anthropometric correlates and prospective determinants of insulin resistance including the potential modifying factors of diet, physical activity and other factors. In the meantime, incorporation of simple anthropometric measures, such as BMI and WC, in health surveillance can provide an indication of the public health challenges ahead.

Table 5.1 - Baffin community Inuit sample population characteristics, age, anthropometry, glucose, insulin and indices of insulin sensitivity.

	Men n=11			Women n=37	
	n	Mean (SD)	(Min-Max)	Mean (SD)	(Min-Max)
Age, years	11	41.0 (15.0)	24.0-71.0	46.0 (17.0)	19.0-77.0
Waist, cm	11	91.6 (15.6)	75.0-116.0	103.5 (14.0)	73.0-127.0
BMIob, kg/m^2	11	26.4 (4.9)	21.0-35.0	32.0 (6.1)	22.0-45.0
BMIstd, kg/m^2	11	25.1 (5.2)	18.7-34.4	28.6 (6.0)	17.1-41.0
Body fat, %	11	22.1 (9.5)	12.0-41.0	40.3 (7.8)	19.0-53.0
Glucose, fasting (mmol/l)	11	4.7 (1.1)	3.2-6.0	5.0 (0.9)	2.7-6.4
Glucose, 2hr (mmol/l)	9	3.1 (1.4)	1.4-5.3	3.7 (1.7)	1.4-8.3
Insulin, fasting (pmol/l)	10	72.2 (36.1)	38.0-135.0	104.0 (43.7)	35.0-253.0
Insulin, 2hr (pmol/l)	9	105.0 (73.8)	38.0-239.0	220.0 (211.0)	52.0-1149.0
IR_{HOMA}	10	2.3 (1.6)	1.0-5.1	3.4 (1.5)	0.9-6.8
QUICKI	10	0.26 (0.02)	0.23-0.26	0.25 (0.01)	0.23-0.28
$ISO_{0,120}$	8	197.0 (80.8)	81.0-340.0	134.8 (60.4)	48.7-290.0

Table 5.2 - Insulin, glucose and insulin sensitivity in subgroups by obesity.

	Men				Women				
	BMI†		Waist‡		BMI†			Waist‡	
	Normal	Obese BMIob	Normal	High	Normal	Obese BMIob	Obese BMIstd	Normal	High
	n=8	n=3	n=7	n=4	n=12	n=25	n=16	n=5	n=31
Glucose, fasting (mmol/l)	4.7 (1.1)	4.5 (1.3)	4.6 (1.1)	4.9 (1.2)	4.8 (0.8)	5.1 (0.9)	5.2 (0.8)	4.7 (0.5)	5.1 (0.9)
Glucose, 2hr (mmol/l)	3.1 (1.5)	3.2 (1.7)	2.8 (1.3)	3.9 (1.7)	3.2 (1.5)	3.9 (1.8)	4.0 (1.8)	3.1 (1.2)	3.9 (1.8)
Insulin, fasting (pmol/l)	70.9 (40.5)	75.3 (30.1)	62.3 (36.9)	87.0 (33.9)	72.4 (31.1)	120.0*** (40.7)	123.7* (45.0)	53.2 (15.3)	113.5** (41.4)
Insulin, 2hr (pmol/l)	84.4 (70.0)	177.0 (29.7)	58.7 (17.3)	197.7* (41.5)	118.0 (74.4)	268.0* (237.0)	263.2 (265.7)	81.0 (38.8)	247.1 (219.4)
IR_{HOMA}	2.3 (1.8)	2.3 (1.2)	1.9 (1.6)	2.9 (1.5)	2.3 (1.2)	3.9*** (1.4)	4.1* (1.4)	1.6 (0.5)	3.7** (1.4)
QUICKI	0.26 (0.02)	0.26 (0.02)	0.27 (0.02)	0.25 (0.02)	0.26 (0.01)	0.24*** (0.01)	0.24* (0.01)	0.26 (0.01)	0.24** (0.01)
$ISI_{0,120}$	211.9 (87.6)	152.4 (44.3)	238.1 (66.8)	128.6 (51.8)	169.1 (67.8)	118.3* (49.9)	114.1 (40.4)	181.7 (53.9)	124.3* (56.9)

Data are means (SD), unless noted otherwise; † For BMI, normal BMIob<30, Obese BMIob ≥30 and BMIstd ≥30; ‡ Waist circumference for men, normal ≤102cm and high >102cm; for women, normal ≤88cm and high >88cm; *Significant at $p \leq 0.05$, **significant at $p \leq 0.01$, ***significant at $p \leq 0.001$

Table 5.3 - Pearson's correlations between anthropometric independent variables.

	Men					Women				
	Age, years	Waist, cm	BMI, kg/m^2	BMIstd, kg/m^2	Body fat, %	Age, years	Waist, cm	BMI, kg/m^2	BMIstd, kg/m^2	Body fat, %
Age, years	-	-	-	-	-	-	-	-	-	-
Waist, cm	0.81**	-	-	-	-	0.17	-	-	-	-
BMIob, kg/m^2	0.73**	0.92***	-	-	-	0.15	0.95***	-	-	-
BMIstd, kg/m^2	0.74**	0.93***	0.98***	-	-	0.14	0.94***	0.98***	-	-
Body fat, %	0.89***	0.95***	0.93***	0.92***	-	0.27	0.94***	0.90***	0.90***	-

*Significant at $p \leq 0.05$, **significant at $p \leq 0.01$, ***significant at $p \leq 0.001$

Table 5.4 - Age-adjusted linear regression *beta* coefficients (SE) conducted separately for each independent anthropometric variable against three insulin sensitivity indices.

	IR_{HOMA}		QUICKI		$ISI_{0,120}$	
	Intercept	B (SE)	Intercept	B (SE)	Intercept	B (SE)
Men						
Waist, cm	-2.771	0.096 (0.053)	0.334	-0.001(0.001)	585.278	-6.348 (2.059) *
BMIob, kg/m^2	-1.553	0.275 (0.130)	0.322	-0.004 (0.001) *	439.179	-11.884 (7.502)
BMIstd, kg/m^2	-1.191	0.284 (0.116)*	0.313	-0.004 (0.001)*	388.415	-10.967 (7.480)
Body fat, %	3.137	0.248 (0.088) *	0.249	-0.004 (0.001) **	231.689	-12.729 (4.300) *
Women						
Waist, cm	-3.874	0.066 (0.015) ***	0.310	-0.001(0.000) ***	370.341	-1.910 (0.622) **
BMIob, kg/m^2	-2.234	0.157 (0.032) ***	0.293	-0.001(0.000) ***	322.431	-4.369 (1.406) **
BMIstd, kg/m^2	-1.327	0.142 (0.035)***	0.285	-0.001 (0.000)***	289.239	-3.665 (1.491)*
Body fat, %	-1.303	0.108 (0.029) ***	0.289	-0.001(0.000) ***	317.681	-3.612 (1.137) **

*Significant at $p \leq 0.05$, **significant at $p \leq 0.01$, ***significant at $p \leq 0.001$

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6. Final conclusion

6.1 Summary of results

The prevalence of obesity among both the Nunavik communities and the Baffin Region community in Nunavut is greater than that of the general Canadian population. However, due to the higher SH/S ratio of Inuit, using a sitting height adjusted BMI among the Nunavik study population provided a prevalence of obesity comparable to that of the general Canadian population. This finding may help explain why in the past, at every level of BMI, Inuit were healthier than general Canadian comparison groups. Therefore, among Inuit, sitting height adjusted BMI may provide another useful perspective when comparing obesity patterns between diverse populations. Further, a positive secular trend for height was observed among younger Inuit. It will be important to monitor this secular trend for future research among Inuit and to assess its impact upon BMI and related health outcomes.

Because obesity has been linked to insulin resistance, and early detection of insulin resistance and implementation of interventions to improve insulin sensitivity may reduce the development of type 2 DM, assessing associations between anthropometric measurements and indices of insulin resistance among Inuit is important. Among the Baffin Region study population, results suggested that anthropometric measures such as BMIob, BMIstd, WC and %BF were associated with indices of insulin resistance/sensitivity. Also, the obese had significantly higher fasting insulin levels than the non-obese. The data indicate that increasing prevalence of obesity among Inuit is likely to have adverse health implications. The findings highlight the importance of health surveillance research and health promotion efforts. In the current study, BMIstd showed similar results to BMIob. However, a larger and more heterogenous study sample is needed to help evaluate the relative importance of the various anthropometric measures.

6.2 Informing study participants

Nunavik participants will be informed of their entire health survey results as per the Institut national de santé publique du Québec (INSPQ) in the fall, 2005. For the Baffin Region community pilot health screening, each participant will be informed of their health screening results by a community research assistant in September, 2005. In the event that the health screening study identified the need for a specialty clinical referral, this information will be provided and appointments will be made available. Participants will also receive culturally relevant information, developed with Inuit partners, regarding nutrition and physical activity for the prevention of obesity and type 2 DM.

6.3 Future research

Due to the small sample size of the Baffin Region study population, especially among men, more research is needed to confirm which anthropometric measure best predicts insulin resistance. Future research is also needed to evaluate associations of diabetic risk factors within an Inuit context to develop appropriate screening guidelines and prevention efforts. Lastly, it would be worthwhile to assess the risk for chronic disease among Inuit in a large prospective study in which measures of adiposity and the interplay of diet, physical activity and other determinants can be examined for their predictive value of future risk of disease. In regards to SH/S ratios and derivations of BMIstd, further work should explore the homogeneity in the regression coefficients of SH/S ratios as it predicts BMI in diverse populations. To date, the available published literature lacks sufficient detail on the analytic work by Norgan (Norgan 1994b; Norgan 1994a; Norgan 1994c; Norgan 1995) that resulted in the equations presented by Collins (Collins et al. 2000)

6.4 Significance

Given the public health priority of obesity and diabetes prevention, the research conducted in Nunavik and the Baffin Region community could help formulate Inuit-specific health promotion programs focused on obesity prevention and intervention, and diabetes screening guidelines. The results from the Baffin Region community pilot health screening will stimulate additional health screenings and research in Nunavut that will help determine screening protocols and prevention efforts throughout the Nunavut Territory.

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APPENDICES

APPENDIX 8.1

McGill University ethics certificate for Nunavik

APPENDIX 8.2

Nunavik consent forms in English and Inuktitut

INFORMATION SHEET (18 years old and over)

Nunavik Health Survey: « Qanuippitaa? », « How are we ?»

Principal Investigators: **Serge Déry**, Nunavik Regional Board of Health and Social Services;
Éric Dewailly, Department of Social and Preventive Medicine, Faculty of Medecine, Laval University, Public Health Research Unit, Centre Hospitalier Universitaire de Québec (CHUQ) and Institut national de santé publique du Québec

Organization in charge: Institut national de santé publique du Québec

Funding Organizations: Québec Ministry of Health and Social Services and Nunavik Regional Board of Health and Social Services.

As you may already know, the Nunavik Regional Board of Health and Social Services (NRBHSS) is undertaking a joint health survey on the 14 Inuit communities of Nunavik with Institut national de santé publique du Québec (INSPQ) and CHUQ's Public Health Research Unit. The 2004 survey is a follow-up of the survey conducted in 1992. Its goal is to assess Inuit health and risk factors. It will also be used to help plan programs and services to prevent heart disease, cancer, anemia, diabetes, and other health or social problems (such as suicide, violence), and to improve living habits and nutrition. Six hundred (600) households, or 2,700 people, will be asked to participate. As in 1992, four major themes will be assessed: your general health and lifestyle, your dietary habits, your heart, and your exposure to environmental contaminants.

What you will be asked to do as a survey participant

- You will answer a questionnaire during a face-to-face interview.

  -The interview will be done onboard the icebreaker "Amundsen".
  -The interview will last approximately two hours.
  -It will include detailed questions about your lifestyle, health, and eating habits.

- During a clinical session, a research nurse will ask you a few questions about your health and

  i. Take a fasting blood sample (45 ml or approximately 3 tablespoons)
  ii. Measure your weight, height, and waist and hip circumference
  iii. Take your blood pressure
  iv. Perform a hearing exam
  v. Take a toenail sample
  vi. Measure bone density for women 35 to 74
  vii. Take your temperature
  viii. Give you a sweetened beverage to drink for diabetes screening and will take a second small blood sample 2 hours after drinking the beverage.

  - This step will take approximately 30–45 minutes.

Blood analyses

The following blood analyses will be done as part of the survey: blood lipids, glucose, insulin, fatty acids, antibodies indicating past infections, environmental contaminants (organic and inorganic compounds such as PCBs, heavy metals), and anemia determinants (for women). Toenail samples will be analyzed for selenium. These blood analyses will allow researchers to determine whether you have normal or abnormal levels of blood lipids and diabetes or anemia (for women) determinants as well as gauge your exposure to past infections and

environmental contaminants. Blood samples will be stored for 15 years at -80° C in freezers located at Institut national de santé publique du Québec in Sainte-Foy, Québec. These blood samples will be the responsibility of NRBHSS. Blood vials will be identified by a code number only and your name will not appear on them. These blood samples will never be used by any commercial or pharmaceutical companies neither for genetic tests.

Benefits

Participating in this survey will give you a deeper understanding of any health risks you may face and what you can do to reduce them. As a preventive measure against heart disease, diabetes, and anemia in particular, it will also allow you to verify your current health and make improvements as needed. Thus, if you have anemia (for women); abnormal blood pressure, blood lipids, glucose, or insulin levels; high levels of antibodies against past infections in conjunction with fever; or a hearing problem, you will be sent a letter advising you to visit your CLSC. The survey also gives you the opportunity to take part in a regional health survey and gauge the health of your community.

Risks

The study should not pose any risk to you. You may develop a slight bruise where blood was drawn.

Confidentiality

All information gathered for this study will be kept confidential. Information will be used for statistical purpose only along with answers from other Nunavik households participating in the survey. Your questionnaire and bloo samples will be identified with a code number only. Your name will not appear on them. Your name will onl appear on a "master" identification sheet that links your name to the numbers. These master sheets and the surve database will be kept under lock and key at INSPQ. Moreover, only authorized INSPQ, URSP-CHUQ, NRBHSS and other experts involved in aspects of the survey will have access to the survey database. Once the study wrap up (December 2006), these master identification sheets will be destroyed. Your name will not appear in an publication or report.

Withdrawal from study

Your participation in this survey is invaluable, but must be voluntary. You are free to withdraw from the study a any time without prejudice. You may choose not to continue even after you have agreed to participate. T withdraw from the study, please inform nurse Suzanne Côté, the field coordinator, or any medical staff.

Honorarium

You will receive a $25.00 honorarium for your time and involvement after you have completed the survey. Those who complete the household questionnaire will receive an additional $10.00.

Contacts

You are welcome at any time during the survey to call the field coordinator, nurse Suzanne Côté, or principal investigators Dr. Serge Déry and Dr. Éric Dewailly to request more information, make comments about the survey, or withdraw from the study. If have any complaints, feel free to call Jeannie May in Kuujjuaq at (819) 964-2222.

Please direct any further requests to:

Ms Suzanne Côté:	(418) 650-5115, ext. 5277 (Québec City)
Dr. Serge Déry:	(819) 471-5148 (Drummondville) or (819) 964-2222 (Kuujjuaq)
Dr. Éric Dewailly:	(418) 650-5115, ext. 5240 (Québec City)

Initials of participants: _____ Initials of witness: _____

INFORMED CONSENT FORM (18 and over)

Nunavik Health Survey: Qanuippitaa? "How are we?"

- **I have read and understood what is involved in the study and hereby give my free consent to participate in the Nunavik Health Survey.**

Yes ☐ **No** ☐

- **I authorize the Nunavik Regional Board of Health and Social Services to share information about me or the people I represent as long as we are not identified (i.e., name, address, or telephone number) by authorized persons, namely INSPQ, URSP, and other survey researchers. I understand that I may obtain the names of these researchers upon request.**

Yes ☐ **No** ☐

- **I authorize the Nunavik Regional Board of Health and Social Services to send abnormal results of blood tests, blood pressure, and hearing tests to my community CLSC as a preventive measure. I understand that if my results are abnormal, I will be duly advised in a letter to consult my CLSC representative.**

Yes ☐ **No** ☐

_____	_____	____/____/____
Name of participant	Signature	Date (y/m/d)
_____	_____	____/____/____
Name of witness	Signature	Date (y/m/d)
_____	_____	____/____/____
Name of principal investigator /or his designated representative	Signature	Date (y/m/d)

The informed consent form has been explained to the participant by the research interviewer:

Name: _____ Phone number: _____

Signature: _____

Date of approval by the Laval University Ethics Committee (CERUL): June 7th 2004 Approval number: 2003-323 A-1
Date of approval by the Comité d'éthique de santé publique du Québec: June 21th 2004

Initials of participants: _____ Initials of witness: _____

ᑐᑭᓯᒪᒃᑎᑦᓯᑦ (18-ᓂᒃ ᐅᑭᐅᓕᓐᓄᑦ ᐊᖓᔪᖅᑯᓐᓄ)

ᓄᓇᕕᒻᒥ ᐃᓅᓯᓕᕆᓂᕐᒥ ᖃᐅᔨᓴᓂᖅ: «Qanuippitaa?»,

«ᖃᓄᐃᑉᐱᑖ ?»

ᖃᐅᔨᓴᕐᑏᑦ: Serge Déry, ᓄᓇᕕᒃ ᓄᓇᓕᓕᒫᑦ ᐃᓅᓯᓕᕆᓂᕐᒥ ᐱᔾᔪᑎᖏᓄᑦ ᑲᑎᒪᔨᖏᑦ
Éric Dewailly, ᐱᓇᓱᐊᕕᒃ ᐃᓅᓯᕐ ᒨᓕᖓᔪᓂᒃ ᐋᓐᓂᐊᖅᑖᕐᑌᓕᓂᕐᓄᓄ ᐋᓐᓂᐊᓯᐅᕆᔪᑎᓂᒃ, ᐋᓐᓂᐊᓯᐅᕆᔪᑏᑦ ᐃᓕᓐᓂᐊᕕᖓ, ᓚᕚᓪ ᓯᓚᑦᑐᓴᕐᕕᖓᓂ, ᓇᐅᓕᒫᓂ ᐃᓅᓯᓕᕆᓂᕐᒥ ᖃᐅᔨᓴᕐᕕᒃ, Centre Hospitalier Universitaire de Québec (CHUQ) ᐊᒻᒪᓗ ᑯᐯᒻᒥ ᑲᓇᑕᓕᒫᒧᓕᖓᔪᖅ ᑎᒥᐅᔪᖅ ᓇᐅᓕᒫᓂ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ

ᑎᒥᐅᔪᖅ ᐊᐅᓚᑦᓯᔪᖅ: ᑯᐯᒻᒥ ᑲᓇᑕᓕᒫᒧᓕᖓᔪᖅ ᑎᒥᐅᔪᖅ ᓇᐅᓕᒫᓂ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ

ᑮᓇᐅᔭᖃᕐᑎᓯᔪᑦ: ᑯᐯᒻᒥ ᐃᓅᓯᓕᕆᓂᕐᒥ ᐱᔾᔪᑎᖏᓄᑦ ᑐᕐᖃᑦᑕᕐᕕᖓ ᐊᒻᒪᓗ ᓄᓇᕕᒃ ᓄᓇᓕᓕᒫᑦ ᐃᓅᓯᓕᕆᓂᕐᒥ ᐱᔾᔪᑎᖏᓄᑦ ᑲᑎᒪᔨᖏᑦ.

ᖃᐅᔨᒪᓕᖅᑦᑐᓴᐅᒐᑦᓯ, ᓄᓇᓕᓕᒫᑦ ᑲᑎᒪᔨᖏᑦ ᐱᓇᓱᒃᑎᖃᕐᒪᑕ ᑯᐯᒻᒥ ᑲᓇᑕᓕᒫᒧᓕᖓᔪᒥᒃ ᑎᒥᖁᑎᐅᔪᒥᒃ ᓇᐅᓕᒫᓂ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ ᐊᒻᒪᓗ ᓇᐅᓕᒫᓂ ᐃᓅᓯᓕᕆᓂᕐᒨᓕᖓᔪᓂᒃ ᖃᐅᔨᓴᕐᕕᒥᒃ ᖃᐅᔨᓴᖁᔭᕐᓗᑎᒃ ᑕᓪᓕᒪᐅᔪᕐᑐᓄ ᓯᑕᒪᓐᓄᓂᒃ ᐃᓄᐃᑦ ᓄᓇᓕᖏᓐᓂᒃ ᓄᓇᕕᒻᒥ. 2004-ᒥ ᖃᐅᔨᓴᕐᓂᖅ ᑭᖑᓂᖓᒎᑦ ᖃᓄᐃᓕᖓᓕᕐᒪᖔᑦ ᖃᐅᔨᒥᐊᕐᓂᐅᑉ 1992-ᒥ ᖃᐅᔨᓴᕐᓂᐅᔪᐱᓂᕐᒥᒃ. ᖃᐅᔨᓴᕐᓂᖅ ᑐᕋᖓᖃᕐᐳᖅ ᕿᒥᕐᕈᓚᖓᓄᓂ ᐃᓄᐃᑦ ᐱᕝᕕᓕᐊᓂᖏᓐᖓᓂᒃ ᖃᓄᐃᖏᑦᓯᐊᕐᓂᒥᒎᑦ ᐊᑦᑕᓇᕐᑐᕐᒥᒎᑎᒥᒎᓇᑕᖏᓐᓂᓄ. ᐸᕐᓃᕆᑕᐅᒐᕐᒥᓯᓂᓄ ᐱᓇᓱᑦᑕᐅᔪᑦᓴᓂᒃ ᐱᔾᔪᑎᓂᕐᓂᓄ ᐋᓐᓂᐊᖅᑖᕐᑌᓕᒎᑎᑦᓴᐅᓄᑎᒃ ᐆᒪᓯᓇᓂᕐᒥᒃ, ᑲᒎᑎᓕᓇᓂᕐᒥ, ᐊᐅᖃᑦᓯᐊᖏᓐᓂᓂᒃ, ᐊᐅᒃᑯᓄ ᒪᒪᕐᓴᐅᑎᖃᓄᐊᕐᓂᓂ/ᐱᑦᑦᓴᖃᓄᐊᕐᓂᓂᒃ ᐊᓯᖏᓐᓂᓄ ᖃᓄᐃᒍᑕᐅᓰᓂᒃ, ᐃᓅᓯᒃᑯᓄ ᐱᐅᓯᕆᐊᕈᑎᑦᓴᐅᓄᓂ ᓂᕆᑦᓯᐊᕆᐊᖃᕐᓂᖓᓐᓄ. 600- ᐊᓂᕋᕆᔭᐅᔪᑦ, 2,700-ᒍᑦᓯᑎᒃ ᐃᓄᐃᑦ, ᐃᓚᐅᕐᑯᔭᐅᓯᒪᔪᑦ. 1992-ᒥᑎᑐᑦ, ᐅᑯᐊ ᖃᐅᔨᓴᕐᑕᐅᒍᑕᐅᓛᕐᑐᑦ: ᐃᓘᓐᓇᒍᑦ ᖃᓄᐃᖏᑦᓯᐊᕐᓃᑦ ᐃᓅᓰᑦ, ᓂᕆᔩᑦ, ᐆᒪᑏᑦ, ᓱᒃᑯᓇᕐᑐᓄᓐᓄ ᐊᑦᑐᑕᐅᓯᒪᓂᕋᑦ.

ᖃᓄᐃᓘᕆᐊᖃᕐᒪᖔᕐᐱᑦ ᐃᓚᐅᒍᕕᑦ ᖃᐅᔨᓴᕐᓂᒧᑦ

- ᕿᑯᔭᐅᓯᒪᓗᑎᑦ, ᐊᐱᕐᓯᑕᐅᓛᕐᑐᑎᑦ ᑲᑎᒪᔭᐅᓗᑎᑦ:

-ᐅᒥᐊᕐᔪᐊᒥ ᐊᐱᕐᓯᑕᐅᓗᑎᑦ, ᓯᑯᓯᐅᑎᒥ “Amundsen”;
-ᐊᐱᕐᓯᑕᐅᒐᔭᕐᑐᑎᑦ ᐃᑲᐅᕐᓃᓂ ᒪᕐᕿᓂᒃ ᓇᑉᐸᒥᓐᓄ ᒥᑦᓴᐅᓵᕐᓯᒍ;
-ᐊᐱᕐᓯᑕᐅᒍᑎᖃᕐᓗᑎᑦ ᐃᓅᓯᕐ ᒨᓕᖓᔪᓂᒃ ᖃᓄᐃᖏᑦᓯᐊᕐᓂᖓᓐᓄ ᖃᓄᐃᓕᖓᓕᕐᒪᖔᕐᐱᑦ ᓂᕆᓯᕐᓃᕕᓐᓄ ᐊᐱᕐᓯᑕᐅᒍᑎᖃᕐᓗᑎᑦ.

- ᐋᓐᓂᐊᓯᐅᕐᑕᐅᕕᒻᒥ, ᖃᐅᔨᓴᖃᑕᐅᔪᒧᑦ ᐋᓐᓂᐊᓯᐅᕐᑎᒧᑦ ᐊᐱᕐᓯᑕᐅᓛᕐᑐᑎᑦ ᖃᓄᐃᖏᑦᓯᐊᕐᓂ ᒨᓕᖓᔪᓂᒃ ᐅᑯᓂᖓᓗ

i. ᐊᐅᖏᕐᑕᐅᓗᑎᑦ ᓂᕆᓪᓚᑰᕐᒥᐊᖃᕐᑐᕕᓂᐅᓗᑎᑦ (48 ml-ᓂᒃ ᐱᖓᓱᓐᓄᑦ ᓘᓐᑦ ᖃᓘᐅᑎᐊᓗᓐᓂᒃ ᒥᑦᓴᐅᓵᓗᒥᑦ);

ii. ᑭᖕᐸᑲᑦᑕᑕᐅᓗᑎᑦ, ᑕᑭᓐᓂᑦ ᓱᕐᖃᑎᑦᑕᐅᓗᓂ, ᕿᑏᒃᒧ, ᓯᕐᐱᐊᖁᒃᒧ;
iii. ᐊᐅᑉᐱᑦ ᓱᑲᒃᓂᖓᒥᐊᓂᖓ ᖃᐅᔨᓴᕐᑕᐅᓗᓂ;
iv. ᑐᓵᑦᓯᐊᒪᓚᕐᐱᑦ ᖃᐅᔨᓴᕐᑕᐅᓗᑎᑦ;
v. ᐳᑐᒃᑯᑦ ᑯᑮᕐᑕᐅᓗᑎᑦ;
vi. ᓴᐅᓂᖏᑦ ᕿᒥᕐᕈᔭᐅᓗᑎᒃ ᐊᕙᑦ ᐅᑭᐅᓖᑦ 35-ᓂᑦ 74-ᒧᑦ.
vii. ᐆᓇᕐᓃᑦ ᖃᐅᔨᓴᕐᑕᐅᓗᓂ
viii. ᒪᒪᕐᓴᐅᑎᓕᒻᒥᒃ/ᐱᑦᓴᓕᒻᒥ ᐃᒥᕐᑎᑕᐅᓗᑎᑦ ᒪᒪᕐᓴᐅᑎᖃᓗᐊᕐᒪᓚᐱᑦ/ᐱᑦᓴᖃᓗᐊᕐᒪᓚᐱᓗ ᖃᐅᔨᓴᐅᑎᒥᒃ ᐊᒻᒪᓗ ᑐᓚᓕᐊᓂ ᐊᐅᓪᓕᕐᑕᐅᒥᐊᓪᓚᓗᑎᑦ ᒪᕐᕉᒃ ᐃᑲᐅᕐᓃᑦ ᓈᑉᐸᓃᒃ ᐃᒥᕐᑎᑕᐱᓂᐅᓗᑎᑦ.

-ᐃᒪᖃ ᐃᑲᐅᕐᓂᐅᑉ ᓇᑉᐹᓂᑦ 45-ᒥᓂᑦᓯᒧᑦ ᓯᐱᑐᓂᐊᕐᔪᕐᑐᖅ.

ᐊᐅᒃᑯᑦ ᖃᐅᔨᓴᕐᑕᐅᓂᖅ

ᐅᑯᐊ ᐊᐅᓪᓕᕐᑕᐅᔪᑎᐅᖃᑦᑖᕐᑐᑦ ᖃᐅᔨᓴᕐᓂᐅᑉ ᐃᓗᐊᒍᑦ: ᐊᐅᒃᑯᑦ ᐅᕐᓱᖃᕐᓂᖅ, ᒪᒪᕐᓴᐅᑎᒃ/ᐱᑦᓴ, ᐱᐊᑦᑐᓯᐊᒍᑎᑦᓯᔪᖅ ᐊᐅᒥᒃ, ᐅᕐᓯᐃᑦ, ᐊᕙᑎᒥᑦ ᓱᒃᑯᑕᐅᓇᑐᐃᑦ (ᐱᓯᐋ-ᒍᓂᕿᕐᑌᑦ, ᓴᐱᕿᔭᑦᓴᖄᑦ). ᐊᒻᒪᓗ ᐊᕙᑦ ᐊᐅᖃᑦᓯᐊᓕᒍᑎᒥᓲᓕᑦ. ᐳᑐᒃᑯᑦ ᑯᑮᔭᕐᑕᐅᓂᖃᓛᕐᒥᔪᖅ ᖃᐅᔨᓴᐅᑎᑦᓴᒥᒃ ᐃᑦᑐᑦᑕᖃᕐᒪᓚᑦ (selenium) ᑕᒪᒃᑯᐊ ᐊᐅᒃᑯᑦ ᖃᐅᔨᓴᕐᑕᐅᔪᑎᐱᓃᑦ ᖃᐅᔨᔪᑕᐅᓛᕐᑐᑦ ᐊᐅᒃᑯᑦ ᐅᕐᓯᐃᑦ ᓇᒻᒪᑑᒻᒪᓚᑦ ᓇᒻᒪᓕᑦᑑᒻᒪᓚᖕᒧ, ᐊᐅᒃᑯᑦ ᐱᑦᓴᖃᓗᐊᕐᒪᓚᑕ ᐊᐅᖃᑦᓯᐊᓕᑦᑑᒪᓚᑕᔪᓐᓃᑦ (ᐊᕙᑦ) ᐊᒻᒪᓗ ᓯᒃᑯᓇᕐᑐᒧᑦ ᐊᑦᑐᑕᐅᓯᒪᒻᒪᓚᐱᑦ. ᐊᒥᐊᒃᑯᐃᑦ ᐊᐅᓪᓕᕐᑕᐅᔪᑎᐱᓃᑦ ᓴᓂᕐᕙᑦᑕᐅᓯᒪᓛᕐᑐᑦ ᐊᕿᒍᓂ ᑖᓚᒪᐅᔭᕐᑐᓗ ᑖᓚᒫᓗᓂ ᓂᖖᓚᒪᓂᓕᒻᒥ -80°C ᑯᐯᒻᒥ ᑲᓇᑕᓖᒎᓕᕐᒪᔭᒥᒃ ᑎᒥᖁᑎᐅᔭᒥ ᓇᐅᓕᒫᓂ ᐃᓗᓯᓕᓇᓂᕐᒍᑦ ᐅᕙᓃᑦᑐᒥ Sainte-Foy (Québec). ᑖᒃᑯᐊ ᐊᐅᓪᓕᕐᑕᐅᔪᑎᐱᓃᑦ ᑲᒪᒋᔭᐅᓛᕐᑐᑦ ᓄᓇᐱᒃ ᓄᓇᓕᓖᑦ ᐃᓗᓯᓕᓇᓂᕐᒥ ᐱᒍᑦᕿᓂᕐᒧᑦ ᑲᑎᒪᔩᖏᓐᓄᑦ. ᐊᐅᖃᐅᑎᐊᐱᑦ ᓇᓗᓂᕐᑕᐅᓯᒪᓛᕐᑐᑦ ᑭᑎᑦᔪᑎᓕᐅᕐᑕᐅᓗᑎᒃ ᐊᑎᕐᓃᐱᑦ ᐊᑎᕐᑕᖃᓛᖖᒋᑐᑦ. ᑖᒃᑯᐊ ᐊᐅᓪᓕᕐᑕᐅᔪᑎᐱᓃᑦ ᐊᑐᕐᑕᐅᓂᐅᔭᖖᒋᑐᑦ ᐊᓯᖏᓐᓄᑦ ᑎᒥᐊᑭᕐᓄᑦ, ᓂᐅᐱᕿᕐᑎᓄᓐᔫᓃᑦ ᐋᖃᓚᕐᑖᐱᓐᓄᔫᓃᑦ ᖃᐅᔨᓴᕐᑕᐅᔪᑎᑦᓴᐅᓗᑎᒃ.

ᐱᕙᓪᓕᕈᑎᐅᓂᖓ

ᖃᐅᔨᓴᕐᓂᒧᑦ ᐃᓚᐅᓂᒃᑯᑦ, ᑐᑭᓯᓕᐅᒥᓖᑦᑐᑎᑦ ᖃᓄᑐᐃᓐᓇᖅ ᐊᑦᑕᓇᕐᓯᒍᑕᐅᒍᓐᓇᑐᒃ ᖃᓄᐃᖖᒋᓯᐊᓇᐊᕐᑲᕐᓂᑯᑦ ᖃᓄᕐᒧ ᐱᑦᓯᐊᓇᐊᕈᓐᓇᐅᑎᑦᓴᓃᐱᑦ ᑐᑭᓯᓗᑎᑦ, ᒥᐊᕐᑲᕐᓂᕈᐱᑦ. ᓯᓕᒧ, ᐋᓂᐊᑖᕐᑌᓕᓂᒃᑯᑦ, ᐱᒧᐊᕐᑐᖅ ᐆᒪᑎᒃᑯᑦ, ᐊᐅᒃᑯᑦ ᐱᑦᓴᖃᓗᐊᕐᓂᒥᒃ, ᐊᐅᖃᑦᓯᐊᕈᓐᓂᕐᒥᓗ, ᑕᒪᑕᒪ ᖃᐅᔨᓴᐅᑎᐅᔪᑎᒍᑦ ᖃᐅᔨᒍᓇᓕᖓᔪᑎᑦ ᖃᓄᐃᓕᕿᓗᐊᕐᒪᓚᐱᑦ ᐱᑦᓯᐊᓇᐊᓪᓚᓇᐊᕐᑲᕐᓃᐱᓪᓗ ᖃᐅᔨᓗᑎᑦ ᒥᐊᕐᑲᕐᓂᕈᐱᑦ. ᐅᑭᐅᓪᓕᑦ, ᐊᐅᑉᐱᑦ ᓱᑲᒃᓂᖓᒥᐊᓂᖓ ᓇᒻᒪᖏᑦᑐᐱᓂᐅᑦᓴᐸᑦ, ᐊᐅᒃᑯᑦ ᐅᕐᓱᖃᓗᐊᑦᓴᓂᕈᐱᑦ, ᐱᑦᓴᖃᕐᓂᕈᐱᑦ ᐅᖕᐸᓗᕐᓃᑦ ᐊᐅᒃᑯᑦ ᐱᐊᑦᑐᓯᐊᒍᑎᖃᑦᓯᐊᓂᖖᒋᑯᐱᑦ, ᐅᖕᐸᓘᕐᓃᑦ ᐊᐅᖃᑦᓯᐊᖏᑦᑑᔭᓇᔪᐅᒍᐱᑦ (ᐊᕐᓇᐅᓗᑎᑦ) ᑐᓵᑦᓯᐊᖏᑦᑑᓂᕈᐱᑦ, ᖃᐅᔨᑎᑕᐅᓛᕐᑐᑎᑦ ᐊᓪᓚᐱᐅᓗᑎᑦ ᐋᓂᐊᐱᐊᐱᓕᐊᕐᑯᔭᐅᒍᑎᓂᒃ. ᑭᖑᓪᓕᐸᐅᑎᓪᓗᒍ, ᑕᒪᑕᒪ ᖃᐅᔨᓴᕈᑎᐅᔦᑦ ᑕᒪ ᐱᐱᑦᓵᑦᐱᒥᐸᑎᑦ ᓄᓇᓕᓖᓃᓕᕐᒪᔪᒧᑦ ᖃᓄᐃᖖᒋᑦᓯᐊᕐᓂᑰᓕᕐᒪᔪᒧᑦ ᖃᐅᔨᓴᕐᑕᐅᖃᑦᑕᐅᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᓚᖑᕐᑎᑕᐅᓂᖏᓐᓄᑦ ᐃᓄᐃᑦ ᖃᓄᐃᓕᕐᒪᓚᑕ.

ᐊᑦᑕᓇᕐᓂᖓ

ᖃᐅᔨᓴᕐᑕᐅᔪᓄᑦ ᐃᓚᐅᒪᓗᐊᕈᐱᑦ ᐊᑦᑕᓇᕐᓯᔭᖑᓇᔭᐅᖖᒋᓕᑎᑦ. ᐊᐅᓪᓕᕐᑕᐅᔪᐱᓂᐅᓗᑎᑦ, ᑐᖑᔪᕐᓯᑐᐃᓐᓇᓇᐊᓕᒃ ᐊᐅᓪᓕᕐᑕᐅᐱᐱᓃᑦ.

ᓇᐅᑐᐃᓐᓇᓄᑦ ᖃᐅᔨᔭᐅᒥᐊᖃᖖᒋᓂᖓ

ᑐᑭᓯᒪᐅᑎᑦᓴᓂᒫᑦ ᑲᑎᔅᓯᑕᐅᔪᐃᓐᓂᑦ ᖃᐅᔨᓴᕐᓂᖅᑎᓗᒍ ᓇᐅᑐᐃᓐᓇᓄᑦ ᖃᐅᔨᔭᐅᓚᖓᕐᒥᒍᑦ. ᑐᑭᓯᒪᐅᑎᑦᓴᑦ ᐊᑐᖅᑕᐅᓚᔭᖅᑐᑦ ᑭᑎᑦᓯᒍᑎᐅᓗᑎᒃ ᑭᐅᒍᑎᐱᓐᓂᓪᓗ ᐃᓗᕐᒥᐅᖃᑎᖏᓄᑦ ᓄᓇᐱᓪᒥᐅᓄᑦ ᖃᐅᔨᓴᕐᓂᒧᑦ ᐃᓚᐅᔪᓄᑦ. ᐊᐱᖅᓱᖅᑕᐅᒍᑎᐱᓂᑦ ᐊᐅᖕᒥᖅᑕᐅᒍᑎᐱᓂᑎᓪᓗ ᓇᓗᓇᖅᑕᐅᓯᒪᓛᖅᑐᑦ ᑭᑎᑦᔪᑎᓂᐅᖅᑕᐅᓗᑎᒃ. ᐊᑏᑦ ᐊᓪᓚᓯᒪᓛᖕᖕᒥᒍᖅ. ᐊᑏᑦ ᐊᓪᓚᑕᐅᓯᒪᓛᖅᑑᒪᓗᐊᖅ ᐊᑎᖃᐅᑎᒻᒪᕆᓪᒥ ᓇᓗᓃᑯᑖᖅᑎᑕᐅᓗᓂ ᑭᑎᑦᔪᑎᓂᒃ. ᑖᒃᑯᐊ ᐊᑎᖃᐅᑎᒻᒪᕆᑦ ᖃᐅᔨᓴᐅᑎᐱᓂᖅᓂᓗ ᑲᑎᖅᓱᐃᒍᑏᑦ ᐸᓂᖅᓯᒪᔾᒦᑦᑎᑕᐅᓛᖅᑐᑦ ᐅᐸᓂ INSPQ. ᓲᕐᓗ. ᑎᒃᑯᐊᑕᐅᓯᒪᔦᑦ ᑭᓱᐊᓂ ᐅᑯᓇᖕᖕᒫᑦ ᐱᓯᒪᔦᑦ INSPQ, URSP-CHUQ, ᓄᓇᕕᒃ ᐃᓗᓯᓕᕆᕕᒃ ᐱᓇᓱᑦᑎᒪᕆᓪᓗ ᑐᑭᓯᒪᔭᐅᑎᑦᓯᒍᑎᑦᓴᔭᖕᒥᓂ ᖃᐅᔨᓴᕐᓂᒨᓕᖕᒪᔦᓂᒃ ᐊᑐᐃᓐᓇᖅᑎᑕᐅᔪᑐᓛᖅᑐᑦ ᖃᐅᔨᓴᐅᑎᐱᓂᖅᓂᒃ. ᖃᐅᔨᓴᕐᓂᖅ ᐱᔭᕇᖅᓯᒪᓕᖅᐸᑦ ᐊᑎᖃᐅᑎᒻᒪᕆᑦ ᐃᒥᑦᑐᓴᓂᐅᓇᔭᐅᓛᖅᑐᑦ. ᐊᑏᑦ ᓄᐃᑕᑎᑕᐅᓂᐅᔭᖕᖕᒥᒍᖅ ᐊᓪᓚᖅᑯᑎᓂᐊᒍᒪᔦᓂ ᑐᓴᖅᑎᓯᒍᑎᓂᓪᓘᓃᑦ.

ᖃᐅᔨᓴᕐᓂᒧᑦ ᐃᓚᐅᒍᓐᓂᖅ

ᖃᐅᔨᓴᕐᓂᒧᑦ ᐃᓚᐅᖅᑕᐅᓃᑦ ᐱᓪᓚᕆᐅᕗᖅ ᒍᒪᓂᖅᒥᓄᓪᓗ ᑭᓯᐊᓂ ᐃᓚᐅᑦᓯᑎᑦ. ᖃᖓᑐᐃᓐᓇᓯᐊᖅ ᓄᖅᑲᕈᓐᓇᑐᑎᑦ. ᐊᖏᖅᓯᒪᔦᐱᓂᐅᒪᓗᐊᕈᐱᑦ ᐃᓚᐅᒪᔭᖅᓂᐃᑦ, ᑲᔦᓱᓐᓃᕈᓐᓇᓯᐊᖅᑐᑎᑦ. ᐃᓚᐅᒍᒫᕈᐱᑦ ᐅᖃᖅᑎᖃᕈᓐᓇᑐᑎᑦ ᐋᓐᓂᐊᓯᐅᖅᑎᒥᒃ Suzanne Côté, ᑐᑭᒧᐊᑦᑎᓯᔨᒥᒃ ᐋᓐᓂᐊᓯᐅᖅᓂᓂᒃ ᓇᓐᓂᑐᐃᓐᓇᕐᒥᓂᓘᓐᓂᑦ ᐱᓇᓱᑦᑎᓂᒃ ᐋᓐᓂᐊᓯᐅᖅᓂᓂᒃ.

ᖃᐅᔨᓴᖅᑕᐅᖃᑕᐅᒍᑏᑦ

$25.00-ᓂᒃ ᑮᓇᐅᔭᖅᑖᖅᓯᔭᖅᑐᑎᑦ ᖃᐅᔨᓴᖅᑕᐅᖃᑕᐅᒍᑎᓂᒃ. ᖃᐅᔨᓴᕐᓂᖅ ᐱᔭᕇᖅᐸᑦ ᕿᑕᐅᓚᔭᖅᑐᑦ. ᐃᓗᕐᒥᐅᖃᑎᒌᓐᓂᖕᒪᔦᒥᒃ ᐊᐱᖅᓱᖅᑕᐅᔪᖅ $10.00-ᒥᒃ ᐁᑦᑐᖅᑕᐅᓚᔭᖅᑐᖅ.

ᖃᐅᔨᒥᐊᕐᐱᓴᑦ

ᖃᖓᑐᐃᓐᓇᓯᐊᖅ ᖃᐅᔨᓴᕐᓂᖅᖃᕐᓂᖅᒪᓂ, ᐅᖃᓚᐱᖅᑳᓂᖕᖕᒥᑐᑎᑦ ᑐᑭᒧᐊᑦᑎᓯᔨᒥᒃ, ᐋᓐᓂᐊᓯᐅᖅᑎᒥᒃ Suzanne Côté, ᖃᐅᔨᓴᕐᓂᒥᓪᓗᐊᓂᑦ ᓯᐳᓂᖅᑐᓂᒃ ᐋᓐᓂᐊᓯᐅᖅᑎᒪᕆᓪᒥᒃ Serge Déry-ᒥᒃ ᐋᓐᓂᐊᓯᐅᖅᑎᒪᕆᓪᒥᒃ Éric Dewaillyᒥᒃ, ᑐᑭᓯᒥᐊᑦᓯᐊᕈᒪᒍᐱᑦ ᖃᐅᔨᓴᕐᓂᒨᓕᖕᒪᔦᓂᒃ, ᐅᖃᐅᓯᑦᓴᖅᑲᖅᐱᖅᑲᕈᐱᓪᓗᐊᓂᑦ ᖃᐅᔨᓴᕐᓂᒨᓕᖕᒪᔦᓂᒃ ᖃᐅᔨᓴᕐᓂᒧᓪᓗᐊᓂᑦ ᐃᒪᐅᒍᒫᕈᐱᑦ. ᐅᓐᓂᐅᓪᓘᑎᑦᓴᖃᕈᐱᑦ ᖃᐅᔨᓴᕐᓂᒨᓕᖕᒪᔦᓂᒃ, ᐅᖄᓚᐱᖃᕈᓐᓇᖅᑯᑎᑦ ᕙᓂ ᒣᒥᒃ, ᑰᔦᐊᒥ: (819) 964-2222.

ᕿᓄᒍᑎᑦᓴᖃᕈᐱᑦ, ᐅᖄᓚᒍᓐᓇᕗᑎᒃ ᐅᑯᓄᖓ:

Ms Suzanne Côté: (418) 650-5115 extension 5277 (Québec)
Dr Serge Déry: (819) 471-5148 (Drummondville) or (819) 964-2222 (Kuujjuaq)
Dr Éric Dewailly: (418) 650-5115 extension 5240 (Québec)

Initials of participants: ____________ Initials of witness: ____________

ᑐᑭᓯᒪᑎᑕᐅᑦᓯᓂ ᐊᖏᕈᑏᑦ

(18-ᓂᒃ ᐅᑭᐅᓖᓐᓄᑦ ᐊᖓᔪᖅᓯᓄᓐᓄ)

ᓄᓇᐱᒻᒥ ᐃᓅᓯᓕᕆᓂᕐᒥ ᖃᐅᔨᓴᓂᖅ: Qanuippitaa «ᖃᓄᐃᑉᐱᑖ? »

-ᐊᑐᐊᕐᓯᓯᒪᔪᖓ ᑐᑭᓯᑦᓯᒥᓐᓄ ᖃᐅᔨᓴᕐᓂᒨᓕᖓᔪᓂᒃ ᐊᖏᕐᓯᒥᓐᓄ ᒍᒪᓂᕐᓅᑉᐸᖓᓄ ᐊᖏᕈᑎᖃᕐᓯᖓ ᖃᐅᔨᓴᕐᑕᐅᖃᑕᐅᒐᔪᕐᓗᖓ ᓄᓇᐱᒻᒥ ᐃᓅᓯᓕᕆᓂᕐᒥ ᖃᐅᔨᓴᕐᓂᒧᑦ.

ᐋᐊ ☐ ᐊᐅᑲ ☐

-ᐊᖏᕈᑎᖃᕐᐳᖓ ᓄᓇᐱᒻᒥ ᐃᓅᓯᓕᕆᓂᐱᑦ ᑐᔅᐅᒪᑎᑕᐅᐱᖃᕐᑎᓯᒥᑦ ᐅᐸᓐᓂᓕᖓᔪᓂᒃ ᑭᒻᒪᑐᕐᑕᓅᓕᖓᔪᓐᓄ ᐊᑎᐳᑦ ᐅᖃᕐᑕᐅᖏᓕᐅᕐᐸᑕ (ᐅᑦᑑᑎᒥᑦᓯᒥᑦ ᐊᑎᖏᑦ ᐅᖃᕐᑕᐅᖃᑦᑕᕈᓐᓇᑎᓪᓗᒥᑦ, ᑐᕋᕈᑎᖏᓪᓗ, ᐅᖄᓕᐅᑎᖏᓪᓘᓃᑦ) ᖃᐅᔨᓴᕐᑎᐅᖃᑕᐅᔪᓄᑦ ᐅᑯᓇᖕᖓᑦ ᐱᓯᒪᔪᓄᑦ INSPQ, URSP ᐊᓯᖏᓐᓄᓗ ᖃᐅᔨᓴᕐᑎᐅᔪᓄᑦ. ᑐᑭᓯᒪᔪᖓ ᑖᒃᑯᐊ ᖃᐅᔨᓴᖃᑕᐅᔪᑦ ᐊᑎᖏᓐᓂᒃ ᑐᑦᓯᕋᕈᓐᓇᕋᒪ.

ᐋᐊ ☐ ᐊᐅᑲ ☐

-ᐊᖏᕈᑎᖃᕐᐳᖓ ᓄᓇᐱᑦ ᐃᓅᓯᓕᕆᓂᐱᑦ ᐊᐅᓪᓚᑎᑦᓯᒪᔪᕐᑎᓗᒍ ᐊᐅᖏᕐᑕᐅᒍᑎᐱᓂᒃᑲ ᐊᐅᒻᒪᓗ ᓯᑲᓐᓂᕆᐊᓕᖓ ᑌᒫᓯᐊᓂᖕᖏᑉᐸᑕ ᑐᔪᕐᓯᐊᒪᖓᒫᕐᒪᓗ ᖃᐅᔨᓴᕐᑕᐅᒍᑎᐱᓂᒃᑲ ᐋᓐᓂᐊᐱᐊᐱᑦᑎᓄᑦ ᓄᓇᓕᑦᑎᓂ ᑕᒪᓐᓇ ᓯᒃᑯᑌᓕᓂᕐᒧᐊᖓᑎᓪᓗᒍ. ᑐᑭᓯᒪᔪᖓ ᖃᐅᔨᓴᕐᑕᐅᒍᑎᐱᓂᒃᑲ ᑌᒦᑦᓯᐊᓂᖕᖏᑉᐸᑕ, ᖃᐅᔨᑎᑕᐅᒐᔪᕐᓯᖓ ᐊᓪᓚᓯᒪᔪᕐᑎᒍᑦ ᖃᐅᔨᓂᐊᕐᑯᔭᐅᓗᖓ ᐋᓐᓂᐊᐱᑦᑕ ᑭᒻᒪᑐᕐᑎᖓᓂᒃ.

ᐋᐊ ☐ ᐊᐅᑲ ☐

ᖃᐅᔨᓴᕐᑕᐅᔪᖅ	ᐊᑎᓕᐅᐱᖓ	ᐅᓪᓗᖓ (y/m/d)
ᑕᑯᓐᓇᑐᖅ	ᐊᑎᓕᐅᐱᖓ	ᐅᓪᓗᖓ (y/m/d)
ᖃᐅᔨᓴᕐᑐᐱᓂᖅ / ᑎᑎᕋᐅᒪᔪᕐᔪᓃᑦ	ᐊᑎᓕᐅᕐᐱᖓ	ᐅᓪᓗᖓ (y/m/d)

Initials of participants: ____________ Initials of witness: ____________

ᐊᖏᕈᑏᑦ ᑐᑭᓯᑎᑦᓯᒍᑎᐱᓅᑦ ᐊᐱᖅᓯᑕᐅᓚᖓᔪᒥᒃ ᐊᐱᖅᓯᑎᑦᓴᒧᑦ:

ᐊᑎᖓ: ______________________ ᐅᖄᓚᐅᑎᖓ: ______________________

ᐊᑎᖓ: ______________________

ᐅᓐᓄᖓ ᐊᖏᖅᑕᐅᐱᐱᓂᖓ ᓚᕚᓪ ᓯᓚᑦᑐᓴᕐᐱᖓᑕ ᐱᓇᓱᐊᕈᓯᐊᓇᐊᖅᑕᕐᓂᒧᑦ ᑲᑎᒪᔨᐊᐱᖏᓐᓄᑦ (CERUL): ᔪᓂ 7, 2004 ᐊᖏᖅᑕᐅᒍᑎᖓ ᑭᑎᑦᔪᑎᖓ 2003-323 A-1

APPENDIX 8.3

McGill University ethics certificate for Nunavut

Guylaine Charbonneau

From: Lynn Murphy [lynn.murphy1@mcgill.ca]
Sent: July 11, 2005 11:33 AM
To: guylaine.charbonneau@mail.mcgill.ca
Subject: RE: thesis + certificates Human ethics

Lynn Murphy
Administrative Coordinator
Macdonald Campus Research Office
McGill University
Faculty of Agricultural and Environmental Sciences
21 111 Lakeshore Road
St-Anne-de-Bellevue, QC H9X 3V9
Tel: 514 398-8716
Fax: 514 398-8732

From: Lynn Murphy
Sent: Thursday, June 09, 2005 2:52 PM
To: 'guylaline.charbonneau@mail.mcgill.ca'
Subject: thesis + certificates Human ethics

Guylaine,

Just checked with the Thesis office and certificate is fine as is. In principle the title of each theses should be there, but they are not that particular and would not delay submission because of it. The grant title is there and that is ok.

Lynn Murphy
Administrative Coordinator
Macdonald Campus Research Office
McGill University
Faculty of Agricultural and Environmental Sciences
21 111 Lakeshore Road
St-Anne-de-Bellevue, QC H9X 3V9
Tel: 514 398-8716
Fax: 514 398-8732

11/07/2005

APPENDIX 8.4

Nunavut Community-CINE research agreement

Hamlet of Pangnirtung
Health Screening and Research Agreement
May 2005

The Centre for Indigenous Peoples' Nutrition and Environment (CINE) agrees to conduct the following activities with the guidance and leadership of the Pangnirtung community.

1. **The overall goals of the current activities and future plans are:**

   - to develop an understanding of what factors are contributing to diabetes and pre-diabetes among the Inuit;
   - to help identify culturally appropriate prevention strategies and messages; and to
   - promote health through the promotion of traditional food and healthy market food.

2. **The May 2005 activities include:**

   - a health screening of adults over 18 years of age;
   - an evaluation of a physical activity questionnaire; and
   - interviews with individuals living with diabetes to learn about how to improve dietary advice.

The work has ethics approval from McGill University and a Nunavut Research License (#0500505R-M).

3. **Community and CINE Partnership**

Community input, advice and leadership is provided by the community steering committee. The Pangnirtung Health Screening Steering Committee members include: Donna Kilabuk, Jonah Kilabuk, Johnny Kuluguqtuq, and Markus Wilcke.

Community interviewers, Susa Qappik and JoJo (Peter Taylor) Aningmiuq, have been hired for the month of May. They will recruit participants, explain the screening and conduct interviews.

4. **Community Health Screening (May 2005).**

The health screening focuses on diabetes, pre-diabetes and heart disease through measurements of blood tests, blood pressure, medical history, diet, physical activity, and body weight for height and percent body fat.

The health screening results will:

- raise awareness of ones own health status and health habits to help prevent future health problems from occurring;
- raise community awareness to help guide development of health promotion efforts;
- help evaluate the factors that are related to the development of pre-diabetes and diabetes among the Inuit.

In addition, as there is an interest in a follow-up health assessment, the current health screening can serve as a baseline assessment upon which to compare a second future assessment to help determine whether health promotion efforts are successful (pending that funding).

5. Scope of Screening:

The health screening does not address cancer risk or other health problems such as arthritis or bone loss.

6. Recruitment Activities:

- Community members will be asked to participate and participation is voluntary.
- A brochure will be mailed to each household;
- Community meetings at Arctic College and radio announcements will inform the community of the project;
- All participants will sign a consent form.

The health screening will take place at Arctic College starting May 16th and end by May 27th. The attached consent forms provide details of what each participant is expected to do.

7. Information collected is to be shared, distributed, and stored in these agreed ways:

The data collected is confidential. Interviewers have signed a confidentiality agreement. Once results are returned to each participant, names and birthdates will be removed from the database that will be used for summary reports. Information that is collected will be kept at CINE. A final report will be distributed to regional, territorial, and national Inuit organizations after approval from the community steering committee.

Any document, such as a conference presentation or a publication, will be shared with the community steering committee for their review. No document or presentation will be

made without the written approval of the community steering committee. The community name will or will not be used in any presentation depending upon the wishes of the community steering committee.

8. **Project progress will be communicated to the community in these agreed ways:**

Each individual will receive their own personal results within 60 days of the completion of the data collection. A visit to the community in the fall of 2005 is planned to provide summary data of the results back to the community.

9. **Communication with the media and other parties (including funding agencies) outside the named researchers and the community will be handled in these agreed ways:**

In the event of media interest, prior consent from the community steering committee will be obtained before any information is released.

FUNDING, BENEFITS, & COMMITMENTS

Funding

CINE has acquired funding and other forms of support for this research project from:

Inuit Tapiriit Kanatami and the Max Bell Foundation.

Benefits

CINE wishes to use the current project in the following ways:

- to learn from the experience to improve the health screening logistics and questionnaires which will be used in other Inuit communities;
- to develop a relevant physical activity questionnaire that can be used in health and health promotion research in Inuit communities;
- to develop an understanding of how diet and other factors are related to pre-diabetic conditions and to present information on these findings at health conferences and in scientific health journals;
- to foster individual and community interest in health promotion and evaluation of health promotion efforts.

Benefits likely to be gained by the community through this project are educational in nature in that the project will raise individual and community awareness of current health status so that the community can decide upon appropriate activities to promote health.

APPENDIX 8.5

Nunavut consent forms in English and Inuktitut

INFORMED CONSENT FORM
Pangnirtung Health Screening

Principal Investigator: Grace Egeland Ph.D., Centre for Indigenous Peoples' Nutrition and Environment (CINE), McGill University.
Co-Investigator: Dr. Kue Young, Department of Public Health Sciences, University of Toronto, Guylaine Charbonneau-Roberts, P.Dt., M.Sc. candidate, CINE, McGill University.
Responsible Institution: CINE, McGill University.
Community Steering Committee: Markus Wilcke, Johnny Kuluguqtuq, Donna Kilabuk, and Jonah Kilabuk.
Other collaborators: Looee Okalik, Inuit Tapiriit Kanatami.

Introduction: We are conducting a health screening to find out blood sugar levels and what factors predict high blood sugar levels among the Inuit. All Inuit adults over the age of 18 years living in your community are invited to be part of the health screening. This consent form will give you a general idea of what the health screening project is about and what your participation involves. Please take the time to read the information carefully and make sure that you understand it.

Purpose: This screening has two main objectives:
1. To find out how many people have high blood sugar in your community.
2. To find out why some Inuit may have a greater chance of getting high blood sugar.

Description of the study: All participants will be asked to visit the Arctic College where an Inuktitut and English speaking team will carry out a health screening. You will be asked about the kinds of food you are eating during a short interview and then you will be asked to come to the clinic in the morning after an overnight fast (a minimum of 8 hours without eating) for about 3 hours. The health screening will include the following:

1. **Face-to-face interview**
   - Physical activity
   - Personal and family medical history
   - The kinds of foods you normally eat
2. **Body measurements**
   - Body weight
   - Body fat composition (for this it will be necessary that you remove your shoes and socks)
   - Height and Sitting height
   - Waist circumference (directly against your skin)
3. **Clinical and laboratory measurements**
   - Blood pressure and heart rate
   - Blood samples (after the overnight fast)
   - Take a sweet drink
   - A blood sample will be taken two hours after drinking the sweet drink

Your blood will be tested for:

- fasting insulin (to find out how well your body can carry sugar and supply your body with energy);
- fasting glucose (sugar);
- good and bad fats in your blood;
- glucose (sugar) level 2 hours after you drink a sweet drink;
- adiponectin (shows what the chances are for a person to have high blood sugar problems later in life).

Initials of participant:_____ Initials of witness:_____

No more than 3 tablespoons (44 ml) of blood will be taken for this study and no amount of blood will be placed in long-term storage for future tests. No other laboratory tests will be done.

Right to refuse participation: Your decision to be part of the study is completely up to you.

Risks of participating:

- A bruise or tenderness where blood was taken.
- Symptoms related to low blood sugar after drinking the sweet drink, such as weakness, fatigue, and hunger, and in some cases, anxiety, nervousness, trembling. These symptoms are easily treated by the nurse and can be avoided by taking a light lunch which will be provided to you at Arctic College at the end of the health screening.

Reason why it may be useful to you to be part of this research: After successfully finishing all parts of the health screening, you will receive your results in a booklet (in English and Inuktitut) within 2 months. A general summary of the results will also be presented to the community in the fall 2005. Everyone participating will receive information about how to prevent high blood sugar. You will also receive a CINE baseball cap and your name will be put in a draw for a variety of prizes.

Confidentiality:

- The interviewers have signed a confidentiality agreement and the data collected is confidential.
- You will be given a unique number to keep your identity confidential.
- We will keep a copy of your name in a locked cabinet in the Centre for Indigenous Peoples' Nutrition and Environment (CINE) director's office so that your results can be returned to you.
- Once your results are returned to you, your name and birth date will be removed from the database which will be used for the summary report; only your number will be given to those looking at the data.
- If you agree, your personal medical results will be given to the Pangnirtung Health Center.
- No other personal information will be shared with any community member, organizations or other agencies.
- Only the overall findings (not your personal results) will be shared with regional and national Inuit organizations concerned with health.

Right to withdraw: Your participation is voluntary and you can stop being part of the study at any time. Also, it is okay if you do not answer some of the questions. Please ask any member of the health screening team if there is something that you do not understand. Also, you own your personal data and can at any time ask to have your own personal data removed from the database.

For more information, comments, complaints or to withdraw from the study, please contact:
Susa Qappik, Phone number: (867) 473-8567
Jojo Aningmiuq, Phone number: (867) 473-8559
Johnny Kuluguqtuq, Phone number: (867) 473-2632
Grace Egeland, Ph.D. Phone number: (514) 398-8642
Kue Young, M.D. Phone number (416) 978-6459

Initials of participant:_____ Initials of witness:_____

INFORMED CONSENT FORM
Pangnirtung Health Screening

I have read and understood what is involved in the study and agree to participate in the Pangnirtung Health Screening.

Yes ☐ **No** ☐

I give permission to the Pangnirtung Health Screening to send my medical results (blood pressure, blood fat, and blood sugar levels) of the health screening to a medical representative at my local health clinic.

Yes ☐ **No** ☐

I give permission to the Pangnirtung Health Screening to find out if my blood sugar has been tested in the past and what my results were. I give permission for my full name, date of birth, and health number to be used to find out my information at the Baffin Regional Laboratory (based in Iqaluit).

Yes ☐ Health Number:_____ **No** ☐

I give permission to the Pangnirtung Health Screening to contact me within the next 5 years for a follow-up health screening.

Yes ☐ **No** ☐

Name of participant	Signature	____/____/____ Date (y/m/d)
Name of witness	Signature	____/____/____ Date (y/m/d)
Name of principal investigator /or his designated representative	Signature	____/____/____ Date (y/m/d)

_____
Participant's address where results are to be sent and phone number

A copy of this consent form has been provided for you. Please keep it for your records and future reference.

Consent explained by: _____ Date (y/m/d): _____

Questions answered by: _____ Date (y/m/d): _____

Initials of participant:_____ Initials of witness:_____

ᑕᑕᑎᓇᐊᓕᒃ ᐊᖏᕈᑦ
ᐸᓐᓂᖅᑑᒥ ᖃᐅᔨᓴᕐᓂᖅ ᑎᒥᐅᑉ ᖃᓄᐃᓐᓂᖓᓄᑦ

ᖃᐅᔨᓇᓯᖅᑎᖑᓗᐊᑕᐅᔪᖅ: (ᒍᕆᐃᔅ ᐃᒥᓚᓐ), Grace Egeland, ᐃᓕᓐᓂᐊᕐᓯᒪᔪᐊᖅᑐᖅ, ᓄᓇᓕᑦᑐᖃᖅᓴᔪᑦ ᐃᓄᖏᓐᓄᑦ ᓂᕿᖏᓐᓄᑦ
ᐊᒻᒪ ᐊᕙᑎᒧᑦ ᒪᒥᐅᑉ ᐃᓕᓐᓂᐊᕝᕕᐊᖓ
ᖃᐅᔨᒪᔪᖅᑕᐅᔪᖅ (ᑯ ᔭᖕ) Dr. Kue Young, ᐊᓂᐊᕐᑐᓕᕆᓂᕐᒥ ᖃᐅᔨᓴᕕᒃ, ᑐᕌᓐᑐ ᐃᓕᓐᓂᐊᕝᕕᐊᖓ, ᒥᓚᐃᓐ ᓴᐸᓄ-ᕿᔪᖕ,
ᐃᓕᓐᓂᐊᖅᑎ, ᓄᓇᓕᑦᑐᖃᖅᓴᔪᑦ ᐃᓄᖏᓐᓄᑦ ᓂᕿᖏᓐᓄᑦ ᐊᒻᒪ ᐊᕙᑎᒧᑦ, ᒪᒥᐅ ᐃᓕᓐᓂᐊᕝᕕᐊᖓ
ᐱᓕᕆᐊᖑᔪᖅ ᐱᓕᕆᐊᕆᔭᐅᓂᐊᕐᑐᒧᑦ ᑲᒪᔭᐅᓂᐊᕐᑐᖅ:
ᓄᓇᓕᑦᑐᖃᖅᓴᔪᑦ ᐃᓄᖏᓐᓄᑦ ᓂᕆᔭᖃᕐᓂᕐᒧᑦ ᐊᒻᒪ ᐊᕙᑎᒧᑦ ᒪᒥᐅᑉ ᐃᓕᓐᓂᐊᕝᕕᐊᖓ
ᐸᓐᓂᖅᑑᒥ ᐸᕐᓇᐃᓂᕐᒧᑦ ᑲᑎᒪᔨᕐᒃᑯᑦ: ᒫᑲ ᐅᐃᑭ, ᔨᓂ ᑯᖓᕈᖅ, ᑖᓇ ᕿᓚᕐᐸᖅ, ᕚᓇ ᕿᓚᕐᐸᖅ
ᐊᓯᖏᖅ ᐱᖃᑕᐅᒥᔪᑦ: ᓗᐃ ᐅᑲᓕᖅ, ᐃᓄᐃᑦ ᑕᐱᕆᑦ ᑲᓇᑕᒥ.

ᓇᓗᓇᐃᔭᕆᐊᕈᑦ: ᐅᐸᒍᓐᓂ ᐱᓕᕆᐊᖃᕐᖓᑕ ᑎᒥᖏᑦ ᖃᓄᐃᓐᓂᖏᓐᓂᒃ ᖃᐅᔨᒪᔪᐊᕐᓂᖏᓐᓂᒃ ᐊᐅᓚᑦ ᓯᕗᕋᐊᕐᓂᖏᓐᓂᒃ ᐊᒻᒪ ᑭᓯ ᐱᔭᕐᑎᒃᑯᑦ ᑕᐃᒪᐃᓐᓂᑕᐅᓕᕐᖓᖅ ᐊᐅᓚᑦ ᓯᕗᕋᐊᕐᓂᐅᔪᖅ ᐃᓅᓕᖅ. ᐃᓄᐃᑦ ᐃᓇᐃᓐ ᐊᕐᕌᒍᓕᑦ 18ᓂᒃ ᐅᖓᑖᓄᑦ ᓄᓇᓯᓂᒥᐅᑦᑕᑦ ᐱᖃᑕᐅᔪᓐᓇᑎᐊᖅᑐᑦ ᑕᒪᑐᒧᖓ ᖃᐅᔨᓇᓯᐊᕐᓂᕐᒧᑦ. ᐅᓇ ᐊᖏᕈᑎᒃᓴᓇᐊᖅᑐᖅ ᑕᑕᑎᓇᐊᓕᒃ ᖃᐅᔨᐸᓗᐊᖅᑎᕆᐊᓇᓂᐊᕐᑕᐃᑦ ᖃᓄᐃᑐᐃᕐᑕᐅᓂᖓᓄᑦ ᐋᓂᐊᕈᑕᐃᓕᒪᓂᕐᒧᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᓂᐊᕐᑐᒧᑦ ᐊᒻᒪ ᐱᖁᑕᐅᔪᕐᓂᕐᓂᒃ. ᐊᒥ ᑐᑭᓯᐊᕈᑎᓴᑦ ᐅᖃᓕᒪᕈᑎᐊᓯᕐᓂᐊᖅᑎᑦ ᐊᒻᒪ ᑐᑭᓯᑎᐊᓯᔭᕐᓗᑎᑦ.

ᐱᔾᔪᑎᖓ: ᐅᓇ ᖃᐅᔨᓴᕐᓂᖅ ᒪᕈᐊᖅᑕᕐᓂᒃ ᑐᕌᖃᑦᑕᔫᔪᖅ:
1. ᖃᐅᔨᔾᔨᑎᒥᓯᐊᕐᓗᒍ ᖃᖓᑦ ᐊᐅᓪᓚᑦ ᑭᑦᑐᐃᓐᓇᐃᓐ ᐃᓄᐃᑦ ᓯᓚᖃᐅᔭᓕᕆᖖᒋᑦ ᐸᓐᓂᖅᑑᒥ;
2. ᖃᐅᔨᔾᔨᑎᒥᓯᐊᕐᓗᒍ ᓯᒪᓐ ᐃᓚᖏᑦ ᐃᓄᐃᑦ ᐊᐅᓪᓚᑦ ᓯᓚᖃᐅᔭᕐᓂᖏᑦ ᐱᓂᐅᓴᓂᖅᓴᐅᑦᑎᒪᖖᒋᑦ

ᓇᓗᓇᐃᔭᕐᓯᒪᓂᖓ ᖃᐅᔨᓴᕐᓂᐅᔪᖅ: ᐱᒃᑕᐅᓂᐊᕐᑐᓕᒫ ᓯᓚᕐᑐᓴᕝᕕᒻᒧᐊᔭᐅᓚᐅᖅᑐᑦ ᑕᕙᓂᓗ ᐃᓄᒃᑎᑐᑦ ᐊᒻᒪ ᖁᓪᓗᓇᑎᑐᑦ ᐅᖃᐅᓯᖃᖅᑐᑦ ᖃᐅᔨᓴᕐᓂᒋᑦ ᐱᓕᕆᐊᖃᖅᓴᔪᑦ. ᐊᐱᕐᓯᖅᑕᐅᓚᐅᖅᑐᑦ ᖃᓄᐃᑐᓂᒃ ᓂᕿᓂᒃ ᓂᕆᑦᑕᕐᒪᖖᒋᑦ ᑕᒪᓐᓇ ᕿᓚᒥᑯᓪᓗᐊᖅᑐᖅ ᐊᒻᒪ ᐋᓂᐊᕐᑯᕐᖁᔭᐅᓚᐅᖅᑐᑦ ᐅᖓᑯᑦ ᐃᑉᐸᖓᒍᑦ ᐅᓐᓄᒃᑯᑦ ᓂᕆᓚᐅᖅᑕᕐᓂᑦ (ᐃᒪᓐᓇᐸᓗᑦ ᐃᑲᕐᑦ 8 ᓂᕆᓚᐅᖅᑕᕐᓂᑦ) ᐋᓂᐊᕐᑯᒥᑲᔭᕐᑐᑎᒃ ᐃᑲᕐᑦ ᐱᖓᓱᐸᓗᐃᑦ. ᑕᒪᓐᓇ ᖃᐅᔨᓴᕐᓂᖅ ᐃᒪᐃᖏᓐᓂᒃ ᐱᑕᖃᕐᓂᖅ:
1. ᐊᐱᕐᓱᖅᑕᐅᓗᑎᑦ
   - ᑎᒥᕕᑦ ᐊᐅᓚᔾᔪᓂᖅᑲᖅᑕᖓᓂᒃ
   - ᐃᓐᕕᑦ ᐊᒻᒪ ᐃᓚᕕᑦ ᐋᓂᐊᖃᖅᑕᕐᓯᒪᓂᖏᑕ ᒥᓴᓄᑦ
   - ᖃᓄᐃᖕᒍᓂᒃ ᓂᕿᓂᒃ ᓂᕆᓗᐊᑦᑕᖅᐸᒃᓯᒪᖖᕕᑦ
2. ᑎᒥᐅᑉ ᐅᑐᕐᑕᐅᓂᖓ
   - ᐅᖁᒪᐃᓐᓂᕐᑦ
   - ᑎᒥᕕᑦ ᐅᕐᓱᕐᓂᖓ (ᐆᒻᒪᓕ ᖃᐅᔨᓴᖅᑕᐅᓂᐊᕐᑐᑎᑦ ᑲᒥᓪᓇᐊᖅᓴᔪᖁᑎᑦ ᐊᒻᒪ ᐊᓕᓯᑭ ᐱᕐᑐᒥᒃ)
   - ᑕᑭᓂᑦ ᐊᒻᒪ ᐃᓯᕙᕐᑐᑎᑦ ᑕᑭᓂᑦ
   - ᕿᑎᑦ ᐅᑐᕐᑕᐅᓗᓂ (ᐃᓐᕕᑦ ᐅᕕᓂᓕᓇᖓᒍᑦ)
3. ᐋᓂᐊᕕᖕᒥ ᐊᒻᒪ ᖃᐅᔨᓴᖅᓴᐅᓂᕐᒧᑦ ᐅᑐᕐᓂᖅ
   - ᐊᐅᕕᑦ ᑎᒃᑎᕐᓂᖓ ᐊᒻᒪ ᐆᒪᑎᕕᑦ ᑎᒃᑎᕐᓂᖓ
   - ᐊᐅᖏᖅᑕᐅᓗᑎᑦ ᖃᐅᔨᓴᖅᓴᒥᒃ (ᐅᓐᓄᒃᑯᓂ ᓂᕆᓚᐅᖅᑕᕐᓂᑦ)
   - ᐃᒥᖁᔭᐅᓗᑎᒋᐊᕐᑎᑦ ᓯᕐᓇᕐᑐᒥᒃ ᐃᒥᖃᓴᒥᒃ.
   - ᒪᕈᒃ ᐃᑲᕐᕿ ᐊᓂᒍᓚᐅᕐᑎᓪᓗᒋᑦ ᐃᒥᓚᐅᕐᑎᓪᓗᑎᑦ ᓯᕐᓇᕐᑐᒥᒃ, ᐊᐅᖏᖅᑲᑕᐅᓂᖅᓴᐅᖁᑎᑦ ᖃᐅᔨᓴᖅᓴᒥᒃ

ᐊᐅᑦ ᖃᐅᔨᓴᖅᑕᐅᓂᐊᖅᐳᖅ ᑯᓄᖓ:
   - ᓂᕆᓚᐅᖅᑐᓂ ᓱᑲᕐᓂᕐᓴᖓ (ᖃᐅᔨᓇᓱᑎᒥᓗᒍ ᑎᒥᑦ ᖃᓄᑎᒥ ᓱᑲᕈᓇᕐᒪᖓ ᐊᒻᒪ ᐊᐅᓚᔾᔪᓇᓂᓂᒃ)
   - ᓂᕆᓚᐅᖅᑐᓂ ᓱᑲᕐᓂᕐᓴᖓ
   - ᐱᑕᖅᓂᖓ ᐅᕐᓱᑎᐊᕙ ᐊᒻᒪ ᐅᕐᓱᐃᑉ ᐃᓐᕕᑦ ᐊᐅᖓᓂ
   - ᓱᑲᕐᓂᖓ ᐃᑲᕐᕿ ᒪᕈᒃ ᐊᓂᒍᓚᐅᕐᑎᓪᓗᒋᑦ ᐃᒥᓚᐅᕐᑎᓪᓗᑎᑦ ᓯᕐᓇᕐᑐᒥᒃ ᐃᒥᓚᐅᕐᑎᓪᓗᑎᑦ
   - ᐅᕐᓱᕐᓂᖓ (ᖃᐅᔨᔾᔨᑎᒥᓯᐊᕐᓗᒍ ᐊᑲᐅᖏᓕᐅᕈᑎᒥᓯᐊᕐᓗᒍ ᐊᐅᓚᔾᔪᓂᖓ ᐃᓅᓯᓇᓂᐊᕐᑕᖅ ᓯᕗᓂᓴᖓᓂ)

ᓇᓗᓇᐃᔭᕐᓂᖓ ᐱᒃᑕᐅᔪᖅ______ ᓇᓗᓇᐃᔭᕐᓂᖓ ᑕᕐᓇᖅᑐᖅ:______

ᐊᓪᓗᑎᕆᓛᑦ ᐱᖑᐃᒍᓚᐅᕐᑐᑦ ᐊᐅᓯᕐᓯᐱᐅᓂᖓᓄᑦ ᑕᒪᑐᒧᖓ ᖃᐅᔨᓴᕐᓂᐅᓚᐅᕐᑐᒧᑦ ᐊᒻᒪᓗ ᐊᐅᑉ ᐊᑯᓂᐅᔪᒧᑦ ᐱᓯᒪᔪᐅᓚᐅᕐᑐᑦ ᓯᕗᓂᐊᒍ ᖃᐅᔨᓴᕐᓴᐅᓗᑎᒃ. ᐊᓯᐊᒍᑦ ᖃᐅᔨᓴᕐᓂᐅᔪᒥᒃ ᐱᑕᖃᕐᔪᖕᑐᖅ.

ᐃᓚᒌᔭᐅᖃᑕᐅᓂᐊᕐᑐᑦ ᕿᐱᓗᒍᓐᓇᕐᓂᖓ: ᐱᖃᑕᐅᒪᓂᕆᔭᐃᑦ ᐅᕙᓂᖓ ᐱᖃᑕᐅᒪᓂᖏᑯᐱᑦ ᐃᓱᒪᕐᓱᕐᑎᓪᓚᕆᑦ.

ᐃᓱᒪᓗᑎᒋᓕᕈᓐᓇᕐᑐᑦ ᐃᓚᒌᔭᐅᖃᑕᐅᓂᕐᒧᑦ:

- ᐊᐅᖏᕐᓯᐱᐅᓂᖏᑦ ᑎᒡᓗᔭᕈᑕᐅᓕᖁᑎᓐᓇᐊᖅᑐᑎᑦ.
- ᐃᓚᒌᓂᒃᑯ ᐃᓚᖏᑦ ᐃᒪᐃᓱᖓᒧᓕᑦ ᐊᑐᕐᑕᐅᓂᖅᓱᖓᒧᓕᑦ ᐊᐅᖏᑦ ᓱᑲᖏᓗᐊᕐᑎᒡᓗᑦ ᓯᕐᓇᕐᑐᒥ ᐃᒥᒐᓴᒥ ᐃᒥᓚᐅᕐᑎᒡᓗᑦ, ᐃᒪᐃᕐᑐᕐᓇᖅᑐᑦ ᓄᕿᕿᓗᓂ, ᑕᖅᓴᕐᓴᐃᒡᓗᓂ, ᐊᒻᒪ ᑳᓗᓂ ᐊᒻᒪᓗ ᐃᓚᖏᓗᑦ, ᑲᕐᐱᐊᓯᕈᕐᓗᓂ, ᐃᓱᒪᓗᕈᕐᓗᓂ, ᐅᕈᔪᕈᕐᓗᓂ. ᑖᒃᑯᓇ ᐊᓂᐊᓯᐅᕐᑎᒧᑦ ᑲᒪᒋᔪᕐᑎᕆᐊᖅᓇᖅᑐᑦ ᐊᒻᒪ ᑕᐃᒪᐃᖏᑉᐱᓴᐅᕆᕐᓗᓂ ᓂᕆᐊᕐᓗᓂ ᐃᓕᖕᓄᑦ ᐱᑕᖅᑎᑕᐅᔪᓐᓇᖅᑐᖅ ᓯᓚᖁᓴᕐᐱᒻᒥ ᖃᐅᔨᓴᕐᑕᐅᓯᒪᔪᓐᓇᕐᑐᒋᑦ.

ᐱᕙᑎᖓ ᓱᒪᖕ ᐃᓕᖕᓄᑦ ᐃᑲᔪᕐᓂᖅᑯᓇᖓᖓ ᐱᖃᑕᐅᓂᕐᑯᑦ ᑕᒪᑐᒧᖓ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ: ᑕᒪᖕᓇᓕ ᑲᒪᒋᔪᓐᓇᐊᖅᑐᖅ ᐱᔪᓐᓇᕐᓯᒪᕐᑎᐊᓕᖅᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ, ᑎᑎᖅᑯᓯᐊᕐᔪᕈᑎᑦ (ᖃᖕᓄᓈᑎᑦ ᐊᒻᒪᓗ ᐃᓄᒃᑎᑐᑦ) ᑕᕝᕙ ᒪᕐᕉ ᐊᓂᒍᓕᐅᕐᑎᖕᓇᖕ. ᓱᓕ ᓇᐃᓇᕐᓯᒪᒐᓗᐊᕐᓗᓂ ᖃᐅᔨᕙᑎᒥᓂᐅᕙ ᓴᕿᑦᑕᐅᔪᓐᓇᖅᑐᑦ ᓄᓇᓕᖕᒧᑦ ᐅᑭᐊᖑᖅ 2005ᒥᓕᒃ. ᐱᖃᑕᐅᕙᓚᖕ ᑐᑭᓯᐊᕐᑎᓴᓂᒃ ᐱᕙᐃᓐᓇᐅᓗᔪᑦ ᖃᓄᖅ ᑲᒪᑎᐊᕈᓐᓇᓂᖕᒥᒃ ᐊᐅᑦᑯᑦ ᓱᖃᑦᑕᐅᕐᑕᐃᓕᒪᕙᓐᓇᓂᖕᒥᒃ. ᓇᓴᕐᑎᕐᑎᑕᐅᔪᓐᓇᖅᑐᑎᑦ ᐊᒻᒪ ᐊᑎᓕᐅᕐᑕᐅᓗᑎᑦ ᐊᑐᔪᕐᓴᐅᔪᖕᓄᑦ ᐊᕐᔨᒋᐅᕈᔪᕐᓄᑦ ᐱᕙᓯᐊᓴᓄᑦ.

ᐅᖃᕐᑕᓇᐊᖅᑯᖕᓂᖅ:

- ᐊᐱᕐᓱᕐᑎᐅᕙᑦ ᐊᑎᓕᐅᕐᓯᒪᔪᑦ ᐃᕐᑯᒥᖕᓂᑦ ᓇᓄᓇᐃᔭᐃᒥᐊᖅᑭᑦ ᐊᒻᒪᓗ ᑲᑎᕐᓱᕐᑕᐅᕙᑦ ᐅᖃᕐᑲᑦᑕᐅᒥᐊᖅᓯᑦ
- ᑖᒃᑯᓗ ᐃᓚᒌᔭᐅᖃᑕᐅᕙᑦ ᐃᓛᒃᑯᑦ ᓈᓴᐅᑎᖅᓯᑎᑕᐅᔪᖕᒃ ᑭᓇᓕᒫᒧᑦ ᖃᐅᔨᔪᐅᔪᖕᒪᖕ.
- ᑐᑭᓯᐊᕈᑎᓴᐃᓗ ᖃᕐᓴᐅᔪᒧᑦ ᐃᓕᔪᐅᔪᖕᒃ. ᖃᕐᓴᐅᔪᕕᓕᖃᑕ ᐃᓕᖕᓄᑦ ᑐᑭᓯᕙᑎᐅᕙᑦ ᑐᓂᕈᑕᐅᕙᒪᕐᑐᑦ ᐃᓕᖕᓄᑦ.
- ᖃᐅᔨᓴᐅᑎᒥᓂᑦ ᐃᓕᖕᓄᑦ ᐅᑎᕐᑎᑕᐅᒍᑎ, ᐊᑎᑦ ᐃᓄᐃᓕᒥᖕᓗ ᐱᕐᑕᐅᔪᕐᑐᖅ ᖃᐅᔨᓴᐅᑎᓂᑦ ᐅᓂᒃᑳᑦ ᐃᓚᓕᐅᑕᐅᕙᓇᓴᕐᑐᑎ ᐊᑎᓕᔪᕐᖏᕐᖑᑎ ᐅᑭᐅᓂᖕᒍ.
- ᑖᒃᑯᓗ ᑭᒃᑯᓂᖏᑕ ᐊᑎᖏᖅ ᑭᓯᒪᕙᑎᑕᐅᔪᖕᒃ ᓄᓇᓕᒻᒥᒧᑦ ᖃᐅᔨᓴᕐᐱᐅᕙᕆᑦᑐᒥ ᓂᕿᓄᑦ ᐊᒻᒪᓗ ᐊᕙᑎᒧᑦ ᐊᐅᓚᓯᒪᕙᑎᑕᐅᕙᑦ ᐃᑉᐱᓐᖑᓂ ᐱᕙᑎᕐᑐᒍ ᖃᐅᔨᕙᐅᕙᑦ ᐱᖃᑕᐅᓯᒪᕙᒧᑦ ᐅᑎᕐᑎᑕᐅᕙᕐᓇᓴᕐᒪᑕ ᖃᐅᔨᓇᓱᖑᖃᖅ.
- ᐃᓯᒃ ᒥᓴᓄᖕᕙᑦ ᑐᑭᓯᕙᑎᓯᑦ ᖃᐅᔨᓴᕐᕙᑎᐅᔪᖕᑐᑦ ᑭᓇᓱᐃᓐᓇᓴᓕᒻ ᓄᓇᓕᒥᐅᑕᐅᕙᓗ, ᑲᑐᔭᖃᑎᒋᓗ ᐅᕙᓂᖓ ᑎᒥᐅᕙᓄᑦ.
- ᖃᐅᔨᕙᑕᐅᕙᑦ ᐱᑕᖃᕐᔪᖕᑐᑦ ᐃᓯᒃ ᐊᑎᖑᓂᖕ ᐅᕙᓂᖓ ᖃᓄᐃᑐᓱᐃᓇᖅ ᑐᑭᓯᐊᕐᑎᖅ ᐊᐅᓪᓚᕈᑎᕙᓇᕐᓴᐅᔪᑎᖅ ᓇᓄᓇᐃᓯᕙᑎᑕᓗᕙᓐᓇᓴᕐᔪᖕᑕ ᑭᓇᒥᖕᒪᖕ.
- ᑖᒃᑯᓕᒫ ᖃᐅᔨᓴᕐᑕᐅᓯᒪᕙᓕᒫᓄᑦ ᑲᑎᑕᐅᓗᑎᑦ ᖃᐅᔨᕙᑎᑦ (ᐃᓕᖕᓄᑦ ᑐᑭᓯᐊᕈᑎ) ᖃᐅᔨᑲᐃᕙᑎᕙᓇᓴᕐᑐᑦ ᐊᐱᕐᓱᕐᓯᒪᕙᓯ ᐊᒻᒪᓗ ᑲᓇᑕᒥ ᐃᓄᐃᑦ ᑲᑐᔭᖃᑎᒋᔪᒪᕙᓪᓗ ᐊᓂᐊᕐᑐᓕᕐᓂᕐᒧᑦ ᐃᓱᒪᓗᑎᖃᕐᓗ.

ᐱᕙᓇᕐᓂᕐᑐᐃᑦ ᐱᖃᑕᐅᒪᔪᒥᕐᓂᕐᓂᕆᔭᐃᑦ: ᐱᖃᑕᐅᒪᓂᕐᑐᐃᑦ ᐱᕙᒪᓂᕐᓗ ᒪᓕᑐᐃᓇᕐᓴᐅᔪᒪᖕ ᐊᒻᒪ ᖃᐅᔨᑐᐃᓇᖅᑎᐊᑯᑦ ᖃᐅᔨᓇᓱᖕᓂᕐᒥᒃ ᐱᔭᖕᓇᖕᓗᑎᑦ. ᓱᓕ ᐃᓚᒌᖕᓂᖕ ᐊᐱᕆᔪᕙᓂᖕ ᑭᐅᕙᓪᓚᖕᓂᖏᑯᐱᑦ ᑭᐅᖏᑦᑕᓇᖕᓗᑎᑦ. ᐊᑎ ᐊᐱᕆᓂᐊᕐᑎᑦ ᐱᓕᕆᐊᖅᑐᓄᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᑐᑭᓯᑎᐊᓂᖏᑯᐱᑦ. ᓱᓕ ᐃᒪᐃᖅᑐᒥᖕ ᑭᓇᑐᐃᓇᕐᒥᒃ ᐱᕐᑎᖅᑯᖕ ᑖᑯᓂᖕ ᖃᐅᔨᓴᕐᑕᐅᓯᒪᕙᓂᖕ ᖃᐅᔨᕙᑎᓯᒪᕙᓂᖕ ᐊᒻᒪ ᑖᒃᑯᐊ ᐃᓯᒃ ᒥᓴᓄᖕ ᑎᑎᕐᑕᐅᓯᒪᕙᑦ ᑕᕝᕙᖕ ᑐᑭᓯᐊᕐᑎᕙᓇᕐᑐᒥᖕ ᐱᑕᐅᓯᒪᕙᓂᖕ ᑕᐃᒪᐃᒍᓇᓂᖕ.

ᑐᑭᓯᐊᑲᓂᕈᒪᒍᕕᑦ, ᐅᖃᐅᓯᖃᕈᕕᑦ, ᐊᑲᐅᖏᑦᑐᕕᑦ ᐱᕈᒪᓂᕈᕕᑦ ᖃᐅᔨᓴᕐᑐᓂᖕᒥᒃ, ᖃᐅᔨᑲᕈᓐᓇᕐᑕᕕᑦ ᓇᓕᐊᑐᐃᓇᖕ

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ᓇᓗᓇᐃᔭᕐᓂᖕ ᐱᖃᑕᐅᔪᖅ______ ᓇᓗᓇᐃᔭᕐᓂᖕ ᑕᒪᓇᑐᖅ:

ᑕᑕᑎᓇᐊᓕᒃ ᐊᖏᕈᑦ
ᐸᓐᓂᕐᑐᒥ ᖃᐅᔨᓴᕐᓂᖅ ᑎᒥᐅᑉ ᖃᓄᐃᓐᓂᖓᓄᑦ

ᐅᕙᖓ ᐅᖃᓕᒫᓯᒪᔪᖓ ᐊᒻᒪ ᑐᑭᓯᓪᓗᖓ ᑖᓇ ᖃᐅᔨᓴᕐᓂᖅ ᖃᓄᐃᑦᑐᓂᐊᕐᓂᖓᓂᒃ ᐊᒻᒪ ᐊᖏᖃᖓ ᐱᖃᑕᐅᔪᒪᓂᕐᓂᒃ ᐸᓐᓂᕐᑐᒥ ᑎᒥᐅᑉ ᖃᓄᐃᓐᓂᖓᓂᒃ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ.

ᐄ ☐ ᐋᒃ ☐

ᐅᕗᖓ ᐱᔪᓐᓇᖁᑎᒋᕙᖓ ᐸᓐᓂᕐᑐᒥ ᖃᐅᔨᓇᓱᒃᑎᐅᔪᑦ ᐊᐅᓚᑦᑎᑦᑎᔪᓐᓇᕐᓗᑎᒃ ᖃᐅᔨᔭᐅᓯᒪᔪᓂᒃ (ᐊᐅᑉ ᑎᓕᕐᓂᖓᓄᑦ, ᐊᐅᑉ ᐅᕐᓱᖃᕐᓂᖓᓄᑦ, ᐊᒻᒪ ᓱᑲᕐᓂᖓᓄᑦ ᖃᐅᔨᓴᕈᑕᐅᓯᒪᔪᓂᒃ ᐅᕙᖓ ᐋᓐᓂᐊᐱᖓᓄᑦ.

ᐄ ☐ ᐋᒃ ☐

ᐅᕙᖓ ᐱᔪᓐᓇᖁᑎᒋᕙᖓ ᐸᓐᓂᕐᑐᒥ ᖃᐅᔨᓇᓱᒃᑎᐅᔪᓂᒃ ᖃᐅᔨᒋᐊᕈᓐᓇᕐᓗᑎᒃ ᖃᐅᔨᓴᖅᑕᐅᔪᑎᒥᓂᕐᓂᒃ ᐊᐅᒪ ᓱᑲᕐᓂᖓᓂᒃ ᐊᒻᒪ ᖃᐅᔨᔭᐅᓯᒪᔪᓂᒃ. ᐱᔪᓐᓇᖁᑎᒋᕙᖓ ᐊᑎᖏ ᐃᓄᒃᑎᓂᖏ ᐊᒻᒪ ᐋᓐᓂᐊᕕᓕᐊᕐᑐᕐᓯᐅᑎᒪ ᓇᒻᒪᖓ ᐊᑐᕐᑕᐅᔪᓐᓇᕐᓗᓂ ᑐᑭᓯᒋᐊᕈᑕᐅᓗᓂ ᕿᑭᖕᒐᓗᑉ ᖃᐅᔨᓴᖅᐱᖓᓂᒃ (ᐃᖃᓗᓐᓂᒃ)

ᐄ ☐ ᐊᓐᓂᐊᕕᓕᐊᕐᑐᕐᓯᐅᑎᒃ: ____________ ᐋᒃ ☐

ᐱᔪᓐᓇᖁᑎᒋᕙᖓ ᐸᓐᓂᕐᑐᒥ ᖃᐅᔨᓇᓱᒃᑎᐅᔪᓂᒃ ᐅᕙᓐᓂᒃ ᖃᐅᔨᑲᐃᔪᓐᓇᕐᓗᑎᒃ ᐊᕐᖁᑦ ᑕᓪᓕᒪᑦ ᐊᓂᒍᖅᑕ ᖃᐅᔨᓴᖅᑲᓐᓂᕐᓂᐅᓚᖓᔪᒧᑦ ᑕᒪᓐᓇ ᖃᐅᔨᓴᕐᓂᖅ ᖃᐅᔨᒋᐊᕈᑕᐅᓂᕐᒧᓂ.

ᐄ ☐ ᐋᒃ ☐

____________ ᐊᑎᖓ ᐱᖃᑕᐅᔪᑦ	____________ ᐊᑎᓕᐅᕈᓯᖓ	___/___/___ ᐊᕐᒍᖓ/ᑕᕿᖓ/ᐅᑭᐅᖓ
____________ ᐊᑎᖓ ᑕᑯᓐᓇᕐᑐᑦ	____________ ᐊᑎᓕᐅᕈᓯᖓ	___/___/___ ᐊᕐᒍᖓ/ᑕᕿᖓ/ᐅᑭᐅᖓ
____________ ᐊᑎᖓ ᖃᐅᔨᓇᓱᒃᑎᐅᓂᐊᕐᑐᑦ ᐅᕝᕙᓘᓐᓃᑦ ᑭᒐᑐᕐᓂᐊᕐᓗᓂ ᑎᓕᓯᒪᔭᖓ	____________ ᐊᑎᓕᐅᕈᓯᖓ	___/___/___ ᐊᕐᒍᖓ/ᑕᕿᖓ/ᐅᑭᐅᖓ

____
ᐱᖃᑕᐅᔪᑦ ᑐᓴᕐᑎᖓ ᖃᐅᔨᔪᑕᐅᓯᒪᔪᑦ ᐊᐅᓚᑦᑎᑕᐅᔾᔪᓇᓐᖏᒪᑕ ᐊᒻᒪ ᐅᖃᓚᐅᑎᖓ

ᐊᖏᕈᑎᐅᔪᑦ ᐊᕐᕌᒍᐊᖓᓂᒃ ᐱᑎᑕᐅᕗᑎᑦ. ᐊᑎ ᐱᓯᒪᓂᐊᖃᑎᑦ ᐊᒻᒪ ᓯᕗᓂᐊᒍ ᖃᐅᔨᒋᐊᕈᑎᒋᑲᕐᓂᕈᓐᓇᖔᖓᒪᑕ.

ᐊᒥᕈᑦ ᓇᓗᓇᐃᖅᑐᖓ ᐆᒪ: ____________ ᐊᕐᒍᖓ/ᑕᕿᖓ/ᐅᑭᐅᖓ: ____________

ᐊᐱᖅᓱᕈᑦ ᑭᐅᔾᔪᖅ ᐆᒪ: ____________ ᐊᕐᒍᖓ/ᑕᕿᖓ/ᐅᑭᐅᖓ: ____________

ᓇᓗᓇᐃᔭᕐᓂᖓ ᐱᖃᑕᐅᔪᑦ____ ᓇᓗᓇᐃᔭᕐᓂᖓ ᑕᑯᓐᓇᕐᑐᑦ:____

APPENDIX 8.6

Publisher waiver form

APPENDIX 8.7

Co-author waiver forms