

**Environmental Influences on Physical Activity and Diet of
Woodland Cree Women in Northern Saskatchewan**

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By

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Abstract

Increased prevalence rates of overweight and obesity (OW/OB) have been reported among Aboriginal women and while the literature suggests that changes in lifestyle (i.e. physical activity and diet) account for this trend, few studies have explored how the physical and sociocultural environments and individual attitudes and beliefs regarding physical activity (PA) and healthy eating may contribute to the increase. The purposes of this project were to: 1) Determine the current prevalence of OW/OB in the community, 2) assess changes in OW/OB from 1991 to 2005, 3) assess current PA and dietary practices, and 4) explore the influence of the physical and sociocultural environments as well as individual attitudes and beliefs regarding PA and healthy eating among the females in the community.

The prevalence of OW/OB was 26% among youth and 68% among adults. Overall, no significant difference in rates of OW/OB among youth or adults occurred over time, however there was a significant decrease in rates of OW/OB for adult males and a tendency towards a greater increase in OW/OB among female youth. A pattern of abdominal obesity among all age groups of females was noted. There was a significant increase in body mass index (BMI) classification over time among individuals with serial data. Walking and housework were the most frequently reported activities. Although the PA data suggests levels associated with health benefits, these results must be interpreted cautiously given housework was performed at a low intensity. Personal, community-specific and environmental factors were highlighted as barriers to PA, whereas organized, age-specific, women-only programs were highlighted as potential enablers for PA. Low intakes of fruits and vegetables and milk products across all age groups, with high intakes

of foods high in fat, oil, sugar, salt, particularly among those under 25 years were reported. Traditional food use increased with increasing age, however was low even among women aged 55+. While food preference was influenced primarily by taste, barriers to healthy eating were largely related to geographic location. Collectively, the results of this study emphasize the importance developing community-based health promotion programs that focus on reducing identified barriers to PA and healthy eating to promote healthy body weights in the community.

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Dedication

This thesis is dedicated to my husband Mark, our daughter Sydney and my parents Glen and Vicky. Mark, your love, support, encouragement and understanding has meant the world to me and I am so thankful that we have been able to travel this journey together. Mom and Dad, you both have provided endless love and support every time I informed you that “I’m going back to school”. I am especially thankful for all the help you provided after the arrival of Sydney and helping me to find some time to continue working on this research project. Sydney, you are the light of my life and bring me so much joy and happiness. Your infectious smile and giggles remind me everyday what is most important in life.

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List of Abbreviations

BMI – Body Mass Index

CCHS – Canadian Community Health Survey

FNITCS – First Nations and Inuit Tobacco Control Strategy

GD – Gestational Diabetes

HNF1A – Hepatocyte Nuclear Factor -1- Alpha

IGT – Impaired Glucose Tolerance

KT – Knowledge Translation

MAQ – Modifiable Activity Questionnaire

MC4-R – Melanocortin 4-receptor

MET – Metabolic Equivalent

NHANES – National Health and Nutrition Examination Survey

NPHS – National Population Health Survey

OB – Obesity

OW – Overweight

PA – Physical Activity

POMC – Pro-opiomelanocortin

PPAR γ – Peroxisome Proliferators-activated Receptor Gamma

SF – Skinfold Measurement

SLHDP – Sandy Lake Health and Diabetes Program

T2DM – Type 2 Diabetes Mellitus

WC – Waist Circumference

WHR – Waist:Hip Ratio

CHAPTER 1
INTRODUCTION AND REVIEW OF LITERATURE

1.1 Introduction

Over the past few decades, the global increase of overweight and obesity has been recognized as a public health concern. As the prevalence has increased substantially, it is now regarded as a pandemic, affecting millions worldwide (World Health Organization 2000). In Canada, surveillance data from five population surveys (1985 and 1990 Health Promotion Surveys and 1994, 1996 and 1998 National Population Health Surveys) indicated that from 1985 to 1998, the overall national prevalence of obesity among adults aged 20 years and older more than doubled, increasing from 5.6% to 14.8% respectively (Katzmarzyk 2002). This data was based on self-reported height and weight to determine body mass index (BMI¹). Self-reported BMI data from the 2000/01 Canadian Community Health Survey (CCHS) reported that 32.4% of the adult population (18 years and older) were overweight and 14.9% were obese (Statistics Canada 2002), the latter finding similar to that reported in 1998. Prevalence rates for overweight and obesity remained rather stable over the next two years as the 2003 edition of the CCHS, which also utilized self-report BMI, reported 33.3% of adults overweight and 14.9% obese (Statistics Canada 2003).

The most recent national data from the 2004 CCHS directly measured BMI of the participants and the findings indicated 36.1% of adults were overweight and 23.1% obese (Tjepkema 2005). One of the most notable increases was among those aged 25-34 years where obesity rates more than doubled from 8.5% to 20.5% in 2004 since the last measured BMI data in 1978/79 (Tjepkema 2005). While these data from the 2004 CCHS revealed similar rates of obesity for males (22.9%) and females (23.2%), females were

¹ BMI (Body Mass Index; weight[kg]/height [m²]) is an indicator of health risk associated with underweight (BMI < 18.5 kg/m²) and overweight (BMI > 25.0 kg/m²). It is not a direct measure of body fat, but is the most useful indicator to date. Health Canada (2003). Canadian Guidelines for Body Weight Classification in Adults. Ottawa, ON, Office of Nutrition, Policy and Promotion.

more likely to have Class III obesity (body mass index [BMI] > 40 kg/m²) (Tjepkema 2005).

Overweight and obesity have been strongly associated with chronic diseases such as Type 2 diabetes mellitus (T2DM), cardiovascular disease and some cancers (Raine 2004). Of these chronic diseases, T2DM appears to be the most directly related with increasing obesity (Jung 1997), and for all age groups, the prevalence of T2DM is also increasing worldwide. In the year 2000, T2DM prevalence was estimated to be 2.8% (171 million), and is projected to be 4.4% (366 million) by the year 2030 (Wild et al. 2004). According to the National Diabetes Surveillance System, 4.8% of Canadians (4.6% women and 5.0% men) aged 20 years and older were reported to have T2DM (Center for Chronic Disease Prevention and Control 2002), and the prevalence of T2DM is projected to increase over the next 20 years due to increasing rates of obesity, physical inactivity and the aging population.

The epidemiological data from the various national surveys outlined above are said to be representative of household residents in all provinces, however one notable exception to these population studies has been those living on First Nations reserves. Based on the data from the 2000/01 CCHS (Statistics Canada 2002), it was suggested that the above-average rates of obesity in the northern territories indicate higher rates of obesity in the Aboriginal² population, given that Aboriginal peoples comprised a large percentage of the northern population (Raine 2004). Despite the suggestion that above-average rates of obesity exist, prevalence rates of overweight and obesity in this population are limited (Raine 2004), with most studies being reported on the pediatric

²The terms 'Aboriginal' and 'Aboriginal peoples' do not describe a homogeneous group. However, for the purpose of this thesis the terms will be used to describe First Nations people (including individuals registered and not registered under the Indian Act), Métis and Inuit peoples, with the exception of the use of specific terms when discussing the results of research studies that have employed specific terms.

population (Bernard et al. 1995; Potvin et al. 1999; Hanley et al. 2000). For the most part, these studies have been community-specific and mostly in Northern Ontario, however the data that has been reported indicates that indeed the prevalence of obesity is increasing in the Aboriginal population.

One of the first studies to investigate the prevalence of obesity in an Aboriginal population was conducted in the central sub-arctic region in Canada in six remote Cree and Ojibwa communities in north-western Ontario and north-eastern Manitoba (Young and Sevenhuysen 1989). A total of 704 participants from these communities took part in this study which involved anthropometric measurements, including height, weight, triceps and subscapular skinfold thickness, waist and hip circumferences, and various survey questions regarding demographics, family history, lifestyle factors and dietary history. The data from this study was compared to Canadian national reference data from the Canada Fitness Survey of 1981, and the results revealed higher rates of obesity in the Aboriginal population compared to the Canadian population. In both males and females in all age groups, the proportion of overweight and obesity, defined as a body mass index (BMI) of $\geq 26 \text{ kg/m}^2$, was higher in the Aboriginal population compared to the Canadian data. In addition, the greatest proportion of overweight and obesity occurred in Aboriginal females aged 45-54 years where almost 90% had BMIs in the overweight to obese range, compared to approximately 40% in the Canadian female population in the same age group (Young and Sevenhuysen 1989). It was also noted that the predominant pattern of body fat was centrally located, as measured by waist:hip ratio (WHR) and subscapular:triceps skinfold ratio (Young and Sevenhuysen 1989).

Similar findings to those of Young and Sevenhuysen (1989) have been reported in a study conducted in three Aboriginal communities in the Okanagan region of British Columbia (Daniel et al. 1995). Body mass index, skinfold measurements (SF) and WHR were assessed among 189 residents of three reserve communities. The results were also compared to the Canada Fitness Survey, and the findings showed that BMI, SF and WHR were higher in the Aboriginal group compared to the Canadian norms and cut-offs for health risk (Daniel et al. 1995).

A more recent study comparing the prevalence of obesity in the Aboriginal population to the Canadian population also demonstrated higher rates among Aboriginals compared to Canadians of European ancestry (Katzmarzyk and Malina 1998). Body mass index and SF measurements were collected on individuals in two communities in Northern Ontario. Participants were recruited from a First Nations community to represent the Aboriginal population, and from a Northern Ontario town to represent those from European descent. The findings from this study revealed prevalence rates of obesity in adults ranging from 51.4% in First Nations males to 60.0% in First Nations females, compared to 38.3% and 33.3% among European descendants. The First Nations youth also had higher rates of obesity with rates ranging from 28.6% in males to 29.4% in females compared to 20.8% and 12.3% in their European counterparts, respectively (Katzmarzyk and Malina 1998). In keeping with the results from Young and Sevenhuysen (1989), this study also suggested a greater central distribution of body fat among First Nations participants compared to those of European descent (Katzmarzyk and Malina 1998).

The most recent data from the First Nations Regional Longitudinal Health Survey (2003) suggests a similar trend of increased rates of overweight and obesity in the Aboriginal population. Although no data on body fat distribution was reported, findings based on BMI report that 37% of First Nations adults are considered overweight and 36% obese, compared to 33% and 15% respectively among Canadians in general (First Nations Center 2003). Similar to the findings outlined above, this study also showed a higher prevalence of obesity among Aboriginal females, compared to their male counterparts (41.1% vs. 31.8%, respectively) (First Nations Center 2003).

Finally, recent data from the 2004 CCHS which, as mentioned previously, are based on direct measures, report findings similar to those outlined above among off-reserve Aboriginal peoples. High rates of overweight/obesity (combined) and obesity were reported (67% and 38% respectively) compared to non-Aboriginal counterparts (55% and 19% respectively) (Garriguet 2008). In keeping with previous literature, it was also reported that much of the difference in prevalence rates was due to the higher rates of overweight/obesity and obesity among Aboriginal women (Garriguet 2008).

As reported in much of the literature to date, not only is there a higher prevalence of obesity in the Aboriginal population, particularly among Aboriginal women, compared to the general Canadian population, but the predominant pattern of obesity is primarily centrally located. This pattern of fat distribution is associated with an increased risk for many chronic diseases including heart disease and T2DM (Kumanyika et al. 2002). Over the past several decades, T2DM has emerged as a serious health concern in the Aboriginal population, and in Canada prevalence rates among Aboriginal adults are estimated to be nearly 20% (First Nations Center 2003). Other literature suggests that

T2DM prevalence rates are higher for those living on-reserve (8.5%) compared to those living off-reserve (5.3%) (Bobet 2000). While these rates are estimated to be two to three times greater than that of the general Canadian population (Stout et al. 2001), it is also believed they underestimate the true rates which are believed to be 2 to 3 times greater due to those undiagnosed (Young et al. 1992; First Nations Center 2003).

The Canadian provinces with the highest rates of T2DM among Aboriginal peoples are Saskatchewan, Manitoba, and Ontario (Saskatchewan Health 2000). In 1990, a prevalence study conducted on reserves in Saskatchewan showed age-adjusted rates for T2DM were 9.7% among First Nations adults, compared to 6.1% among non-First Nations adults (Pioro et al. 1996). A more recent report suggests that in Saskatchewan the age and sex-adjusted prevalence rates of T2DM for Aboriginal peoples is three times that of the rest of the population (Saskatchewan Health 2000). In addition, the prevalence of T2DM between 1994 and 1996 among Aboriginals in Saskatchewan increased by 14% (Saskatchewan Health 2000). It should be noted that these data included only those First Nations individuals with treaty status and did not include non-treaty Indians or Métis peoples, and thus these rates likely underestimate the true rates of T2DM among Aboriginal peoples in Saskatchewan.

Within the Aboriginal population it appears that females are at an increased risk, as approximately two-thirds of those with T2DM are women (Health Canada 2000). This finding is not apparent in the general Canadian population where T2DM rates are similar between men and women, or slightly higher in men (Health Canada 2002). The previously mentioned study examining prevalence rates of T2DM on Saskatchewan First Nations reserves reported age-adjusted rates of 12.1% for women and 7.2% for men, with

the suggestion that the higher rates for women may be due to higher rates of obesity possibly due to acculturation (Piroo et al. 1996). It remains to be established however, why Aboriginal women are at an increased risk of developing obesity and T2DM compared to their male counterparts.

As outlined above, both obesity and subsequently T2DM are increasing in the Aboriginal population, particularly among Aboriginal women. Prevention or treatment strategies are urgently needed, particularly as rates of both conditions are expected to increase further. There are several factors driving the obesity epidemic such as food availability, physical activity, individual behavior and cultural and societal factors (Aronne 1998). Therefore, one of the goals of this thesis was to explore how the physical and sociocultural environments, as well as individual attitudes and beliefs influence physical activity and dietary patterns (specifically healthy eating) among women in the community.

Physical activity and diet are two modifiable risk factors linked to preventing and controlling both unhealthy body weights and T2DM, and the literature suggests low levels of physical activity and altered dietary patterns among the general population, including the Aboriginal population. In Canada, the 1991 Aboriginal Peoples Survey (comprised of individuals self-identified as either North American Indian, Métis or Inuit, and living in both reserve and non-reserve communities) showed that only half of Aboriginal adults participated in leisure-time physical activity (Health Canada 1991). More recent data (comprised of individuals from First Nations communities in all provinces and territories except Nunavut) indicated that only 21% of First Nations adults perform sufficient amounts of physical activity (i.e. at least 30 minutes of moderate or

vigorous physical activity at least four days per week) for health (First Nations Center 2003). In addition to low physical activity levels generally reported within the Aboriginal population, the literature suggests that Aboriginal females are less active than their male counterparts (Kriska et al. 2001; First Nations Center 2003).

Historically, Aboriginal peoples subsisted on traditional foods that required hunting, trapping, fishing and gathering and that were generally high in animal protein and low in fat and carbohydrates (Willows 2005). Today's diet is now comprised of less traditional foods and more processed, market foods (Whiting and Mackenzie 1998; Willows 2005) requiring less physical effort to obtain. While we know that both physical activity and diet contribute to body weight, what remains to be understood is how the realities of their everyday lives influence physical activity and dietary behaviors in the Aboriginal population. Therefore, the objectives of this thesis were to: 1) determine the prevalence of overweight and obesity; and 2) explore how the physical and sociocultural environments, and individual attitudes and beliefs influence physical activity and healthy eating among Cree women in Northern Saskatchewan. A further objective of this research was to provide knowledge to the community leaders, program developers and policy makers so that effective, culturally appropriate overweight and obesity prevention and reduction programs can be better designed and implemented.

1.2 Review of Literature

The following review of literature includes sections on topics, not limited to physical activity and diet, that have been associated with the increasing rates of overweight and obesity in the Aboriginal population, as well as the role they may play in the increase in T2DM. Type 2 diabetes mellitus is included in this review given that both

obesity and T2DM have become serious health problems among Canadian Aboriginal peoples over the past several decades (Young et al. 2000), and that obesity is one of the strongest modifiable risk factors for T2DM (Tuomilehto et al. 2001). In addition, the majority of the literature that has addressed the issue of overweight and obesity in the Aboriginal population has done so within the context of the high prevalence rates of T2DM. Prior to reviewing the factors believed to contribute to the increased prevalence of overweight and obesity and T2DM, these terms must be described.

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (World Health Organization 2006), and which result from an imbalance between energy intake and energy expenditure (Aronne 1998). In Canada, the body mass index (BMI), an index of weight to height (kg/m^2), is used to classify individuals as overweight ($25.0 - 29.9 \text{ kg}/\text{m}^2$) or obese ($\geq 30 \text{ kg}/\text{m}^2$) (Health Canada 2003). BMI is considered to be a useful indicator of weight-related health risk as it is positively correlated with total body fat (Health Canada 2003). It should be noted that an individual with a BMI of $25.0 - 29.9 \text{ kg}/\text{m}^2$ is considered to be overweight but not obese, however an individual with a BMI $\geq 30 \text{ kg}/\text{m}^2$ is classified as obese and is also assumed to be overweight given the BMI is $> 25.0 \text{ kg}/\text{m}^2$ (Kuczmarski and Flegal 2000). Because of the distinction between overweight and obesity based on BMI, it is recommended that BMI ranges be provided to indicate the specific classification (Kuczmarski and Flegal 2000). This is of particular importance when the term overweight is used, as it can be used to describe all-inclusive overweight (i.e. $> 25.0 \text{ kg}/\text{m}^2$) or overweight but not obese (i.e. $25.0 - 29.9 \text{ kg}/\text{m}^2$). To avoid confusion, this thesis describes overweight as a BMI

of 25.0 - 29.9 kg/m², obesity as a BMI \geq 30 kg/m² and overweight/obesity as a BMI of > 25.0 kg/m².

Although BMI is used to classify overweight and obesity, it does not provide an indication of the distribution of body fat related to health outcomes (Health Canada 2003). Waist circumference, however, is an independent predictor of health risk associated with abdominal obesity as it is positively correlated with abdominal fat (Health Canada 2003). Body fat distribution, specifically abdominal obesity, has been shown to be a more powerful predictor of a variety of chronic diseases compared to BMI (Zhu et al. 2002; Janssen et al. 2004). Waist circumference (WC) is a simple and practical method used to estimate abdominal fat and the cutoffs to classify individuals at an elevated health risk are \geq 88 cm for women and \geq 102 cm for men (Health Canada 2003).

The body weight classification system for Canada outlined above is based on data from descriptive studies of large populations consisting of individuals in different life-stages and different ethnic or racial backgrounds, however these were predominantly Caucasian populations in the United States and Europe (Health Canada 2003). The Canadian guidelines for weight classification are intended for use for adults aged 18 years and older (i.e. individuals who have reached full growth potential), however there are some limitations associated with their use (Health Canada 2003). For example, under or over-estimates may occur in individuals with the following characteristics: (1) individuals who are very tall or short, or have long or short limb lengths relative to trunk length, (2) individuals who have a lean body build or are very muscular, (3) adults over the age of 65, and (4) certain ethnic or racial groups (e.g. American Blacks, Caucasians,

Chinese, Ethiopians, Indonesians, Polynesians and Thais.), possibly due to differences in body build or body proportions (Health Canada 2003). In Canada, limited research exists regarding different levels of BMI and/or WC associated with health risk among First Nations peoples. While the health implications associated with a given BMI range may not be the same for the Aboriginal population as the reference population (Wang et al. 2000), the present body weight classification system is, in general, appropriate for all ethnic or racial groups in Canada despite these limitations (Health Canada 2003). In addition, it can be useful for identifying body weight patterns within a population and subpopulations to inform targeted intervention strategies and to evaluate changes in body weight patterns following interventions, as well as to identify trends in longitudinal surveillance studies (Health Canada 2003). Thus, the use of BMI and WC can assist in comparing health risk patterns associated with unhealthy body weight between and within populations and to identify populations at increased risk of chronic diseases associated with overweight and obesity (Health Canada 2003).

There is a lack of accepted definitions of overweight and obesity in the pediatric population (Cole et al. 2000). In the past, the classification of body weight into overweight and obesity in children and youth was typically defined using reference centiles, such as the 85th and 95th percentile. More recently however, sex and age specific BMI cut off points from the International Obesity Task Force (IOTF) have been developed for use with children and youth aged 2-18 years (Cole et al. 2000). These cutoffs were derived from a large international sample by extrapolating centile curves for BMI that correspond to the adult cutoffs for overweight (25 kg/m²) and obesity (30 kg/m²) (Cole et al. 2000). One of the advantages of using the IOFT cutoffs is that they

avoid arbitrarily choosing reference data (i.e. data from the United States National Health and Nutrition Examination Surveys) and cutoff points for overweight and obesity (e.g. 85th and 95th percentiles respectively). The other advantage is that the IOFT standards are sensitive to the timing of puberty, which is important given that sexual maturation influences body fat (Shields 2005). While there are limitations associated with the use of BMI with children and youth, similar to those outlined for adults (i.e. may over-estimate individuals with greater lean body mass), it is generally accepted as a reliable indicator of body fat in children and youth, as well as adults.

The remainder of this literature review outlines the factors believed to play a role in the increased prevalence of overweight and obesity in the Aboriginal population, keeping in mind that most studies have primarily addressed overweight and obesity within the context of T2DM. The factors believed to contribute to T2DM, and thus obesity within the Aboriginal population include a genetic susceptibility (Zimmet et al. 1985; Hegele 2001), environmental factors (physical and geographic) (Zimmet et al. 1985; Hegele 2001; Kumanyika 2001; Hill et al. 2003), sociocultural changes experienced over the last half century (Young et al. 2000), and increasing rates of gestational diabetes mellitus among Aboriginal women (Dyck et al. 1995; Young et al. 2002). Each of these factors is reviewed below.

It is important to note that the literature review draws on studies related to different Aboriginal groups within Canada, as well as Aboriginal/Indigenous groups from Australia and the United States. Although there is obvious diversity in nationality, linguistics, and ethnic and cultural traditions between the various Aboriginal groups

within these nations, there are some commonalities which make it possible to apply these studies as relevant background literature.

Among Canadian Aboriginal Peoples, culture, language and tradition are key aspects of their holistic view of health (Canadian Institute for Health Information 2004). In addition, many Indigenous cultures around the world view well-being as an inter-relationship between physical, mental/intellectual, spiritual and emotional factors (Canadian Institute for Health Information 2004).

The history of colonization and its impact on the lives and health of Aboriginal/Indigenous peoples has been experienced globally. Many Indigenous communities live in social and political conditions that are responsible for extreme levels of poverty, poor educational opportunities and chronic ill health (Burger 1987; Tuhiwai Smith 1999). The poor health among many Indigenous communities is said to be an indicator of the social position of these communities (i.e. poverty, unemployment, poor housing, etc) as a result of colonization which was experienced by those groups referenced in this thesis (i.e. the Aborigines of Australia, the Maoris of New Zealand and the native peoples of North America) (Burger 1987). In addition, Canada, the United States, Australia and New Zealand are countries that have some of the highest standards of living in the world, yet the Indigenous peoples in these countries are often as poor as the most disadvantaged in Third World Countries, and their health status is often reported to be below average (Burger 1987).

Finally, a further commonality relevant to this thesis are the high rates of T2DM among the Native Americans, the Aborigines of Australia and the Maori of New Zealand, which mirrors that of many Aboriginal groups in Canada. Therefore, despite the apparent

diversity between the Aboriginal groups referenced in this thesis, the similarities between health disparities, health status, marginalization and socioeconomic disadvantages provide the rationale for the use of literature which extends beyond the national borders.

1.2.1 Genetic predisposition to overweight/obesity and type 2 diabetes mellitus in the Aboriginal population

While obesity results from an imbalance between energy intake and energy expenditure, largely due to environmental factors, there is a growing body of literature regarding specific gene variants known to influence obesity. Although a comprehensive review of the genetics of obesity is beyond the scope of this thesis, a general discussion regarding the role of genetics on obesity is warranted as estimates of genetic influences on weight variation range from 30-80% (Clement 2005).

It is the general belief that multiple genes contribute to varying degrees of obesity, and these genes can impart either minor or major risks of becoming obese (Beamer 2003). Some of the genes screened for mutations that have been found to have major effects as to the cause of obesity include leptin, pro-opiomelanocortin (POMC), melanocortin 4-receptor (MC4-R) and peroxisome proliferators-activated receptor-gamma1 and 2 (PPAR- γ), however mutations of these genes have been found in only a small minority of people (Bougneres 2002; Beamer 2003). Although these 'major genes' may account for a small fraction of the number of cases of obesity, they do confirm that obesity can be strongly influenced by genetics. What is noteworthy however, is that the increase in prevalence of obesity in recent years suggests that most cases of obesity are due less to genetics and more to genetic influences that manifest themselves in a calorie-rich environment (Bougneres 2002; Beamer 2003).

The Aboriginal population is thought to be one of the best examples of environmental factors influencing a population possibly genetically susceptible to developing obesity, given the rapid increase in obesity rates among this population over the last half century (Young et al. 2000). The most widely known theory proposed to explain the relationship between genetic susceptibility and the environment is the ‘thrifty gene theory’ (Neel 1962). This theory was based on the premise that for thousands of years populations who relied on hunting and fishing (i.e. “hunter-gatherers”) for food experienced periods of feast, alternating with periods of famine. According to the theory, Neel (1962) suggested that having a thrifty genotype provided a more efficient use of food which lead to a rapid gain in body weight during times when the food supply was abundant, and thus acted as a survival mechanism when food was limited. However, during times where there was an ample and a seemingly limitless supply of food, coupled with a lack of physical activity to obtain the food, this metabolic trait was now seen as a liability as it was thought to promote obesity and the subsequent development of T2DM (Neel 1962). It is believed a thrifty genotype is particularly applicable to the Aboriginal population given that both obesity and T2DM have become prevalent in the last half century (Young et al. 2000), as well as the suggestion that this population has experienced a rapid change in lifestyle with reductions in physical activity and increased consumption of processed foods (Kriska et al. 2001).

While the thrifty genotype theory provides us with an intriguing hypothesis to explain the increase in T2DM among the Aboriginal population, there are numerous physiological systems that influence energy balance (i.e. those influencing appetite, energy expenditure, lipid metabolism, insulin sensitivity) (Beamer 2003). Neel himself

has more recently acknowledged that the original hypothesis emphasizing feast or famine was an overly simplistic view of the transition from a traditional to modern lifestyle (Neel 1999). For example, the thrifty genotype hypothesis did not take into account changes in body composition that have been observed over time, such as a shift from greater muscle mass to greater fat mass, thus producing a different effect related to insulin sensitivity (i.e. skeletal muscle has an increased sensitivity to insulin compared to fat mass) (Neel 1999). In addition, it may not be the limitless supply of food that promotes obesity as Neel suggested, but rather a change in the type of food consumed. Some literature suggests that a diet with a high glycemic index (a measure of the change in blood glucose following ingestion of carbohydrate-containing foods) or glycemic load (the product of the glycemic index of the food and the amount of carbohydrate in a serving) leads to the development of T2DM (Salmeron et al. 1997; Hu et al. 2001). Typical food sources of the ancestors of modern Aboriginal peoples were protein and fat from animal sources (Szathmary and Ferrell 1990), and carbohydrates in the form of plant foods high in fiber which would produce low glycemic and insulin responses (Cordain et al. 2002) and thus are much different from typical 'western' diets of today which are high in fats and refined carbohydrates.

Despite reservations regarding the concept of the thrifty genotype hypothesis, community-specific studies in Canada have explored the possibility of a thrifty genotype among the Aboriginal population within the context of T2DM. Some of the most extensive genetic testing on T2DM in the Aboriginal population in Canada has been conducted in Sandy Lake, Ontario (Hegele 2001), an Oji-Cree community in Northern Ontario with reportedly the third highest prevalence of T2DM in the world (Harris et al.

1997). In this community, genetic mapping and candidate gene sequencing (an educated guess regarding which genes may be involved in weight regulation and subsequently searching these genes for mutations) (Beamer 2003) were used to identify genes susceptible to T2DM. Through genetic mapping, four genomic markers suggestive of an association with T2DM were identified, none of which had been previously linked with T2DM (Hegele 2001). Subsequent candidate gene sequencing resulted in the discovery of a mutation in a gene expressed predominantly in the liver, kidneys and pancreatic β -cells (hepatocyte nuclear factor-1-alpha; HNF1A G319S) (Hegele 2001). This gene was found to be strongly associated with T2DM in the Sandy Lake Oji-Cree and predicted the clinical severity of diabetes mellitus in this population (Hegele 2001). Given this particular gene was absent in participants representing six other ethnic groups, it was felt to be population specific (Hegele 2001). While the HNF1A G319S gene was strongly associated with T2DM in this community, it was also found that many individuals with T2DM, particularly females, did not possess the variant of this gene, but were found to have a variant of a different gene (peroxisome proliferators-activated receptor-gamma2 A12; PPAR γ A12) which plays a role in insulin sensitivity and was strongly associated with T2DM (Hegele et al. 2000). The authors suggested that both of these variant genes have attributes of a thrifty genotype and thus increase the susceptibility of developing T2DM in this population in the presence of a sedentary lifestyle and a high-fat diet (Hegele et al. 2000; Hegele 2001).

Associations with the unique HNF1A G319S gene have also been documented in other Aboriginal populations in Canada, with the research focusing on Aboriginal youth. Researchers examined the prevalence of HNF1A G319S in 51 Aboriginal youth with

T2DM in Manitoba (Sellers et al. 2002). Given 21 of the participants (41.2%) had at least one copy of this unique gene, the results were felt to support the findings of Hegele et al. (2001) of an increased frequency of this gene in the Aboriginal population, as well as its association with T2DM. What was of particular interest to the authors however, was that of the 21 participants with a copy of the HNF1A G319S gene, 14 were from a remote northeastern Oji-Cree community in Manitoba. The authors suggested that this finding, along with those from Hegele et al (2000; 2001), suggest this gene may be specific to this particular population (i.e. Oji-Cree), given the close geographic, cultural and linguistic links between Sandy Lake and the community in Manitoba (Sellers et al. 2002). It is important to highlight however that the results of these studies should be interpreted with caution. For example, Poudrier (2007) suggests that the above-mentioned studies assume that Aboriginal communities are racially, genetically and culturally homogeneous because of shared language and geography, thus implying 'genetic homogeneity'. It is argued that the notion of 'genetic homogeneity' does not take into account interactions between communities which would have resulted in inter-tribal relationships thus influencing the gene pool so that identifying specific genetic variants would be unlikely (Poudrier 2007).

Despite the controversy, genetic studies within other Aboriginal communities continue. For example, the genetics of T2DM has also been studied in the Pima Indian populations of Arizona who have the highest reported prevalence of T2DM in the world (Knowler et al. 1978). Members of the Gila River Indian Community have been involved in a longitudinal study on the etiology of T2DM since 1965 (Knowler et al. 1978), and the research from this community has shown that at least one major gene influences the

risk of T2DM in this population by affecting the age of onset (Hanson et al. 1995). Estimates of heritability among the Pima Indians have also shown that nearly half of the variance in insulin action is familial, independent of obesity (Baier and Hanson 2004). Since that time, several other genetic studies have been carried out in this community which have included candidate gene sequencing and genome-wide linkage scans (determining regions of chromosomes likely to contain a risk gene and ruling out areas where there is a low chance of finding a risk gene) (National Institutes of Health) followed by positional cloning (identifying genes by location first then discovering the gene's function (National Institutes of Health; Baier and Hanson 2004). The results of these and other genome-wide scans on a variety of populations have consistently identified a linkage to T2DM on chromosomes 1 and 11 (McCarthy 2003; Baier and Hanson 2004) which suggests susceptibility genes may be the same across multiple ethnic groups (Baier and Hanson 2004).

Although obesity and T2DM may be influenced by genetic factors, some genes may be dependent upon environmental variables (Baier and Hanson 2004) and are likely due to a combination of changes in the environment and human behaviour and lifestyle, particularly as not all people become obese and not all obese individuals develop T2DM (Baier and Hanson 2004) Given this, studies addressing environmental influences on overweight/obesity and T2DM have also occurred in the past few decades.

1.2.2 Influence of the physical environment on overweight/obesity, type 2 diabetes mellitus, nutrition and physical activity in the Aboriginal population

Although it is still unclear as to what degree a genetic component may contribute to the increasing rates of obesity and T2DM in specific Aboriginal groups, the general

consensus among researchers is that the environment plays a significant role in this epidemic (French et al. 2001; Hill et al. 2003), particularly when environmental factors, such as geographic location, and those related to physical activity and diet are shared among family members and members of a community. While genetic studies involving the Pima Indians of Arizona have provided some evidence which supports the influence of genetics on T2DM, other research has focused on environmental influences in this population. Studies involving the Pima Indians of Arizona and Mexico, two closely related populations with a reported similar potential genetic predisposition yet distinct living conditions, were thought to be ideal to investigate the gene-environment interaction on the prevalence of obesity and T2DM (Ravussin et al. 1994).

To determine the prevalence of obesity and T2DM, Ravussin et al. (1994) compared a group of Mexican Pima Indians to the Pima Indians of Arizona, a group, as mentioned previously, reported to have the highest prevalence of obesity and T2DM in the world (Knowler et al. 1990). The Pima Indians in Arizona live near the Gila River in the Sonora Desert which is now known as Southern Arizona. With the addition of irrigation canals, the desert land was converted into an agricultural area where the Pimas were able to grow corn, beans and squash, and gathered desert plants for food. At the end of the 19th century however, water became scarce and the Pimas were forced to become dependent on foods they received from surplus commodities, resulting in a change of diet from low-fat, high-carbohydrate and fiber (mainly from vegetable sources) to a diet that was more typical of western foods and similar to that of the average United States diet (Knowler et al. 1990). The loss of agriculture also resulted in less physical work to obtain their food. The Pima Indians of Mexico however, live in a remote

location in northwestern Mexico in the Sierra Madre mountains, and up until 1991 the only access to this region was an 8 to 10 hour drive through the mountains. To assess the impact of the environment on the prevalence of obesity and T2DM, anthropometric measurements, physical activity and dietary habits were collected on the Mexican Pimas. This data was compared to data collected in 1965 on the Arizona Pimas, which was part of a longitudinal study on T2DM and its complications (Knowler et al. 1990). The results showed that the prevalence of obesity, measured by BMI, was significantly lower among the Mexican Pimas compared to the Arizona Pimas, as the average BMIs were $24.9 \pm 4.0 \text{ kg/m}^2$ and $33.4 \pm 7.5 \text{ kg/m}^2$ respectively (Ravussin et al. 1994). Dietary assessment revealed contrasting diets. The Pima Indians in Mexico consumed primarily beans, corn and potatoes which were grown traditionally and were physically demanding to harvest (Ravussin et al. 1994). The Arizona Pimas' however, adapted a high-fat, highly refined diet of foods such as milk, cheese, bacon and beans, as well as canned meats, vegetables and fruits, which resulted in less physical demand to obtain as these foods were supplied to them (Neel et al. 1998). Differences among physical activity levels were also noted between the two Pima populations as the Mexican Pimas had higher levels of physical activity when compared to the activity levels of the Arizona Pimas (Ravussin et al. 1994). These findings lead the investigators to suggest that the higher prevalence of obesity in the Arizona Pimas was due to living a more 'affluent' lifestyle (Ravussin et al. 1994). More specifically, higher obesity rates were thought to be due to lower levels of physical activity and changes in diet resulting in a shift from high-carbohydrate, low-fat and high-fiber to one of store-bought foods and a higher fat diet (Knowler et al. 1990). It was therefore suggested that despite a similar potential

genetic predisposition between the two groups of Pima Indians, a traditional lifestyle, characterized by greater energy expenditure in physical labor and a diet comprised of less animal fat and more complex carbohydrates may be protective against developing obesity (Ravussin et al. 1994).

In Canada, many Aboriginal groups live in remote northern communities, which have markedly different environments when compared to those of the Pima Indians in Arizona and Mexico (Young et al. 1990). To investigate the environmental predictors of T2DM among Canadian Natives, a geographic mapping study was undertaken by Young et al (1990). Prevalence rates of T2DM for each province were determined based on known cases reported to the Medical Services Branch and the Department of National Health and Welfare. Highest prevalence rates were found in the Atlantic region and Ontario, followed by the prairie provinces (Manitoba, Alberta, Saskatchewan) and Quebec, with lowest prevalence rates in British Columbia, the Yukon and the Northwest Territories. The authors also found several other notable findings related to geographic location. For example, higher overall rates of T2DM were found among Natives living in the northeast culture area compared to the artic, urban compared to remote areas, and in the south compared to the north. As well, highest prevalence rates were reported among those living in an eastern longitude and southern latitude (Young et al. 1990). It was thought that perhaps the higher rates of T2DM in the various geographic areas were due to non-native influences resulting in a shift in lifestyle. It was also proposed that higher T2DM rates in different culture areas may be due to differences in subsistence patterns resulting in either dietary change or consumption of few calories if consuming wild foods, as well as higher activity levels required for the procurement of these foods

(Young et al. 1990). It was also noted that while geographic isolation appeared to have an impact on the prevalence of T2DM when considered alone, it did not have an impact on prevalence rates when compared to the other predictors (i.e. latitude and culture area) (Young et al. 1990). Collectively, these findings suggested that while genetics undoubtedly plays a role in developing T2DM, environmental factors also appear to influence the varying rates of T2DM among the Aboriginal population in Canada (Young et al. 1990).

More relevant to Saskatchewan, a descriptive study illustrated the potential influence of the environment on the increasing rates of obesity in the Aboriginal population. Dyck et al (1995) examined obesity and T2DM rates in three Aboriginal communities in northern Saskatchewan, each with differing geographic accessibility to urban centers. In this particular study, the most accessible community (Deschambault Lake) was located approximately 140 km from an urban setting, the least accessible community (Black Lake) was located east of Lake Athabasca and had no road to the south, while the third community (Wollaston Lake) was located approximately 100 km south of the least accessible community, could be accessed by air or barge, and was approximately 450 km to an urban setting by road. The results from measured BMIs showed increasing rates of obesity with increasing accessibility to urban centers (Dyck et al. 1995). Similar to the results of Young et al (1990), these findings raised the question of whether exposure to non-Aboriginal lifestyles increased the rates of obesity in Aboriginal peoples (Dyck et al. 1995). The authors noted that the two less accessible communities (i.e. Black Lake and Wollaston Lake) were Dene, while the most accessible community (i.e. Deschambault Lake) was Woodland Cree. While genetic differences

may have played a role in differing obesity and T2DM prevalence rates between the most accessible and least accessible communities (Deschambault Lake and Black Lake), this would not be the case for the two less accessible communities (Black Lake and Wollaston Lake) (Dyck et al. 1995). Although this study did not assess changes in physical activity and dietary intake, changes in physical activity levels and altered dietary patterns are believed to have occurred among the Aboriginal population (Young et al. 1990). Though this may in part explain the increased prevalence of obesity in this population, the influence of physical activity and diet requires further investigation.

A change in diet as a result of acculturation has been hypothesized to play a role in the increasing rates of obesity and T2DM among the Aboriginal population, however food choices are also dependent upon attitudes and behaviors, preparation, promotion, as well as availability and cost in different environments (Kumanyika 2001). This is particularly relevant in northern remote locations where the land may not always be suitable for growth of their own produce (i.e. gardens) and residents may have to commute long distances and pay higher costs to purchase fresh, affordable fruits and vegetables. As mentioned, food choice is also dependent on availability, which is influenced by changes in the physical environment, which can subsequently threaten traditional food systems of Aboriginal populations (i.e. plant and animal species). The consequences of a loss of traditional food systems include decreased cultural-specific food activities and dietary diversity, decreased physical activity if hunting/gathering is not practiced, as well as health consequences, namely an increase in chronic diseases such as obesity and T2DM (Kuhnlein and Receveur 1996).

Deforestation, climate change, and a decrease in land use and harvesting have also been suggested as environmental factors affecting food choice (Kuhnlein and Receveur 1996; Willows 2005) given their influence on changes to the number and density of plant and animal species. For example, construction projects, dams and roadways may result in flooding of hunting grounds, disturbed migration patterns, and changes in wildlife inhabitants, as well as increased distances to travel to hunt and fish (Wheatley 1998). Receveur and colleagues (1997) assessed the diets in 16 Dene/Métis communities in the Canadian Arctic and found a decline in traditional foods such as berries, birds, fish and land animals by the younger generation compared to the older generations. While the authors did not comment on the reasons for the decrease in traditional foods, changes in diet were characterized by an increase in absolute energy intake as well as increases in fat, saturated fat, and carbohydrate, particularly in the form of sucrose (Receveur et al. 1997). Others have reported similar results in that store foods are replacing traditional foods, with a subsequent decline in nutrient density and increase in fat and sugar-containing foods (Wolever et al. 1997).

Industrial pollution and construction projects associated with hydroelectric dams and power stations have also resulted in increasing concerns related to environmental contaminants which also affect the food supply (Kuhnlein and Receveur 1996; Wheatley 1998; Willows 2005). In the Mohawk community of Akwesane, contamination of the water was shown to be responsible for altering the diet among members of this community. A diet composed primarily of fish, meat and vegetables changed to one of high carbohydrates, with an accompanying high prevalence of diabetes mellitus documented in this community following the resultant changes in the environment

(Wheatley 1998). Even concern over potential contamination was reported to influence dietary intake in the Inuit community of Salluit, where residents ceased consuming country foods because of a fear over the safety of these foods due to high levels of mercury (Wheatley and Wheatley 1981).

As mentioned, these changes to the physical environment not only affect the diet of Aboriginal peoples, but may also contribute to changes in physical activity levels, as decreases in activities such as hunting and fishing may be replaced with less active activities leading to an increase in obesity (Rode and Shephard 1993; Kuhnlein and Receveur 1996). An increase in sedentarism, due to changes in lifestyle such as a decrease in physical activity required to obtain food, is becoming increasingly prominent in the Aboriginal population (First Nations Center 2003). While this may in part be due to changes in the physical environment affecting hunting and gathering practices, less is known about attributes of the physical environment which influence levels of physical activity among Aboriginal peoples.

Examining attributes of the physical environment is a relatively new area of study in the physical activity literature in general (Humpel et al. 2002), and much of the current research related to the Aboriginal population in this area has focused on Aboriginal women. American Indian/Alaskan Native women aged 40 years and older were surveyed as part of the US Women's Determinants Study which showed that environmental characteristics such as unattended dogs, heavy traffic, lack of sidewalks and safety were identified as barriers to physical activity (King et al. 2000). When the data was split between urban and rural women, a lack of enjoyable scenery was also identified as a barrier to physical activity among rural women (Wilcox et al. 2000). Other literature has

also noted safety, a lack of facilities and/or programs and weather as environmental barriers to physical activity among American Indian women (Eyler et al. 1998; Henderson and Ainsworth 2003; Thompson et al. 2003). Further, Thompson et al (2002) conducted focus group interviews with sedentary American Indian women living in two reservation communities and the findings revealed aspects of living in a rural environmental such as lack of paved roads, no shoulders on the sides of the roads and inadequate walking trails were environmental barriers to physical activity. Similar to other studies, inclement of weather and a lack of facilities and programs also emerged as factors related to the environment that hindered physical activity (Thompson et al. 2002). The women also highlighted safety issues such as stray dogs, snakes, dangerous drivers on the dirt roads and fear of break-ins if they left their homes as barriers to being physically active (Thompson et al. 2002). There were no environmental characteristics which appeared to act as enablers in this study. In addition to the various environmental factors which appear to influence levels of physical activity and dietary intake, sociocultural factors, which overlap with elements of the physical environment, have also been shown to influence physical activity and nutrition in the Aboriginal population.

1.2.3 Influence of the sociocultural environment on overweight/obesity, type 2

diabetes mellitus physical activity and nutrition in Aboriginal women

The shift from a hunter-gatherer lifestyle to one of altered dietary patterns and less physical activity to obtain food has been the most widely cited cause for the rising levels of obesity and T2DM among the Aboriginal population (Knowler et al. 1990; Ravussin et al. 1994; Kuhnlein 1995; Receveur et al. 1997; Wolever et al. 1997; Neel et al. 1998). There is however, some literature to suggest that other social factors and

cultural traditions may also play a role in these increasing epidemics, particularly as they relate to preventative measures such as physical activity and healthy eating³. For example, economic variables, social support systems and cultural norms have been found in some cases to act as barriers to adopting or maintaining a physically active lifestyle, as well as to influence healthy eating practices.

The literature examining economic factors related to physical activity among Aboriginal women is equivocal. Some studies have found that household income, employment and number of children were not associated with physical activity (Fischer et al. 1999; Harnack et al. 1999; Thompson et al. 2003), whereas King et al (2000) reports lower annual household income to be statistically significant. Despite the inconsistency between the studies assessing the relationship between socioeconomic variables and physical activity within the population, little research has examined these correlates and thus it cannot be assumed that these factors do not influence physical activity levels among Aboriginal peoples (Coble and Rhodes 2006).

The social environment has been found to be an important correlate of physical activity in Native American women. For example, Native American women who reported knowing people who exercise were five times more likely do some activity compared to those not knowing anyone who exercised (Thompson et al. 2003). Similarly, those who saw people in their neighborhood exercising were almost four times more likely to engage in physical activity (Thompson et al. 2003). The literature has also identified a lack of social support from family members, friends and community members as barriers to physical activity (Thompson et al. 2002; Eyler et al. 2003; First

³ "Healthy eating" refers to eating practices and behaviors associated with improving, maintaining and/or enhancing health Power, E. (2005). "Determinants of healthy eating among low-income Canadians." *Canadian Journal of Public Health* **96**: S37-S42.

Nations Center 2003) as well as a lack of child care and support for chores (Thompson et al. 2002; Eyler et al. 2003). These social support barriers ultimately leave women with little time or energy for physical activity.

Cultural norms such as the traditionally expected roles of being a homemaker have also been expressed by American Indian women as a challenge for incorporating physical activity into their lives (Eyler et al. 1998; Henderson and Ainsworth 2000; Thompson et al. 2002). In the past, physical activity was often seen as an integral component of Aboriginal culture to meet the needs of rural life for their ancestors. More recently however, it has been reported as a low priority among American Indian women, in part due to a lack of maintenance of facilities, equipment and programs (Thompson et al. 2003). Henderson and Ainsworth (2000) also described the cultural importance of physical activity to American Indian women, such as traditions and ceremonies. However, participants described loss of some of their traditions over the years as a result of assimilation into the urban culture (Henderson and Ainsworth 2003). Another cultural factor highlighted as influencing physical activity for American Indian women was the perception of being judged by other women in the community, and the fear of being ridiculed for breaking societal norms if they were to do something for themselves (Thompson et al. 2002). Similar findings were also reported among urban Australian Aboriginal women in that they rarely participate in physical activities for the purpose of maintaining their own health or preventing illness as it was viewed negatively in the community (Thompson et al. 2000). Furthermore, it was reported that if physical activity was done solely for the benefit of the individual, it was seen as shameful or as disconnecting their ties to their social world (Thompson et al. 2000).

Social factors and cultural norms may also be relevant to dietary intake in the Aboriginal population. As mentioned previously, attitudes and beliefs, preparation, promotion and cost can all influence food choice (Kumanyika 2001). Thompson et al. (2000) reported on the attitudes and beliefs that Australian Aboriginal women have regarding different types of food in their culture. Three types of food were identified and included fast food, diet food and family food. Fast food was said to be purchased merely to satisfy physical hunger with no social meaning attached to it (Thompson et al. 2000). Diet foods were viewed to be undesirable as they are considered to be unsocial, isolating and separate the individual from social connections because they are linked with the 'medical world' rather than family and community (Thompson et al. 2000). Family foods however, were said to be associated with connections to the past and family as they are prepared and eaten together with the family (Thompson et al. 2000). Similar findings were reported among American Indian women in that food represents symbolic connections to belonging and a sense of place within the Aboriginal community (Thompson et al. 2002).

The promotion of certain foods and/or portion sizes may also have a subsequent effect on body weight. For example, studies have reported that because of the importance of food on family relationships among some Aboriginal peoples, they feel pressured to eat a lot to avoid being rude to members of their family, even if it is bad for their health (Thompson et al. 2000; Thompson et al. 2002). The literature also suggests that preferences for specific food types passes through generations and there may be resistance to change, as adopting healthier food practices may be good for future health but is detrimental for connections to the past (Thompson et al. 2000). Boston et al (1997)

also reported that food habits and beliefs become problematic when avoidance of certain foods, combined with cultural taste, results in a barrier to promoting foods required for the prevention and treatment of diabetes mellitus. For example, among the James Bay Cree, food considered to be healthy for the Cree lifestyle, such as fatty meat from goose, bear, duck, beaver, caribou, raw ptarmigan or fatty fish, are not considered to be optimal foods for diabetics (Boston et al. 1997).

Preparation of foods may also serve as a risk factor for unhealthy body weights as it is believed that Aboriginal peoples are consuming more total fat in their diet than previously as lard has replaced natural fats for cooking and baking (Health Canada 1994). For example, high amounts of lard, vegetable shortening or animal fat drippings to prepare fish meat or bannock have been reported among the Ojibway-Cree of Sandy Lake (Gittelsohn et al. 1998). The addition of fat, primarily lard, to the preparation of foods has also been found to be associated with an increased risk of T2DM and glucose intolerance among the Ojibway-Cree of Sandy Lake (Gittelsohn et al. 1998), however there is a lack of literature examining the direct relationship between food preparation methods and obesity.

Economic factors such as cost have also been reported to be related to healthy eating, primarily the high cost of fruits and vegetables (Wein 1994). Given that fruit and vegetable consumption has been shown to help manage and prevent obesity (Tohill et al. 2004) and has been linked to a lower risk of developing T2DM (Williams et al. 1999; Sargeant et al. 2001), cost of food is thus another aspect to consider as a potential cause for the increase in unhealthy body weights. In northern Saskatchewan, a study conducted in 2001 compared the costs of food among different sizes of communities and various

regions across the province (Irvine and Hendrickson 2002). The average cost of feeding healthy foods to a family of four for one week, based on Canada's Food Guide to Healthy Eating (Health and Welfare Canada 1998), was approximately 75% higher for those who lived in the far north compared to those who lived in larger southern cities (Irvine and Hendrickson 2002). The cost of food as a barrier to healthy eating is not limited to those living in northern communities. Higher food costs have been shown to influence the diet of individuals living in Aboriginal communities where perishable foods such as fruits and vegetables are limited (Wein 1994). As well, cost has also been shown to influence the diet of Aboriginal peoples living off reserves as food insecurity (availability of nutritionally adequate foods is limited or uncertain because of lack of money; Power 2005; p.S37); (Che and Chen 2003) was found to be strongly associated with household income (Che and Chen 2003).

1.2.4 Maternal influences for overweight/obesity and type 2 diabetes mellitus in Aboriginal women

As mentioned in the previous section, the rising levels of obesity and T2DM among the Aboriginal population have been linked to a genetic predisposition and environmental changes which have negatively influenced levels of physical activity and dietary patterns. More recently however, the role of the intrauterine environment and its connection to the rising levels of overweight and obesity has received much attention. Most of the literature surrounding the propensity for offspring to become obese comes from epidemiological evidence related to maternal T2DM occurring before and during pregnancy.

A study to identify factors explaining the increase in T2DM among Aboriginal youth found that maternal T2DM was one of the strongest risk factors for the development of T2DM (Young et al. 2002). Similarly, a study on Pima Indian children between the ages of 5-19 years found that the strongest risk factor for T2DM was exposure to diabetes mellitus in utero (Dabelea et al. 1998). To further determine the role of the intrauterine environment, Dabelea et al (2000) compared the prevalence of T2DM to BMI in Pima Indian siblings born before and after maternal diagnosis of T2DM. This study demonstrated a greater risk of developing T2DM and being obese if born after maternal diagnosis of diabetes mellitus, compared to siblings born before the mother's diagnosis with T2DM (Dabelea et al. 2000). Because the offspring had the same parents, it was suggested the siblings had the same risk of inheriting susceptibility genes and thus the differences in risk among those born before and after the mother develops T2DM were likely not due to genetic differences but reflect the effect of the intrauterine environment (Dabelea et al. 2000). While these studies suggest that maternal T2DM plays a role in the development T2DM and obesity, gestational diabetes is also believed to increase the risk.

Gestational diabetes (GD) is defined as glucose intolerance with the onset or first recognition during pregnancy (Metzger and Coustan 1998; Canadian Diabetes Association 2003), and is thought to be an important factor leading to the increase in obesity and T2DM in the Aboriginal population (Pettitt et al. 1993). In the general population, GD is reported to occur in up to 3.8% of all pregnancies, compared to the Aboriginal population where rates are estimated to be at least as high as 18% (Canadian Diabetes Association 2003). In Saskatchewan, a study conducted in three northern

Saskatchewan communities of varying geographic accessibility to urban centers reported GD rates to range from < 2% in the least accessible community to 9.9%-14% in the most accessible communities (Dyck et al. 1995). In the Sioux Lookout Zone of northwestern Ontario, GD prevalence rates were reported to be 8.4% (Harris et al. 1997), with similar rates documented among Swampy Cree women in Moose Factory, James Bay (8.5%) (Godwin et al. 1999). Prevalence rates higher than those nationally have also been reported among women residing in nine communities in the James Bay region of Northern Quebec, and ranged from 9.3% in the coastal communities to 18% in the inland communities (Rodrigues et al. 1999).

There are various factors which increase the risk of developing GD and include older maternal age (>35 years), higher maternal pre-pregnancy weight, family history of diabetes mellitus and previous history of GD (Canadian Diabetes Association 2003). Although higher rates of GD have been reported among Aboriginal women, compared to non-Aboriginal women, a prospective study conducted in Saskatchewan investigated if these higher rates were due to the known risk factors for GD or if Aboriginal ethnicity itself was a risk factor (Dyck et al. 2002). A comparison of rates and risk factors between Aboriginal and non-Aboriginal women revealed that Aboriginal ethnicity was an independent predictor of GD, even in the presence of other known risk factors (Dyck et al. 2002). Further, the study's data suggested that overweight Aboriginal women had a higher risk of GD compared to overweight non-Aboriginal women (Dyck et al. 2002). The high prevalence rates of GD are of importance given the long-term risks for the mother as well as her offspring (Canadian Diabetes Association 2003). With a diagnosis of GD, women have up to a 70% chance of developing T2DM later in life (Kim et al.

2002), with an approximate 50% risk of developing T2DM within 5 years after delivery (Inzucchi 1999). Apart from the risks of developing complications associated with T2DM such as cardiovascular disease, dyslipidemia, hypertension and kidney disease, among others (Canadian Diabetes Association 2003), the importance of these findings also relate to the increased risk of high birth weights in the children, with a subsequent development of obesity (Dabelea et al. 1999) and T2DM (McCance et al. 1994).

High birth weight (macrosomia) is defined as a term body weight of more than 4000 g (Inzucchi 1999). Macrosomia is the result of fat deposits, the product of a combination of high blood glucose levels from the mother and high insulin levels in the fetus, which cause the fetus to grow more than what is appropriate for gestational age (Oken and Gillman 2003). The nutrients received by the fetus come directly from the mother's blood. While maternal glucose is freely transferred to the fetus through the placenta, maternal insulin is not. The fetal pancreas responds to the glucose load by producing insulin which not only has a hypoglycemic effect but also acts as a fetal growth hormone (Oken and Gillman 2003). The effects of insulin exposure during fetal life may ultimately influence the long-term impact of body weight regulation of the offspring by having a lasting influence in determining body composition (i.e. fat cell size or number) (Oken and Gillman 2003).

Within the Canadian Aboriginal population, high birth weight rates have been reported in newborns in Saskatchewan (Dyck and Tan 1995), British Columbia (Thomson 1990) and Ontario (Armstrong et al. 1998). In Saskatchewan, a retrospective study comparing high birth weights between Aboriginals and non-Aboriginals revealed that the yearly percentage of high birth weights rose from 12.6% to 19.2% in the north

(comprised mainly of Aboriginal peoples) and from 10.2% to 12.8% in the south (mainly non-Aboriginals) over a 13 year time span. The relative increase in high birth weight for the Aboriginal population was 53%, whereas for the non-Aboriginal population, the relative increase was 25% (Dyck and Tan 1995). These results imply that high birth weight rates are increasing more rapidly in the north, and given the demographics of those living in the north are primarily of Aboriginal ethnicity, the authors suggested that high birth weights are increasing in the Aboriginal population (Dyck and Tan 1995).

An increase in high birth weights was also reported in the Aboriginal population in British Columbia. Thompson (1990) reports an increase in high birth weight from 12% to 22% between 1962 and 1983. It was also found that high birth weights were 50% more frequent among Natives than non-Natives (Thomson 1990). A prevalence study from the James Bay Cree of northern Quebec has also reported an increase in rates of high birth weight babies as 36% of infants born between 1985 and 1995 had birth weights greater than 4000g (Armstrong et al. 1998).

The suggestion that an abnormal intrauterine environment and high birth weight leads to the early expression of T2DM has been further established on the Pima Indians in Arizona. The literature suggests that Pima Indians born with high birth weights had an increased prevalence of T2DM (McCance et al. 1994). Subsequent studies have indicated that 10-15% of new cases of T2DM were the result of children of diabetic pregnancies (Bennett 1999). A further study investigating Pima Indian children has found that a U-shape relationship exists between birth weight and diabetes mellitus with the increased risk of T2DM among Pimas with high birth weight being largely explained by maternal GD (Dabelea et al. 1999).

Investigations have further examined the relationship between high birth weight and future development of T2DM. In the Saskatchewan Aboriginal population, Dyck et al (2001) found a higher proportion of high birth weight babies in diabetic Registered Indians (16.2%) compared to diabetics in the general population (10%). When the data were examined over time, they also showed that high birth weights in diabetic Registered Indians increased from 14.5% to 19.3% between 1950-59 and 1970-84. Conversely, in the general population and non-diabetic Registered Indians, there was a decrease in high birth weights over time (Dyck et al. 2001).

Other literature which suggests a relationship between diabetic pregnancies and the subsequent development of obesity/T2DM is the emerging pattern of T2DM in Aboriginal children and youth (Dyck et al. 2001). In the mid 1980's, prevalence rates for T2DM in children were relatively rare, however by 1992 T2DM had been documented in adolescents as young as 15 years of age in Manitoba (Dean et al. 1992) and by 1998 had been reported in children as young as 5 years of age (Dean 1998). Similar findings have been reported among American Aboriginal children with T2DM being documented as young as 10 years of age (Dabelea et al. 1998). The epidemiologic literature also indicates an increase in T2DM among youth. The prevalence per 1000 among 15-19 year olds is reported to be 50.9 in the Pima population, 4.5 in the American Indian population and 2.3 in the Canadian Cree and Ojibwa population in Manitoba (Fagot-Campagna 2000). More recent reports however, suggest that in less than a decade, the prevalence has increased by 68% in those aged 15-19 years and 47% among those aged 20-24 years (Story et al. 2003).

To summarize, for the mother, the presence of GD places her at an increased risk for the future development of GD, as well, the risk of developing T2DM later in life. Infants born to women with GD and pre-existing T2DM have a high risk of being born with macrosomia (high birth weight) and thus have a high risk of developing obesity, which has been documented as early as 5 years of age. Research has shown that this early onset of obesity leads to an increase in T2DM, which has been reported in children as young as 10 years of age. Obesity is also a risk factor for the development of GD. The end result is that by the time the female offspring of women with GD reach childbearing age, they may already have obesity or T2DM, and if not, they would be at a high risk of developing GD, thus perpetuating the cycle. The interrelationship between GD, T2DM and obesity in the Aboriginal population described above highlights the importance of obesity prevention programs and intervention strategies.

1.2.5 Current prevention and intervention approaches related to overweight/obesity and type 2 diabetes mellitus in the Canadian Aboriginal population

To date, few intervention research and prevention programs have specifically addressed the issue of overweight and obesity in the Aboriginal population. However, a variety of community-based studies have indirectly addressed the problem of obesity through intervention studies which have focused on reducing the prevalence of T2DM in this population. A brief review of interventions targeting Canadian Aboriginal peoples is provided.

The most widely known T2DM prevention strategy targeting Aboriginal peoples in Canada is the Kahnawake Schools Diabetes Prevention Program (Macaulay et al. 1997). The community of Kahnawake is located 15 km from Montreal, Quebec and has a

population of approximately 7200. This 3-year community-based participatory research approach investigated the effect of a community-based primary prevention program for T2DM, targeting elementary school children. The authors chose the target population of youth for several reasons. Their rationale included the premise that most lifestyle habits associated with T2DM are learned early in life, many risk factors track from childhood into adulthood, changes in lifestyle in childhood could lead to prevention, and that this population represented a captive audience (Macaulay et al. 1997). The goals of this project were to decrease the future occurrence of T2DM and to reduce the prevalence of obesity, high-calorie and high-fat diets and physical inactivity among the Kahnawake children aged 6 to 12 years. Other objectives of the project were to incorporate cultural traditions and foster community empowerment to facilitate the long-term maintenance of the project. The focus of this intervention was the development and implementation of health education programs for children in grades 1-6 which consisted of ten 45 minute lessons during the year. Although the target group of this intervention were the youth in the community, various activities were also targeted towards the parents, teachers and the community as a whole. The 8-year follow up results from this study were less than desirable for health outcomes as the main objective of reducing the prevalence of obesity was not achieved (Paradis et al. 2005). Although there were improvements in physical activity, physical fitness and television viewing, repeated cross-sectional measures showed progressive increases in skinfolds and BMI (Paradis et al. 2005). Additionally, while consumption of high-fat and high-sugar foods and soft drinks decreased, so did the consumption of fruits and vegetables (Paradis et al. 2005). Several possible explanations for these results were provided by the residents of the community which included

increased wealth and income over the study period, increased availability of fast-food restaurants, a perceived importance in the community of computer literacy for the youth and an increase in the number of both parents working which may have resulted in less time for supervision of meals and leisure activities (Paradis et al. 2005). The authors suggested that the forces influencing obesity are strong and may require more intense and comprehensive efforts than those provided in a community-specific health-promotion program (Paradis et al. 2005).

Another community-based T2DM project, the Sandy Lake Health and Diabetes Program (SLHDP) was conducted in Sandy Lake, Ontario, a remote Oji-Cree community. This community is located approximately 2000 km northwest of Toronto, is accessible only by air for over 10 months of the year, and has a population of about 2000 (Macaulay et al. 2003). The initial goals of the project were to determine the prevalence of T2DM and impaired glucose tolerance (IGT), identify the anthropometric, metabolic and lifestyle characteristics associated with T2DM and IGT, and to use qualitative methods to aid in developing culturally appropriate data collection instruments and intervention strategies. Following an extensive ethnographic survey to identify local perceptions related to health and behavior, a community-based program consisting of four components was developed: (1) home visits with a focus on T2DM education, including diet and exercise were provided to each participating family; (2) community activities which included weekly radio broadcasts for both adults and youth, educational programs at all community events and incentive programs to participate in physical activity; (3) grocery store tours and healthy food demonstrations in the “Northern”, the only local grocery store; and (4) a morning snack program and a school curriculum

program for grades 3 to 5 focusing on lifelong healthy eating and exercise (Harris 1998). The authors reported a high degree of community participation (72% of eligible participants) (Hanley et al. 1995) in components of the study, however few follow up results have been reported on the effectiveness of the project with the exception of the school-based program.

The SLHDP school-based program targeted children in grades 3 through 5 and consisted of five components. The curriculum component focused on knowledge and skill development related to healthy eating, physical activity and diabetes education. The family component informed parents and members of the community about the messages the children were receiving in school. A school-wide policy banning high-fat, high-sugar snack foods was implemented and a healthy breakfast program was initiated. Finally, a peer component provided an opportunity for peers to act as role models (Saksvig et al. 2005). While the mean BMI and percent body fat increased over the one year study duration, there was an improvement in diet (increased fiber intake) and an increase in dietary self-efficacy and knowledge of low-fat foods (Saksvig et al. 2005). An encouraging finding was that a follow up assessment of the parent purchasing habits indicated an increase in low-fat, low-sugar, high-fiber foods which suggested the school-based intervention was also affecting the home environment (Saksvig et al. 2005). Another positive outcome of the SLHDP was the adaptation of various intervention strategies in other First Nations reserve communities in the region to determine their feasibility in the development of an integrated diabetes prevention program (Ho et al. 2006). The foremost initiative developed for the SLHDP, the school prevention program, was the most well-received intervention strategy in all three communities. The school

prevention program, as well as store-based and community-wide health promotion programs are being planned for seven First Nations communities in Northwest Ontario (Ho et al. 2006).

In western Canada, a community-based T2DM prevention and control program was initiated in British Columbia's rural Okanagan region near Vernon, BC. This project also used a participatory approach and targeted on-reserve residents in three matched communities; one intervention community and two comparison communities (Daniel et al. 1999). The focus of this two year project was both primary and secondary prevention in that the goals were to reduce the prevalence of risk factors for T2DM, to prevent the development of T2DM, to screen for early detection and treatment of unrecognized cases of T2DM, and to assist with providing successful management of the disease. The focus of this study was targeted towards the adult population, however pregnant women were excluded (Daniel et al. 1999). A qualitative approach was used to collect data regarding knowledge, attitudes and values about T2DM and overall health, as well as to identify strategies for the intervention. Based on the qualitative data, the greatest needs identified by the community included areas targeted towards healthful diets and exercise programs. The intervention included a media campaign involving educational articles, newsletters with tips on diet, exercise and weight loss and information about project events. Various project events included a walking group, aerobic exercise classes, cooking demonstrations, supermarket and restaurant tours, forums on T2DM and a diabetic support group. Individuals at high risk for developing T2DM were followed over a 16 month period, however follow up testing revealed the project yielded few quantifiable outcomes. It was noted that although there were improvements in the strength of

commitment to T2DM prevention, changes in dietary behavior and physical activity levels did not occur. Given the residents were just beginning to embrace the project as the intervention was ending, it was concluded that the duration of the intervention may have been insufficient to enable individual and collective change (Daniel et al. 1999).

The study outlined above excluded pregnant women from participating, however other studies have focused specifically on pregnant women and gestational diabetes (GD). As mentioned previously, GD is increasing in the Aboriginal population and may contribute to the increasing prevalence of obesity and T2DM. To address this problem, a diet and activity intervention during pregnancy was initiated in four Cree communities in the James Bay region in northern Quebec (Gray-Donald et al. 2000). The purpose of this project was to determine if a reduction in the rate of weight gain was feasible and effective for preventing overweight pregnant Cree women who do not have T2DM from developing GD. The intervention included educational information in the form of radio shows and pamphlets about healthy eating during pregnancy. It encouraged breastfeeding, provided supermarket tours, cooking demonstrations and exercise/walking groups, as well as individual counseling. The study participants were compared with non-participants living in their communities at the same time. Following the intervention there were no differences in diet, rate of weight gain over the second half of pregnancy, plasma glucose levels between 24 and 30 weeks, mean birth weight or maternal weight at 6 weeks post-partum (Gray-Donald et al. 2000). The authors concluded that the intervention had only a minor impact on diet and that self-reported physical activity levels were very low. In the control group, 23% of the women reported being sedentary while 61% in the intervention group reported sedentary behavior (Gray-Donald et al.

2000). The authors speculated that the reason why significantly more women in the intervention group reported being sedentary was because they likely had a more realistic assessment of their activity levels, which may in part be due to the consistent encouragement they had to be active as part of the study (Gray-Donald et al. 2000). The authors discussed their findings with women in the community where it was revealed that being plump was desirable, and that physical activity during pregnancy was undesirable. Although no reasons were given for these insights, elders in the community suggested the notion of physical inactivity during pregnancy was a recently new phenomenon (Gray-Donald et al. 2000). The authors also suggested that perhaps the dietary intervention was not sufficiently intense given that the nutritionists providing the counseling were not always in the community. The investigators hypothesized that increases in physical activity did not occur due to environmental challenges such as inclement weather, and cultural factors such as fitness classes being seen as inappropriate for pregnant women (Gray-Donald et al. 2000). One of the suggestions offered was that intervention programs targeting healthy foods, physical activity and body weight may be more successful if researchers have an awareness and understanding of the influences that sociocultural and environmental factors may play in relation to physical activity, nutrition and healthy body weights in the population being studied (Gray-Donald et al. 2000).

Another study which focused on preventing GD in pregnant Aboriginal women was carried out in Saskatoon, Saskatchewan (Dyck et al. 2002). In this pilot project, participants took part in an exercise program consisting of 45 minute sessions (5 min warm up, 30 min aerobic exercise, 10 minute cool down) three times a week until late in the third trimester. The exercise sessions were supervised by a nurse, an Aboriginal

facilitator and an exercise instructor, and the type of exercise varied according to participant preference and stage of pregnancy. The referral rate was low which resulted in only seven participants starting the exercise program. Six of the seven women participated in at least one exercise session per week which was deemed the minimum acceptable level (Dyck et al. 2002). The authors outlined a variety of incentives facilitating participation in the project which included transportation, childcare, education, socialization and flexibility (Dyck et al. 2002). Due to the low number of participants, the authors were unable to draw any conclusions, however it was felt that given the continued participation by the women enrolled, an exercise program targeting Aboriginal women with a prior history of GD is feasible (Dyck et al. 2002). It was further noted that any successes of this program were a function of understanding the life context of each participant as well as including an Aboriginal facilitator whom the participants could identify with as well as who could provide guidance for non-Aboriginal colleagues (Dyck et al. 2002).

Finally, the Northern Diabetes Prevention Coalition is an awareness and prevention initiative specifically relevant to northern Saskatchewan. This diabetes prevention program is a partnership involving health, education, recreation and community groups and organizations throughout northern Saskatchewan which supports healthy eating, physical activity and non-smoking (Northern Diabetes Prevention Coalition 2006). Some of the initiatives encouraged through this program include promoting healthy food choices at rinks and recreation centers, in vending machines, at schools and at community gatherings. A health education curriculum guide designed for grade nine students was also developed, as well as an informational website, a diabetes

discussion forum and a prevention video (Northern Diabetes Prevention Coalition 2006). This initiative is not a formal research project and thus does not report on specific results, however it is one strategy which promotes the creation of a healthier environment in an effort to prevent the increasing prevalence of T2DM among the residents of northern Saskatchewan.

1.2.6 Summary of the Review and Problem Statement

Obesity and subsequently type 2 diabetes mellitus (T2DM) are increasing in Canada in general, however prevalence rates indicate that the increase of these two conditions are occurring more rapidly in the Aboriginal population. To date, obesity research within the Canadian Aboriginal population has primarily focused on the pediatric population (Bernard et al. 1995; Potvin et al. 1999; Hanley et al. 2000), or has been community-specific in Manitoba and Northern Ontario (Young and Sevenhuysen 1989; Katzmarzyk and Malina 1998). However, findings from these studies do report an increased prevalence of obesity in the Aboriginal population. These findings have also highlighted a predominantly centrally located pattern of obesity (Young and Sevenhuysen 1989), which is associated with an increased risk for T2DM (Young et al. 2000), and which is of concern for all individuals, including Aboriginal peoples (Health Canada 2002).

Several factors are suggested to contribute to the increasing prevalence of obesity. These include an interaction between genetics and the environment, as well as social and cultural changes that the Aboriginal population have experienced over the past several decades. The literature suggests that Aboriginal women appear to be particularly at risk because the increasing rates of gestational diabetes in the Aboriginal population are

severe, and this has led researchers to investigate the influence that the intrauterine environment may have on obesity rates within this population.

Few prevention and intervention studies in the Aboriginal population have directly focused on reducing rates of overweight and obesity, however many have focused on lifestyle factors such as diet, and to a lesser extent physical activity, with the goal of reducing the incidence of T2DM. While these interventions may indirectly affect rates of overweight and obesity by addressing two of the modifiable risk factors, this gap in the literature still exists. Furthermore, the majority of these studies have reported only minor impacts on health outcomes (i.e. decreases in BMI), which suggests that further work in this area is required. In addition, few studies have focused on the female Aboriginal population which is surprising given that approximately two-thirds of the Aboriginal population with T2DM are women. Additionally, much of the literature to date suggests a greater proportion of Aboriginal females are overweight or obese compared to their male counterparts. These findings highlight the importance of targeting research programs for this subpopulation. Previous literature has suggested that women, particularly those of childbearing age, may be an ideal group to target for prevention and intervention programs as they may be motivated for the health of their unborn children and may also serve as role models for health enhancing behaviors within their families and communities (Dyck and Cassidy 1995). Therefore, the focus of this project was directed towards First Nations women, while recognizing it would not be possible to study them in isolation of their community, because of their social responsibilities, such as working, being homemakers and child-rearing. While the prevention and intervention programs outlined above have developed partnerships with

the communities, have incorporated community consultations to guide their program design, and have incorporated traditional learning styles, one component which seems to be absent from many of these studies is exploring the meanings and interpretations that the participants have towards the specific lifestyles behaviors (i.e. physical activity and/or healthy eating) targeted in the interventions. Also absent is the investigation of the influence that the sociocultural and physical environments play in these health promoting behaviors, both of which are important to consider prior to designing health promotion interventions.

1.3 Objectives

1.3.1 Purpose

Two distinct but interrelated projects were conducted as part of this thesis. Project 1 sought to determine the current prevalence of overweight and obesity in the community and to determine if there has been a change in prevalence rates over time. The purpose of project 2 was two-fold. The first was to determine the current physical activity and dietary practices among women in the community, and secondly to explore the potential social, cultural and physical environmental influences on these two behaviors as well as individual attitudes and beliefs regarding physical activity and healthy eating. Together, these two projects help to ‘paint the picture’ of the status of overweight and obesity in the community, how physical activity and diet may contribute to overweight and obesity in the community, as well as how the realities of their everyday lives influence these two risk factors. Collectively, these two projects address the overall purposes of this thesis which were to first determine the prevalence of overweight and obesity in the community, and then to explore how the physical and sociocultural

environments influence physical activity and healthy eating, as well as the attitudes and beliefs that Woodland Cree women in Northern Saskatchewan have regarding these two health behaviors. An additional purpose of this study was to provide a source of knowledge to educate the community about unhealthy body weights, as well as to provide information back to the community which could thus be used to enhance health promotion initiatives around physical activity and nutrition.

1.3.2 Research Questions

1.3.2.1 Project 1

1. What is the current prevalence of overweight and obesity in the community of Deschambault Lake?
2. Has the prevalence of overweight and obesity in the community of Deschambault Lake changed over the past 14 years?

1.3.2.2 Project 2

1. What are the current lifestyle behaviors of physical activity and diet intake of females aged 15 years and older living in Deschambault Lake?
2. What are the social, cultural and physical environmental factors that influence physical activity and dietary behaviors among females aged 15 years and older living in Deschambault Lake?
3. What are the attitudes and beliefs regarding physical activity and healthy eating among females 15 years and older in the community?

1.4 Thesis Structure

As outlined above, this thesis involved two separate but interrelated projects. For ease of understanding and clarity, the methods section has been divided into six

sections which outlines following; 1) the approach followed for conducting research within an Aboriginal community, 2) issues surrounding ownership, control, access and possession of the data, 3) obtaining consent, 4) a profile of the community where the research took place, 5) as well as the methodology for each the two project. Following this, the two projects are written as three complete and separate manuscripts and include the introduction, methods, results, discussion and conclusion sections. Key aspects from the introduction, research approach and methodology are repeated in each manuscript. A complete list of references cited in the introduction, methods and in each manuscript are included at the end of the thesis document. Chapter 7 presents a general discussion and conclusions of both projects, including limitations of the projects and future research directions.

CHAPTER 3
METHODS

3.1 Positionality as a researcher

When conducting research of any type, one needs to be cognizant that the positionality of the researcher, relative to the research participants can influence both access to participants as well as, and perhaps more importantly, the information provided by the participants. Therefore, it is important for me to state upfront who I am, where I come from, how I became interested in the area of health promotion focusing on women's health and any biases that I have related to this research.

I am a Caucasian female in her mid-thirties who was raised in a middle-class family in a small town in rural Saskatchewan. I was fortunate to have had parents who provided me with many opportunities related to physical activity in the form of family holidays that focused on physical activity (e.g. snow skiing, water sports), as well as encouragement to participate in sports and activities through school (e.g. volleyball, badminton, track and field) and the community (e.g. figure skating, curling). I was also very fortunate to be afforded the opportunity to attend figure skating schools and camps in the spring and summer months throughout my youth. I have always been physically active and value physical activity and sport as an important part of my life. My personal experience with physical activity and sport is what attracted me to pursue a degree in kinesiology.

After completing an undergraduate degree in kinesiology, my career aspirations focused on the area of health promotion and the prevention of chronic disease, with a specific focus on decreasing negative lifestyle-related behaviors such as physical inactivity and poor nutrition. My previous experience as an exercise therapist with the Tri-Hospital Cardiac Rehabilitation Program and the First Step Program (an education

and exercise program for people with chronic disease) provided me with the opportunity to have a positive influence on people adopting health-enhancing lifestyle behaviors, while gaining the appreciation that there are many factors contributing to the development of disease states. Although I was privileged with my upbringing, my personal background has enabled me to recognize the diverse challenges facing individuals in rural Saskatchewan, particularly as they relate to access to services, resources and opportunities to lead a healthy lifestyle. Thus, I had a strong desire to explore these challenges as they relate to physical activity and nutrition.

I first became interested in women's health issues during my involvement with the Tri-Hospital Cardiac Rehabilitation Program. I noted that many of my female clients had very different medical experiences related to their heart health when compared to their male counterparts. A reoccurring theme became apparent in that many times some of the symptoms described by the women I followed were initially dismissed by their physicians as anxiety-related rather than 'heart' related problems. However, their eventual participation in the Cardiac Rehab program essentially confirmed that their described symptoms were indeed related to their heart health as all of these women either suffered a heart attack or underwent some type of intervention procedure (i.e. angioplasty or bypass grafting). As I reflect upon this now, I realize that it was this experience that shaped my research interest in women's health.

After completing my master's thesis, in which I examined the influence of physical activity and nutrition on women with polycystic ovary syndrome, I was contracted to work on a grant proposal in the area of obesity and Aboriginal health. This experience allowed me the opportunity to understand more fully the unique challenges

facing Aboriginal People in Saskatchewan. My involvement in this grant, combined with my knowledge of the high prevalence rates of diabetes mellitus in Aboriginal individuals in Saskatchewan, and more specifically high rates of obesity and Type 2 diabetes mellitus (T2DM) in Aboriginal women, peaked my interest of working in this area. After being accepted into the PhD program, I was very fortunate to be presented with the opportunity to conduct my research on a First Nations reserve in northern Saskatchewan. The community had identified a need to examine the issue of obesity and T2DM in their community and had requested assistance in conducting a research project in this area.

I recall my first visit to the community vividly. We (my advisor and one of my committee members was from the community) chartered a plane from Saskatoon to Flin Flon and then rented a car and drove to the community. We arrived around noon and had lunch at the health center and were introduced to several of the staff. Following lunch, we had informal discussions with the health director and staff members about collaborating on a project, and then subsequently met with members of the community. Following these initial meetings, everyone was keen to begin a project which would focus on unhealthy body weights, as well as physical activity and nutrition in the community. It was after this first meeting that I became even more excited about my PhD project and the unique opportunity of working in an Aboriginal community.

As I continued to travel regularly to the community, I was always impressed by how I was treated by the staff at the clinic as they seemed to embrace my visits. While there were certainly times when I felt very much like an outsider (e.g. when people in the clinic spoke Cree and I did not know what they were saying), there were also times when they went out of their way to include me in various activities (e.g. being invited to play

broomball, speak to various women's groups about physical activity and nutrition, judge an essay contest on health) during my visits to the community.

Although it was very apparent that I was an outsider in the community, I did not sense as though there was resistance to me being there. However, I was often asked who I was, where I was from and if I worked in the health clinic. Many, if not all the participants were aware that I was not employed by the health clinic, but was from the University of Saskatchewan. My positionality as a researcher from the University may have had influenced the process of data collection as well as the quality of data collected as the perception of being an 'outsider' has typically been thought of as being undesirable in the research process (Herod 1999). Although some may perceive that being an 'insider' is more advantageous when conducting a research project, as it places the researcher in a better position to understand the culture and history of the community, it also presents its own challenges as community members may find it difficult to accept the double role of the researcher as an academic and a community member (Roberts 2005). I believe that my positionality as an 'outsider', who was associated with the health center in the community, may have enhanced the willingness of some participants to become involved in the project. I believe this was due in part to association of the project with the health center as many individuals in the community visit the health center on a regular basis for care and treatment and thus I was visible in the community and this afforded me the opportunity to develop a rapport with the participants prior to beginning any type of data collection. I also believe that my position as an 'outsider' was beneficial with regards to the quality of data collected in the one-on-one interviews as I clearly explained to the participants the details of confidentiality and anonymity. I could sense

the participants had a level of comfort and trust in me not discussing any details of the interviews or surveys with other members of the community. Although I emphasized that any information provided would remain confidential and would only be reported collectively as a group with information from the other participants, on occasion the community research assistant was present during the interviews and survey data collections to provide interpretation for translation and clarification purposes. As the community research assistant was a member of the community, I was aware that this may potentially influence the quality of the data collected. Initially, I was concerned that the presence of another community member during the interviews would result in the participants being cautious of the degree of information shared. However, during the interviews themselves I had the sense that the majority of the time this was not the case as the community research assistant was valuable in translating my questions to Cree and their responses to English, particularly for those participants over the age of 55. As well, prior to the beginning of each interview, each participant, with the exception of one, consented to the community research assistant being present for the interview.

While the majority of the time I felt that my positionality as an “outside researcher” was beneficial, I was also cognizant that my positionality as a physical activity and health researcher could influence the quality of the data. For example, it is possible that the participants over-reported their physical activity and/or under-reported their food intake as they were aware that my background was in physical activity and health. However, withholding or altering information is inherent with any type of research, particularly that related to physical activity and diet. While it is also possible the participants told me what they perceived I wanted to hear during the interviews, given

the participants outlined several barriers to participating in physical activity and the challenges associated with eating a healthy diet, I feel this was unlikely.

Although the women I interviewed, and those who completed the surveys, were very willing to participate, there was also a degree of apprehension among some women in the community who chose not to participate in the study. The most common response I received from potential participants when they were approached about the study was that they were “too busy”. While this may have been true, I also believe that the reluctance of some women to participate was due to a lack of interest in the topic (i.e. physical activity and nutrition), particularly those aged 25-39 years, as well as their knowledge that I was “from the city” and “a researcher”. A non-response bias is common with survey research, however it may be more apparent within the Aboriginal population because of the ‘helicopter style’ of research which was often the norm in many Aboriginal communities (Smylie et al. 2004). It was also very apparent to me that many of the women in the community were shy and this likely influenced their request not to participate when asked if they would like to take part in the project. This was particularly the case for the interview and survey data collections, as many women would smile, giggle and shake their heads from side to side whereas when asked if they would like to have their height and weight measured they generally agreed. I did not pressure any women to participate in any of the data collections as I respected their choice and did not want to be perceived as ‘pushy’, thus potentially jeopardizing further data collections.

During the course of my research, there were certainly times when I wanted to ‘throw in the towel’ because I felt that the issues I was investigating (i.e. healthy body weights, physical activity and nutrition) were the least of the residents’ concerns.

However, I was reminded of the importance of this project as an overall health promotion strategy in the community and that if one or two health concerns in the community could be addressed (i.e. unhealthy body weights), this could potentially have a beneficial influence on other health behaviors in the community.

There were several challenges of collecting data in this community. At times, the distance to travel from Saskatoon to the community (approximately 500 km) became an issue, particularly in the winter when the roads were less than ideal for travel. Another challenge was the frequent turnover of staff at the clinic and changing of jobs which made it difficult at times to arrange visits to the community for data collection, and to know whom I should be speaking with about certain project details. Despite these challenges, it was possible to eventually complete the data collection, although it took a minimum of 6 months longer than I had anticipated.

When I reflect back on my journey over the past four years, I realize this experience has strengthened my commitment to studying women's health issues. While I have always felt that I am a compassionate person, I feel I have become more empathetic of the life situations of others. I have also become more cognizant of some of the many issues involving Aboriginal peoples, particularly those of Aboriginal women living in a reserve community. It is my hope that this project positively affects members of this community, as one of my goals of conducting this research was to provide valuable knowledge back to the community in terms of healthy body weights, physical activity and healthy eating, primarily related to women. It was also my goal to provide a voice for the women in the community so that health promotion programs could be designed based on their wants and needs.

3.2 Research Project Approach

Historically, there has been distrust and resistance on the part of Aboriginal communities in relation to university-based researchers. Negative experiences with research have been due to a lack of community control of research projects, lack of local benefits, and interpretation of the data in isolation of the social context (Henderson et al. 2002). This mistrust has essentially been fueled by the “helicopter approach” (Smylie et al. 2004) to research, where investigators merely arrive in a community, collect the information they require with minimal interaction among members of the community, and then publish their findings in scientific journals without the input from the community in which the research was based. More recently, Aboriginal communities and organizations, as well as research granting agencies, have begun to develop protocols and ethical guidelines for working *with* Aboriginal communities (American Academy of Pediatrics 2004; Canadian Institutes for Health Research et al. 2005; Canadian Institutes for Health Research 2007). These documents suggest initial and continual consultation with the community, obtaining informed consent from community leaders prior to obtaining it from individuals, and directly involving community members in conducting the research. This process begins with engaging the community, thereby facilitating building rapport and trust, two objectives which must be established so individuals feel comfortable expressing their opinions and beliefs. Apart from establishing trust and rapport, it has also been suggested that engaging a community for health decision-making is an important component for health promotion and disease prevention (Centers for Disease Control and Prevention 1997).

3.2.1 Community Engagement

Community engagement is defined as “the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people” (Centers for Disease Control and Prevention 1997). A crucial element of community engagement is participation by members of the community, community-based organizations and other organizations that will be affected by the project. The involvement of community members is essential for community-based research to be successful, as the community is seen as an integral component in the planning and development of health promotion strategies, their eventual implementation, and outcome evaluation. Given this, a participatory approach, which has been increasingly accepted in research projects involving Aboriginal communities (Smylie et al. 2004) was applied to this project.

Participatory research, defined as “systematic inquiry with the collaboration of those affected by the issue being studied, for purposes of education and taking action or effecting social change” (Frankish et al. 1997), is a type of research that has evolved to help reduce the distrust of people being studied (Brown and Tandon 1983). Given the negative experiences many Aboriginal peoples have had with research in the past (Smylie et al. 2004), participatory research is said to be suited for and accepted in First Nations communities (Park 1993). Participatory research attempts to negotiate a balance between developing valid knowledge that benefits the community, and to improve research by incorporating the knowledge and expertise of community members into the research protocols (Macaulay et al. 1999). Participatory research involves inclusion of community members in all phases of the research which includes the generation of research

questions, the manner in which the study is carried out, interpretations of the data, drawing conclusions, and dissemination of the findings. This approach to research has been used successfully in the Kahnawake Schools Diabetes Prevention Project (KSDPP) (Macaulay et al. 1997). All of the activities in the KSDPP were the result of collaboration between the researchers and the community advisory board. The participatory nature of this program was reflected in the management of the project. The day to day decisions for the intervention and evaluation were controlled by the Native staff, as this ensured the project reflected community norms, values, and priorities (Macaulay et al. 1997). The technical expertise in T2DM and health promotion, counseling on the strategic direction of the project, assistance with defining the operational objectives, and the design of the evaluation was provided by the non-Native researchers (Macaulay et al. 1997). The collaborators with this project suggested that one of its most important attributes was that the researchers were willing to acknowledge and respect the high level of ownership the community had taken for the project (Macaulay et al. 1997). Further, the complementary knowledge brought about from the collaboration between the community and the academic researchers added a perspective that broadened the interpretations of the findings both for the Native and non-Native researchers (Macaulay et al. 1997). In addition, because of the involvement of the community members, the credibility of the oral and written results were embraced within the community itself (Macaulay et al. 1999).

Participatory research often begins with a needs assessment or a problem that has been identified (Frankish et al. 1997). Projects such as the KSDPP followed the three core elements of participatory research; research through collaboration, education and

action (Health Canada 1997). Collaboration in participatory research involves a partnership that allows for the sharing of different perspectives which leads to a more complete understanding of what is being researched as well as what is found (Morris 2002). Education and learning take place during participatory research as co-learning is a central feature to the process where each participant learns from the other (Health Canada 1997). Action in participatory research may refer to one of two objectives or both; addressing the underlying causes of problems and/or finding solutions to specific problems (Health Canada 1997).

The collaborative component of this particular research project began after members of the community identified physical inactivity and unhealthy body weights as two areas of concern in their community, and expressed an interest in becoming involved in a project focusing on increasing levels of physical activity and promoting healthy body weights. The identification of this need in the community initiated the collaboration between members of the community and the College of Kinesiology at the University of Saskatchewan. The initial collaborative efforts for this project involved continuous consultation with the community, building trust and rapport with community members, and working with informal leaders in the community. Approval was also sought from the chief and council, the health board, and health portfolio counselors to conduct the project, a process which began by establishing a partnership with Peter Ballantyne Health Services Inc. Initial exploratory meetings were held with community members who expressed an interest in participating in a project focusing on increasing physical activity and promoting healthy body weights in the community. A community project worker was subsequently hired to provide a voice for the community and to assist with project

organization and data collection. The project took place at the health center in the community, and was facilitated by members of the health board and health director. Regularly scheduled visits were made to the community by myself approximately every 8 weeks over the first year of the project to establish rapport with employees at the health center and to help develop and plan the research project. After the initial planning stages, and to further facilitate collaboration, extended visits to the community occurred where I became immersed in the day-to-day lives of the community members to further facilitate the participatory research approach and to assist with carrying out the research project.

The second key element of participatory research involves education. In a participatory approach to research, education is a bi-directional process in which researchers and the community learn from one another and share expertise and knowledge (Macaulay et al. 1998). The education and subsequent learning that take place during a participatory research project enables and supports community participants and the external researchers to develop new skills and expertise, with a particular focus on producing local knowledge (Frankish et al. 1997). In my specific research, technical and theoretical knowledge on physical activity, healthy eating and the health risks associated with overweight and obesity, as well as designing, implementing and evaluating research projects was transferred from myself to the community. Practice-based knowledge on Cree culture and traditions as well as the local values and beliefs of the community were transferred from the community to me. Thus, this project produced both the sharing of knowledge and the generation of knowledge obtained from the research project itself on how to address physical inactivity and unhealthy body weights in a way which was most relevant for this particular community.

The generation of new knowledge leads directly to the third element of participatory research; action. In this approach, action refers to acting on the results developed from the research questions, and this ‘action’ can take any form that both the community researchers and the university researchers believe is useful (Frankish et al. 1997). Participatory research emphasizes the relationship between the community and the researcher, however the outcome of the research should be of direct benefit to the community (Macaulay et al. 1999). Therefore, information on physical activity, healthy eating and healthy body weights was gathered in this project to inform action. For example, the information collected in project 1 informs the community on prevalence rates of overweight/obesity in their community. The information collected in project 2 helps to elucidate if the lifestyle behaviors commonly associated with these conditions are areas where health promotion projects should be targeted, as well as provides further information regarding the various factors (social, cultural and geographic) specific to women in the community that affect their ability to be regularly physically active and consume a healthy diet. Integrating the knowledge obtained from both projects informs community leaders and healthcare providers on the components of health promotion strategies that are most relevant to the community, its culture and its geographic location.

3.2.2 Ownership, Control, Access and Possession (OCAP)

As stated previously, a participatory approach to research stresses participatory policies which include access, ownership, identification of needs, planning and designing programs, and delivery and evaluation. Although this form of research involves working collaboratively with Aboriginal peoples, several recurring criticisms about research and researchers over the past years have involved the issues of control of research projects

and data, individual and community consent to conduct research, ownership of and access to the data, and the dissemination of research findings that are meaningful, both culturally and linguistically to the community (Schnarch 2004). Examples of issues that have been raised in the past include the following: a lack of community involvement in the initial stages of research projects due to researchers often presenting completed research designs and seeking only community approval rather than collaboration; researchers failing to explain their studies in a language and manner to ensure fully informed consent; individuals feeling pressured to participate in research projects because community authorities have consented; the analysis, interpretation and reporting of data on First Nations being done without consent, approval, review or input by the appropriate representatives; and research funding being controlled externally and generally not accessible to First Nations communities or organizations (Schnarch 2004). As many of these are issues that most First Nations communities can relate to, it is important to address these potential concerns at the outset and offer possible solutions to avoid or minimize these pitfalls.

The principles of ownership, control, access and possession (OCAP) have been proposed by the Steering Committee of the First Nations Regional Longitudinal Health Survey as an approach to rebuild trust, improve the quality and relevance of research and decrease bias when conducting research with and in Aboriginal communities (Schnarch 2004). Ownership, in the context of a First Nations community refers to the cultural knowledge and information in that community, such that a community owns this information collectively, similar to an individual owning his/her own personal information (Schnarch 2004). Although the term ‘ownership’ as defined above identifies

the relationship between a people and their data, possession of the data is the way in which ownership is protected, particularly when the data owned by one group is in the possession of another (Schnarch 2004). The concept of access is related to ownership and possession and refers to the right of First Nations peoples and communities to have access to information about themselves and their community, regardless of where this information is stored (Schnarch 2004). It also refers to the management and decision making process regarding access to this information (Schnarch 2004). To address these three principles, the storage of the data during the project was shared between the community and the university, where the data were stored in a secure place at the health center in the community and the College of Kinesiology at the University of Saskatchewan. In addition, access to all data were restricted only to those individuals involved in the project. The storage of the data following completion of the data collection continues to be shared between the community and university. As this information was collected in the community, the community ultimately owns this data and therefore consent will continue to be required from the community to use any data for purposes other than those outlined in this thesis. The storage of the data at the University will continue for a minimum period of five years (as per University regulations) upon which time the data will be stored by the community.

The principle of control focuses on the rights of First Nations peoples and their communities to control all aspects of the research, from design of the project to its completion (Schnarch 2004). As this research project was conducted *with* the community and individuals, rather than *on* or *for* them, control of the project was shared between the community authorities and representatives, the community at large and myself. This was

achieved by active participation of all those who wished to be involved in all stages of the research project. Using the participatory approach, community members had the opportunity to share their knowledge and expertise on details of the project such as how it should be carried out in the community in terms of appropriate personnel and methods for data collection, interpretation of the data, and the suitable timeframes to gather the data.

3.2.3 Consent

When conducting research of any type, and prior to collecting data, one of the first considerations is that of obtaining consent. As outlined by the Canadian Institutes for Health Research, “community consent is distinct from, and additional to, informed consent from each research participant” (Canadian Institutes for Health Research 2007). Informed consent for this project was developed in stages which included approval of the study by the Peter Ballantyne Cree Nation Health Board, as well as obtaining community consent from the local governance, health portfolio councilors, the health committee and appropriate community leaders and/or elders. The details of the proposed project were outlined and included the purpose and the scope of the study, my personal role in the study, the proposed methods to obtain individual informed consent, and how the information gathered would be distributed. Once all details of the project were mutually agreed upon and community consent was granted, informed consent from individuals was obtained. Informed consent from each individual agreeing to participate in each project was obtained according to the guidelines established by the University of Saskatchewan Advisory Committee on Ethics in Behavioral Science Research (Appendices B, C, E, F, G and H). The process of obtaining individual consent was previously approved by the health director and all details of the consent were done in collaboration and consultation

with the health director and the community project worker to ensure appropriate language and content of each consent form. When seeking informed consent, the potential benefits and harmful effects of the research on the individual, on the community, and/or on the environment were explained in the participant's language of choice, using an interpreter as required. There was no pressure placed on an individual to participate and it was made clear that there would be no negative consequences should they choose not to participate in any or all projects, or choose to withdraw at any time. The issue of confidentiality was also explained, and all participants were assured that their information would remain anonymous.

The term 'consent' entails a responsibility on the part of the researcher not only to the participants during the research process but also after the research is completed (Schnarch 2004). One of the criticisms of past research in Aboriginal communities is that the results may have not been returned to the community, or may have been done so in a language that is difficult to understand (Macaulay et al. 1999). In the academic world, presentations at scientific conferences and research papers submitted to scientific journals are the desired method for dissemination of results, however this approach would be of little use to the community. Therefore, prior to the completion of any reports, the health director was provided with interpretation of the data, thus allowing the community to give consent to the way the research results were presented back to the community. To date, dissemination of the results have consisted of newsletters, designed in collaboration with the community. Possible additional dissemination strategies include community presentations, summary reports and any additional methods requested by the community, health board and chief and council. Regardless of the form of dissemination, all

acknowledgements reflect the details of the research being a joint project and the community's role in formulating its development and direction.

3.2.4 Building Best Practices with Communities

The ultimate goal of participatory research is to involve community members in all phases of the research project (i.e. planning, development and implementation) and to empower them to assume ownership of the research process and use the results to improve their quality of life (Macaulay et al. 1998) however, negative past experience may still result in reluctance to participate. In an effort to minimize these challenges, the “Building Best Practices with Communities” research framework (First Nations and Inuit Health Branch 2002) was used. This framework was developed as part of the First Nations and Inuit Tobacco Control Strategy (FNITCS), aimed at developing alternative choices for the misuse of tobacco products. It is based upon the following guiding values: respect for others, trust building, individual and community responsibility, freedom, holism, kindness, compassion and humility, as well as engagement of the participants in the entire research process (First Nations and Inuit Health Branch 2002). As these values form the basis upon which participatory approaches to research can be developed (First Nations and Inuit Health Branch 2002), these core values were used to help guide this project.

A core value of traditional North American cultures is ‘respect’ and thus, *respect* was shown to the community members for differences in values and needs of individuals and the community, as well as for cultural practices, sacred beliefs, and customary law. Respect was also reflected by showing gratitude and appreciation to those who contributed and participated in this project. This project was based on capacity-building

processes that build and enhance *trusting relationships* between the external researcher and the community leaders and members. Participation in this research project relied on trust; trust in the researcher, trust in the community, and trust in the project. For this project to be successful, the community needed to have trust in the knowledge and abilities of myself to assist them in designing, implementing and evaluating the research project.

As the researcher, I needed to have trust in the community to provide knowledge on the Cree culture and traditions as well as the local values and beliefs of the community so that the project was relevant and appropriate for the community. The community and the researcher also need to have trust in the process of the participatory approach to accomplish the goals of the project which were to provide relevant information to the community on physical activity, healthy eating and healthy body weights. The *responsibility* for reaching these goals lay with individual community leaders to support the project and to serve as role models by making personal choices to practice lifestyle behaviors such as engaging in physical activity and healthy eating. My responsibility was to facilitate achieving the goals of the project and to enable and support community participants in obtaining new skills (e.g. research design, implementation and evaluation) and knowledge (e.g. physical activity, healthy eating, healthy body weights).

This framework also proposes *freedom* of the individuals in making choices to become involved in this project. Therefore, individual consent was obtained from all individuals prior to obtaining any information. It was recognized that this project was one of many projects aimed at building a healthy community. This *holistic* perspective thus implied that everybody in the community, as well as myself, had a role to play in

this project and that physical activity and healthy eating would be viewed as one piece of an overall community health promotion strategy. *Kindness* and compassion were exhibited throughout the research process to members of the community and to the participants involved in the study. This included how information was provided to the community in terms of the risks and benefits related to physical activity, healthy eating and healthy body weights. It also included how individuals were treated during the process of data collection, and how the results were presented with and to the community.

The final guiding value was *humility* which is a quality of being respectful and courteous to others. Being humble is also a characteristic of an individual who does not think that he or she is important or better than others. Therefore, I adopted a humble approach by being friendly, courteous and respectful when dealing with community leaders, community researchers and the participants within the community throughout the entire research process. I also strived to help when asked by whomever and wherever possible with various activities offered through the health clinic.

3.3 Project 1 Methodology

The purpose of project 1 was to determine the current prevalence of overweight and obesity in a Woodland Cree community in northern Saskatchewan and to ascertain if there has been a change in prevalence rates over time by comparing the data collected in 2005 to that collected in 1991.

3.3.1 Participant recruitment

All individuals in the community aged 7 years and older were eligible to participate in the project. To obtain a representative sample of the community and to maximize the number of participants in the project, a number of recruitment strategies

were employed. These included two health fairs, the weekly programs offered through the health clinic, as well as home visits and personal invitations inviting those individuals who may have been overlooked during prior recruitment methods to attend the health center at their convenience to participate in the project. All recruitment strategies were facilitated through the health center with the assistance of the community project worker.

3.3.2 Participants

A total of 289 participants (37% male and 63% female) between the ages of 7 and 82 years (mean age 31.0 ± 16.5 years) took part in this study. Within this sample population, 81 of the participants were youth (37% male and 63% female; mean age 12.7 ± 2.9 years) and 208 were adults (38% males and 62% females; mean age 38.1 ± 14.0 years). Table 1 represents the population characteristics of the participants compared those eligible in the community to take part in the project.

Table 1 Population characteristics of project participants compared to eligible community members.

	Participants	Community
Overall	n =289	n=767
Males (%)	37	52
Females (%)	63	48
Adults	n=208	N=495
Mean age (yrs)	38.1 ± 14.0	36.0 ± 14.5
Males (%)	38	52
Females (%)	62	48
Youth	n=81	n=272
Mean age (yrs)	12.7 ± 2.9	12.3 ± 3.0
Males (%)	37	52
Females (%)	63	48

The data for this study were compared to that collected in 1991 which consisted of 316 participants (50% males and 50% females) between the ages 7 and 78 years (mean age = 24.6 ± 15.6); 138 youth (49% male and 51% female; mean age 11.3 ± 3.2 years) and 178 adults (51% males and 49% females; mean age 34.8 ± 13.4 years).

3.3.3 Procedures

Anthropometric measurements of height and weight were obtained to determine body mass index (BMI) and waist circumference was measured to assess health risk (i.e. risk of Type 2 diabetes mellitus) associated with abdominal obesity included (Appendix D). These data were collected from September 2004 to May, 2005. All measures were obtained using standard procedures outlined by the Canadian Society for Exercise Physiology (1996)(Canadian Society for Exercise Physiology 1996) with the participants dressed in light clothing and without shoes. Height was determined using a wall-mounted tape measure and set square and weight was measured using a standing floor scale (Detecto). Waist circumference was measured by positioning a tape measure horizontally at the level of the noticeable waist narrowing and the measurement was read at the end of a normal expiration. When the point of narrowing was not found, an indeterminate waist was approximated by finding the lateral level of the 12th or lower floating rib and the girth was recorded at that site (Canadian Society for Exercise Physiology 1996). Waist measurements were taken twice and recorded to the nearest 0.5 cm. When the difference between the first and second measure was greater than 0.5 cm, a third measurement was taken and the average was determined from all three measurements. Waist circumference was measured only at the follow up data collection in 2005.

3.3.4 Data analyses

The sample populations from both 1991 and 2005 were divided into youth (7-17 years) and adult (18+ years) age cohorts. The BMI classification used for overweight and obesity for adults was according to the guidelines outlined by Health Canada in which overweight was defined as a BMI of $\geq 25 \text{ kg/m}^2$ and obesity as $\geq 30 \text{ kg/m}^2$ (Health Canada 2003). Given these guidelines are not intended for use with individuals under the age of 18 years, the classification for overweight and obesity for youth was based on the BMI cutoffs for children from the International Obesity Task Force (Cole et al. 2000). These cutoffs were derived from a large international sample by constructing centile curves for BMI that correspond to the adult cutoffs for overweight (25 kg/m^2) and obesity (30 kg/m^2) (Cole et al. 2000). Health risk associated with increased waist circumference for adults was defined according to the Canadian Guidelines for Body Weight Classification in Adults and therefore a waist girth of $>88 \text{ cm}$ for women and $>102 \text{ cm}$ for males was defined as a health risk (Health Canada 2003).

Data analyses were performed using the Statistical Package for the Social Sciences (SPSS v. 14) and Statistical Analysis System (SAS v. 9.0). Rates of overweight and obesity and mean BMI for each time point were determined by descriptive statistics. Generalized Estimating Equations (GEE) was used to statistically test for differences in prevalence rates of overweight/obesity between the two data collection time points in the community (i.e. 1991 and 2005). The use of GEE was deemed to be the most appropriate statistical technique given the total sample (participants from both 1991 and 2005) was partially dependent and partially independent (i.e. some participants were measured at both time points). A total of 77 individuals had anthropometric data from both time

points and therefore a sub-analysis using the Kappa statistic was used to assess change in BMI classification (i.e. normal weight, overweight, obese) over time in this group of individuals with repeated data.

3.4 Project 2 Methodology

The purpose of project 2 was to assess the current levels of physical activity and dietary intake among Woodland Cree women in the community as well as to explore the attitudes, beliefs and perceptions that a sub-sample of these females have regarding healthy body weights, physical activity and healthy eating. To address these purposes, a mixed methods approach was used to collect and analyze the data.

Mixed methods is a class of research which allows the researcher to combine quantitative and qualitative research techniques, methods, approaches, concepts or languages into a single study (Johnson and Onwuegbuzie 2004). Quantitative research focuses on deduction, and testing hypotheses and theory with the data. It takes a rather narrow-angled lens to describe, explain or predict outcomes. Qualitative research focuses on induction to generate new hypotheses and theory from the data. It take a wide-angled lens to examine phenomenon and to describe, explore and discover. Mixed methods research focuses on both induction and deduction and uses a multi-lens approach to address research questions. The goal of using a mixed methods approach is to use different strategies, approaches and methods to collect multiple data in a way which compliments the strengths and minimize the weaknesses of each method (Johnson and Onwuegbuzie 2004).

As outlined by Johnson and Onwuegbuzie (2004), there are several rationale for using a mixed methods approach. These include triangulation, complementarity,

initiation, development and expansion. Examples of these include corroboration of results from different methods (triangulation), elaboration, enhancement and clarification of the results (complementarity), re-framing of research question resulting from discovering paradoxes and/or contradictions (initiation), using findings from one method to inform another method (development), and seeking to expand the range of research using different methods for different components of inquiry (expansion) (Johnson and Onwuegbuzie 2004). While mixed methods research is often used to triangulate research findings, the goal of mixed methods is not merely to corroborate the findings, but to expand one's understanding (Onwuegbuzie and Leech 2004). Because physical activity and dietary practices are complex behaviors, the benefits of using a mixed methods approach not only afforded the ability to validate the quantitative results, but also provided the opportunity for a more in depth understanding of physical activity and diet practices and the factors that enable and inhibit these behaviors.

3.4.1 Participant recruitment

The participants recruited for both the quantitative and qualitative data collections included women in the community from four different age cohorts: 15-24 years, 25-39 years, 40-54 years and 55+ years. The first age group (15-24 years) was chosen to provide a voice for young women in the community, the 25-39 year age group represented women with young families and the third age group (40-54 years) was selected to capture the perspective from a different generational viewpoint. The fourth group (55+ years) provided the “elders” perspective and was seen as an integral component to this project, particularly as the change in the traditional hunter-gatherer

lifestyle is believed to have occurred within the last half of the century (Young et al. 2000).

The participants recruited for this study were approached through a number of different programs offered through the health clinic. These programs included a parenting group, youth, women's and elder's groups, wellness and dental clinics, home visits to potential participants, as well as the local high school. The age range of the women participating in the parenting groups was approximately 15-35 years. The youth group targets all youth in the community up to the age of 18 years, and this group, along with parenting group and the high school were felt to represent the two youngest age ranges (i.e. 15-24 and 25-39 years). The women attending the women and elder's groups comprised the upper two age groups (i.e. 40-54 and 55+ years). Recruiting participants from these groups helped to ensure the representativeness of the sample. The proportion of participants in each age group closely reflected that of the community and thus were felt to be representative of the community.

3.4.2 Physical activity assessment

In order to assess physical activity as accurately as possible, the assessment tool must obtain information on the types of physical activities that encompass the majority of energy expenditure in the study population (Kriska 2000). For this study, an interviewer-administered physical activity questionnaire that assessed historical, past-year leisure and occupational activity was chosen; the Modified Activity Questionnaire (MAQ) (Appendix J). The use of this instrument for assessing physical activity levels is believed to overcome many of the problems encountered previously in measuring physical activity in ethnic populations such as Aboriginal peoples (Kriska et al. 1990). Challenges to

assessing physical activity levels have included determining the contributions of different types of activities (i.e. leisure and occupational), variability in interpretations of words (i.e. 'leisure', 'physical activity', or 'exercise'), and interpretations of intensity levels of various activities (Kriska 2000). The MAQ has been found to be both reliable and valid for assessing physical activity levels through comparison with activity monitors, fitness testing and the doubly labeled water technique in both adults and adolescents (Kriska et al. 1990). As the name suggests, the MAQ can be modified based upon pilot testing to maximize the feasibility and appropriateness to the population of interest, and it is recommended that both a list of leisure activities and types of occupational activities common to the population be compiled and included in the questionnaire (Kriska 2000). In the current study, the questions were modified with input from female community members who participated in pilot testing the instrument, as well as the community research assistant. The pilot testing ensured that both leisure and occupational activities correctly represent those of this population and the geographic location in which they reside.

As mentioned, the MAQ assesses both past year leisure and occupational physical activities. The leisure section of the questionnaire instructed participants to identify all activities they engaged in more than ten times in the past year from a list of common activities in the local and surrounding area and to record any additional activities that were not provided on the list. For each activity identified, the participants were asked to average the number of times per month they participated in the activity, the average number of minutes for each session and to indicate if the intensity was light (light change from normal breathing), medium (above normal breathing), or heavy (heavy breathing).

To determine physical activity from occupational activities, participants were asked to list all jobs that they had over the past year for at least one month. For each job entry, participants were instructed to report the time spent walking or cycling to work per day, their average job schedule (number of months per year, days per week and hours per day), the number of hours spent sitting at work, as well as to indicate from a list the most common physical activities performed when not sitting.

Estimates of leisure and occupational activity were calculated separately as hours per week (h/wk) averaged over the past year. Each activity was weighted by its relative estimated metabolic cost to derive metabolic equivalent hours per week (MET h/wk). For example, 1 MET represents the energy expenditure for an individual at rest, brisk walking is estimated to be 3.5-4 METS and jogging/running are estimated to be 7 METS and higher (Ainsworth et al. 2000). In keeping with previous literature (Kriska et al. 2003) only those leisure time activities that demanded an energy expenditure greater than that required by activities of daily living (i.e. > 2.0 METS) and only those occupational physical activities that were categorized by the participants as moderate and hard were included in the analysis.

3.4.3 Physical activity data analyses

The physical activity data were analyzed using SPSS (v. 14.0). The most common types of leisure-time activities are presented as the percentage of participants participating in each activity over the past year. Estimates of leisure, occupational and total physical activity (median, [25%, 75%]) were determined for the sample overall, as well as by age group (15-24 years, 25-39 years, 40-54 years, 55+ years). To assess for differences between age groups, the Kruskal-Wallis test was used. To test for differences

within age groups, the Wilcoxon Signed Ranks Test was used. The level of significance was set at $p < 0.05$. High and low activity levels were assessed for each age group using a cutoff of 16 MET hours per week of physical activity, which is approximately equal to a daily 30 minute brisk walk.

3.4.4 Dietary assessment

To measure food intake, the 24-hour recall method was used. The 24-hour recall is an interviewer-administered questionnaire in which the respondents recall in detail all the food and drink consumed in the previous 24 hours (Lee and Nieman 2003). This method provides an inexpensive, easy way to collect detailed information on specific foods. It is fairly quick to administer (approximately 20 minutes), has a low respondent burden, and has been used previously in the Aboriginal population (Trifonopoulos et al. 1998). The list of foods are open-ended and the method is thought to be more objective than diet histories or food frequency questionnaires. Additional advantages of using a 24-hour recall to assess diet are that the personal contact during the data collection contributes to the reliability of the information collected, it is applicable for broad populations of different ethnicity, and there is no literacy requirement (Biro et al. 2002). Although a single 24-hour recall does not represent the usual intake of individuals, due to the intra-individual variability, it has been found to be valid for characterizing the average intake of a group or population (Biro et al. 2002), and thus was the rationale for choosing this method for this particular study.

Each participant was asked to recall all the food and drink consumed the previous day (Appendix K). In addition to recalling what was consumed, each participant was also asked to estimate the portion sizes for each item. Underreporting due to withholding or

altering information or because of poor memory are limitations to dietary recall, however to minimize this bias and to obtain more accurate information about food intake, the multiple pass method was utilized (Lee and Nieman 2003). Using this method, the first pass (i.e. the first series of questions) involved compiling a quick list of all the food and drink consumed in the previous 24-hours. The second series of questions, or second pass, involved asking the participants to clarify the description of each item on the list, including methods of preparation as well as any additional sauces, dressings, condiments, etc. that may have been used. The third pass was used to review the data with each participant and probe for additional eating occasions and to obtain clarifications on portion sizes. The use of household dishes and measures (e.g. cups, bowls, glasses spoons) and geometric shapes (e.g. circles, triangles and rectangles) were used to assist the participants in approximating portion sizes (Lee and Nieman 2003). To increase the accuracy of the information obtained, and to overcome potential language barriers between the participant and the interviewer, the community research assistant was present during the data collection for translation purposes when required. To capture differences in day-to-day intakes, the recalls were performed on different days of the week whenever possible.

3.4.5 Dietary data analyses

Data collected from the 24-hour recalls were entered into *The Food Processor SQL* (v. 8.5), a computerized dietary analysis program, to determine the number of servings from each food group (i.e. grain products, vegetables and fruits, milk products and meats and alternatives) for each participant. The data were then transferred to SPSS (v. 14.0) to assess mean serving sizes (mean \pm SD), total kilocalories (mean \pm SD) and

macronutrient intake (mean percentage from carbohydrate, protein and fat). The Kruskal-Wallis test was used to determine differences between groups. The level of significance was set at $p < 0.05$. When there were significant differences between groups, multiple Mann-Whitney tests with Bonferonni correction conservatively adjusted to $p < 0.008$ were performed. To determine frequency estimations of traditional foods used, each food item was coded as traditional (bannock, berries, birds, fish and land animals) or market food (all other foods). Each food item was only coded once, regardless of whether they were consumed multiple times during the day (Kuhnlein et al. 2004).

3.4.6 Qualitative methodology

A focused ethnographic approach (Muecke 1994) was used to explore the local attitudes and beliefs that Cree women have regarding physical activity, healthy eating and healthy body weights. Ethnography is defined as a description and interpretation of a cultural or social group or system which involves examining groups learned patterns, customs and ways of life (Creswell 1998). Focused ethnography, also known as a rapid ethnography, draws on research techniques used in classical anthropologic ethnography, such as interviews and participant observation. While both focused ethnography and classical ethnography use the same methods of data collection, classical ethnography typically involves prolonged observation of a group by the researcher who resides in the community and is immersed in the day-to day lives of the people (Creswell 1998). In contrast, focused ethnography typically involves selected episodes of participant observation, combined with unstructured or semi-structured interviews (Muecke 1994). The core of ethnography is to examine a group's observable patterns of behavior,

customs and way of life (Creswell 1998), whereas focused ethnography is typically a time-limited, exploratory study among a specific group of people which is problem-focused and content specific (Muecke 1994). This focused ethnography shares many of the basic characteristics of classical ethnography. For example, the data gathering was carried out in a specific locality (the community), interviews were the primary source of data gathering, and an emphasis was placed on describing the perspective of the participants (Creswell 1998). As stated previously, one of the distinctions between classical ethnography and focused ethnography is the breadth of focus of the research. The data collection for this study were focused on pre-determined, overarching questions such as “What are Cree women’s perceptions about healthy bodies?”, “What influences physical activity in Cree women?”, and “What influences the diet of Cree women?” (Appendix I). Particular attention was given to exploring the attitudes and beliefs of physical activity, healthy eating and healthy body weights in a social and cultural context, as well as how the physical environment (e.g. geographic factors) influences physical activity and healthy eating. For example, traditions such as women being the homemakers and the cultural influence on family responsibilities as a top priority, the social norms in eating (e.g. portion sizes and typical foods), opportunities for physical activity (e.g. barriers and enablers) and perceptions of a healthy body were explored (Appendix I).

A stratified purposeful sampling approach was used which involved both opportunistic (i.e. following leads and selecting participants as the opportunity arises) and snowball (i.e. identifying participants from other participants and individuals) sampling techniques (Creswell 1998). A total of 19 female participants from four age groups took

part in the interviews; six aged 15-24 years, four aged 25-39 years, five aged 40-54 years and four over the age of 55 years.

A community research assistant was trained to assist with the interviews to provide interpretation for translation and clarification purposes to overcome potential language barriers between the participant and the interviewer, thus encouraging participants to use their “typical native language” (Spradley 1979). The interview sites were chosen by each participant and were conducted either in the participant’s home or in the health center. Prior to all interviews, participants were provided with a clear explanation of the purpose of the project and informed consent was obtained. Each interview began with general questions in an effort to establish rapport and to learn a little bit about each of the participants. A semi-structured interview guide was used which asked questions regarding attitudes and beliefs about health (e.g. What do you think makes people healthy?), healthy bodies (e.g. What does a healthy body look like to you?), physical activity (e.g. Do you consider yourself to be physically active?) and healthy eating (e.g. What would you describe as ‘healthy eating’?) (Appendix I). The interviews typically lasted 45 minutes to one hour and were audiotaped with the permission of the participants and transcribed verbatim by the interviewer.

In addition to one-on-one interviews, data were also collected through participant observation. Observational data were recorded during each community visit in the form of field notes (Creswell 2003), and included observing potential physical activity opportunities in the community, spontaneous physical activity in the community, the types of foods available in the two local convenience stores and the content of various food hampers and food trays provided to individuals taking part in programs offered

through the health center. The field notes were used to supplement data obtained from the interviews to provide a source of credibility (i.e. internal validity) and confirmability (i.e. objectivity) to increase the rigor of the findings (Guba 1981). Member checks (returning descriptions or themes back to the participants to determine if they are accurate) of the transcribed data were also performed to increase internal validity (Guba 1981).

3.4.7 Qualitative data analyses

Data analysis proceeded concurrently with data collection and began by reviewing the field notes and interview transcripts. Through content analysis, the data were analyzed by identifying topics, categories and patterned regularities and variations in the data (Wolcott 1994; Patton 2002). The interviews were guided by a semi-structured questionnaire intended to elicit information related to the participants' attitudes and beliefs regarding four topics; health, healthy body weight, physical activity and healthy eating. Thus, the first step of analysis involved organizing the data from each interview into the four topics (Patton 2002). The interviews were also designed to identify barriers and enablers associated with physical activity and healthy eating and therefore within each of topic, the data were sorted into separate categories (e.g. perceptions of physical activity, physical activity barriers, physical activity enablers). The transcripts were re-read and coded to identify any additional information relevant to each category (i.e. data that related to more than one category). Once all the interviews were completed, each topic and category was then analyzed to identify similarities and differences in the data. As one of the objectives was to obtain a trans-generational perspective, the data in each category were then re-sorted as outlined above and similarities and differences were

examined between the age groups. The field notes, which included direct observations, were used to triangulate the data by providing a source of data to validate and cross-check the findings of the interviews (Patton 2002). Similar to the interview data, the field notes were analyzed by sorting the data based on topics (e.g. physical activity, healthy eating) and then organized into relevant categories (e.g. barriers to physical activity, healthy eating barriers, etc). Standard procedures for establishing trustworthiness were applied which included member checks of the transcribed data (returning the transcripts back to the participants to determine accuracy) and establishing an audit trail (Lincoln and Guba 1985). The audit trail included all raw data (audiotapes of the interviews, transcripts with notes and field notes), data reduction and analysis notes and instrument information (interview questions, schedules, etc).

3.5 Community Profile

The Community

The setting for this research project was a reserve community in northern Saskatchewan, within the Peter Ballantyne Cree Nation. The community is located approximately 500 km northeast of Saskatoon and is accessible throughout the year by a gravel road approximately 30 km off the main highway. The closest larger centers are Flin Flon, MB (border city to Creighton SK), located approximately 140 km east of the community, and Prince Albert, SK located approximately 340 km southwest of the community on the Hanson Lake Road (Highway #106). Most of the residents regularly travel to these centers for shopping, medical appointments and to do business.

As the name reflects, the community is situated on Lake Deschambault and is surrounded by trees. Four distinct seasons are apparent, with warm summer (i.e. >20°C)

and cold winter temperatures (i.e. reaching lows $\geq -30^{\circ}\text{C}$). In 2005, when much of the data were collected for this thesis, the population was estimated to be approximately 972 residents (48% females and 52% males), as reported through a door-to-door survey conducted by the health center. The majority of the residents were Woodland Cree and the mean age was 23.1 ± 17.5 years. Approximately 60% of the population was under the age of 25 years. Although there is no current census information available during the data collection period, the most recent census data from 2001 reported the median total income of persons over the age of 15 years to be \$7,312, and median household income to be \$16,928, with nearly half (47%) of the income received from government transfers (Statistics Canada 2002). The unemployment rate was reported to be 40% and approximately 60% of residents over the age of 20 years reported less than a high school diploma (Statistics Canada 2002). The majority of the homes were built prior to 1991 (57%) and are rented (55%) (Statistics Canada 2002). The main industries in the community included commercial fishing, some trapping in the winter, the saw mill and public service employment (Band).

Various departments exist within the Peter Ballantyne Cree Nation (PBCN) Band office. The PBCN Band Administration is the major employer in the community. The Band departments include the following: Social Development, Education, Economic Development, Outreach, Treaty Land Entitlement, Housing, among others. Other affiliated local services include the Post Office, Deschambault Lake (Ossey) Fishermen's Cooperative, the Indian Child and Family Services, The PBCN Health Services Inc., the Royal Canadian Mounted Police (RCMP) and a tourist outfitting business.

At the time this project began, there were two schools in the community, one elementary (Kistapiskaw School) and one high school (Kimosom-Pwatinahk Collegiate), however in March, 2005, the elementary school succumbed to a fire which resulted in students in the elementary school attending classes at the high school, in the youth center, and in portable classrooms. There are two retail stores, one which sells fuel, and both of which sell primarily confectionary goods, packaged and canned foods and a limited supply of fresh fruits and vegetables (i.e. only apples, bananas, oranges, onions and potatoes). There is also a group home, a youth center, and a wellness center which is home to the Aboriginal Head Start program.

Health care in the community is delivered through the Jonah Sewap Memorial Health Center (referred to hereon in as the health center). The health center is open Monday thru Friday and offers a variety of health programs, treatment services and 24-hour emergency care. A physician from Prince Albert visits two days per week and the nurses live in the community in fully furnished duplexes and trailers located near the health center. In addition to the physician and nurses, the health center offers 12 health programs and employs 32 local staff members in a variety of health positions ranging from health director, community health developers, dental assistant and dental therapist, to transportation and data entry clerks, homecare nurses, home health aides, a diabetic resource worker, receptionist, as well as a janitor and maintenance and security personnel. In addition, coordinators and staff members involved with the holistic, youth, elder, prenatal and postnatal, and Aboriginal Head Start programs are employed through the health center.

Within the community, various facilities and natural settings exist which provide ideal locations for physical activity. As mentioned, the community is situated on Lake Deschambault which is accessible to the residents of the community in both the summer and winter months. Thus, there are opportunities for water activities in the summer such as swimming and canoeing and ice sports such as hockey, skating, broomball, etc. in the winter. An outdoor arena is located near the high school and in 2004 a newly built indoor ice center was opened. The high school, built in 2003, has an indoor gymnasium which is accessible for a variety of indoor activities and games for children as well as various sports (e.g. volleyball, basketball, badminton, etc) and activities (e.g. dance, aerobics, yoga, etc) for youth and adults in the community. A playground, located near the previous site of the elementary school includes a 'jungle gym' and basketball court and hoops. The youth center and community wellness center, two other indoor venues in the community, are also potential locations for various physical activity programs. These two venues, as well as the high school and health center also provide ideal locations for nutrition-related programs as all are equipped with full kitchens.

Table 2 provides a summary of the various physical activity and nutrition programs that have previously been implemented in the community over the past several years. Some of the initiatives are offered regularly throughout the year (e.g. pre and post-natal classes, fruit basket program) while other programs are offered as one to three day events (e.g. broomball tournament, walkathon, wellness derby, bike rodeo), with the exception of the walking group which ranged from 4 months to 1 year in duration. Regardless of the frequency throughout the year or the duration of the program, most of the initiatives occur on an annual basis. Many of the programs have been targeted

towards the community as a whole, however some programs, such as Camp Grizzly (a camp located near the community), focused on the youth in the community. The pre and post-natal program was the primary program targeting younger women in the community, with the emphasis placed on nutrition (i.e. less, if any physical activity). The elder's group focused on women over the age of 55 years, however little emphasis was placed on nutrition and/or physical activity. Although a weekly men's group was organized, limited programming focusing on nutrition and physical activity was targeted towards men in the community.

The price of food in the community is substantially higher for some items, compared to the price in a more urban location (i.e. Saskatoon). Table 3 outlines data collected in the March, 2006 which compares the price of select foods that could be purchased in the community, compared to the same foods purchased at *Safeway* in Saskatoon. Given the limited supply and relatively high costs of food sold in the community, many residents purchase much of their food outside of the community (i.e. in Flin Flon and/or Prince Albert).

Table 2. Physical activity and nutrition programs offered within the community of Deschambault Lake from 1995 to 2003

Year	Program Name	Focus	Participants	Number Participants	Duration	Dates	Activities/ Topics
2003	Community Kitchen	Nutrition & Diabetes	NR	Unknown	Unknown	December	Nutrition, budgeting, shopping, label reading
2003	Diabetic Resource/ Community Kitchen	Nutrition	NR	Unknown	1 month	November	Nutrition, budgeting, shopping, label reading
2003	Pre-natal Classes	Nutrition	Women (moms)	Varies	1 month	November	Cooking
2002	Walkathon	Diabetes	Community-wide	Unknown	1 Day (annually)	May 13	Walking
2002	Diabetes Workshop	Diabetes	Community-wide	Unknown	1 Day	February 22	Exercise, healthy eating
2002	Broomball Tournament	Broomball	Community-wide	8 teams	3 days	February 5-8	Broomball
2002	Wellness Walks	Walking	NR	10	4 Months	February, April, May, December	Weekly walks with healthy snack and prizes
2001	Good Food Box	Healthy Eating	Community-wide	Unknown	Unknown	Unknown	NA
2001	Mini-Olympics	Physical Activity	Youth	55	1 Day	November 17	NA
2001	Fruit Basket Program	Healthy Eating	Moms & Babies	Varies	2 Months	November/December	NA
2001	Pre/Post-natal Classes	Health and Wellbeing	Women (moms)	Varies	1 Month	April	NR
2001	Walking Program	Walking	NR	Unknown	2 Months	November/December	Walked roundtrip from Health Clinic to School
2001	Wellness Derby	Physical Activity & Diabetes	Community-wide	Unknown	1 Day	April 7	NA
2001	Weight Loss Group	Weight Loss	Women	30	4 Months	February 6 – May 31	Weight Loss
2000	Bike Rodeo	Biking	Youth	36	1 Day	Unknown	Biking
1999	Bike Rodeo	Biking	Youth	40	1 Day	Unknown	Biking
1997	Weight Loss Program	Weight Loss	NR	Unknown	7 Months	February - August	Weight Loss
1997	Well Women Walking Group	Walking	Women	Unknown	Unknown	Unknown	Walking
1995	Weight Loss Program	Weight Loss	NR	Unknown	Unknown	Began February 1995	Diet & PA Counseling, prizes
1995	Well Women Walking Group	Walking	Women	Unknown	1 Year	Unknown	Walking

NA = Not applicable

Table 3. Comparison of select food prices in Deschambault Lake, SK vs. Saskatoon, SK from March, 2006

Food Item	Price in Deschambault Lake	Price in Saskatoon (Safeway)
4 liters 2% milk	\$7.25	\$3.69
Bananas (per pound)	\$1.00	\$0.57
Small naval oranges (per bag)	\$6.45	\$3.99
Spartan apples (per bag)	\$4.80	\$3.29
Fresh onions (per pound)	\$1.39	\$0.99
Fresh potatoes (10 pound bag)	\$7.70	\$6.99
Canned creamed corn	\$1.70	\$0.95
Canned mushrooms	\$1.05	\$1.05
Canned green beans (French cut)	\$1.20	\$1.08
Canned whole tomatoes	\$1.70	\$1.49
Bran Flakes (475 g)	\$5.80	\$3.98
Cream of Wheat	\$3.25	\$3.67
Bread (white/ 60% whole wheat)	\$1.85	\$1.49
Spaghetti (Catelli 900g)	\$2.65	\$2.58
Ground beef (per pound)	\$1.05	\$1.99

CHAPTER 4

PROJECT 1

4.1 Prevalence of Overweight and Obesity in a Woodland Cree Community:

14 Year Trends

4.1.1 Introduction

It is well recognized that the global increases of overweight and obesity are public health concerns, and given their substantial collective increase in prevalence are regarded as a pandemic affecting millions worldwide (World Health Organization 2000). The most recent Canadian data indicates that 36.1% of adults were overweight (i.e. body mass index [BMI] of 25-29.9 kg/m²) and an additional 23.1% were obese (i.e. BMI of >30 kg/m²), a substantial increase from the 13.8% reported 25 years ago (Tjepkema 2005). One of the most notable increases was among those aged 25-34 years where obesity rates more than doubled from 8.5% in 1978/79 to 20.5% in 2004 (Tjepkema 2005). While these data revealed similar rates of obesity for males (22.9%) and females (23.2%), females were more likely to have Class III obesity (BMI > 40 kg/m²) (Tjepkema 2005). Overweight and obesity have been shown to be strongly associated with chronic diseases such as Type 2 diabetes mellitus (T2DM), cardiovascular disease and some cancers (Raine 2004). However, T2DM appears to be most directly related to increasing obesity (Jung 1997), with the prevalence of T2DM also increasing worldwide (Wild et al. 2004). While the Canadian data for overweight (BMI 25-29.9 kg/m²) and obesity (BMI >30 kg/m²) prevalence trends were derived from a target population which included long-term residents in health institutions, and household residents in all provinces and territories, one notable group omitted from these population studies has been those living on First Nations reserves. Although the Canadian data suggested higher rates of obesity in the

Aboriginal⁴ population, (based on the notion that Aboriginal peoples comprise a large percentage of the northern population), prevalence data of overweight and obesity in this population are limited (Raine 2004). To date, Canadian research has primarily focused on the pediatric population (Bernard et al. 1995; Potvin et al. 1999; Hanley et al. 2000), or have been community-specific in Manitoba and Northern Ontario (Young and Sevenhuysen 1989; Katzmarzyk and Malina 1998). However, results from these studies have reported an increased prevalence of obesity in the Aboriginal population. Among adults, a recent report from the Canadian Community Health Survey also indicates high rates of overweight/obesity (combined) and obesity among off-reserve Aboriginal peoples compared to non-Aboriginal counterparts (67% vs 55% and 38% vs 19% respectively) (Garriguet 2008). Anthropometric data have also highlighted a predominantly central pattern of obesity (Young and Sevenhuysen 1989), associated with an increased risk for T2DM (Young et al. 2000), which is of concern for Aboriginal peoples (Health Canada 2002).

One of the few studies to determine rates of obesity among the adult Aboriginal population was conducted in three northern Saskatchewan communities with varying accessibility to urban centers (Dyck et al. 1995). The results of this study showed that BMI increased with increasing accessibility to urban centers (Dyck et al. 1995). For this particular study, obesity was defined as >10% above the Canadian mean, and according to this criterion approximately 45% of males and 65% of females in the ‘most accessible’ community were classified as obese, proportions greater than the two communities with less urban accessibility (Dyck et al. 1995).

⁴ The terms ‘Aboriginal’ and ‘Aboriginal peoples’ do not describe a homogeneous group. However, for the purpose of this thesis the terms will be used to describe First Nations people (including individuals registered and not registered under the Indian Act), Métis and Inuit peoples, with the exception of the use of specific terms when discussing the results of research studies that have employed specific terms.

Given the reported high prevalence of obesity among Aboriginal peoples, the purpose of this study was to determine current overweight and obesity rates in the ‘most accessible’ Aboriginal community in the study conducted by Dyck et al (1995). This study also afforded us the unique opportunity to compare the current rates of overweight and obesity with those from 1991(Dyck et al. 1995). Therefore, the second purpose of this study was to determine if there had been an increase in rates of overweight and obesity over time.

4.1.2 Methods

4.1.2.1 Research Project Approach

Historically, there has been a “helicopter approach” (Smylie et al. 2004) to research in Aboriginal communities, where investigators merely arrive in a community, collect the information they require with minimal interaction among members of the community, and publish their findings in scientific journals without input from the community in which the research was based. This “style” of research has resulted in distrust and resistance on the part of Aboriginal communities in relation to university-based researchers, given the lack of community control, local benefits and interpretation of the data in isolation of the social context (Henderson et al. 2002). In keeping with more recently developed protocols and ethical guidelines for working *with* Aboriginal communities (American Academy of Pediatrics 2004; Canadian Institutes for Health Research et al. 2005), this project began by collaborating with the health services organization representing the Band and the health director in the community, as the need to examine the issue of obesity was identified by the community. In addition, initial exploratory meetings were held with community members expressing an interest in

participating in a follow up project on healthy body weights. A community project worker was hired through the health clinic to assist with data collection and project organization. Regularly scheduled visits were made by the university researchers to establish rapport and trust with employees at the health clinic and members of the community, as well as to help develop and plan the research project.

4.1.2.2 Consent

Informed consent for this project was developed in stages. The first stage involved obtaining consent from the local governance, including board members, health portfolio councilors, the health committee and appropriate community leaders and/or elders. The details of the proposed project were outlined and included the purpose and scope of the study, the proposed methods to obtain individual informed consent, and how the information gathered would be provided back to the community. Approval for the community's participation in the project was established prior to any form of individual consent. Once all details of the project were mutually agreed upon and community consent was granted, informed consent was obtained from the University Advisory Committee on Ethics in Behavioral Science Research, following which informed consent was obtained from each participant (Appendices B and C). The process of obtaining individual consent was approved by the health director and all details of the consent were done in collaboration and consultation with the health director and the community project worker to ensure appropriate language and content.

4.1.2.3 Participants

All individuals aged 7 years and older were eligible to participate. A number of strategies were used to obtain a representative sample of individuals and to maximize the

number of participants in the project. Recruitment strategies were facilitated through the health clinic and included two health fairs, weekly health clinic programs and personal invitations to those who may have been overlooked during prior recruitment methods. These individuals were invited to attend the clinic at their convenience to participate in the project.

A total of 289 male and female participants between the ages of 7 and 82 years (mean age 31.0 ± 16.5 years) participated in this study. This included 81 youth (mean age 12.7 ± 2.9 years) and 208 adults (mean age 38.1 ± 14.0 years) (Table 4). The data for this study was compared to the 316 male and female participants between the ages 7 and 78 years (mean age = 24.6 ± 15.6); 138 youth (mean age 11.3 ± 3.2 years) and 178 adults (mean age 34.8 ± 13.4 years), who participated in the study conducted in 1991. (Table 4). As shown in Table 4, the total sample size in 2005 was slightly smaller and the participants were slightly older, compared to those in 1991. In addition, there was a greater proportion of females compared to males who participated in the follow-up study in 2005, while the same proportion of females and males participated in 1991 (Table 4).

Table 2 Comparison of Mean Age (years) and Percentage Male and Female Adult and Youth Participants in 1991 vs. 2005.

	1991	2005
Overall	n =316	n=289
Mean age (yrs)	24.6 (\pm 15.6)	31.0 (\pm 16.5)
Males (%)	50	37
Females (%)	50	63
Adults	n=178	N=208
Mean age (yrs)	34.8 \pm 13.4	38.1 \pm 14.0
Males (%)	51	38
Females (%)	49	62
Youth	n=138	n=81
Mean age (yrs)	11.3 \pm 3.2	12.7 \pm 16.5
Males (%)	49	37
Females (%)	51	63

4.1.2.4 Procedures

Anthropometric measurements included waist circumference, height and weight to calculate body mass index (BMI) (Appendix D). All measures were obtained using standard procedures (Canadian Society for Exercise Physiology 1996) with the participants dressed in light clothing and without shoes. Height was determined using a wall-mounted tape measure and set square, and weight was measured using a standing floor scale (Detecto). Waist circumference was measured by positioning a tape measure horizontally at the level of the noticeable waist narrowing and the measurement was read at the end of a normal expiration. When the point of narrowing could not be found, an indeterminate waist was approximated by finding the lateral level of the 12th or lower floating rib and the girth was recorded at that site (Canadian Society for Exercise Physiology 1996). Waist measurements were taken twice and recorded to the nearest 0.5 cm. When the difference between the first and second measure was greater than 0.5 cm, a third measurement was taken and the average was determined from all three measurements. Waist circumference (WC) was only measured in 2005. The data were collected from September 2004 to May, 2005.

4.1.2.5 Data analyses

The sample was divided into age cohorts; youth aged 7-17 years and adults aged 18+ years. The body mass index (BMI) classification used for overweight and obesity for adults was according to the guidelines as outlined by Health Canada where overweight is defined as a BMI of $\geq 25.0 \text{ kg/m}^2$ and obesity as $\geq 30.0 \text{ kg/m}^2$ (Health Canada 2003). Given these guidelines are not intended for use with individuals under the age of 18 years, the classification for overweight and obesity for youth aged 7-17 years

was based on the age-specific BMI cutoffs for children from the International Obesity Task Force (Cole et al. 2000). These cutoffs were derived from a large international sample by constructing centile curves for BMI that correspond to the adult cutoffs for overweight (25 kg/m^2) and obesity (30 kg/m^2) (Cole et al. 2000). Health risk associated with increased waist circumference for adults was defined according to the Canadian Guidelines for Body Weight Classification in Adults (Health Canada 2003). Analyses were performed using the Statistical Package for the Social Sciences (SPSS v. 14) and Statistical Analysis System (SAS v. 9.0)

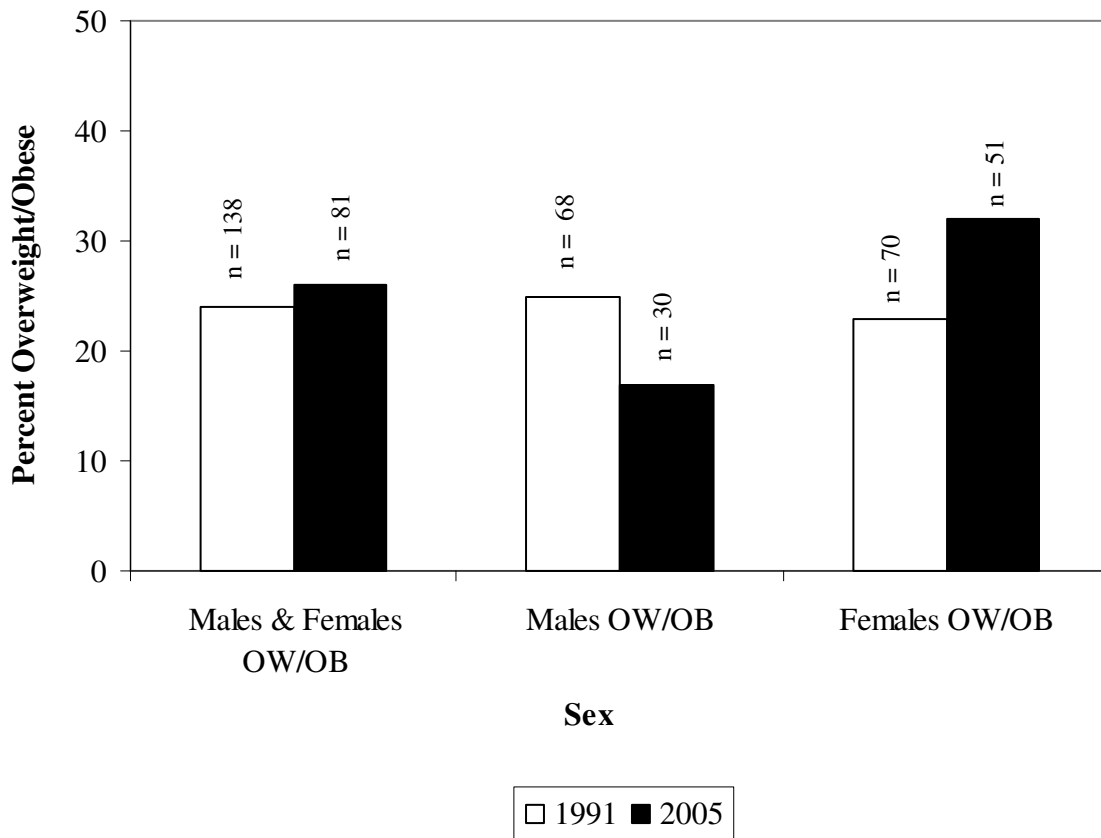
Rates of overweight and obesity and mean BMI for each time point were determined by descriptive statistics. As the sample was partially dependent and partially independent (i.e. some participants were measured at both time points), Generalized Estimating Equations (GEE) was used to statistically test for differences in prevalence rates of overweight and obesity between the two time points (1991 and 2005). GEE is a statistical technique used to analyze dichotomous outcomes of longitudinal correlated data (Hanley et al. 2003). Therefore, the raw BMI data for the GEE analysis was dichotomized into overweight/obese and not overweight/obese. A total of 77 individuals who had anthropometry data at both time points were included in this analysis. A sub-analysis using the Kappa statistic was used to assess change in BMI classification (i.e. normal weight, overweight, obese) over time in the individuals with repeated data.

4.1.3 Results

4.1.3.1 Youth (7-17 years)

Figure 1 shows that in 1991 nearly one-quarter (24%) of the youth population was overweight/obese (23% females and 25% males), however there was no significant

Figure 1 Percentage of youth (aged 7-17 years) classified as overweight/obese (OW/OB) and percentage of male and female youth classified as overweight/obese (OW/OB) in 1991 and 2005.



difference in rates of overweight/ obesity over time ($p = 0.74$) as 26% of the sample was overweight/obese in 2005 (32% females and 17% males). When stratified by sex, there was also no significant difference in rates of overweight/obesity over time for males ($p = 0.37$) or females ($p = 0.30$). Although the differences were not significant, it was deemed important to identify if a specific age or age group(s) influenced the change in overweight/obesity rates over time, particularly among the female youth. The data were stratified by age, and the mean BMIs for each age group overall and for males and females are reported in Table 5. Although the sample size for each age group was small in 1991, the mean BMIs for two age groups of males (9 and 15 years) and females (13 and 17 years) were classified as overweight according to the criteria outlined by Cole et al. (2000). No age groups for either males or females were considered obese in 1991. In 2005, the BMI for the one male participant aged 7 years was classified as overweight. The mean BMIs of four female age groups (7, 11, 14 and 17 years) were classified as overweight and one age group (8 years) classified as obese.

Table 3 Body Mass Index (BMI; kg/m²) for male and females youth aged 7- 17 years for 1991 and 2005.

Age Group	1991 (n=138)	2005 (n=81)	1991 (n=68)	2005 (n=30)	1991 (n=70)	2005 (n=51)
	Overall		Males		Females	
7 Years	n = 15 17.5 ± 2.0	n = 5 20.6 ± 3.8	n = 6 16.6 ± 0.7	n = 1 21.0 ^a	n = 9 18.0 ± 2.4	n = 4 20.5 ± 4.3 ^a
8 Years	n = 18 17.4 ± 1.9	n = 5 22.6 ± 7.8	n = 6 17.1 ± 1.1	n = 1 14.8	n = 12 17.5 ± 2.2	n = 4 24.5 ± 7.5 ^b
9 Years	n = 18 18.5 ± 2.4	n = 0	n = 8 19.8 ± 2.8 ^a	n = 0	n = 10 17.5 ± 1.3	n = 0
10 Years	n = 15 18.0 ± 3.3	n = 9 16.8 ± 1.9	n = 9 17.9 ± 2.4	n = 3 15.9 ± 3.0	n = 6 18.1 ± 4.5	n = 6 17.2 ± 1.2
11 Years	n = 10 19.8 ± 2.3	n = 9 21.2 ± 8.2	n = 4 20.4 ± 4.0	n = 3 17.3 ± 0.6	n = 6 19.4 ± 1.2	n = 6 23.2 ± 9.7 ^a
12 Years	n = 12 19.3 ± 2.4	n = 7 20.1 ± 5.2	n = 6 19.4 ± 2.4	n = 4 21.2 ± 6.7	n = 6 19.3 ± 2.6	n = 3 18.6 ± 2.4
13 Years	n = 8 22.1 ± 4.4	n = 10 18.7 ± 2.2	n = 5 19.9 ± 2.4	n = 4 19.8 ± 2.9	n = 3 25.9 ± 4.7 ^a	n = 6 17.9 ± 1.4
14 Years	n = 13 21.4 ± 2.4	n = 11 22.1 ± 4.9	n = 8 21.4 ± 2.8	n = 5 18.8 ± 1.9	n = 5 21.4 ± 2.0	n = 6 24.8 ± 5.0 ^a
15 Years	n = 12 23.9 ± 3.5	n = 8 21.6 ± 8.6	n = 6 23.9 ± 4.9 ^a	n = 4 19.7 ± 4.1	n = 6 23.9 ± 1.8	n = 4 23.5 ± 12.0
16 Years	n = 6 21.7 ± 1.9	n = 11 22.2 ± 4.2	n = 3 21.6 ± 2.5	n = 4 22.2 ± 5.4	n = 3 21.8 ± 1.5	n = 7 22.2 ± 3.8
17 Years	n = 11 27.2 ± 4.3	n = 6 25.7 ± 6.5	n = 7 23.9 ± 2.7	n = 1 22.9	n = 4 28.2 ± 9.1 ^a	n = 5 26.3 ± 7.1 ^a

^a denotes BMI classified as overweight^b denotes BMI classified as obese

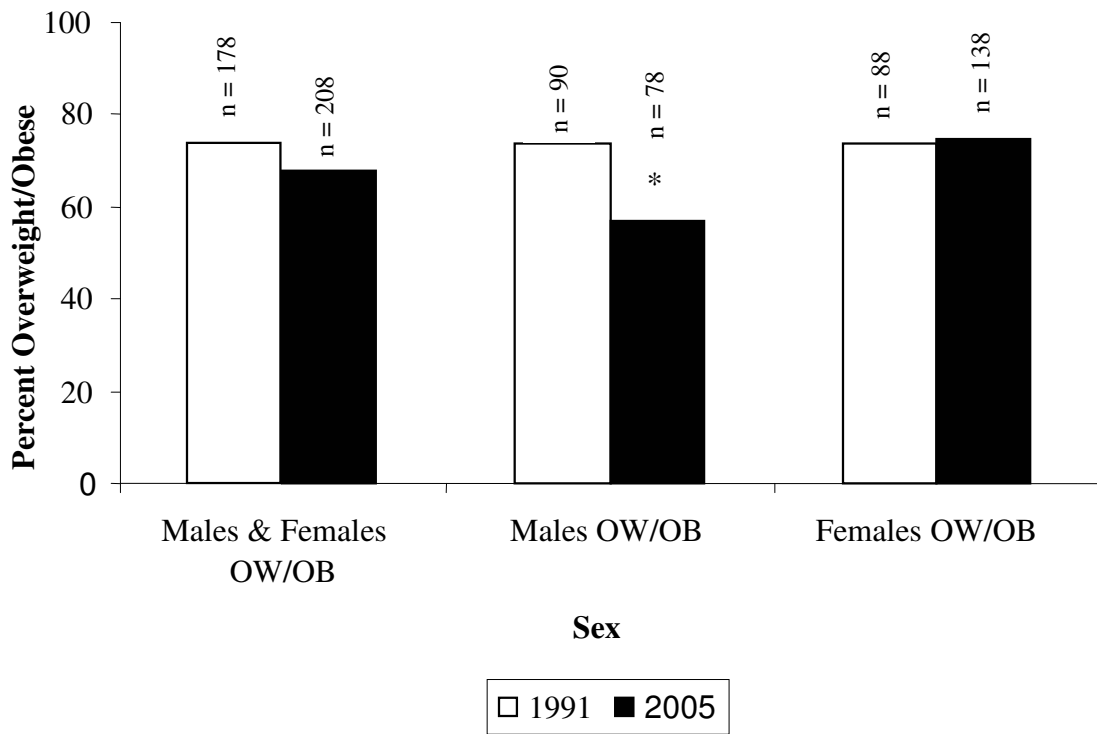
4.1.3.2 Adults (18+ Years)

The mean age of the participants in 1991 was 34.8 years (± 13.4), which was slightly lower compared to the mean age in 2005 (38.1 years ± 14.0), however this difference was not significant. Similar to the findings reported among youth in the community, there was no significant difference in overall prevalence rates of overweight/obesity over time ($p = 0.59$). However, three-quarters (74%) of the population in 1991 and over two-thirds (68%) in 2005 were overweight/obese (Figure 2). When stratified by sex, there was a significant decrease ($p = 0.04$) in rates of overweight/obesity over time for males (74% to 57%) but not for females ($p = 0.20$) as these prevalence rates remained essentially unchanged (74% to 75%) (Figure 2). As shown in Table 6, BMI tended to increase with increasing age in both 1991 and 2005. The mean BMIs for all age groups at both time points are consistent with the criteria for either overweight or obesity (Health Canada 2003). When stratified by sex, the mean BMIs for all age groups were classified as overweight or obese with the exception of males aged 18-34 years in 2005. The findings for females aged 18-34 years revealed that mean BMI values in both 1991 and 2005 were above the Canadian guidelines for overweight, however, all other age groups exceeded the guidelines for obesity.

Overall, the mean WC for females was 102.1 ± 12.5 cm and for males was 96.2 ± 13.0 cm. As shown in Figure 3, WC increased with increasing age for both males and female. The mean WC for all female age groups were above the recommended Canadian guidelines of 88 cm (Health Canada 2003) while the mean WC for all male age groups, with the exception of those aged 65+, were below the guidelines of 102 cm (Health

Canada 2003). These findings suggest a particularly increased health risk for adult women in this community, given their distribution of body fat.

Figure 2. Percentage of adults (aged 18+ years) classified as overweight/obese (OW/OB) and percentage of male and female adults classified as overweight/obese (OW/OB) in 1991 and 2005.



* Significantly different from 1991; $p < 0.05$

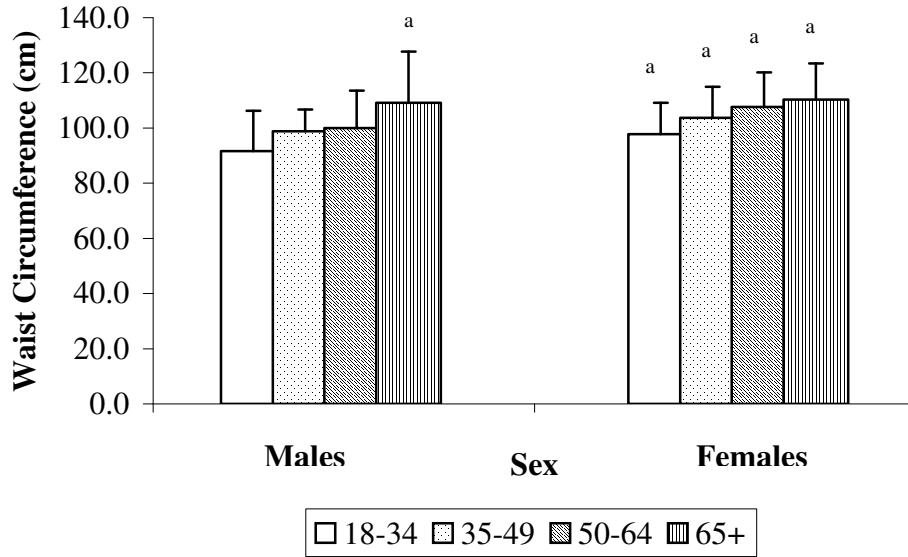
Table 4. Comparison of Body Mass Index (BMI; kg/m²) from 1991 to 2005 for male and female adults aged 18+ years.

Age Group	1991 (n=178)	2005 (n=208)	1991 (n=90)	2005 (n=78)	1991 (n=88)	2005 (n=130)
	Overall		Males		Females	
18-34 Years	n = 105 27.2 ± 4.3 ^a	n = 91 26.2 ± 5.0 ^a	n = 52 26.6 ± 3.3 ^a	n = 34 24.6 ± 5.2	n = 53 27.9 ± 5.1 ^a	n = 57 27.2 ± 4.7 ^a
35-49 Years	n = 48 30.2 ± 5.9 ^b	n = 74 29.9 ± 5.2 ^a	n = 23 30.1 ± 6.4 ^b	n = 25 28.7 ± 4.3 ^a	n = 25 30.3 ± 5.6 ^b	n = 49 30.6 ± 5.5 ^b
50-64 Years	n = 16 31.0 ± 4.5 ^b	n = 32 29.5 ± 5.4 ^a	n = 9 30.7 ± 3.9 ^b	n = 16 28.4 ± 5.6 ^a	n = 7 31.2 ± 5.6 ^b	n = 16 30.6 ± 5.2 ^b
65+ Years	n = 9 31.8 ± 4.8 ^b	n = 11 31.1 ± 6.5 ^b	n = 6 30.3 ± 3.8 ^b	n = 3 30.3 ± 6.8 ^b	n = 3 34.9 ± 6.1 ^b	n = 8 31.5 ± 6.8 ^b

^a denotes BMI classified as overweight

^b denotes BMI classified as obese

Figure 3. Mean waist circumference (cm) for males (n = 78) and females (n = 138) in each age group in 2005.



^a Denotes increased health risk associated with excess abdominal adiposity

4.1.3.3 Paired Data

A separate sub-analysis using the paired data from 77 individuals measured in both 1991 and 2005 revealed that of the 35 participants classified as normal weight in 1991, 48.6% remained normal weight, 42.9% became overweight and 8.6% became obese in 2005. Of the 23 participants classified as overweight in 1991, 52.2% remained overweight, 39.1% became obese while 8.7% were categorized as normal weight in 2005. Finally, of the 19 participants who were obese in 1991, 90% remained obese in 2005 and 10% were reclassified as overweight. Kappa test was estimated as 0.410 and indicated there was a significant change in the classification of BMI between two time points ($p < 0.001$).

4.1.4 Discussion

The results of this study revealed that there was a significant decrease in rates of overweight/obesity among adult males in the community, but no significant difference for youth or adult females over time. Although not significant, there is some indication that overweight/obesity has increased among the female youth, as reflected in the increased prevalence of overweight/obesity from 1991 to 2005. Although the prevalence of overweight/obesity among males decreased, there was relatively little change among females, which is not surprising given the high prevalence of overweight/obesity when measured initially. The findings also show that in the sub-sample of participants with paired data, there was a significant increase in BMI classification over time.

More specifically related to the younger population, it appears that the risk for unhealthy body weights is greater for females and may begin at an earlier age, compared to their male counterparts. This is concerning as Aboriginal ethnicity is an independent

predictor of gestational diabetes (GD) when it interacts with pre-pregnancy obesity (Dyck et al. 2002). Obesity increases the risk of developing GD (Inzucchi 1999), and a woman who has had GD is at a high risk of perpetuating the cycle by giving birth to an infant with a high propensity of becoming obese and developing T2DM at an early age (Inzucchi 1999; Dabelea and Pettitt 2001). In addition, women with GD have up to a 70% chance of developing T2DM later in life (Kim et al. 2002), with a 50% risk of developing T2DM within 5 years after delivery (Inzucchi 1999).

The prevalence rates among youth at both time points reported in this study are lower compared to other community-specific surveys involving Aboriginal youth (Trifonopoulos 1995; Katzmarzyk and Malina 1998; Hanley et al. 2000; Young et al. 2000). However, there is a similar trend in these studies and ours in that there is typically a greater proportion of females overweight and/or obese compared to their male counterparts. One exception is the data reported by Katzmarzyk and Malina (1998) where similar rates of obesity for males and females (28.6% and 29.4%, respectively) were reported. It should be noted that the reference data used to define overweight and obesity in these studies were based on the 85th and 95th percentiles from the National Health and Nutrition Examination Survey (NHANES) II and III but the classifications were not consistent across all studies. For example, some studies defined overweight as $\geq 85^{\text{th}}$ percentile (Trifonopoulos 1995; Hanley et al. 2000; Young et al. 2000) while Katzmarzyk and Malina (1998) used the same criteria to define obesity. Given the reference standards for defining overweight and obesity have varied between studies, direct comparisons between our study and those of others should be made with caution. What is important to note however, is that regardless of the reference standards used and

the communities or First Nations groups assessed (e.g. Mohawk, Oji-Cree, Woodland Cree), the findings of this study and others have reported a high proportion of children and youth with BMIs classified as overweight or obese, particularly among females.

These findings are important given that obesity is believed to track from childhood into adulthood (Serdula et al. 1993; Power et al. 1997). Furthermore, the duration of obesity is thought to increase the risk of developing T2DM (Everhart et al. 1992), thus increasing health risks as the Aboriginal population ages. In this regard, the findings from our serial data, which showed a significant increase in BMI classification over time, highlight the importance of continued surveillance and early intervention strategies. Decreasing rates of overweight and obesity would reduce the associated long-term health consequences within our First Nations communities.

Within the adult population, overweight and obesity continue to remain a special concern for females, particularly after the age of 35 where mean BMIs in all age groups were classified as obese. In Canada, there have been few studies assessing prevalence rates of overweight and obesity in the adult Aboriginal population. However, of those that have been published, Katzmarzyk and Malina (1998) reported the prevalence of obesity among Anisnabai Temagami First Nation males and females to be 51% and 60% respectively. Although these results are higher than our findings for both males and females at both time points, it should be noted that Katzmarzyk and Malina (1998) defined obesity as a BMI $\geq 27.8 \text{ kg/m}^2$ for males and $\geq 27.3 \text{ kg/m}^2$ for females, the criteria outlined in the 1988 Canadian Guidelines for Healthy Weights (Health and Welfare Canada 1988). Since our study used the current guidelines defining overweight as a BMI $\geq 25.0 \text{ kg/m}^2$ and obesity as $\geq 30.0 \text{ kg/m}^2$ for both males and females (Health

Canada 2003), this again limits direct comparison between studies. However, similar to the data reported among the youth, higher rates of obesity are demonstrated in both studies among Aboriginal females compared to males. Compared to our study, earlier data from six First Nations communities in northwestern Ontario and northeastern Manitoba also reported higher combined rates of overweight/obesity among both males (40-80%) and females (40-90%) ranging in age from 20 to 64 years (Young and Sevenhuysen 1989). The criteria used to classify overweight and obesity were similar to our study (i.e. overweight $\geq 26.0 \text{ kg/m}^2$ and obesity $\geq 30.0 \text{ kg/m}^2$).

While BMI is a practical method for measuring and classifying overweight and obesity, it does not measure pattern of body fatness which is a risk factor for disease, independent of level of obesity (Power et al. 1997). More specifically, abdominal fat distribution is associated with an increased risk of cardiovascular disease and T2DM (Snijder et al. 2006). In adults, waist circumference (WC) is commonly used to measure abdominal obesity (Power et al. 1997; Snijder et al. 2006) and thus health risk. Few studies have assessed WC among Canadian Aboriginal peoples for which comparisons to our data can be made. In Sandy Lake, similar results to our data for males (i.e. mean WC was below 102 cm) have been reported (Hanley et al. 2003). However, the data for females was somewhat different. Although both studies report mean WC greater than 88 cm, the mean WC for our data was over 10 cm higher than that reported by Hanley et al. (2003) ($102.1 \pm 12.5 \text{ cm}$ vs. $90.6 \pm 13.8 \text{ cm}$, respectively). While WC values were not reported by Young and Sevenhuysen (1989), the authors did report that the pattern of obesity was centrally located. Contrary to our findings, however, this was greater among males compared to females. Our results suggest that females in all adult age ranges (i.e.

18 years and older) are at an increased risk of developing health problems as the mean WC values were greater than the Canadian guidelines for women of 88 cm (Health Canada 2003). As WC increases with age, these results further highlight the health risks for women in this community and the need for intervention programs targeting unhealthy body weights.

Although there is limited Canadian data regarding the prevalence of overweight and obesity among First Nations groups, the results of this study support findings from previous studies which suggest that high levels of overweight and obesity exist in First Nations communities. While there was no significant increase in overweight/obesity over time using a cross-sectional sample in the community, the results from our paired data showed a significant difference in the number of individuals who had an increase in BMI classification. This findings of this study and other Canadian studies reporting high rates of overweight and obesity, particularly among Aboriginal females highlights the need for intervention strategies targeting unhealthy body weights. The results of this study and previous literature suggest that developing surveillance measures to document changes in age-specific prevalence rates of overweight and obesity among various First Nations groups may be warranted. Tracking changes in overweight and obesity may be particularly useful for determining the effectiveness of intervention programs promoting healthy body weights. In keeping with recently developed protocols and ethical guidelines for working with Aboriginal communities (American Academy of Pediatrics 2004; Canadian Institutes for Health Research et al. 2005), it will be important to ensure that such surveillance initiatives are wanted by the community and would be valuable in terms of health program planning and evaluation. It is also important to highlight that

continuing research programs be carried out using a participatory approach where communities are involved in all aspects of project design, implementation and dissemination and that all information collected is owned and managed by the community (Schnarch 2004). This approach may help to increase capacity in the community (Macaulay et al. 1998) so that future projects (e.g. continued surveillance, interventions focusing on healthy body weights) remain community-driven and controlled.

This study contributes new knowledge regarding overweight and obesity among Aboriginal people in Canada. One of the strengths of this study is the use of measured height, weight and waist circumference. Self-reported values tend to underestimate weight, particularly among heavier participants, while height tends to be over-estimated (Power et al. 1997). An additional strength is the follow up nature of the study. As limited surveillance data exist, this study is a first step in tracking overweight and obesity at the community level, with future research attempting to obtain measurement data from individuals participating in the previous studies.

The limitations to this study must also be acknowledged. The first is the cross-sectional nature of the study. As in many studies conducted within First Nations communities (Young and Sevenhuysen 1989; Katzmarzyk and Malina 1998; Potvin et al. 1999; Hanley et al. 2000), all eligible individuals in the community were invited to participate but many did not. Although this resulted in under sampling of males in the community, and therefore may limit the sample representativeness, it should be noted that the proportion of individuals in each age group in this study is reflective of the demographics of the eligible participants in the community (i.e. a greater proportion 18+ years of age). Second, although we did not assess changes in socioeconomic status over

time, and the most recent census data is not available, a crude comparison of the 1991 and 2001 census data showed an increase in median household income by approximately \$7000 (\$16,928 to \$23 915). Despite the increase, the median income is well below the provincial median (\$40,251) in 2001 and this may influence health-related determinants such as nutrition and physical activity that impact overweight and obesity as socioeconomic status has been shown to be inversely related to healthful lifestyles (Canadian Institute for Health Information 2004). Third, we encountered a limited ability to compare our results to other studies. In this study, we elected to use the cut-points for overweight and obesity derived by Cole et al. (Cole et al. 2000) for our youth sample, given the lack of accepted definition of obesity in the pediatric population (Cole et al. 2000), and because this approach is said to avoid arbitrarily choosing reference data (i.e. NHANES surveys) and cut off points for overweight and obesity (e.g. 85th and 95th percentiles respectively). Additionally, the cut-points derived by Cole and colleagues are based on a worldwide population, and correspond to the adult cut-off points of overweight and obesity, the latter allowing us to examine differences in BMI in our subsample over time. Of note, we did analyze our data using the BMI percentiles, and the proportion of individuals classified as overweight and obese were similar with both methods. Finally, while the Canadian Guidelines for Body Weight Classification in Adults (Health Canada 2003) are said to be appropriate for all racial/ethnic groups in Canada, further research is still required to determine if the cutoffs used for the general population are appropriate for Aboriginal populations (Douketis et al. 2005).

4.1.5 Conclusions

The findings from this study support previous literature showing high rates of overweight and obesity among Aboriginal peoples. Our findings also show that females, among both youth and adults, have higher rates of overweight/obesity compared to their male counterparts, which increases their risk of developing associated health problems. The high proportion of youth and females classified as overweight/obese highlights the need for intervention programs targeting these two sub-groups. While our cross-sectional data showed no significant increase in overweight/obesity over time, we did demonstrate a significant increase in BMI classification in the individuals measured in both 1991 and 2005. Since obesity tracks from childhood to adulthood, prevention programs targeting unhealthy body weights in Aboriginal communities should begin at a young age. Prior to developing such programs however, future research should be undertaken to gain an understanding of the local belief systems (Willows 2005) and practices regarding modifiable risk factors for overweight and obesity, such as physical activity and dietary practices.

CHAPTER 5
PROJECT 2A (PHYSICAL ACTIVITY)

5.1. Physical Activity Attitudes, Beliefs and Practices Among Women in a Woodland Cree Community

5.1.1 Introduction

Overweight, obesity and Type 2 diabetes mellitus (T2DM) have become prevalent in many Aboriginal⁵ populations over the last half century (Young et al. 2000), with a change in diet and levels of physical activity linked to this increase (Young et al. 1990). While obesity alone is a risk factor for developing T2DM, the risk increases when compounded by physical inactivity (American Diabetes Association et al. 1999). Physical activity is considered to be one of the cornerstones to treating T2DM, along with diet and medication, (Miller and Dunstan 2004), and the literature documents the efficacy of lifestyle modifications, which includes regular moderate physical activity, to delay or prevent T2DM in various populations (Pan et al. 1997; Tuomilehto et al. 2001; Diabetes Prevention Program Research Group 2002).

Despite the beneficial effects of physical activity for the prevention and treatment of T2DM, the literature supports the premise that a sedentary lifestyle is becoming increasingly prominent among various Aboriginal populations with nearly 80% not meeting the recommended amounts of physical activity (Stolarczyk et al. 1999; First Nations Center 2003). Further studies assessing physical activity have reported Aboriginal women being less active than men (Kriska et al. 2001), and that physical activity is no longer a priority for women (Thompson et al. 2002). While community-based diabetes prevention programs incorporating nutrition and physical activity

⁵ The terms 'Aboriginal' and 'Aboriginal peoples' do not describe a homogeneous group. However, for the purpose of this thesis the terms will be used to describe First Nations people (including individuals registered and not registered under the Indian Act), Métis and Inuit peoples, with the exception of the use of specific terms when discussing the results of research studies that have employed specific terms.

components have been successfully initiated in Aboriginal communities (Hanley et al. 1995; Macaulay et al. 1997; Daniel et al. 1999), their impact on increasing levels of physical activity have been less effective (Paradis et al. 2005; Saksvig et al. 2005). The lack of positive results have been attributed to a lack of training and reinforcement for the physical activity component in the school (Saksvig et al. 2005), as well as a decrease in physical education classes, less parental supervision of leisure activities and a perceived importance of computer literacy in the community (Paradis et al. 2005). However other factors such as sociocultural influences that may have influenced physical activity have yet to be reported from these interventions.

A recent review of the physical activity literature among Native Americans suggests that the social environment is an important correlate of physical activity in this population (Coble and Rhodes 2006). For example, social support from family members, friends and community members (Thompson et al. 2002; Eyler et al. 2003; First Nations Center 2003), as well as child care and support for household tasks (Thompson et al. 2002; Eyler et al. 2003) were reported to influence physical activity among Aboriginal women. In addition, Aboriginal women have also identified cultural norms as barriers to physical activity such as expected roles of being a homemaker (Eyler et al. 1998; Henderson and Ainsworth 2000; Thompson et al. 2002), physical activity as a low priority in the community (Thompson et al. 2003), and the fear of being ridiculed or shamed for breaking societal norms if they were to do something for themselves (Thompson et al. 2000; Thompson et al. 2002). Henderson and Ainsworth (2000) suggest that the way in which people act and live is shaped by the larger circumstances in which they find themselves. Therefore, attempting to understand if and why Aboriginal

women engage in physical activity and the social and cultural factors that enable or inhibit their physical activity may assist health practitioners in developing effective culturally-relevant education programs and interventions to be implemented for this population. The need for effective physical activity interventions for Aboriginal women is highlighted by the higher prevalence of obesity (Young and Sevenhuysen 1989; Katzmarzyk and Malina 1998) and lower levels of physical activity (Kriska et al. 2001) among this population. Therefore, the purposes of this study were: (1) To explore the physical activity attitudes and beliefs of Woodland Cree women living in a reserve community in northern Saskatchewan; and (2) To assess the current levels of physical activity among women in this community. This paper is part of a larger study which included exploring healthy body weight attitudes and beliefs and healthy eating attitudes, beliefs and practices among Woodland Cree women.

5.1.2 Methods

5.1.2.1 Consent

Approval for the community's participation was established prior to individual participant consent and was obtained from the local governance which included board members, health portfolio councilors, the health committee, community leaders and elders. The process of obtaining individual consent was approved by the health director and all details of the consent were done in collaboration and consultation with the health director and the community project worker to ensure appropriate language and content. Consent was also obtained from the participating University's Advisory Committee on Ethics in Behavioral Science Research (Appendix E, F, G and H)

5.1.2.2 The Community

The participating community was located approximately 140 km west of a larger center on the Manitoba border and 350 km northeast from a major Saskatchewan urban city. It is situated on a lake in northern Saskatchewan and is accessible by a gravel road 30 km off the main highway throughout the year. At the time of data collection, the majority of the community members were Woodland Cree and the population was estimated to be approximately 972 residents. Approximately 60% of the population was under the age of 25 years (mean age 23.1 ± 17.5 years).

5.1.2.3 Community Engagement

Prior to collecting the data, it was important that rapport and trust be established with members of the community as well as the individual participants. This was achieved by immersion of the researcher (BB) in the community and the day-to-day lives of the community members through regular visits of three to five days (approximately every 6-8 weeks) over the course of a year. The visits were facilitated through the health clinic which employed approximately 25 staff from the community and offered various health programs targeting all ages of the community. Involvement in the delivery of these weekly programs provided an opportunity for members of the community to become familiar with the researcher and thus began the process of developing rapport and trust. A community project worker was hired through the health clinic to provide a voice for the community and to assist with project organization which included participant recruitment, data collection, ensuring appropriate language of the consent forms and interview questions, as well as to provide translation if required.

5.1.2.4 Participants

The participants included Aboriginal women from four different age cohorts: 15-24 years, 25-39 years, 40-54 years and 55+ years. The first age group (15-24 years) was chosen to provide a voice for young women in the community, the 25-39 year age group represented women with young families and the third age group (40-54 years) was selected to capture the perspective from a different generational viewpoint. The fourth group (55+ years) provided the “elders” perspective and was seen as an integral component to this project, particularly as the change in the traditional hunter-gatherer lifestyle is believed to have occurred within the last half of the century (Young et al. 2000). The proportion of participants in each age group closely reflected that of the community. The women were recruited through programs offered through the health center which included a parenting group, wellness and dental clinics and home visits to potential participants, as well as the local high school.

5.1.2.5 Procedures

Quantitative and qualitative methods were used with both types of data collected concurrently. A sub-sample of participants who completed the physical activity survey also participated in qualitative interviews.

5.1.2.5.1 Qualitative methodology

A focused ethnography was used to explore the local attitudes and beliefs that Aboriginal women have regarding physical activity and healthy body weights. Particular attention was given to exploring these attitudes and beliefs in a social and cultural context, as well as how the physical environment influenced physical activity. A focused ethnography, also known as rapid ethnography, was chosen as it draws on research

techniques used in classical anthropologic ethnographies (i.e. in-depth interviews, participant observation) yet is problem-focused, content specific and time-limited (Muecke 1994). A classical ethnography typically involves prolonged observation of a group by the researcher who resides in the community and is immersed in the day-to day lives of the people (Creswell 1998), whereas a focused ethnography involves selected episodes of participant observation, combined with unstructured or semi-structured interviews (Muecke 1994). Focused ethnographies are becoming more common in health research given the limited budgets and fixed time schedules that often accompany health research, as well as the purpose of developing knowledge which can then be put into practice (Muecke 1994). This focused ethnography shared many of the basic characteristics of a classic ethnography. The data were collected in a specific locality (i.e. the community), interviews and participant observation were the primary sources of data collection and emphasis was placed on describing the participants perspective (Creswell 1998).

A stratified purposeful sampling approach was taken, using both opportunistic and snowball sampling (Creswell 1998). A total of 19 female participants from four age groups took part in the interviews; six aged 15-24 years, four aged 25-39 years, five aged 40-54 years and four over the age of 55 years. A community research assistant was present at all interviews to provide translation and clarification for the participants, as well as to provide interpretation, thus encouraging participants to use their “typical native language” (Spradley 1979). The interview sites were chosen by each participant and included either the participant’s home or the health center. Prior to all interviews, participants were provided with a clear explanation of the purpose of the project and

informed consent was obtained. In an effort to establish rapport and to learn a little bit about each participant, each interview began with general questions (e.g. How long have you lived in the community? Do you ever travel outside of the community? What do you enjoy the most about living in the community? What are some of the challenges of living in the community?). A semi-structured interview guide was used to elicit information regarding attitudes and beliefs about health (e.g. What do you think makes people healthy?), healthy bodies (e.g. What does a healthy body look like to you?), physical activity (e.g. Do you consider yourself to be physically active?) and healthy eating (e.g. What would you describe as 'healthy eating?') (Appendix I). The interviews typically lasted 45 minutes to one hour, were audiotaped with the permission of the participants and transcribed verbatim by the interviewer. The results reported in this paper are those related to physical activity.

Observational data were recorded during each community visit in the form of field notes (Creswell 2003), and included observing potential physical activity opportunities in the community and spontaneous physical activity in the community. The field notes were used to complement the data obtained from the interviews to provide a source of credibility (i.e. internal validity) and confirmability (i.e. objectivity) to increase the rigor of the findings (Guba 1981).

5.1.2.5.2 Qualitative data analysis

Data analysis proceeded concurrently with data collection and began by reviewing the field notes and interview transcripts. Transcribed interviews were analyzed through content analysis by identifying relevant topics and categories, as well as similarities and differences in the data (Wolcott 1994; Patton 2002). As one of the objectives was to

explore attitudes and beliefs from a trans-generational viewpoint, the data were then re-grouped and examined by age group once all the interviews were completed. The field notes, which included direct observations, were used to triangulate the data by providing a source of data to validate and cross-check the findings of the interviews (Patton 2002). Similar to the interview data, the field notes were analyzed by sorting the data based on topics (e.g. physical activity) and then organized into relevant categories (e.g. barriers to physical activity, etc). Standard procedures for establishing trustworthiness were applied (Lincoln and Guba 1985) and included member checks of the transcribed data to determine accuracy, and establishing an audit trail. The audit trail included all raw data (audiotapes of the interviews, transcripts with notes and field notes), data reduction and analysis notes and instrument information (interview questions, schedules, etc).

5.1.2.5.3 Quantitative Methodology

A total of 58 participants (mean age 27.2 ± 14.2 years) from the four age groups (15-24, 25-39, 40-54 and 55+ years) completed the Modifiable Activity Questionnaire (MAQ) (Kriska 2000), an interviewer-administered physical activity questionnaire designed to assess past year leisure-time and occupational activity (Appendix J). The MAQ was pilot tested on women in the community from each age group and was modified with input from the community researcher assistant to ensure the leisure-time and occupational activities correctly represented those of this population and geographic location.

The questionnaire was comprised of two sections. The leisure section of the questionnaire instructed participants to identify all activities they engaged in more than ten times in the past year from a list of common activities in the local and surrounding

area and to record any additional activities that were not provided on the list. For each activity identified, the participants were asked to average the number of times per month they participated in the activity, the average number of minutes for each session and to indicate if the intensity was light (light change from normal breathing), medium (above normal breathing), or heavy (heavy breathing). To determine physical activity from occupational activities, participants were asked to list all jobs they had over the past year for at least one month. For each job entry, participants were instructed to report the time spent walking or cycling to work per day, their average job schedule (number of months per year, days per week and hours per day), the number of hours spent sitting at work, as well as to indicate from a list the most common physical activities performed when not sitting.

Estimates of leisure-time and occupational activity were calculated separately as hours per week (h/wk) averaged over the past year. Each activity was weighted by its relative estimated metabolic cost, deriving metabolic equivalent hours per week (MET h/wk). For example, 1 MET represents the energy expenditure for an individual at rest, brisk walking is estimated to be 3.5-4 METS and jogging/running are estimated to be 7 METS and higher (Ainsworth et al. 2000). In keeping with previous literature (Kriska et al. 2003) only those leisure time activities that demanded an energy expenditure greater than that required by activities of daily living (i.e. > 2.0 METS) and only those occupational physical activities that were categorized by the participants as moderate and hard were included in the analysis.

5.1.2.5.4 Quantitative Analysis

The physical activity data were analyzed using SPSS (v. 14.0). The most common types of leisure-time activities were presented as the percentage of participants participating in each activity over the past year. Estimates of leisure, occupational and total physical activity (median, [25%, 75%]) were determined for the sample overall, as well as by age group (15-24 years, 25-39 years, 40-54 years, 55+ years). The Kruskal-Wallis test was used to assess differences between age groups and the Wilcoxon Signed Ranks Test was used to test for differences within age groups. Level of significance was set at $p < 0.05$. To determine the percentage of participants in each age group with high and low activity levels, physical activity was categorized into two groups with a cutoff of 16 MET hours per week, which is approximately equal to a 30 minute brisk walk daily (Kriska et al. 2003).

5.1.3 Results

5.1.3.1 Physical Activity Attitudes and Beliefs

5.1.3.1.1 Demographics

The women ($n = 19$) who consented to the interviews ranged in age from 15-69 years (mean age 37.6 ± 16.9 years) and were a diverse group. Overall, seven participants were employed full-time, four had part-time employment, five did not work outside of their home and three were students. Nine of the participants were married or common-law, three were divorced or separated, two were widowed and five were single. Two participants aged 55+ lived alone and all other participants lived with others, which included spouse/common-law partner, members of their extended family (e.g. grandparents, aunts, cousins), their children or their parents. The majority of the

participants (> 80%) reported living in the community their entire life. The three most common reasons identified for traveling outside of the community were to purchase groceries (approximately every two to three weeks), to attend medical appointments and to visit family in nearby communities.

5.1.3.1.2 Physical Activity in the Community

In this study, physical activity (PA) was defined broadly as the range of activities that moves your body, similar to that described by Casperson (Casperson et al. 1985). Thus, this definition encompassed sports, exercise, household and occupational activities as well as other daily and leisure activities. The participants, regardless of age, described a wide variety of physical activities that women could do in the community which included team sporting activities (i.e. broomball, volleyball, hockey, baseball), individual sport-related activities (i.e. walking, running, skating, skiing), traditional activities (i.e. berry picking, fishing, canoeing), as well as home-related activities (i.e. housework, cooking, looking after the children, shoveling snow, hauling wood). Despite the definition of PA provided, boating and bingo were described as physical activities available to women in the community, particularly among those aged 25-39 and 40-54 years.

5.1.3.1.3 Perceptions of Physical Activity

The majority of the women identified PA as an important component for good health, however the participants perception of PA extended beyond health. For example, participants in the youngest age group commented that PA was fun, while women aged 25-54 described the psychosocial benefits to being active (e.g. to meet people, get fresh air, feel better about yourself, get your mind off things, have fun with your grandkids),

and participants in the oldest age group generally described PA as a way to “be busy” and “not to be lazy”. Regardless of age, all participants believed PA promoted good health. Only two participants (aged 40-54 years) reported a lack of PA as a health concern in the community, and this was related to being overweight and having Type 2 diabetes and high blood pressure.

When asked to provide perceptions of their own level of PA and to identify examples of their PA, all participants in the youngest age group (15-24 years) believed they were physically active, however their personal perceptions of what constituted PA varied. Half the participants identified various sports such as volleyball, baseball and swimming as PA, whereas others described home-related activities such as cooking, “cleaning up” and shoveling, as well as “walking a lot in the house”. Many women in the two older age groups (25-39 and 40-54 years) felt they were either not active, or ‘not active enough’ with most activity described as home-related such as “cleaning the house”, “taking care of the kids”, as well as “walking around work”. Only one participant in the 25-39 year age group described callisthenic-type of activities such as push-ups, crunches and leg lifts in addition to housework and walking. Most elders felt they did some PA and generally described traditional-types of PA such as smoking meat, hauling wood, sewing and beading, commercial fishing and berry picking, in addition to walking.

5.1.3.1.4 Barriers to Physical Activity

Despite the belief that PA was important, several barriers were identified by the participants as reasons for not being active (Table 7). Many barriers were similar

between age groups, and were related to personal, community-specific and environmental factors.

Table 5. Sociocultural and physical environmental influences on physical activity.

Environmental Influences on Physical Activity	
Sociocultural	Physical
<i>Barriers</i>	<i>Barriers</i>
Family responsibilities	Inclement weather
Lack of time	Safety
Too tired	
Lack of opportunities	
Lack of encouragement for women	
<i>Enablers</i>	<i>Enablers</i>
None identified	Scenery
	Size of the community

Personal barriers identified by all but the oldest age group included lack of time, being too tired, and childcare responsibilities. All age groups identified laziness as a barrier to PA and was described by two participants as a personal barrier to engaging in more structured types of physical activity (e.g. regular walking program). Community specific barriers were also similar among participants aged 15-54 and included a lack of childcare, a lack of encouragement and opportunities for women to be active, and a lack of organized physical activities. Environmental barriers such as cold weather and personal safety (including safety from animals such as wolves and bears) were common among all age groups. Most women commented they were more active in the summer

compared to the winter, mainly due to environmental factors. Although some of the barriers to PA outlined were associated with social factors (i.e. taking care of the kids, lack of encouragement and opportunities for women), few cultural factors were cited as influencing PA among women by any of the age groups. Some women in the two older age groups suggested that PA levels have changed over time because of a decrease in hunting and trapping. In addition, the increase in modern conveniences has resulted in less physical work such as chopping and hauling wood, however many of these factors were in reference to the community as a whole and not specific to women.

Participants were asked to identify enablers to PA related to the community and their family life. Only two participants (one each in the 15-24 and 25-39 year age groups) provided examples, however these were both community-specific and included nice scenery and the small size of the community being conducive to walking anywhere. All other participants restated the barriers identified previously.

5.1.3.1.5 Physical Activity Preferences

Participants were asked to provide ideas on how to help women in the community become more physically active. Participants in all age groups identified the need for “women only” PA programs which could be age-specific or open to all ages. It was also suggested that community-wide PA programs such as team sports (i.e. volleyball, hockey, baseball, broomball) as well as activities that could be done as an individual or group (i.e. walking/jogging club, badminton, yoga, canoeing, hiking, swimming, skating, skiing and curling) would be important for increasing PA in the community. Further, women in the two younger age groups added that if activities were organized, people

would participate. Finally, participants from all but the oldest age group also identified that all programs should provide access to childcare.

5.1.3.2 Physical Activity Practices

5.1.3.1.1 Leisure-time Physical Activity

A total of 58 participants between the ages of 15 and 69 years (mean age 27.2 ± 14.2 years) completed the physical activity questionnaire. The most frequently reported leisure-time activities (performed at least ten times in the past year) among all participants included walking (84.5%), housework (58.6%), volleyball, (50%), running (41.4%), dance (36.2%) and basketball (29.3%) (Table 8 and Appendix K). While there were some similarities between the age groups, the younger age groups tended to report more sport-related activities (i.e. volleyball, basketball) while women in older age groups reported more traditional activities (i.e. berry picking, fishing).

Table 6. Most commonly reported activities in order of frequency by each age group over the past year.

Overall N = 58	15-24 yrs n = 34	25-39 yrs n = 12	40-54 yrs n = 8	55+ yrs n = 4
Walking	Walking	Walking	Walking	Housework
Housework	Volleyball	Housework	Housework	Walking
Volleyball	Running	Yard work	Yard work *	Berry Picking *
Running	Basketball	Dance	Shoveling*	Shoveling*
Dance	Housework	Shoveling	Canoeing*	Summer fishing*
			Dance*	Hauling wood*

* Indicates activities reported at the same frequency

When all leisure-time physical activities (LTPA) were included, the youngest age group had the highest levels of LTPA and those aged 40-54 years had the lowest overall levels (Table 9). To more accurately reflect LTPA, and because the PA demands associated with house-related activities (i.e. cooking and housework) are believed to be difficult to quantify (Kriska et al. 2001), the data were analyzed both with and without these items. The data showed a significant decrease in LTPA levels in all but the 55+ age group when house-related activities were removed, with lowest LTPA levels among those aged 25-39 (Table 9). Although walking was the most frequently reported activity among women in this community, previous literature suggests that recalling an activity that is done out of necessity (i.e. for transportation) is likely more difficult to recall than an activity that is done once or twice per week (Kriska et al. 1990). The potential difficulty with recall limits accurate assessment and therefore the data were also analyzed both with and without the inclusion of walking, as suggested by Kriska et al. (1990). When only walking was removed from analysis, LTPA levels decreased significantly in all but the oldest age group, with lowest LTPA levels reported among participants aged 15-24 years (Table 9). When both leisure walking and home-related activities were removed, LTPA levels decreased significantly in all the but the 55+ age group, with lowest LTPA levels observed in the 25-39 year age group (Table 9). There was no significant difference between age groups and levels of LTPA when all activities were included in the analysis ($p = 0.86$) or when home-related ($p = 0.86$), walking ($p = 0.85$), or both ($p = 0.81$) were excluded from the analysis.

Table 7. Median leisure-time physical activity levels (MET hr/wk, 25th and 75th percentiles) overall and for each age group.

Age Group	Median MET hr/wk Total (25%,75%)	Median MET hr/wk NH(25%,75%)	Median MET hr/wk NW (25%, 75%)	Median MET hr/wk NHW (25%,75%)
Overall (N = 58)	33.8 (14.4, 57.0)	21.9 ‡ (9.5, 54.9)	21.4 ‡ (9.6, 44.6)	10.0 ‡ (3.6, 38.1)
15-24 years (n = 34)	39.0 (14.4, 62.0)	25.0 ‡ (11.0, 56.7)	17.6 ‡ (9.0, 48.8)	9.8 ‡ (5.0, 41.8)
25-39 years (n = 12)	34.4 (14.8, 59.2)	13.9 † (7.6, 54.7)	21.4 † (12.9, 57.0)	8.0 † (0.9, 51.3)
40-54 years (n = 8)	29.3 (9.8, 44.6)	17.1 * (9.7, 37.1)	27.0 * (9.2, 37.1)	15.7 * (4.1, 33.4)
55+ years (n = 4)	35.6 (16.2, 97.2)	25.1 (7.9, 62.6)	26.0 (14.0, 94.3)	15.0 (5.0, 60.4)

NH = Total leisure MET hr/wk without house-related activities (cooking and housework)

NW = Total leisure MET hr/wk without walking

NHW = Total leisure MET hr/wk without house-related activities or walking

Denotes significantly different from Total Median MET hr/wk: * p<0.05, † p<0.01, ‡ p<0.001

Table 10 illustrates the contribution of house-related activities, walking and traditional activities (e.g. Aboriginal dance, berry picking, canoeing, fishing, hunting, paddling, setting snares, chopping and hauling wood) to overall LTPA in all age groups. There were no significant differences between age groups for walking ($p = 0.67$) or house-related activities ($p = 0.07$), however there was a significant difference between age groups for traditional activities ($p < 0.001$).

5.1.3.1.2 Occupational Physical Activity

Total occupational PA per week was estimated over the past year and the results indicated that the contribution of energy expenditure from moderate and hard activities was nearly non-existent for many of the participants as median values for all age groups were 0 MET hr/wk. Further analysis revealed that nearly 80% of the participants classified their occupational PA as light. This included jobs such as being a homemaker, receptionist, community health developer, or a student.

5.1.3.1.3 Total Physical Activity

When all LTPA and occupational PA were included, the results were similar to those for LTPA in that PA levels were lowest among those in the 40-45 year age range and highest in the youngest age group (Table 11). When home-related activities and/or walking were removed from the analysis, PA levels decreased significantly in all but the oldest age group with the lowest PA levels in the 25-39 year age group. Similar to leisure activities, there were no significant differences between age groups and levels of PA for total PA levels ($p = 0.77$) or when home-related ($p = 0.48$), walking ($p = 0.96$), or both ($p = 0.63$) were excluded from the analysis.

Table 8. Contribution of walking, house-related activities and traditional activities to total leisure-time physical activity levels (MET hr/wk, 25th and 75th percentiles) overall and for each age group.

Age Group	Total Activity Median MET hr/wk (25%,75%)	House-related activities Median MET hr/wk (25%,75%)	Walking Median MET hr/wk (25%, 75%)	Traditional Activities Median MET hr/wk (25%,75%)
Overall (N = 58)	33.8 (14.4, 57.0)	4.1 (0, 10.4)	5.6 (0.4, 12.5)	0 (0, 0.8)
15-24 years (n = 34)	39.0 (14.4, 62.0)	0 (0, 8.7)	7.6 (0.3, 23.6)	0 (0, 0)
25-39 years (n = 12)	34.4 (14.8, 59.2)	9.5 (0.9, 23.8)	5.5 (1.2, 13.3)	0 (0, 0)
40-54 years (n = 8)	29.3 (9.8, 44.6)	1.6 (0, 17.3)	3.7 (0.6, 7.6)	3.7 (0, 8.0)
55+ years (n = 4)	35.6 (16.2, 97.2)	13.0 (5.0, 35.5)	4.3 (0, 10.8)	15.0‡ (4.3, 59.9)

‡ Denotes significantly different between age groups (p<0.001)

Table 9. Median total (leisure and occupational) physical activity levels (MET hr/wk, 25th and 75th Percentiles) overall and for each age group

Age Group	Median MET hr/wk Total (25%,75%)	Median MET hr/wk NH(25%,75%)	Median MET hr/wk NW (25%, 75%)	Median MET hr/wk NHW (25%,75%)
Overall (N = 58)	37.7 (20.1, 81.8)	27.2 ‡ (12.0, 76.1)	25.7 ‡ (12.5, 64.8)	17.6 ‡ (6.0, 58.5)
15-24 years (n = 34)	44.1 (25.3, 91.7)	39.0 ‡ (16.2, 84.8)	25.9 ‡ (11.4, 67.5)	22.8 ‡ (7.5, 59.4)
25-39 years (n = 12)	36.6 (14.8, 79.9)	18.4 † (7.6, 79.9)	21.4 † (12.9, 78.8)	8.0 † (0.9, 78.7)
40-54 years (n = 8)	30.5 (13.9, 44.6)	24.4 * (10.0, 37.7)	28.4 * (13.1, 37.1)	22.1 * (4.1, 34.8)
55+ years (n = 4)	35.6 (16.2, 97.2)	25.1 (7.9, 62.6)	26.0 (14.0, 94.3)	15.0 (5.0, 60.4)

NH = Total MET hr/wk without house-related activities (cooking and housecleaning)

NW = Total MET hr/wk without walking

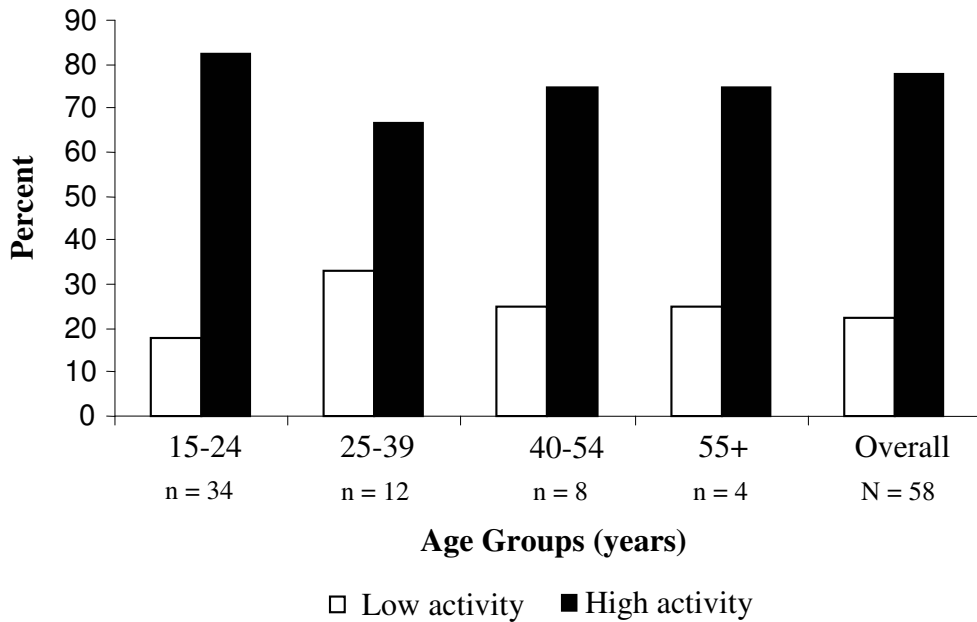
NHW = Total MET hr/wk without house-related activities or walking

Denotes significantly different from Total Median MET hr/wk: * p<0.05, † p<0.01,

‡ p<0.001

When categorized into low and high activity, total activity levels for the majority of participants were classified as high (Figure 4), regardless of whether walking or house-related activities were removed. When house-related activities were removed, half the participants aged 25-39 years had low activity levels while all other age groups remained essentially the same. When both walking and house-related activities were removed, over two-thirds of those aged 25-39 years had low activity levels, whereas the proportion of participants with high activity levels in the other age groups ranged from 50-63%.

Figure 4. Percentage of individuals with low and high total (leisure and occupational) activity levels.



Low total activity = < 16 MET hr/wk
 High total activity = >16 MET hr/wk

5.1.4 Discussion

The in-depth interviews conducted with a diverse group of women in the community revealed some differences between age groups, however many attitudes and beliefs were similar among all participants. While all participants believed that PA was important for health, many women, particularly those between the ages of 25 and 54 years, felt they did not engage in enough PA and perceived themselves to be in poor health, primarily the result of not engaging in health promoting behaviors such as being active. This finding is likely linked to the constraints identified by the participants regarding PA. For example, several barriers were provided as reasons why women in the community were not physically active. Of these barriers, those related to childcare responsibilities, such as the lack of personal time to engage in PA, as well as the lack of child care available in the community were the most salient. Similar findings have been reported among Aboriginal women in the literature previously where family responsibilities and difficulty in balancing multiple roles related to being a homemaker and parent prevented American Indian women from participating in more physical activities (Eyler et al. 1998; Thompson et al. 2002). While other barriers to PA such as being too tired, personal safety and inclement weather have also been consistently reported in the literature in the general population (Trost et al. 2002), as well as among Aboriginal women (Eyler et al. 1998; Heesch et al. 2000; Thompson et al. 2002), the participants in this study also identified a lack of regularly organized activities as a barrier. While barriers to PA remain a challenge to address, particularly personal barriers, it may be more realistic to address some of the community-specific barriers identified, such as lack of childcare, lack of opportunity and lack of organized activities.

Many of the community-specific barriers have the potential to be reduced through the design of future PA programs that provide childcare services and are offered regularly throughout the year. Several women in the study also identified the need for 'women only' PA programs. Therefore weekly group-based activities that provide a source of social interaction such as volleyball and broomball, popular activities reported among the participants in both the interviews and activity questionnaires, may subsequently result in reducing some of the personal barriers (i.e. lack of time, too tired, etc.) by providing sources of both fellowship and fitness. As many women in this age group (i.e. 25-54 years) have young children, their participation in regular PA may have a positive influence on the younger generations in the community.

Given the barriers to PA identified, it was not surprising that the majority of women over the age of 25 perceived they were not active. What is of interest however, was that the qualitative findings were not always supported by the quantitative results. For example, the participants interviewed highlighted laziness as a reason for not being active, yet the PA questionnaire data suggested rather high median MET values for total leisure-time physical activity. The contradictory findings may be related to the participants perceptions of physical activity. Although nearly all participants reported housework as a type of physical activity (an option provided on the questionnaire) which would increase the values for energy expenditure (i.e. MET values), it is possible that the perception of laziness among the participants may be in reference to leisure-time activities that are not required to be done on a daily basis and out of necessity. For example, two participants described that they were 'too lazy' to engage in a regular walking program.

It is also of interest that the findings from this study, with the exception of those aged 25-39 years, are inconsistent with much of the literature reporting low PA levels among the Aboriginal population in general (Stolarczyk et al. 1999; First Nations Center 2003) and particularly among Aboriginal women (Kriska et al. 2001; Kriska et al. 2003). This may also be explained by the type of activities reported. As mentioned, many of the women, particularly in the two oldest age groups, reported physical activities consisting mainly of domestic responsibilities such as housework and cooking. Although median MET values decreased in all age groups when these activities were removed, the data would suggest a large proportion of participants would still have PA levels associated with health benefits (i.e. > 16 MET hr/wk). Although encouraging, these results should be interpreted with caution. It should be highlighted that the MET values reported are absolute values and do not take into account individual differences (e.g. body weight) that may alter the energy expenditure for a given activity (Ainsworth et al. 2000). Furthermore, the MET values are based on actual movement (i.e. actual time spent doing the activity) and also do not provide precise energy costs (Ainsworth et al. 2000). In addition, further examination of the data revealed that the majority of participants reported house-related activities as light intensity. Current public health recommendations suggest that moderate-intensity physical activity which “noticeably accelerates the heart rate” in addition to “routine activities of daily living” is required to promote and maintain health (Haskell et al. 2007). The intensity with which household activities are performed is a key component to consider as some literature does suggest that household activities (e.g. sweeping, window cleaning, vacuuming) may confer health benefits if performed at a sufficient intensity (i.e. > 3.0 METs) (Lawlor et al. 2002;

Brooks et al. 2004). While these findings may be particularly encouraging for women with young families who find it challenging to engage in more structured forms of PA due to family responsibilities, the results from this study suggest that although the duration and frequency with which domestic activities were performed contributed to total energy expenditure, it is less likely they are contributing to overall health benefits given the low intensity with which they were performed.

The significant decreases in activity levels when both walking and house-related were removed suggests that a large portion of PA is achieved by these activities, a finding similar to previous research (Ainsworth et al. 1999; Kriska et al. 2001) . The data further suggest walking and house-related activities comprise a large portion of PA for women aged 25-39 years, given the increase in the proportion of participants in this age group classified with low activity levels when these activities were excluded. Although house-related activities may contribute to overall levels of PA and have the potential to provide health-related benefits if performed at a sufficient intensity, the barriers identified by the participants (i.e. lack of child care, lack of encouragement and opportunities for women) suggest that house-related activities serving as the primary type of PA may be more a function of social factors rather than a lack of interest or desire to participate in other forms of leisure-time physical activities. Many of the participants highlighted the psychosocial benefits of being active, such as meeting new people, feeling better about yourself, getting fresh air, etc. Although this was not fully explored, household activities are typically done alone, indoors and may not necessarily be enjoyable when performed out of necessity. This further highlights the importance of providing physical activity opportunities that are enjoyable, provide a source of social interaction as well as

contribute to health benefits. Given the decrease in overall activity reported among women aged 25-39 when house-related activities are removed, this particular age group may be an ideal sub-population to target initial PA programs in the community. The potential of a targeted approach may be successful given the participants indicated that organized, age-specific, women-only programs would be one way of increasing levels of PA among women in the community who are less active.

While this study adds new knowledge to the literature on understanding factors that influence PA, as well as attitudes and beliefs regarding PA among Aboriginal women, there are both strengths and limitations to the study. One of the strengths of this study is inclusion of both qualitative and quantitative data. This mixed methods approach makes it possible to link the different types of data to provide a more holistic picture of PA among women in the community. For example, the quantitative data provides insight regarding the type and frequency of PA, whereas the qualitative data enables the ability to begin to understand the factors that contribute to their participation (or lack of) in PA. Because PA is a complex behaviour, the benefits of linking quantitative data to qualitative data not only affords the ability to validate the quantitative results, but also provides the opportunity for a more in depth understanding of PA practices and the factors that enable and inhibit this behaviour. Second, the use of the Modifiable Activity Questionnaire (MAQ), which has been found to be reliable and valid for assessing PA levels in adults and adolescents over the age of 15years (Kriska et al. 1990; Aaron et al. 1995), is also a strength of this study. The MAQ is said to overcome many of the problems encountered previously in measuring PA in ethnic populations, including Aboriginal peoples (Kriska et al. 1990). These include the contributions of different

types of activities (i.e. leisure and occupational), variability in interpretations of words (i.e. 'leisure', 'physical activity', or 'exercise'), and interpretations of intensity levels of various activities (Kriska 2000). Finally, there has been little literature that uses qualitative methods to attempt to identify and understand the various factors that affect levels of PA among Aboriginal women in Canada. While there are strengths and weaknesses to each method, the addition of a qualitative approach, as highlighted previously, provides a more in-depth understanding of why people behave the way they do and thus provides a more complete picture. Therefore, the knowledge gained from using a mixed methods approach, such as the one in this study, can be used as a template to better inform and tailor effective culturally appropriate PA programs and interventions for Aboriginal women.

In addition to the strengths of this study, there are some limitations which must be acknowledged. First, the self-reported recall of the PA data, as well as the time-frame of the recall required (i.e. one year), may have resulted in either under-reporting or over-reporting of PA. Therefore, assessing PA multiple times over a year may provide a more accurate picture of PA levels and patterns. In addition, the Compendium of Physical Activities (Ainsworth et al. 2000) from which the MET intensities were derived does not take into account individual differences (e.g. age, body weight, cardiorespiratory fitness, etc) and therefore the MET values may be over- or under-estimated. It is important to recognize however, that the compendium was developed to facilitate the coding of physical activities and to compare across studies and therefore the findings of this study can be compared to future research using the compendium to derive MET values on similar populations. Third, given this study used convenience sampling, the findings may

not represent the PA levels of Aboriginal women living in other regions, however a recent review of physical activity patterns of Aboriginal people in Canada reports findings similar to this study in that women tend to engage in activities that are generally lower in intensity such as walking, childcare and housework (Young and Katzmarzyk 2007).

5.1.5 Conclusions

The findings of this study suggest that while the majority of women are attaining MET values associated with health benefits, much of the activity is in the form of domestic responsibilities and was reported as low intensity. The low levels of leisure-time physical activity among women aged 25-39 years make this sub-population an ideal group to target for a physical activity intervention. Health promotion programs that focus on reducing identified barriers to physical activity, specifically those related to childcare and lack of organized activities, may help to increase physical activity levels among those less active in the community. Designing physical activity programs based on the preferences of women in the community may also provide an incentive to engage in other types of activities in addition to house-related activities, which are often performed out of necessity. Finally, improving the physical activity levels among women in the community not only has the potential for positive health outcomes for the women participating, but their involvement may have a valuable influence on other members of the family, particularly their children, by fostering the importance of a physically active lifestyle.

CHAPTER 6
PROJECT 2B (NUTRITION)

6.1 Nutrition Attitudes, Beliefs and Practices Among Women in a Woodland Cree Community

6.1.1 Introduction

Over the past few decades, there has been an increase in prevalence rates of obesity and Type 2 diabetes mellitus (T2DM) observed in the Aboriginal⁶ population (Young and Sevenhuysen 1989; Katzmarzyk and Malina 1998; Potvin et al. 1999; Young et al. 2000). The rise of both obesity and T2DM is believed to be an interaction between genetics and the environment, namely changes in levels of physical activity and dietary intake (Young et al. 2000). While there is some evidence to suggest that a sedentary lifestyle is becoming increasingly prominent among various Aboriginal populations (Stolarczyk et al. 1999; First Nations Center 2003), other research suggests that there has also been a shift in dietary intake from ‘traditional’ foods to a more ‘westernized’ diet (Kuhnlein and Receveur 1996; Whiting and Mackenzie 1998) which has resulted in health problems such as obesity and T2DM (Kuhnlein and Receveur 1996).

Much of the research focusing on nutrition among Aboriginal peoples in Canada has been limited, as most studies have focused on Arctic Indigenous peoples (Kuhnlein et al. 2004), and within Dene and Métis communities in the Northwest Territories and Yukon (Receveur et al. 1997; Batal et al. 2005). While these studies have provided important information on food use and dietary patterns in these geographic areas, there is a lack of literature specifically examining if similar patterns are occurring within other Aboriginal groups in Canada. There is also a gap in the literature exploring the reasons for these changes from the perspective of Aboriginal peoples. A recent review by

⁶ The terms ‘Aboriginal’ and ‘Aboriginal peoples’ do not describe a homogeneous group. However, for the purpose of this thesis the terms will be used to describe First Nations people (including individuals registered and not registered under the Indian Act), Métis and Inuit peoples, with the exception of the use of specific terms when discussing the results of research studies that have employed specific terms

Willows (2005) suggests that factors such as food insecurity (the inability to obtain nutritionally adequate and safe foods), modifications to the physical environment (e.g. deforestation, climate change and contamination) and individual choice have all been associated with the changing patterns for diet intake among Aboriginal peoples.

However, a better understanding of the social, cultural, behavioral and environmental factors influencing the diet of Aboriginal peoples is required if effective culturally-relevant education and program interventions are to be implemented. Given this, the purpose of this study was to explore the attitudes and beliefs that women living in a Woodland Cree reserve community in northern Saskatchewan have regarding healthy eating⁷, and to assess their current dietary practices. This paper is part of a larger study investigating healthy body weight attitudes and beliefs as well as physical activity attitudes, beliefs and practices among Woodland Cree women.

6.1.2 Methods

6.1.2.1 Research Approach, Obtaining Consent and Community Engagement

In the past, research in Aboriginal communities has been likened to a “helicopter approach” where investigators arrive in a community, collect their data, and publish their findings with minimal interaction among members of the community (Smylie et al. 2004). The result of this ‘style’ of research in Aboriginal communities was a distrust and resistance to involvement in other research projects because of a lack of community control and local benefits, and interpretation of the data in isolation of the social context (Henderson et al. 2002). More recently, ethical guidelines for working *with* Aboriginal communities have been developed which suggest initial and continual consultation with

⁷ “Healthy eating” refers to eating practices and behaviors associated with improving, maintaining and/or enhancing health. Power, E. (2005). "Determinants of healthy eating among low-income Canadians." *Canadian Journal of Public Health* **96**: S37-S42.

the community, obtaining informed consent from community leaders prior to obtaining it from individuals and directly involving community members in conducting the research (American Academy of Pediatrics 2004; Canadian Institutes for Health Research et al. 2005). The need to examine the issue of obesity was identified by the community thus this project began by collaborating with the health services organization representing the Band and the health director in the community, as well as engaging members of the community through exploratory meetings.

Informed consent for the project was obtained from the local governance, which included board members, health portfolio councilors, the health committee, community leaders and elders. Approval for the community's participation was established prior to any form of individual participant consent. The process of obtaining individual consent was approved by the health director and all details of the consent were done in collaboration and consultation with the health director and the community project worker to ensure appropriate language and content. Approval was also obtained from the participating University's Advisory Committee on Ethics in Behavioral Science Research (Appendices E, F, G, H).

A community project worker was hired to help develop and plan the research project and assist with data collection and project organization. Regularly scheduled visits, facilitated through the health center, were made by the researcher (BB) to establish rapport and trust with employees at the health center and members of the community. At the time this study was conducted, the community health center employed approximately 25 staff from the community and offered various health programs targeting all ages of the community. Involvement in the delivery of these weekly programs provided an

opportunity for the researcher to become familiar to members of the community and thus began the process of developing rapport and trust.

The participating community is situated on a lake in northern Saskatchewan, located approximately 140 km west of a larger center and 350 km northeast from a major urban city, and is accessible by a gravel road 30 km off the main highway throughout the year. At the time of data collection, the population was estimated to be approximately 972 residents, the majority of which were Woodland Cree. The average age of the community was 23.1 ± 17.5 years with 60% of the population under the age of 25 years.

6.1.2.2 Participants

Aboriginal women from four different age cohorts (15-24 years, 25-39 years, 40-54 years and 55+ years) participated in the study. The first age group (15-24 years) was chosen to provide a voice for young women in the community while the 25-39 year age group was selected to represent women with young families. The third age group (40-54 years) captured the perspective from a different generational viewpoint, and the fourth group (55+ years) provided the “elders” perspective and was seen as an integral component to this project, particularly as the change in the traditional hunter-gatherer lifestyle is believed to have occurred within the last half of the century (Young et al. 2000). The proportion of participants in each age group closely reflected that of the community. The women were recruited through programs offered through the health center which included a parenting group, wellness and dental clinics and home visits to potential participants, as well as the local high school.

6.1.2.3 Procedures

Quantitative and qualitative methods were used in this study and the data were collected concurrently. A sub-sample of participants who completed the nutrition survey also participated in qualitative interviews.

6.1.2.3.1 Quantitative methodology

A total of 39 participants aged 15-69 years (mean age 33.3 ± 15 years) completed the dietary assessment. The 24-hour recall method was used to measure food intake, given it has a low respondent burden (Trifonopoulos et al. 1998), is an easy, inexpensive tool to collect detailed information on specific foods, and has previously been used in the Aboriginal population (Trifonopoulos et al. 1998; Garriguet 2008). This interviewer administered questionnaire asks respondents to recall in detail all the food and drink consumed in the previous 24 hours (Lee and Nieman 2003) (Appendix L). Although a single 24-hour recall does not represent the usual intake of individuals, due to the intra-individual variability, it has been found to be valid for characterizing the average intake of a group or population (Biro et al. 2002). Using the multiple-pass method (Lee and Nieman 2003), each participant was asked to recall all the food and drink consumed the previous day, including any additional sauces, dressings, condiments, etc. that may have been used, as well as methods of preparation. Using household dishes and measures (e.g. cups, bowls, glasses spoons) and geometric shapes (e.g. circles, triangles and rectangles), the participants were also asked to estimate the portion sizes for each item. To capture differences in day-to-day intakes, recalls for different participants were performed on different days of the week.

6.1.2.3.2 *Quantitative data analyses*

Data collected from the 24-hour recalls were entered into *The Food Processor SQL* (v. 8.5), a computerized dietary analysis program, to determine the number of servings from each food group (i.e. grain products, vegetables and fruits, milk products and meats and alternatives) for each participant. Whenever possible, Canadian foods were chosen from the food lists provided by the database. The data were then transferred to SPSS (v. 14.0) to assess mean serving sizes (mean \pm SD), total kilocalories (mean \pm SD) and macronutrient intake (mean percentage from carbohydrate, protein and fat). To determine differences between groups, the Kruskal-Wallis test was used and when there were significant differences ($p < 0.05$), multiple Mann-Whitney tests with Bonferonni correction conservatively adjusted to $p < 0.008$ were performed. To determine frequency estimations of traditional foods used, each food item was coded as traditional (bannock, berries, birds, fish and land animals) or market food (all other foods). Each food item was only coded once, regardless of whether they were consumed multiple times during the day (Kuhnlein et al. 2004).

6.1.2.3.3 *Qualitative methodology*

A focused ethnographic approach (Muecke 1994) was the qualitative methodology used in this study. Focused ethnography draws on research techniques used in classical anthropologic ethnography (e.g. data gathering carried out in a specific locality, interviews as the primary source of data gathering, and an emphasis placed on describing the perspective of the participants), however it is a problem-focused, content specific, time-limited exploratory study among a specific group of people (Muecke 1994). The data collection for this study were focused on pre-determined, overarching

questions such as “What are Cree women’s perceptions about healthy bodies?” and “What influences the diet of Cree women?” (Appendix I). Therefore, a focused ethnography, also known as a rapid ethnography (Muecke 1994) was chosen given the clear focus of the study was to explore the local attitudes and beliefs that Aboriginal women have regarding healthy eating and healthy body weights. Particular attention was given to exploring these attitudes and beliefs in a social and cultural context, as well as how physical/geographic factors relate to healthy eating.

A stratified purposeful sampling approach was taken, using both opportunistic and snowball sampling (Creswell 1998). A total of 19 female participants from four age groups took part in the interviews; six aged 15-24 years, four aged 25-39 years, five aged 40-54 years and four over the age of 55 years. The community research assistant was trained to assist with the interviews to provide translation and clarification to overcome potential language barriers between the participants and the interviewer, thus encouraging participants to use their “typical native language” (Spradley 1979). The interview sites were chosen by each participant and were conducted either in the participant’s home or at the health center. Prior to all interviews, participants were provided with a clear explanation of the purpose of the project and informed consent was obtained. The interview began with general questions in an effort to establish rapport and to learn a little bit about each of the participants. A semi-structured interview guide was used which asked questions regarding attitudes and beliefs about health (e.g. What do you think makes people healthy?), healthy bodies (e.g. What does a healthy body look like to you?), physical activity (e.g. Do you consider yourself to be physically active?) and healthy eating (e.g. What would you describe as ‘healthy eating’?) (Appendix I). The

interviews typically lasted 45 minutes to one hour and were audiotaped with the permission of the participants and transcribed verbatim by the interviewer.

In addition to one-on-one interviews, data were also collected through participant observation. Observational data were recorded during each community visit in the form of field notes (Creswell 2003), and included observing the types of foods available in the two local convenience stores and the content of various food hampers and food trays provided to individuals taking part in programs offered through the health center. The field notes were used to supplement data obtained from the interviews to provide a source of credibility (i.e. internal validity) and confirmability (i.e. objectivity) to increase the rigor of the findings (Guba 1981).

6.1.2.3.4 Qualitative data analyses

Transcribed interviews were analyzed through content analysis by identifying relevant topics and categories, as well as similarities and differences in the data (Wolcott 1994; Patton 2002). Once all the interviews were completed, the data were then re-grouped and examined by age group, given one of the objectives was to explore attitudes and beliefs from a trans-generational viewpoint. The field notes, which included direct observations, were used to triangulate the data by providing a source of data to validate and cross-check the findings of the interviews (Patton 2002). Similar to the interview data, the field notes were analyzed by sorting the data based on topics (e.g. healthy eating, healthy bodies) and then organized into relevant categories (e.g. perceptions of healthy eating, barriers to healthy eating barriers, etc). Standard procedures for establishing trustworthiness were applied which included member checks of the transcribed data (returning the transcripts back to the participants to determine accuracy)

and establishing an audit trail (Lincoln and Guba 1985). The audit trail included all raw data (audiotapes of the interviews, field notes and transcripts with notes), data reduction and analysis notes, and instrument information (interview questions, schedules, etc).

6.1.3 Results

6.1.3.1 Dietary Practices

The total energy intake varied widely among participants, ranging from 518 kcal per day to 3575 kcal per day (mean kcal 1469 ± 685). Table 12 illustrates that as age increased, total energy intake decreased ($p = 0.036$), however pair-wise comparisons revealed no significant differences. Although there were no significant differences between age groups for energy intake from carbohydrates, fats or protein, as age increased there was a tendency towards a decrease in the consumption of carbohydrates ($54.2\% \pm 8.7$ to $39.4\% \pm 13.7$) and an increase in fat ($30.0\% \pm 9.9$ to $38.6\% \pm 7.2$) (Table 12).

According to Canada's Food Guide for First Nations, Inuit and Métis (Health Canada 2007), all age groups met the minimum recommended guidelines for meat and alternatives, with the exception of those aged 40-54 who were below the recommendations (Table 13). Only those participants aged 15-24 years met the minimum recommended guidelines for grain products. The mean number of servings from the vegetables and fruit group and the milk products group were well below the minimum guidelines in all age groups. The number of servings of 'other' foods (e.g. foods that are mostly fat, oil or sugar, high fat/salt snack foods and beverages), which is suggested to be of a limited amount, comprised a large component of daily intake, particularly for the youngest age group (Table 13). Of note, a serving of fat, oil, or

sweets, as described by the nutrition analysis software, was defined as “the number of grams in 1 tbsp of fat for butter, margarine, oils and shortening”, “the number of grams in 1 tsp of sugar”, “a multiple of the fat standard for the specific meat” and “a multiple of 12.8 grams (g) for milk products and mixed foods” (ESHA Research 2006). As an example, on average 100 g of lean beef contains 11 g of fat and any cut of beef with more than 11 g per 100 g of beef would have a value assigned to ‘other’ foods (ESHA Research 2006).

Table 10. Mean total kilocalorie (kcal) intake and percent (%; \pm SD) macronutrient intake overall and for each age group.

	Overall (n = 39)	15-24 Years (n = 13)	25-39 Years (n = 12)	40-54 Years (n = 9)	55+ Years (n = 5)
Mean Total kcal (\pm SD)	1469 (685)	1904 (851)	1370 (570)	1158 (433)	1132 (100)
% CHO (\pm SD)	48.7 (11.8)	54.2 (8.7)	47.8 (13.0)	47.3 (11.0)	39.4 (13.7)
% Pro (\pm SD)	18.3 (8.7)	16.0 (10.1)	20.1 (8.4)	17.3 (7.4)	21.8 (7.5)
% Fat (\pm SD)	33.0 (9.1)	30.0 (9.9)	32.2 (8.7)	35.2 (8.6)	38.6 (7.2)

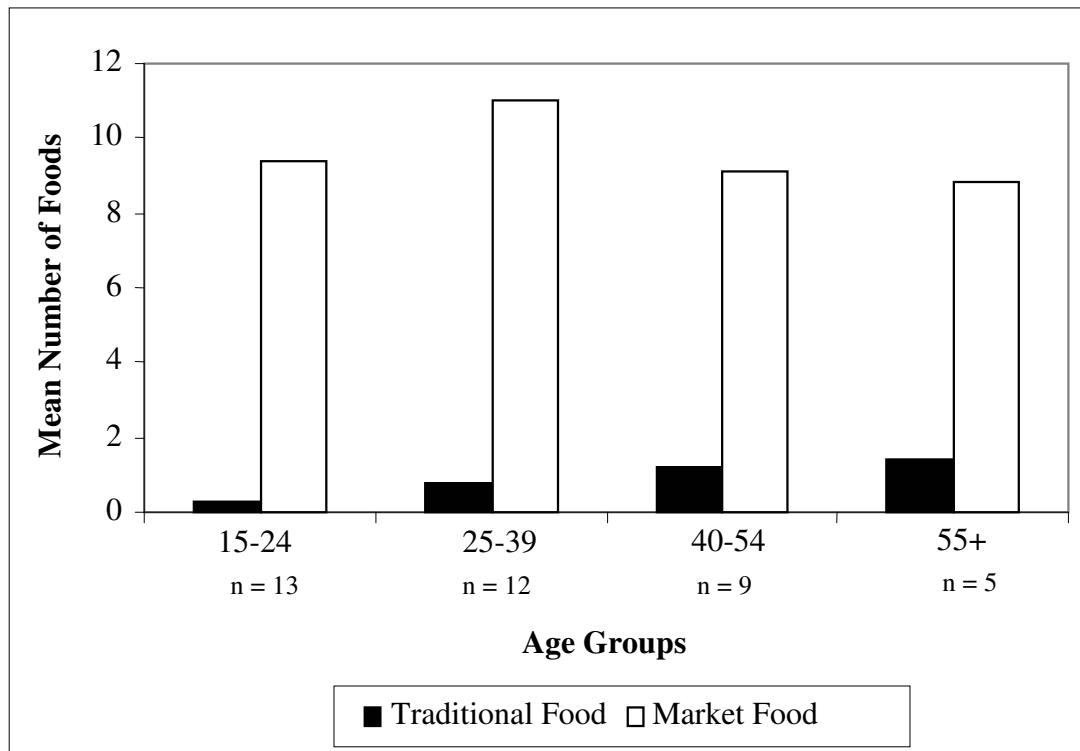
kcal = Kilocalorie
 CHO = Carbohydrate
 Pro = Protein
 SD = Standard deviation

Table 11. Mean number of servings from each food group (mean \pm SD) per day overall and for each age group.

Food Group	Recommended Servings	Overall (n = 39)	15-24 Yrs (n = 13)	25-39 Yrs (n = 12)	40-54 Yrs (n = 9)	55+ Yrs (n = 5)
Grain Products	6-7	5.0 (3.3)	6.4 (3.0)	4.5 (2.8)	5.2 (3.1)	2.4 (1.7)
Vegetables & Fruits	7-8	2.3 (2.4)	2.9 (2.6)	2.8 (2.7)	1.1 (1.3)	1.6 (1.4)
Milk and Alternatives	2-4	0.9 (0.9)	0.7 (0.6)	1.1 (1.1)	1.0 (1.2)	0.7 (0.7)
Meat and Alternatives	2	2.2 (1.7)	2.2 (2.0)	2.4 (1.5)	1.7 (1.6)	2.7 (1.3)
Other Foods (fats, oils, sweets)	Limited amounts	16.1 (17.3)	24.3 (23.6)	14.2 (1.6)	8.4 (3.5)	13.0 (9.6)

Figure 5 illustrates the mean number of traditional foods compared to market foods consumed by the participants in each age group. The number of traditional foods increased with age while the number of market foods consumed decreased with age. The most commonly reported traditional foods from the 24-hour recalls included moose meat and bannock, with few participants reporting fish and no participants reporting birds or berries. Tea, sugar, and canned milk were the most commonly reported market foods. My field notes indicate a similar trend in that moose meat, ‘neck bones’, rabbit and bannock were commonly consumed traditional foods, and that tea with sugar and *Pacific* canned milk were regularly consumed several times a day.

Figure 5. Mean number of traditional and market foods consumed per day for each age group.



6.1.3.2 Healthy Eating Attitudes and Beliefs

6.1.3.2.1 Perceptions of Healthy Eating

Healthy eating was seen as a health-promoting behavior in all age groups, yet many of the women did not perceive themselves to be in good health due to lifestyle behaviors which included what they eat, smoking and lack of physical activity. Despite the perception of their poor health, due in part to their diet, only one woman interviewed (aged 40-54 years) believed that poor eating was a health concern in the community.

Given the increasing prevalence of overweight and obesity among Aboriginal peoples (Young et al. 2000), participants were asked to describe what they believed could contribute to unhealthy bodies (i.e. body size or weight). Females in the youngest age group described factors related to low body weight such as “not eating enough” and the use of drugs, alcohol and smoking. Conversely, women in the three older age groups primarily described diet-related factors as being associated with excess body weight such as overeating, and an increase in “store-bought” fast foods, described as “white man stuff”.

In all age groups, the majority of participants associated healthy eating with the consumption of fruits, vegetables and various types of meat (e.g. moose, rabbit, hamburger, pork), however participants in the two older age groups most commonly described healthy eating as “Indian food”, “traditional food” or “mostly wild” food such as moose, rabbit, deer, caribou, beaver, muskrat as well as grouse and fish. One participant expressed that these foods “...are like Native caviar.” Although few fruits and vegetables were mentioned, carrots, potatoes and berries were identified by the participants as healthy cultural foods.

6.1.3.2.2 Food Preferences

Food preference was primarily influenced by taste in all age groups, however participants from the two oldest age groups also commented that some food choices were based on health, such as eating fruits and vegetables because they knew they were healthy. While many participants in the older age groups indicated a preference for traditional food, many also said it was difficult to obtain because of the reliance on family members to hunt and the lack of animals due to changes to the environment (e.g. deforestation). Many of the participants stated that younger members of the community prefer store-bought foods rather than traditional foods, likely because of a lack of exposure to traditional foods.

6.1.3.2.2 Barriers to Healthy Eating

Several barriers to healthy eating were outlined by the participants (Table 14). All participants explained that groceries were regularly purchased outside the community due to the high cost and lack of variety locally. They also described a lack of availability of many foods locally, particularly fruits and vegetables, and as one participant described, it is “mostly junk food sold in the stores”. Observational data revealed that the two retail stores sold primarily confectionary foods (e.g. chips, chocolate bars, pop, etc), packaged foods, and the fresh fruits and vegetables were limited to apples, bananas, oranges, onions and potatoes. Therefore, the purchasing of packaged foods (e.g. chicken nuggets, pizza pops, Kraft Dinner, macaroni, ground beef and chicken legs), rather than fresh foods in this community was high.

Table 12. Sociocultural and physical environmental influences on healthy eating.

Environmental Influences on Healthy Eating	
Sociocultural	Physical
<i>Barriers</i>	<i>Barriers</i>
Lack of exposure to traditional foods	Lack of availability
	Limited options
	High cost
<i>Enablers</i>	<i>Enablers</i>
Health clinic	None identified

Participants in the youngest age group generally did not consider obtaining and purchasing food to be a challenge, despite the need to leave the community. This view was not shared by women from the older age groups however, as many expressed the challenges associated with having to travel approximately 145 km one way to purchase much of their food. First, the high cost associated with traveling was particularly problematic for those on social assistance who had limited financial resources as well as those individuals (primarily older individuals) who did not have their own vehicles or did not drive, as it resulted in further costs to pay individuals to drive them to purchase their food. Second, the majority of participants purchased their food every two weeks or once a month when they were paid. Due to this, some participants expressed that if they purchased enough fresh food to last approximately two weeks, much of it would spoil, whereas not buying enough resulted in having to rely on what could be purchased locally, which was often expensive. A comparison of prices of select food between the community and an urban center (Saskatoon, SK), revealed that the cost of many fresh

foods in the community were double compared to an urban center. For example, the cost locally for 4 liters of milk was \$7.25 compared to \$3.69; a pound of bananas locally were \$1.00 compared to \$0.57, and a bag of oranges locally were \$6.45 compared to \$3.00. While several canned vegetables were more comparable in price, these foods were still generally more expensive in the community compared to the urban center (refer to Table 3, pg 91 for a more detailed description).

The geographic location of the community and the challenges it created for the health center in promoting and providing healthy food choices were also observed. For example, the health center routinely offered fruit baskets and fruit and vegetable trays to individuals attending programs and special events through the health center, however this required staff members to travel approximately 300 km round trip to obtain these foods. It was obvious these types of foods (i.e. fruits and vegetables) were well received and appreciated in the community as my observational data indicated they were often the first foods eaten by participants at various functions, despite cheese, crackers and processed meat being offer at the same time.

6.1.4 Discussion

Understanding the various circumstances related to health behaviors in the Aboriginal population, specifically those related to healthy eating, can help us to better appreciate what influences behavior change and thus design effective prevention and intervention strategies. The one-on-one interviews conducted with women of different age groups revealed some of the factors influencing healthy eating among this population which can inform the design of healthy eating education and intervention programs.

Although healthy eating was identified as an element of good health, many participants felt that a poor diet played a role in their self-perceived poor health with several barriers related to healthy eating being highlighted. For example, availability and access to foods, primarily fruits and vegetables, emerged as the most salient issues for many women. As a result of the reported 'junk food' in the stores and limited availability of fruits and vegetables locally, packaged foods were commonly purchased in the community. The findings from this study are consistent with previous research where poor quality, lack of variety and lack of availability of perishable foods and high cost were found to be barriers to purchasing healthy foods, primarily fruits and vegetables (Wein 1994; Harnack et al. 1999).

Although food preference was primarily influenced by taste, it was clear that the various barriers related to healthy eating impact the participants current dietary practices. The data from the 24-hour recalls are concerning given the below minimum intakes of milk and alternatives and vegetables and fruit. Findings similar to these from the Canadian Community Health Survey (CCHS): Nutrition Cycle 2.2 have recently been reported among off-reserve Aboriginal peoples in Canada (Garriguet 2008). Although the mean daily servings of vegetables and fruit and milk products (alternatives) for those living off-reserve were slightly higher in the CCHS (3.6 servings/day and 1.3 servings/day, respectively), compared to the data from this study (2.3 servings/day and 0.9 servings/day, respectively), a large proportion did not consume the recommended servings of these two food groups (Garriguet 2008). Although it was not possible to assess nutrient intake from a single recall, these findings are suggestive of inadequate intakes for several vitamins and nutrients such as calcium, vitamin A, B vitamins, and

vitamins C, E and K. The inadequate intake from these food groups is not only significant from a biological standpoint (e.g. growth and development, regulation of metabolism), but are also important from a health perspective. For example, the role of calcium in bone health is well established (Cashman 2002), and vegetable and fruit consumption has been shown to help manage and prevent obesity (Tohill et al. 2004) and has been linked to a lower risk of developing Type 2 diabetes mellitus (T2DM) (Williams et al. 1999; Sargeant et al. 2001). Given the increasing prevalence of obesity and T2DM among the Aboriginal population (Young et al. 2000), these findings suggest the need for strategies to improve the selection and cost of local foods, or alternatively to design community-based programs to provide greater access to foods such as fruits and vegetables. For example, two programs which have shown some success in improving affordable access to healthy foods include food distribution networks (e.g. Good Food Box) (Brownlee and Cammer 2004) and collective kitchens (multiple families purchasing groceries and preparing meals in bulk) (Engler-Stringer and Berenbaum 2007). Indeed, when asked of ways to provide affordable vegetables and fruits available in the community, re-establishing the Good Food Box was suggested by some of the women, as this program had previously been implemented in the community. Although one of the participants indicated there was a lack of community involvement to lead the program (i.e. lack of volunteerism), it was generally agreed that this method of providing fresh vegetables and fruits would be a worthy alternative to having to travel more frequently to access these foods. One potential strategy to re-establish the Good Food Box would be for the health center to lead this initiative, given its health-promoting role in the community and the regular travel of staff members to larger centers to purchase fruit

baskets and food trays for programs offered through the health center. In other communities, the concept of cooperative shopping has been highlighted as a strategy to improve healthy eating whereby one or two individuals collect the shopping list of community members and for a small fee purchase their groceries outside of the community (Abonyi 2001).

The dietary analysis also indicated age-related differences in food consumption, such as an increase in traditional food usage with age, although the amount of traditional food consumed was still relatively small. Some literature has also noted age variations in traditional food use (Campbell et al. 1994; Receveur et al. 1997; Wolever et al. 1997), however few studies have addressed the reasons for this decline. Potential causes for the decline in traditional food use have included a loss of knowledge of harvesting and preparing traditional foods (Willows 2005), which may largely be influenced by colonization and assimilation. While these were not specifically explored in this study, the process of colonization and the legacy of the residential school system may be used in part to explain the decline in traditional food use. For example, the relocation of many Aboriginal communities resulted in a loss of hunting, trapping, and for some access to marine resources, which greatly influenced their access to 'traditional' foods and which increased the reliance on food supplies obtained from social welfare (Royal Commission on Aboriginal Peoples 1996). The influence of residential schools on the diet of First Nations peoples was illustrated by Iwama (2000) where she described that "Removing children from their homes was central to realizing assimilation: confinement interrupted the transmission of culture in each nation. Traditional food practices went underground, and students were nourished by their food only in memory or during family visits."

(Iwama 2000). A decrease in traditional food use has also been linked to the reduced availability of animal and plant species (Kuhnlein and Receveur 1996; Wheatley 1998). The latter of these was highlighted by the participants in this study, particularly those over the age of 40, as they reported it was difficult to obtain traditional (wild) foods due to a lack of wild animals in the area, as well as relying on family members to hunt, which is becoming increasingly rare in the community. In this study, seasonality may have also influenced traditional food use such as fish, berries and birds in all age groups, given the recalls were performed in February and March, a time when access to these foods may be limited. Regardless of the potential influence of seasonality, an additional component related to the decline in traditional food is that many of the older participants described that their grandkids would rather eat store-bought food as they are often not provided the opportunity to have traditional foods and thus do not like the taste. The lack of exposure to traditional foods, in part due to the difficulty in obtaining these foods, may explain the age-related differences in traditional food use, particularly between the youngest and oldest age groups in this study.

While this study adds new knowledge to the literature on understanding some of factors that influence healthy eating, and the attitudes and beliefs that Aboriginal women have toward healthy eating, there are both strengths and limitations to the study. The inclusion of both qualitative and quantitative data is a strength of this study as this approach provides a more holistic picture of dietary practices among women in the community. For example, the information gathered quantitatively provides insight regarding the types of foods typically consumed (or not consumed), whereas the qualitative data further informs the survey data gathered by offering an understanding of

why some foods may be consumed more (or less) than others. In addition, there is a lack of literature using qualitative methods to understand the various factors that affect healthy eating among Aboriginal women in Canada. A second strength is the use of the 24-hour recall to assess diet. The advantages of using this method include the personal contact during the data collection which contributes to the reliability of the information collected, it is applicable for broad populations of different ethnicity and there is no literacy requirement (Biro et al. 2002). As well, the 24-hour recall is thought to be more objective than diet histories or food frequency questionnaires as the list of foods is open-ended. This method also provides an inexpensive, easy way to collect detailed information on specific foods, has a low respondent burden, and has been used previously in the Aboriginal population (Trifonopoulos et al. 1998).

There are also limitations to this study which warrant recognition. First, inherent with dietary recall is the potential for over or underreporting of nutrition data due to withholding or altering information (Lee and Nieman 2003). There was an attempt to minimize this bias by using the multiple pass method to obtain more accurate information about food intake (Lee and Nieman 2003). In addition, many of the nutrition recalls were performed in the participants homes which allowed for more accurate reporting as the participants were able to provide actual foods and serving sizes consumed. Second, because the dietary practices were assessed using a single 24-hour recall, the data do not represent usual intakes from the from participants. However, data from the one-on-one interviews support the findings from 24-hour recalls, particularly those related to fruit and vegetable intake. Finally, this study used convenience sampling, had a small sample size, and was limited to one community. Therefore the findings may not represent the

dietary intakes or attitudes and beliefs regarding healthy eating of all women in the community or of Aboriginal women living in other regions.

6.1.5 Conclusions

The changing diet of Aboriginal peoples is multi-dimensional and encompasses psychosocial, behavioral and environmental barriers. The findings of this study suggest that barriers related to the geographic location of the community can have a substantial impact on access and availability of healthy, affordable foods which makes consuming a healthy diet challenging. The dietary practices described in this study highlight the need for strategies to be designed to provide affordable, nutritious foods to residents living in northern and remote areas. Pilot studies at the community level to assess the acceptability and feasibility of programs such as the Good Food Box and collective kitchens may be practical methods for improving the diet and subsequent health of the residents living in northern and remote communities.

CHAPTER 7
GENERAL CONCLUSIONS, LIMITATIONS,
KNOWLEDGE TRANSLATION AND FUTURE RESEARCH

7.1 General Conclusions

There are three major conclusions that can be summarized from the conclusion sections of each manuscript in this thesis. First, the rates of overweight/obesity (OW/OB) among females are a concern in the community. While not statistically significant, OW/OB among female youth has increased over the past decade, and more importantly, although rates of OW/OB have remained relatively unchanged among adult females over time, approximately three-quarters of the women are classified as OW/OB. Furthermore, when examining the same individuals over time, there was a significant increase in the number of individuals who became either overweight or obese. What is especially noteworthy is that unhealthy body weights are apparent at an early age (i.e. as young as 7 years), and this is particularly concerning given obesity tracks from childhood into adulthood and the perpetuating cycle of obesity, gestational diabetes and Type 2 diabetes.

Second, despite the identified barriers, the majority of participants (with the exception of those aged 25-39 years) would appear to have physical activity levels that are typically associated with health benefits (i.e. >16 MET hrs/wk) with domestic responsibilities comprising a large proportion of the total physical activity in both the 25-39 and 55+ year age groups,. These findings need to be interpreted cautiously however given that body weight, which may alter the energy expenditure for a given activity, was not taken into account, the time frame of the activity recall (i.e. one year) may have resulted in either under-reporting or over-reporting of activity levels and that the majority of participants reported house-related activities as light intensity. While household activities (e.g. sweeping, window cleaning, vacuuming) may confer health benefits if

performed at a sufficient intensity (i.e. > 3.0 METs), the results from this study suggest it is less likely they are contributing to overall health benefits given their low intensity.

Many of the barriers to physical activity identified by the Aboriginal women in this study are consistent with reported barriers to physical activity within the general population.

The most salient barriers to physical activity were those related to childcare responsibilities such as the lack of personal time to engage in physical activity and lack of child care available in the community. In addition, a lack of organized activities in the community was commonly cited as a barrier to engaging in physical activity. Thus, physical activity programs that focus on reducing identified barriers may be helpful for improving increasing activity levels, particularly among those women aged 25-39 years.

Third, the nutrition data revealed low intakes of various food groups, specifically fruits and vegetables and milk and alternatives. These findings appear to be a function of a lack of availability to various foods as well as high costs of foods purchased locally as these barriers were highlighted as challenges to healthy eating in this particular community. These findings are suggestive of inadequate intakes for various vitamins and nutrients which are likely to have a significant influence on overall health status over time, particularly given the health benefits of consuming a diet with appropriate intakes of fruit and vegetables. Therefore, health promotion strategies which focus on providing affordable, nutritious foods are required to improve the diet and overall health of community members. While there was an increase in traditional food usage with age, it was also reported that access to traditional foods was challenging and the lack of exposure to these types of foods is believed to have directly influenced the preference for non-traditional foods among youth in the community.

7.2 Limitations

This thesis sought to determine the current prevalence of overweight/obesity in the community and combined qualitative and quantitative methods to determine current physical activity levels and dietary intake as well as explore factors that influence physical activity and diet and the potential role they play in unhealthy body weights. While this thesis adds new knowledge to the area of Aboriginal women's health, there are some limitations which must be acknowledged. The first is the cross-sectional design of both projects as well as the use of convenience sampling. While many studies examining body composition, physical activity and nutrition within Aboriginal populations have been cross-sectional in nature and employ convenience sampling, this may have resulted in under sampling of certain age groups and therefore may limit the generalizability of the findings. As well, this study was community-specific, and therefore the generalizability of the results to other First Nation groups and to different geographic locations is also limited. Second, changes in socioeconomic status over time were not assessed, and this may have provided more information related to changes in opportunities for physical activity and healthy eating, both at the individual and community level. Third, the physical activity and nutrition data were collected using self-reported questionnaires and thus under-reporting or over-reporting of both physical activity and nutrition data may have occurred. In addition, the physical activity and nutrition data and the anthropometric data were collected at different time points and therefore limits the ability to draw direct comparisons to levels of physical activity, dietary intake and unhealthy body weights. Finally, the number of participants completing the physical activity and nutrition surveys was small and again, this limits the

generalizability of the findings. In addition, the small sample size limited the statistical ability to compare between age groups.

7.3 Knowledge Translation

Over the past several years, there has been an increasing push for researcher to communicate findings from the research setting into real-world applications (Canadian Institutes for Health Research). Knowledge translation (KT), the process of transferring research-based knowledge from the community to key audiences (Lyons and Warner 2005), promotes “active exchange of information between the researchers who create new knowledge and those who use it”. (Canadian Institutes for Health Research). Historically, KT typically involved the dissemination of research findings by researchers to academic audiences by publishing findings in scientific journals or through presentations at academic conferences. More recently however, KT in health research has expanded to include the general public, health care professionals and organizations as well as policy makers (Lyons and Warner 2005). Knowledge translation strategies and activities are particularly relevant for this project given one of the key elements of participatory research is that research results should directly benefit the community (Frankish et al. 1997).

One of the purposes of this project was to provide information back to the community regarding healthy body weights as well as how current physical activity and healthy eating practices, attitudes and beliefs might contribute to possible increased rates of overweight/obesity. To date, I have provided initial findings back to the community through two newsletters which were prepared with the assistance of the community project coordinator and with input provided by the health director. As the project was

facilitated through the health clinic, the health director suggested that the newsletter be included as part of the larger monthly newsletter which is distributed throughout the community. The initial newsletters contained only the quantitative data (i.e. anthropometry and physical activity and dietary habits), however now that the project is completed and all the data have been analyzed, more comprehensive KT activities which include the qualitative results will be disseminated. An Executive Summary of the project which outlines the key findings and provides practical recommendations to improve physical activity and healthy eating behaviors in the community has been prepared. A presentation summarizing the findings has also been prepared with plans to be presented and discussed with members of the Peter Ballantyne Cree Nation Health Services board members. Examples of other potential KT strategies may include a newsletter to be distributed through the health clinic which will update the community on the results of the project, as well as a presentation for a community forum where all members of the community will be invited to discuss the findings. Additional KT activities, based on input from the community, may also be designed. Regardless of the form of dissemination, it will be important for all acknowledgements to reflect that the details of the research were a joint project and the community's role in formulating its development and direction.

Overall, it is hoped that the information obtained from this project will be useful to the community, in particular to community health developers and policy makers, so that effective programs can be designed and implemented to help promote physical activity, encourage and facilitate healthy eating and thus promote healthy body weights in the community, specifically among women.

7.4 Future Research

There are several recommendations to be made for future research examining healthy body weights, physical activity and dietary practices, and physical activity and healthy attitudes and beliefs among Aboriginal women and Aboriginal populations in general. However, prior to outlining future research recommendations, it is important to reiterate principles that must be respected when conducting research with Aboriginal communities.

The negative past experiences of Aboriginal communities with research and the recent protocols and ethical guidelines that have been developed for working with Aboriginal communities (American Academy of Pediatrics 2004; Canadian Institutes for Health Research et al. 2005) highlights the importance of active involvement of the community in any type of research, including surveillance studies. A participatory approach, which directly involves members of the community in conducting the research, offers a suitable and acceptable approach to carrying out long-term research projects. Because participatory research involves members of the community in all phases of the research process, from generating ideas to disseminating the findings, it has the potential to build capacity in the community to sustain research projects and provide a true sense of ownership of the project that can empower a community to use the results to affect change locally. As Schnarch (2004) indicates “...in an Aboriginal context, community relevance and community usefulness may be the most telling measures of the worth of a study”, and therefore it is necessary to ensure future research initiatives are not only wanted by the community but are also seen as valuable in terms of health program

planning and evaluation. The following recommendations for future research must be considered with this context.

Currently, there is limited surveillance data which tracks overweight/obesity among First Nation groups. In view of this, longitudinal studies may be particularly useful to more accurately assess changes in prevalence rates over time, as well as to determine the effectiveness of intervention programs designed to promote healthy body weights. In addition, although it is believed that increasing rates of overweight/obesity among Aboriginal peoples are due to changes in the hunter-gatherer lifestyle, limited data exists examining physical activity and diet over time. Given the proposed relationship between overweight/obesity, decreases in physical activity and changes in dietary practices, longitudinal studies examining changes in these variables may help to better explain the prevalence rates of overweight/obesity observed. As well, given physical activity and diet are two modifiable risk factors for overweight/obesity, it is recommended that future longitudinal research collect all relevant data simultaneously so that relationships between changes in physical activity, diet and overweight/obesity can be made.

A second future recommendation is to aim to collect more comprehensive demographic data such as income, education, housing and living arrangements. Evaluating changes in socioeconomic status (SES) are likely to clarify changes in patterns and practices of physical activity and dietary intake as SES has been shown to be inversely related to healthy lifestyles (Canadian Institute for Health Information 2004). In addition, few studies have examined SES among Aboriginal peoples, specifically as it relates to physical activity, nutrition and body composition.

Third, there is a lack of literature using qualitative methods to understand the factors that influence physical activity levels and dietary practices among Aboriginal women. Qualitative data provides a more in depth understanding of why individuals behave the way they do (i.e. choose to or not to engage in physical activity) and how various factors (e.g. their environment, community, family) influence health promoting behaviors. Thus, future research addressing physical activity and nutrition among Aboriginal peoples should incorporate qualitative research methods in their study design. In addition, using objective measures to assess physical activity such as accelerometry or pedometers may help to better assess the actual contribution of common, lower-intensity activities to overall physical activity, particularly as domestic activities and walking are frequently reported among Aboriginal women yet are difficult to quantify (Kriska et al. 1990; Kriska et al. 2001).

Future research should also aim to recruit a larger sample as well as extend the research to other First Nations groups in different locations to further explore similarities and differences among the various factors that influence physical activity and healthy eating. In addition to understanding the factors that influence physical activity and healthy eating among Aboriginal peoples, further health promotion strategies targeting these two areas should be implemented and evaluated.

As highlighted above, prior to beginning research within and with an Aboriginal community, as well as when continuing existing research projects, it is important to work collaboratively with members of the community. It is equally important for researchers to be cognizant of issues surrounding ownership, control, access and possession (OCAP) as it relates to research data and results. Although research may be carried out

collaboratively between academic researchers and communities, the community “owns” the data and has the right to control all aspects of the research and management of the information which impacts them, which includes how the data is protected and who has access to the information (Schnarch 2004). Engaging in respectful research with Aboriginal communities also includes following appropriate protocols for obtaining consent from the community, as well as from individual participants, in addition to gaining an understanding of the local belief systems regarding the focus of the research (e.g. physical activity, healthy eating, healthy body weights). The goal of working collaboratively with Aboriginal communities through a participatory approach is to improve negative past experiences with research, promote partnerships to address health concerns in communities, and to address health problems of interest to the community in a meaningful way.

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Appendix A
Certificate of Ethical Approval



Certificate of Approval Study Revisions

PRINCIPAL INVESTIGATOR

Karen Chad

DEPARTMENT

Kinesiology

BEH#

Beh 04-109

STUDENT RESEARCHER(S)

Kristal Anderson, Brenda Bruner (Lindstrom)

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED (STUDY SITE)

University of Saskatchewan

Saskatoon, SK

SUB-INVESTIGATOR(S)

Sylvia Abonyi

Adam Baxter-Jones

Bonita Beatty

Roland F. Dyck

Ronald Labonte

Evelyn Peters

Susan J. Whiting

SPONSOR

CANADIAN INSTITUTES OF HEALTH RESEARCH (CIHR)

TITLE

Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

CURRENT APPROVAL DATE

29-Jun-2004

CURRENT RENEWAL DATE

01-Jun-2006

CERTIFICATION UPDATE

Addition of Student Researchers

APPROVED ON

30-Mar-2006

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the proposed revisions to your study. The revisions were found to be acceptable on ethical grounds.

The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS

The term of this approval is five years, but the approval must be renewed on an annual basis. In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions:

APR-21-2006 14:27

- 2 -

PRINCIPAL INVESTIGATOR

Karen Chad

<http://www.usask.ca/research/ethical.shtml>

DEPARTMENT

Kinesiology

Bio#

Beh 04-109

APPROVED.



Valerie Thompson., Chair
Behavioural Research Ethics Board
University of Saskatchewan

Please send all correspondence to:

Ethics Office
University of Saskatchewan
Room 306, Kirk Hall, 117 Science Place
Saskatoon, SK S7N 5C8
Phone: (306) 966-2064 Fax: (306) 966-2069

Appendix B
Anthropometry Adult Consent

CONSENT FORM (ADULTS 18 yrs +)

Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on height, weight, and risk factors for diabetes. This study is a follow up to a study that was carried out in your community in 1990/1991. The findings from this project will provide important information to health educators in developing future programs aimed at reducing obesity, maintaining healthy body weights, and preventing diabetes in your community.

While participation in this study is optional, we hope that many individuals in your community will consent to participate. If you decide to participate, your role as a participant is to complete a short health survey. With your permission, we would also measure your height, weight, and waist girth. All testing will be carried out by a qualified researcher and will follow standard procedures performed at the Wellness Center in your community. The health survey will be read to you by a researcher in the form of an interview. The survey and the measurements will take about 10 minutes in total to complete.

There are no foreseeable risks to your participation in this study. Participation is completely voluntary and you can withdraw at any time. You will be encouraged to ask questions during completion of the questionnaire or the body composition testing if you need clarification. Feedback will be given to you by the research assistants during the entire study. If you need assistance in translation, a research assistant will be happy to assist you by verbally translating the questionnaire.

The data from this study will be published and presented at conferences; however, your identity will be kept confidential. Results are completely anonymous. You may withdraw from the study at any time, following which your data would be deleted from the study and destroyed. Withdrawal from the study will not affect your access to, or continuation of, services provided by the University of Saskatchewan. All of the information will be kept confidential and stored by the principal researcher, Dr. Karen Chad, in a locked office on the University Campus for a minimum of five years after the completion of the study.

If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided below if you have questions at a later time. Any questions regarding your rights as a participant may be addressed to the Office of Research Services (966-2084). Out of town participants may call collect.

The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this study also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

If you decide that you would like to be a part of this study, please complete the attached form. If you have any questions or concerns about this study, please do not hesitate to contact Dr. Karen Chad (966-1071) at any time.

This research is supported by a grant obtained from the Canadian Institutes for Health Research.

PLEASE READ and SIGN YOUR CONSENT

I have read and understood the purpose of this study and my involvement in this study. I am aware that my identity will remain anonymous throughout the study and in any written results of the data collection through participation in this project. I am aware that I have the right to withdraw from the study at any time without penalty. If I have any questions or concerns I can contact Dr. Karen Chad (966-1071), or if I wish to clarify my rights as a research participant, I may call the Office of Research Services (966-2084). I have received a copy of the consent letter for my records.

I, _____ give permission to allow _____
to participate in the study conducted by the College of Kinesiology.

Participant's Signature _____ Date _____

Researcher's Signature _____ Date _____

*The University of Saskatchewan Advisory Committee on Ethics in Behavioural Sciences
Research reviewed and approved this research project in June 2004.*

Dr. Karen Chad
Principal Investigator
College of Kinesiology
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 5B2
Phone: 306-966-1071
Fax: 306-966-6502
Email: chadk@duke.usask.ca

Appendix C
Anthropometry Youth Consent

CONSENT FORM (YOUTH PARTICIPANT – under 18 yrs)

Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on height, weight, and risk factors for diabetes. This study is a follow up to a study that was carried out in Deschambault Lake in 1990/1991. The findings from this project will provide important information to health educators in developing future programs aimed at reducing obesity, maintaining healthy body weights, and preventing diabetes in your community.

While participation in this study is optional, we hope that many individuals in your community will consent to participate. If you decide to participate, your role as a participant is to complete a short health survey. With your permission, we would also measure your height, weight, and waist girth. All testing will be carried out by a qualified researcher and will follow standard procedures performed at the Wellness Center in your community. The health survey will be read to you by a researcher in the form of an interview. The survey and the measurements will take about 10 minutes in total to complete. If you would like, we can give you a copy of the questionnaire to look over before making your decision about the study.

There are no foreseeable risks associated with participating in this study. Participation is completely voluntary and you can withdraw at any time. You will be encouraged to ask questions during completion of the questionnaire or the body composition testing if you need clarification. Feedback will be given to you by the research assistants during the entire study. If you need assistance in translation, a research assistant will be happy to assist you by verbally translating the questionnaire.

The data from this study will be published and presented at conferences; however, your identity will be kept confidential. Results are completely anonymous. You may withdraw from the study at any time, following which your data would be deleted from the study and destroyed. Withdrawal from the study will not affect your access to, or continuation of, services provided by the University of Saskatchewan. All of the information will be kept confidential and stored by the principal researcher, Dr. Karen Chad, in a locked office on the University Campus for a minimum of five years after the completion of the study.

If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided below if you have questions at a later time. Any questions regarding your rights as a participant may be addressed to the Office of Research Services (966-2084). Out of town participants may call collect.

The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this study also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

This research is supported by a grant obtained from the Canadian Institutes for Health Research.

If you and your parent decide that you would like to be a part of this study, please complete the attached form. If you or your parent has any questions or concerns about this study, please do not hesitate to contact Dr. Karen Chad (966-1071) at any time.

Youth Please Read and Sign Your Consent

I _____ voluntarily consent to participate in the study:
Northern LITES.

I have discussed this study and consent form with the researcher, and my parents/guardians. I understand the purpose of the study and my involvement, and that I have the option to withdraw from the study at any time without penalty of any sort. I also agree that if I withdraw from the study at any time, any data that I have contributed will be destroyed. My information will be used for research purposes only, and any details that may reveal who I am will not be included in study reports and presentations. If me or my caregiver has any questions, I may call the Office of Research Services (966-2084) at the University of Saskatchewan. I have been given a copy of this form to keep.

Participants Signature: _____
Date: _____

If you have any questions or concerns about this study, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

*The University of Saskatchewan Advisory Committee on Ethics in Behavioural Sciences
Research reviewed and approved this research project in June 2004.*

Dr. Karen Chad
Principal Investigator
College of Kinesiology
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 5B2
Phone: 306-966-1071
Fax: 306-966-6502
Email: chadk@duke.usask.ca

CONSENT FORM (PARENTS OF YOUTH)
Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

We would like to ask for your son or your daughter's assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on height, weight, and risk factors for diabetes. This study is a follow up to a study that was carried out in Deschambault Lake in 1990/1991. The findings from this project will provide important information to health educators in developing future programs aimed at reducing obesity, maintaining healthy body weights, and preventing diabetes in your community.

While participation in this study is optional, we hope that many youth in your community will consent to participate. If your son or daughter decides to volunteer, his/her role as a participant is to complete a short health survey. With your permission, we would also measure his/her height, weight, and waist girth. All testing will be carried out by a qualified researcher and will follow standard procedures performed at the Wellness Center in your community. The health survey will be read to your child by a researcher in the form of an interview. The survey and the measurements will take about 10 minutes in total to complete. If you would like, we can give you and your son/daughter a copy of the questionnaire to look over before making your decision about the study.

There are no foreseeable risks associated with participating in this study. Participation is completely voluntary and your son/daughter can withdraw at any time. All youth will be encouraged to ask questions during completion of the questionnaire or the body composition testing if they need clarification. Feedback will be given to you and your son/daughter by the research assistants during the entire study. If your son/daughter needs assistance in translation, a research assistant will be happy to assist them by verbally translating the questionnaire.

The data from this study will be published and presented at conferences; however, your son or daughters identity will be kept confidential. Results are completely anonymous. Your son or daughter may withdraw from the study at any time, following which their data would be deleted from the study and destroyed. Withdrawal from the study will not affect their access to, or continuation of, services provided by the University of Saskatchewan. All of the information will be kept confidential and stored by the principal researcher, Dr. Karen Chad, in a locked office on the University Campus for a minimum of five years after the completion of the study.

If you or your son/daughter has any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided below if you have questions at a later time. Any questions regarding your rights as a participant may be addressed to the Office of Research Services (966-2084). Out of town participants may call collect.

The results of this project will be made available to you and your son/daughter and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this study also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

This research is supported by a grant obtained from the Canadian Institutes for Health Research.

If you and your child decide that you would like to be a part of this study, please complete the attached form. If you or your son/daughter has any questions or concerns about this study, please do not hesitate to contact Dr. Karen Chad (966-1071) at any time.

Parents Please Read and Sign Your Consent

I _____ voluntarily consent to participate in the study:
Northern LITES.

I have discussed this study and consent form with the researcher, and my son/daughter. I understand the purpose of the study and my child's involvement, and that he/she has the option to withdraw from the study at any time without penalty of any sort. I also understand that if they withdraw from the study at any time, any data that they have contributed will be destroyed. My son/daughter's information will be used for research purposes only, and any details that may reveal who they are will not be included in study reports and presentations. If I have any questions, I may call the Office of Research Services (966-2084) at the University of Saskatchewan. I have been given a copy of this form to keep.

Participants Signature: _____ **Date:** _____

If you have any questions or concerns about this study, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

The University of Saskatchewan Advisory Committee on Ethics in Behavioural Sciences Research reviewed and approved this research project in June 2004.

Dr. Karen Chad
Principal Investigator
College of Kinesiology
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 5B2
Phone: 306-966-1071
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Email: chadk@duke.usask.ca

Appendix D
Anthropometric Data Sheet

Consent Obtained _____

University of Saskatchewan, College of Kinesiology
Anthropometric Data Sheet

Participant # _____

Name _____

Birthdate: Day _____ Month _____ Year _____

Sex: Male _____ Female _____ Treaty Number: _____

THANK YOU VERY MUCH FOR COMPLETING THIS QUESTIONNAIRE!

Anthropometric Data

Participant # _____

Trial #	Height (cm)	Weight (kg)	Waist Girth (cm)
1			
2			
3			
Average			

Appendix E

Physical Activity and Nutrition Adult Consent

CONSENT FORM

Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on physical activity and healthy eating. The findings from this project will provide important information to health educators in developing future programs aimed at reducing obesity, maintaining healthy body weights, and preventing diabetes in your community.

While participation in this project is optional, we hope that many individuals in your community will consent to participate. If you decide to participate, your role as a participant is to complete two short surveys on physical activity and nutrition during class time in your school. The surveys will be read to you by a researcher in the form of an interview. If you would like, we can give you a copy of the questionnaire to look over before making your decision about the project.

There are no foreseeable risks associated with participating in this project. Participation is completely voluntary and you can withdraw at any time. You will be encouraged to ask questions during completion of the questionnaires if you need clarification. Feedback will be given to you by the research assistants during the entire project. If you need assistance in translation, a research assistant will be happy to assist you by verbally translating the questionnaire.

The information from this project will be published and presented at conferences; however, your identity will be kept confidential. Results are completely anonymous. You may withdraw from the project at any time, following which your information would be deleted from the project and destroyed. Withdrawal from the project will not affect your access to, or continuation of, services provided by the University of Saskatchewan. All of the information will be kept confidential and stored by the principal researcher, Dr. Karen Chad, in a locked office on the University Campus for a minimum of five years after the completion of the project.

If you have any questions concerning the project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided below if you have questions at a later time. Any questions regarding your rights as a participant may be addressed to the Office of Research Services (966-2084). Out of town participants may call collect.

The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this project also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

This research is supported by a grant obtained from the Canadian Institutes for Health Research.

I _____ voluntarily consent to participate in the project:
Northern LITES.

Participants Signature: _____ **Date:** _____

If you have any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

*The University of Saskatchewan Advisory Committee on Ethics in Behavioural Sciences
Research reviewed and approved this research project in June 2004.*

Dr. Karen Chad
Principal Investigator
College of Kinesiology
University of Saskatchewan
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Phone: 306-966-1071
Fax: 306-966-6502
Email: chadk@duke.usask.ca

Appendix F

Physical Activity and Nutrition Youth Consent

CONSENT FORM (YOUTH PARTICIPANT – under 18 yrs)
Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on physical activity and healthy eating. The findings from this project will provide important information to health educators in developing future programs aimed at reducing obesity, maintaining healthy body weights, and preventing diabetes in your community.

While participation in this project is optional, we hope that many individuals in your community will consent to participate. If you decide to participate, your role as a participant is to complete two short surveys on physical activity and nutrition during class time in your school. The surveys will be read to you by a researcher in the form of an interview. If you would like, we can give you a copy of the questionnaire to look over before making your decision about the project.

There are no foreseeable risks associated with participating in this project. Participation is completely voluntary and you can withdraw at any time. You will be encouraged to ask questions during completion of the questionnaires if you need clarification. Feedback will be given to you by the research assistants during the entire project. If you need assistance in translation, a research assistant will be happy to assist you by verbally translating the questionnaire.

The information from this project will be published and presented at conferences; however, your identity will be kept confidential. Results are completely anonymous. You may withdraw from the project at any time, following which your information would be deleted from the project and destroyed. Withdrawal from the project will not affect your access to, or continuation of, services provided by the University of Saskatchewan. All of the information will be kept confidential and stored by the principal researcher, Dr. Karen Chad, in a locked office on the University Campus for a minimum of five years after the completion of the project.

If you have any questions concerning the project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided below if you have questions at a later time. Any questions regarding your rights as a participant may be addressed to the Office of Research Services (966-2084). Out of town participants may call collect.

The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this project also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

This research is supported by a grant obtained from the Canadian Institutes for Health Research.

If you and your parent decide that you would like to be a part of this project, please complete the attached form. If you or your parent has any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad (966-1071) at any time.

Youth Please Read and Sign Your Consent

I _____ voluntarily consent to participate in the project:
Northern LITES.

I have discussed this project and consent form with the researcher, and my parents/guardians. I understand the purpose of the project and my involvement, and that I have the option to withdraw from the project at any time without penalty of any sort. I also agree that if I withdraw from the project at any time, any information that I have contributed will be destroyed. My information will be used for research purposes only, and any details that may reveal who I am will not be included in project reports and presentations. If me or my caregiver has any questions, I may call the Office of Research Services (966-2084) at the University of Saskatchewan. I have been given a copy of this form to keep.

Participants Signature: _____ **Date:** _____

If you have any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

*The University of Saskatchewan Advisory Committee on Ethics in Behavioural Sciences
Research reviewed and approved this research project in June 2004.*

Dr. Karen Chad
Principal Investigator
College of Kinesiology
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Phone: 306-966-1071
Fax: 306-966-6502
Email: chadk@duke.usask.ca

CONSENT FORM (PARENTS OF YOUTH)
Northern LITES: Northern Lifestyle Initiatives Targeting the Environments

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on physical activity and healthy eating. The findings from this project will provide important information to health educators in developing future programs aimed at reducing obesity, maintaining healthy body weights, and preventing diabetes in your community.

While participation in this project is optional, we hope that many youth in your community will consent to participate. If your son or daughter decides to volunteer, his/her role as a participant is to complete two short surveys on physical activity and nutrition. The surveys will be read to your child by a researcher in the form of an interview. If you would like, we can give you and your son/daughter a copy of the questionnaire to look over before making your decision about the project.

There are no foreseeable risks associated with participating in this project. Participation is completely voluntary and your son/daughter can withdraw at any time. All youth will be encouraged to ask questions during completion of the questionnaire or the body composition testing if they need clarification. Feedback will be given to you and your son/daughter by the research assistants during the entire project. If your son/daughter needs assistance in translation, a research assistant will be happy to assist them by verbally translating the questionnaire.

The information from this project will be published and presented at conferences; however, your son or daughters identity will be kept confidential. Results are completely anonymous. Your son or daughter may withdraw from the project at any time, following which their information would be deleted from the project and destroyed. Withdrawal from the project will not affect their access to, or continuation of, services provided by the University of Saskatchewan. All of the information will be kept confidential and stored by the principal researcher, Dr. Karen Chad, in a locked office on the University Campus for a minimum of five years after the completion of the project.

If you or your son/daughter has any questions concerning the project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided below if you have questions at a later time. Any questions regarding your rights as a participant may be addressed to the Office of Research Services (966-2084). Out of town participants may call collect.

The results of this project will be made available to you and your son/daughter and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this project also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

This research is supported by a grant obtained from the Canadian Institutes for Health Research.

If you and your child decide that you would like to be a part of this project, please complete the attached form. If you or your son/daughter has any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad (966-1071) at any time.

Parents Please Read and Sign the Consent

I _____ voluntarily consent to participate in the project:
Northern LITES.

I have discussed this project and consent form with the researcher, and my son/daughter. I understand the purpose of the project and my child's involvement, and that he/she has the option to withdraw from the project at any time without penalty of any sort. I also understand that if they withdraw from the project at any time, any information that they have contributed will be destroyed. My son/daughter's information will be used for research purposes only, and any details that may reveal who they are will not be included in project reports and presentations. If I have any questions, I may call the Office of Research Services (966-2084) at the University of Saskatchewan. I have been given a copy of this form to keep.

Parent's Signature: _____ **Date:** _____

If you have any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

*The University of Saskatchewan Advisory Committee on Ethics in Behavioural Sciences
Research reviewed and approved this research project in June 2004.*

Dr. Karen Chad
Principal Investigator
College of Kinesiology
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Email: chadk@duke.usask.ca

Appendix G

One-on-one Interview Adult Consent

Consent Form
Physical Activity and Healthy Eating
One-on-one interviews

You are invited to participate in a study entitled Northern LITES: Northern Lifestyle Initiatives Targeting the Environments. Please read this form carefully, and feel free to ask questions you might have.

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on factors that facilitate physical activity and healthy eating as well as barriers to achieving such lifestyle behaviors. We would like to explore the cultural influence on family responsibilities, demands related to participating in traditional cultural events, physical activity opportunities and the availability of different types of food. The findings from this project will provide valuable information to assist in developing future physical activity and nutrition programs for your community, however the development of such programs are not guaranteed.

If you decide to volunteer as a participant, you will be asked to participate in a one-on-one interview. The interviews will be approximately one hour in length and will be audiotaped. You will have the option to skip any questions that you feel uncomfortable answering. You can choose to discontinue at any time and the information that has been recorded will be destroyed. You will be given the opportunity to review the final transcripts and sign a release form to acknowledge that the transcript accurately reflects what you said or intended to say. You will have the right to withdraw any part of or all of your responses if you choose to do so. If, after signing the consent and having been provided with a transcript of the tape recording for alterations and deletions, and after those alterations and deletions have been made, you refuse to sign the transcript release form, any comments made by you in the interview will be deleted and destroyed. All the information provided through the interviews will be confidential and stored by the principal investigator, Dr. Karen Chad, in a locked office on the University of Saskatchewan Campus for a minimum of five years after the completion of the study.

There are no foreseeable risks to your participation in this study.

The data from this study will be published and presented at conferences; however, your identity will be kept confidential. Although we will report direct quotations from the interview, you will be given a pseudonym (false name), and all identifying information will be removed from our report. The researcher will undertake to safeguard the confidentiality of the discussion, but cannot guarantee that other members of the group will do so. Please respect the confidentiality of the other members of the group by not disclosing the contents of this discussion outside the group, and be aware that others may not respect your confidentiality. Because the participants for this study have been selected from your community, it is possible that you may be identifiable to other people on the basis of what you have said. After your interview, and prior to the data being included in the final report, you will be given the opportunity to review the transcript of your interview, and to add, alter, or delete information from the transcripts as you see fit.

You may withdraw from the study at any time and following which your data will be deleted from the study and destroyed. Withdrawal from the study will not affect your access to, or

continuation of, services provided by the University of Saskatchewan. Results are completely anonymous. Direct words, comments and/or quotations from the transcripts may be used, however only group results will be published.

If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Sciences Research Ethics Board on (July 13, 2004). Any questions regarding your rights as a participant may be addressed to that committee through the Office of Research Services (966-2084). Out of town participants may call collect. The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this study also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I consent to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

Participants Signature: _____ **Date:** _____

If you have any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

Dr. Karen Chad
College of Kinesiology
87 Campus Drive
University of Saskatchewan
Saskatoon, SK S7N 5B2
(306) 966-1071
Email: chadk@duke.usask.ca

Appendix H

One-on-one Interview Youth Consent

Consent Form (Youth)
Physical Activity and Healthy Eating
One-on-one interviews

You are invited to participate in a study entitled Northern LITES: Northern Lifestyle Initiatives Targeting the Environments. Please read this form carefully, and feel free to ask questions you might have.

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on factors that facilitate physical activity and healthy eating as well as barriers to achieving such lifestyle behaviors. We would like to explore the cultural influence on family responsibilities, demands related to participating in traditional cultural events, physical activity opportunities and the availability of different types of food. The findings from this project will provide valuable information to assist in developing future physical activity and nutrition programs for your community, however the development of such programs are not guaranteed.

If you decide to volunteer as a participant, you will be asked to participate in a one-on-one interview. The interviews will be approximately one hour in length and will be audiotaped. You will have the option to skip any questions that you feel uncomfortable answering. You can choose to discontinue at any time and the information that has been recorded will be destroyed. You will be given the opportunity to review the final transcripts and sign a release form to acknowledge that the transcript accurately reflects what you said or intended to say. You will have the right to withdraw any part of or all of your responses if you choose to do so. If, after signing the consent and having been provided with a transcript of the tape recording for alterations and deletions, and after those alterations and deletions have been made, you refuse to sign the transcript release form, any comments made by you in the interview will be deleted and destroyed. All the information provided through the interviews will be confidential and stored by the principal investigator, Dr. Karen Chad, in a locked office on the University of Saskatchewan Campus for a minimum of five years after the completion of the study.

There are no foreseeable risks to your participation in this study.

The data from this study will be published and presented at conferences; however, your identity will be kept confidential. Although we will report direct quotations from the interview, you will be given a pseudonym (false name), and all identifying information will be removed from our report. The researcher will undertake to safeguard the confidentiality of the discussion, but cannot guarantee that other members of the group will do so. Please respect the confidentiality of the other members of the group by not disclosing the contents of this discussion outside the group, and be aware that others may not respect your confidentiality. Because the participants for this study have been selected from your community, it is possible that you may be identifiable to other people on the basis of what you have said. After your interview, and prior to the data being included in the final report, you will be given the opportunity to review the transcript of your interview, and to add, alter, or delete information from the transcripts as you see fit.

You may withdraw from the study at any time and following which your data will be deleted from the study and destroyed. Withdrawal from the study will not affect your access to, or continuation of, services provided by the University of Saskatchewan. Results are completely anonymous. Direct words, comments and/or quotations from the transcripts may be used, however only group results will be published.

If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Sciences Research Ethics Board on (July 13, 2004). Any questions regarding your rights as a participant may be addressed to that committee through the Office of Research Services (966-2084). Out of town participants may call collect. The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this study also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I consent to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

Participants Signature: _____ **Date:** _____

If you have any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

Dr. Karen Chad
College of Kinesiology
87 Campus Drive
University of Saskatchewan
Saskatoon, SK S7N 5B2
(306) 966-1071
Email: chadk@duke.usask.ca

Consent Form (Parents of Youth)
Physical Activity and Healthy Eating
One-on-one interviews

Your daughter is invited to participate in a study entitled Northern LITES: Northern Lifestyle Initiatives Targeting the Environments. Please read this form carefully, and feel free to ask questions you might have.

We would like to ask for your assistance with a project that is being carried out by the Deschambault Lake Health Clinic and the Colleges of Kinesiology, Medicine, Pharmacy & Nutrition and Arts & Sciences at the University of Saskatchewan. The purpose of this project is to gather information on factors that facilitate physical activity and healthy eating as well as barriers to achieving such lifestyle behaviors. We would like to explore the cultural influence on family responsibilities, demands related to participating in traditional cultural events, physical activity opportunities and the availability of different types of food. The findings from this project will provide valuable information to assist in developing future physical activity and nutrition programs for your community, however the development of such programs are not guaranteed.

If your daughter decide to volunteer as a participant, she will be asked to participate in a one-on-one interview. The interviews will be approximately one hour in length and will be audiotaped. She will have the option to skip any questions that she feels uncomfortable answering. She can choose to discontinue at any time and the information that has been recorded will be destroyed. She will be given the opportunity to review the final transcripts and sign a release form to acknowledge that the transcript accurately reflects what she said or intended to say. She will have the right to withdraw any part of or all of her responses if she chooses to do so. If, after signing the consent and having been provided with a transcript of the tape recording for alterations and deletions, and after those alterations and deletions have been made, she refuses to sign the transcript release form, any comments made by her in the interview will be deleted and destroyed. All the information provided through the interviews will be confidential and stored by the principal investigator, Dr. Karen Chad, in a locked office on the University of Saskatchewan Campus for a minimum of five years after the completion of the study.

There are no foreseeable risks to her participation in this study.

The data from this study will be published and presented at conferences; however, her identity will be kept confidential. Although we will report direct quotations from the interview, she will be given a pseudonym (false name), and all identifying information will be removed from our report. The researcher will undertake to safeguard the confidentiality of the discussion. Because the participants for this study have been selected from your community, it is possible that she may be identifiable to other people on the basis of what she has said. After the interview, and prior to the data being included in the final report, she will be given the opportunity to review the transcript of her interview, and to add, alter, or delete information from the transcripts as she sees fit.

She may withdraw from the study at any time and following which her data will be deleted from the study and destroyed. Withdrawal from the study will not affect her access to, or continuation of, services provided by the University of Saskatchewan. Results are

completely anonymous. Direct words, comments and/or quotations from the transcripts may be used, however only group results will be published.

If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Sciences Research Ethics Board on (July 13, 2004). Any questions regarding your rights as a participant may be addressed to that committee through the Office of Research Services (966-2084). Out of town participants may call collect. The results of this project will be made available to yourself and the community in the form of newsletters and presentations in collaboration with community organizations. A copy of any reports resulting from this study also will be made available to the community and participants through newsletters and presentations in collaboration with community organizations.

I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I consent my daughter to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

Parent's Signature: _____ **Date:** _____

If you have any questions or concerns about this project, please do not hesitate to contact Dr. Karen Chad at any time at the address below.

Researcher's Signature _____ **Date** _____

Dr. Karen Chad
College of Kinesiology
87 Campus Drive
University of Saskatchewan
Saskatoon, SK S7N 5B2
(306) 966-1071
Email: chadk@duke.usask.ca

Appendix I
One-on-one Interview Questions

One-on-One Interview Questions
Healthy Body Weight Physical Activity & Nutrition

Provide a brief explanation of the purpose for the interview – to explore their beliefs, attitudes and perceptions on health, body weight, physical activity and nutrition.

Explain that the purpose for tape recording is to help me be as accurate as I can with the words that they say and that if I were to write things down I might miss something. Stress how important their words are to me and that no one would be able to listen to the tape except for me. I will write everything out and go over it with them in person and if they choose at that time, they can keep the tape.

If they are reluctant to tape, let them know that we could start taping and if it really bothers them, then we can stop.

To begin, I'd like to know a little bit about you:

- a. How old are you
- b. How long have you lived in Deschambault Lake
- c. How often do you travel to other communities (PROBE reasons for travel)
- d. What do you enjoy about living here
- e. What do you find challenging about living here?

OVERARCHING QUESTION: What are Cree women's' perceptions of health?

Health

1. What do you think health is?
 - a. What is a healthy body?
 - b. What is a healthy mind?
2. How would you define 'good health'?
 - a. Would you say that you have good health? Can you tell me why you feel that way?
3. What do you think makes people healthy? What about things that make people unhealthy?
4. What do you think are health issues in your community?

OVERARCHING QUESTION: What are Cree women's' perception about healthy bodies (Not a number for body weight, but what a healthy body looks like)?

Body weight:

1. What does a healthy body look like to you? What can it do (or not do)? PROMPT: Does it look a certain way?
 - a. What does an unhealthy body look like? What can it do (or not do)?
2. Do you see unhealthy bodies (or body weight) as being a problem in your community?
 - a. For who?
 - i. Older people/younger people?
 - ii. Males/females
 - iii. SES
3. In your culture are some body types (weights) more accepted than others? If so, what? PROMPT: Are people encouraged to be heavier (lighter)?
4. What do you feel causes people to have unhealthier bodies than others?

OVERARCHING QUESTION: What influences physical activity in Cree Women? Does their culture affect their PA? Does the social environment affect their PA? Does the physical environment affect their PA?

Physical Activity

1. When talking about 'physical activity' (the range of activities that moves your body), what would a physically active person be doing? What would an inactive person be doing?
2. Do you consider yourself to be physically active? Can you give me a description of what you do? Does anyone do these activities with you?
 - a. Do these activities change with the seasons? (Are they different in the summer compared to the winter)?
3. What influence does age have on the types of activities people do? PROBE: Do people who are younger do different activities than those who are older? What would these be?
4. Think about the community of Deschambault Lake. Is there anything about this community that makes it easy or hard for you to be active?
 - a. Is there anything about the geography helps or prevents activity?
 - b. What about the climate?
 - c. Is there a hunt break? What do they do out there?
5. Is there anything about your family that affect what activities you do?
 - a. Talk a bit more about family supports/barriers
 - b. Talk a bit more about levels of support (parents, children, sisters/brother, aunties/uncles, cousins)

- c. What do you think are some things that would make women in the community want to do physical activities? PROMPT: Are there things in the community that could help, i.e. being outdoors/indoors, groups/individual, women only, older and younger together/separate

OVERARCHING QUESTION: What influences the diet of Cree Women? Does their culture affect the foods they choose and how to prepare them? Does the social environment affect the foods they choose and how to prepare them? Does the physical environment affect the foods they choose and how to prepare them?

Nutrition:

1. What would you describe as 'healthy eating'? PROMPT: What would be some foods you would eat on a 'healthy food day' or a 'good for you day'?
 - a. Is it difficult for you to get some of these foods? Why? PROBES: money, availability
2. What would you describe as 'healthy foods' in your culture?
 - a. What would be the healthiest/unhealthiest?
 - b. When would you eat these foods?
 - c. Where do you get these foods?
 - d. How would you prepare these foods?
 - e. Who is there when you prepare them? What language is spoken
3. Are there any other food that you believe to be 'healthy foods'? PROMPT: Any foods that you do not eat now but would like to? What prevents you from eating these foods?
4. What do you think would be a good way to make them more accessible (easier to get)?
5. Is there anything about your family that affects what food you eat? Similar to what we talked about with the activities, can you...
 - a. Talk a bit more about any supports/barriers (parents, children, sisters/brother, aunties/uncles, cousins)
 - b. Talk a bit more about levels of support
6. Think about the community of Deschambault Lake. Is there anything about this community that affects what you eat?
 - a. Is there anything about the geography affects what you eat?
 - b. What about the climate?
7. What do you think are things that would encourage women in your community to choose to eat the healthier foods?
 - a. Are there things in the community/in a person's household?

Is there anything else that you would like to tell me that we haven't talk about already?

Appendix J
Modifiable Activity Questionnaire (MAQ)

PHYSICAL ACTIVITY

Circle all of the activities that you done more than 10 times in the PAST YEAR.

- | | | | | |
|-------------------|-----------------------|---------------------|-------------------|------------------|
| Aerobics | Dancing | Home exercises | Ski - Downhill | Trapping |
| Badminton | Dancing (Aboriginal) | Horseback Riding | Ski-X-Country | Ultimate Frisbee |
| Baseball | Dance-Break | Housework | Skipping | Volleyball |
| Basketball | Elliptical Trainer | Hunting | Snowboarding | Walking |
| Berry Picking | Fishing (ice) | MartialArts/Kickbox | Snowshoeing | Weight training |
| Biking-Outdoors | Fishing (summer) | Paddling | Soccer | Wrestling (play) |
| Biking-Stationary | Football | Ping Pong | Softball | Yoga |
| Broomball | Garden/Yard Work | Ringette | Strength training | Other |
| Bowling | Golf | Rowing | Swim-Diving | _____ |
| Boxing | Gymnastics | Rugby | Swim-Laps | _____ |
| Camping | Hacki sac | Running | Swim-Leisure | _____ |
| Canoeing | Hiking | Shoveling | Tae-bo | _____ |
| Croquet | Hockey (ice) | Skateboarding | Tennis | |
| Curling | Hockey (street/floor) | Skating-Ice | Trampoline | |

1. List each activity that you circled above in the “Activity” box below.
2. For each activity, record the average number of times you did each activity each month. Record this for each month.
3. For each activity, estimate the average number of minutes that you spent doing each activity each time. Only report the time that you were **actively participating in the activity**
4. For each activity, record the intensity as **Light** (light change from normal breathing), **Medium** (above normal breathing), or **Heavy** (heavy breathing)

Activity	J a n	F e b	M a r	A p r	M a y	J u n	J u l	A u g	S e p	O c t	N o v	D e c	Average # of Minutes Each Time	Average Intensity L=Light M=Medium H=Heavy

2. In general, how many HOURS per DAY do you usually spend watching TV? _____ hrs

3. Over this past year, have you spent more than one week confined to a bed or chair as the result on an injury, illness or surgery? Yes_____ No_____

If yes, how many weeks over this past year were you confined to a bed or chair? _____weeks

4. Do you have difficulty doing any of the following activities?

- a. Getting in or out of bed or chair? Yes_____ No_____
- b. Walking across a small room without resting? Yes_____ No_____
- c. Walking for 10 minutes without resting? Yes_____ No_____

5. Did you ever compete in an individual or team sport (not including any time spent in sports performed during school physical education classes)? Yes_____ No_____

If yes, how many total years did you participate in competitive sports? _____years

6. Have you had a job for more than one month over this past year, from last _____ to this _____?

List all Jobs that you had over the past year for more than one month. Account for all 12 months of the past year. If unemployed/disabled/retired/homemaker/student during all of part of the past year, list as such and indicate the job activities of a normal 8 hour, 5 day week.

Job Name	Job Code (e.g. student, homemaker, retired, etc)	Walk or bicycle to/from work Min/Day	Average Job Schedule			Hours spent sitting at work	Check the category which best describes job activities when not sitting		
			Months/Yr	Days/Wk	Hrs/Day		A	B	C

- Category A:** Sitting, standing still, light cleaning (ironing, cooking, washing, dusting), driving a bus, taxi, tractor, general office work, occasional short distance walking.
- Category B:** Carrying light loads, continuous walking, heavy cleaning (mopping, sweeping, scrubbing, vacuuming), gardening, painting/plastering, plumbing/welding, electrical work.
- Category C:** Carrying moderate to heavy loads, heavy construction, farming (hoeing, digging, mowing, raking), digging ditches, shoveling, chopping/sawing wood, tree/pole climbing, water/coal/wood hauling

Appendix K

**Percentage of individuals participating in each leisure-time activity
at least ten times over the past year**

Activity	Overall (%) N = 58	15-24 years (%) N = 34	25-39 years (%) N =11	40-54 year (%) N =8	55+ years (%) N =5
Badminton	10.3	14.7	0	12.5	0
Baseball	15.5	17.6	27.3	0	0
Basketball	29.3	50	0	0	0
Berry Picking	10.3	0	18.2	25	40
Biking-outdoors	20.7	23.6	9.1	37.5	0
Biking-stationary	1.7	2.9	0	0	0
Broomball	22.4	29.4	9.1	25	0
Bowling	3.4	5.9	0	0	0
Boxing	3.4	5.9	0	0	0
Camping	6.9	2.9	9.1	25	0
Canoeing	19.0	14.7	9.1	50	20
Cooking	1.7	2.9	0	0	0
Croquet	12.1	8.8	18.2	25	0
Curling	1.7	2.9	0	0	0
Dance	36.2	35.3	45.5	50	0
Dance Aboriginal	3.4	5.9	0	0	0
Elliptical Trainer	1.7	0	9.1	0	0
Fishing-commercial	1.7	0	0	0	20
Fishing-summer	13.8	5.9	9.1	37.5	40
Fishing-ice	12.1	11.8	9.1	25	0
Football	1.7	2.9	0	0	0
Gardening	5.2	5.9	0	12.5	0
Golf	15.5	23.5	0	12.5	20
Gymnastics	1.7	2.9	0	0	0
Hacki Sac	15.5	26.5	0	0	0
Hiking	15.5	23.5	0	37.5	0
Hockey-street	6.9	11.8	0	0	0
Hockey-ice	15.5	26.5	0	0	0
Home exercises	6.9	0	27.3	12.5	0
Housecleaning	58.6	47.1	72.7	62.5	100
Hunting	3.4	0	9.1	12.5	0
Paddling	3.4	2.9	0	0	20
Running	41.4	58.8	18.2	25	0
Setting Snares	5.2	0	9.1	25	0
Shoveling	25.9	14.7	36.4	50	40
Skating-ice	15.5	17.6	9.1	25	0
Skiing-downhill	1.7	2.9	0	0	0
Skiing-x-country	3.4	2.9	9.1	0	0
Skipping	5.2	5.9	0	12.5	0
Snowboarding	3.4	5.9	0	0	0
Snowshoeing	1.7	0	0	12.5	0
Soccer	13.8	23.5	0	0	0
Softball	10.3	17.6	0	0	0
Strength training	6.9	5.9	9.1	12.5	0
Swim-diving	12.1	20.6	0	0	0
Swim-lake	3.4	2.9	9.1	0	0
Swim-leisure	15.5	20.6	18.2	0	0
Tennis	6.9	11.8	0	0	0
Trampoline	24.1	41.2	0	0	0
Volleyball	50	73.5	27.3	12.5	0
Walking	84.5	85.3	90.9	87.5	60
Wood chopping	1.7	0	0	0	20
Wood hauling	5.2	0	0	12.5	40
Wrestling-fun	10.3	11.8	9.1	12.5	0
Yard work	29.3	20.6	54.5	50	0
Yoga	1.7	0	9.1	0	0

Appendix L
24-Hour Diet Recall

24-Hour Diet Recall Recording Form

Name _____ Date _____ Day of Week _____

Time of Day	Food Items	Type	How prepared	Amount	Brand name or where bought
Morning	Cereal	Plain oatmeal	Boiled	1 cup	Quaker

Was this intake usual? Yes No: Why _____

Do you take any vitamin or mineral supplements? Yes No

Supplement	Brand Name	Dose	Amount taken
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Appendix M
Transcript Release Form

NORTHERN LITES
TRANSCRIPT RELEASE FORM

I, _____, have reviewed the complete transcript of my interview in this project, and have had the opportunity to add, alter, and delete information from the transcript as appropriate. I confirm that the transcript accurately reflects what I said in this interview. I hereby authorize the release of this transcript to Dr. Karen Chad to be used in the manner described in the consent form.

Participant

Date

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