Aboriginal Women and Obesity in Canada: A Review of the Literature

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INTRODUCTION

Obesity is becoming an alarming health issue in Canada, as already high rates of overweight and obesity continue to grow (Bélanger-Durcharme & Tremblay, 2005). The issue has been identified as particularly significant in Aboriginal populations where obesity rates are substantially higher than the national average (Assembly of First Nations, 2007; Bernard, Levallée, Gray-Donald & Delisle, 1995; Hanley et al., 2000; Health Council of Canada, 2005; Shields, n.d.; Tremblay, Pérez, Ardern, Bryan & Katzmarzyk, 2005; Willows, 2005). For example, the 2004 Canadian Community Health Survey (CCHS) reported obesity rates of 37.8 percent among off-reserve Aboriginal groups as compared with 25.2 percent for white Canadians and 23.1 percent for the Canadian population[1] as a whole (Tjepkema, 2005). Similarly, the 2002/03 First Nations Regional Health Survey (FNRHS) revealed an obesity rate of 36 percent for First Nations peoples living on-reserve (Assembly of First Nations, 2007).

This review exploring the body of literature examining obesity issues among Aboriginal women contains four main sections: the parameters of the review and methodological challenges; an overview of the available research respecting sex and gender and obesity-related health risks; predominant research areas and approaches; and considerations for engaging in an economic cost-benefit analysis. The first section defines terms, describes the search strategy and the parameters of the literature reviewed, and provides some Canadian context regarding obesity and First Nations, Métis, and Inuit women. The second section explores sex-disaggregated obesity prevalence rates as well as the implications of these rates for First Nations, Métis, and Inuit

[1] The "Canadian population" refers to all Canadians represented in the sample for the purposes of the CCHS survey. The survey targeted adults over 18 years of age living in private occupied dwellings in the ten provinces. Excluded from the sampling frame were residents of the three territories, persons living on Indian reserves or Crown lands, persons living in institutions, full-time members of the Canadian Forces and residents of some remote regions. It should be noted that use of the "Canadian population" as a source of comparison includes Aboriginal persons living off-reserve in Canada.

women and girls. In particular, this section focuses on obesity-related health risks, such as diabetes, vision and hearing impairments, respiratory problems, cardiovascular issues, and musculoskeletal conditions. The prevalence rates, sex differences, and gender implications respecting care and treatment for each of these co-morbid conditions are also discussed. The third section details five main areas or themes in the research: biogenetic approaches; behavioural and lifestyle factors (such as physical activity and food consumption); environmental factors; social and cultural considerations (including socio-economic status); and socio-political analysis. The fourth and final section considers the economic costs of obesity and obesity-related health conditions and consequent implications for Aboriginal populations. A summary of salient points concludes this review.

SCOPE & METHODOLOGICAL CHALLENGES

The literature review searched common web browsers (such as Google), academic databases (such as PubMed/Medline and Sociological Abstracts), and Government of Canada reports for terms such as “Aboriginal”, “Métis”, “Inuit”, “First Nations”, “Indigenous”, “women”, “girls”, “gender”, “sex differences”, “obesity”, etc. This section provides some clarification as to the usage of these terms, both in the literature and in this review, as well as some of the methodological challenges relevant to evaluating this body of research.

Definition of Terms

In reviewing literature respecting the Aboriginal population in Canada it is important to clarify common terms as they are often used interchangeably in the research. The term “Aboriginal”, for instance, is generally used as an umbrella term that includes all First Nations, Métis, and Inuit populations in Canada. The use of such a broad term tends to obscure the considerable cultural, linguistic, and socio-economic diversity both among and between

communities. For instance, it cannot be assumed that the Inuit of Nunavut and the Inuit of Labrador have identical cultural beliefs and practices or political and social priorities. Therefore, wherever possible, the regional make-up of the population being researched is included for the studies reviewed. Some studies reviewed in this document refer solely to "Aboriginal" peoples in Canada while others specifically focus on one (or more) group(s) in particular. These distinctions are noted when provided in the original research. Also, American research tends to refer to Native, Native American, American Indian, or Indian populations while studies from New Zealand and Australia focus on Aborigine, Indigenous, and Pacific Islander populations. Throughout the literature review, language consistent with that provided in the original study is used.

While the term "Aboriginal" should not be construed to mean one people or culture, there is a good deal of shared history among First Nations, Métis, and Inuit populations in Canada and an awareness of this shared history is important as is an understanding of the significant regional and cultural variation among Aboriginal groups in Canada. For instance, the First Nations, Métis, and Inuit peoples have all historically been defined by the government of Canada; however, each group has different relationships with government and issues around inclusion and exclusion (Bent, Havelock & Haworth-Brockman, 2007; Clow, Pederson, Haworth-Brockman & Bernier, forthcoming). Furthermore, the First Nations distinction includes those who meet certain criteria are registered under the *Indian Act* (referred to as "status Indians[2]") as well as those not registered (or "non-status"), which impacts access to health services among many other rights (Canadian Population Health Initiative, 2004; Clow et al., forthcoming). "Status" itself is a gendered construct as historically, for married women, it was dependent on the status of the husband – non-Indian women lost their Canadian citizenship and were eligible for status if they

[2] Use of the terms "Indian" and "status" in this context refer to a First Nations person's standing under the law.

married an Indian man, and conversely, Indian women in Canada lost their status eligibility if they married a non-Indian man (Clow et al., forthcoming). While Bill C-31 passed in 1985 reversed this discriminatory regulation, women registering under the revised legislation are not necessarily extended rights in a specific reserve community as some First Nations reserves dictate their own criteria for Band membership by federal law (Bent et al., 2007; Clow et al., forthcoming). The federal government maintains responsibility for providing health care over and above provincial health care services to those persons registered under the *Indian Act*, which in some cases, extends to all status Indians, and in others depends on residency on-reserve (Clow et al., forthcoming). There is frequently lack of clarity around the consequent rights to and complicated jurisdictional responsibilities for health services such as ambulance services, medications financed by the province, and dental care, among others (Clow et al., forthcoming).

In a literature review considering obesity research, it is important to discuss relevant operational definitions of the term "obesity" as well as some frequently cited critiques and concerns respecting how this definition is determined. Obesity is almost exclusively defined according to body mass index (BMI) a number determined by dividing weight in kilograms by height in meters squared. The World Health Organization (WHO) places the cutoff for obesity at a BMI of 30 or over and the range for overweight at a BMI of 25 to less than 30, which is the standard most often used in the research. Using BMI as the gold standard, research demonstrates that, obesity and overweight affect different populations at different rates and have different health consequences. For examples, health risks associated with obesity may differ between ethnic groups when the level of body fat remains constant (McAuley, Williams, Mann, Goulding & Murphy, 2002). Pacific Island women in New Zealand have a lower percentage of body fat (38.9 percent) at a BMI of 30 than do European women (42.5 percent) (Tyrrell et al., 2001).

Therefore, percentage of body fat may be a more accurate indicator of certain health risks for some Aboriginal populations than BMI alone. Interestingly, First Nations adults living off-reserve and the Canadian population exhibit comparable rates of overweight, but they are almost twice as likely to be considered obese (Tjepkema, 2002). Accordingly, this review focuses on obesity rates unless otherwise stated.

Research demonstrates that BMI is far from an ideal measure of health and fitness, especially across ethnic groups because this measure was developed and tested primarily among people of European descent (Duncan, Schofield, Duncan, Kolt & Rush, 2004; Health Canada, 2003a; Razak et al., 2007). For example, the obesity cutoff of a BMI of 30 or over has been shown to under-represent the risk of heart disease associated with obesity in different ethnic populations, including Aboriginal peoples in Canada (Razak et al., 2007). Accordingly, Duncan et al. (2004) advocate ethnic population and country specific BMI cutoffs for determining overweight and obesity prevalence rates and related health risks. Other research has criticized the use of BMI as an isolated indicator of obesity (Potvin et al., 1999) maintaining the need to incorporate other, more reliable predictors of health risk measures, such as waist circumference (Assembly of First Nations, 2007; Duncan et al., 2004; Janssen, Katzmarzyk & Ross, 2004). The relationship between weight and health and/or fitness is clearly more complex than analysis of BMI measures alone will allow. Despite the existence of more accurate models that account for multiple aspects of body composition, BMI continues to be the most prevalent method used in Canada and the developed world for defining obesity because it is considered the most cost-effective and practical method available (Duncan et al., 2004).

Methodological Challenges

One of the challenges we face when reviewing the research on obesity in First Nations, Métis, and Inuit populations in Canada is that comprehensive data for health indicators are sporadic for First Nations and Inuit populations and, with a few exceptions, are unavailable for the Métis population, (Health Council of Canada, 2005). There is more data available regarding the health status of First Nations and Nunavut Inuit populations; however, there is insufficient information to allow for comparison with both the non-Aboriginal population and other Aboriginal groups (Health Council of Canada, 2005). There are two national surveys that provide the bulk of health statistics for Aboriginal peoples in Canada: the First Nations Regional Health Survey (FNRHS) and the Canadian Community Health Survey (CCHS). The FNRHS originated in response to the absence of First Nations reserve and Inuit populations in three national longitudinal surveys conducted in the early 1990s (First Nations Centre, 2006). It is coordinated and governed by national and regional First Nations organizations using the Ownership, Control, Access, and Possession (OCAP) principles, which ensure data is used according to self-determined research objectives that serve the best interests of First Nations communities (First Nations Centre, 2006). It is conducted every four years with First Nations youth and adults 15 years of age and older living on-reserve. The CCHS is a national health survey conducted by Statistics Canada each year (prior to 2007 every two years) with a wide-scale sample of Canadians 12 years of age and older, excluding reserve communities.
These two surveys comprise the most thorough health research and are most consistently referenced in other works. Another common data source addressing the health and well-being of Aboriginal populations is the Aboriginal Peoples Survey (APS), also conducted by Statistics

Canada, which captures data on the social and economic conditions of First Nations (off-reserve), Métis, and Inuit peoples ages six and older in Canada.

According to the Health Council of Canada (2005) there is a significant gap in reliable and consistent BMI data for First Nations, Métis, and Inuit populations in Canada. One factor affecting the consistency of BMI data is that some surveys use self-reporting methods while others rely on physical measurements. Self-reporting bias and inaccuracy is a concern identified across populations, including among Aboriginal peoples, because self-reported measures of weight tend to under-represent obesity (Booth, Hunter, Gore, Bauman & Owen, 2000; Elgar & Stewart, 2008; Roberts, 1995; Strauss, 1999); however, underreporting is more common among individuals with higher BMIs (Katzmarzyk & Ardern, 2004). When assessing rates of childhood obesity, relying on parental reports of children's height and weight reveals a different bias. Shields (n.d.) notes that parents tend to underestimate their children's height which results in higher BMIs and therefore reported higher obesity rates for children and youth.

Contextual Background

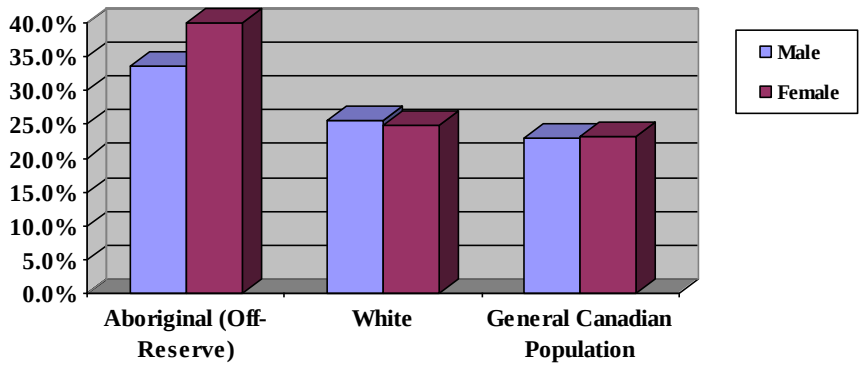
In providing a cultural context for this review on obesity-related health research, it is necessary to consider how Aboriginal conceptualizations of health differ from, and continue to be marginalized within, traditional Western understandings of health. Findings from Barksdale et al.'s study exploring Caucasian/white, African/Black and Aboriginal Nova Scotian women's personal understandings of health indicated that Aboriginal women's subjective definition of health often fell outside traditionally Western conceptualizations (as cited in Maritime Centre of Excellence for Women's Health (MCEWH), 2001). Western definitions typically included themes around the absence of disease, physical fitness and energy, ability to perform roles or functions, psychological fitness, and lifestyle/health maintenance while Aboriginal women

tended to refer to balance, wholeness, and wellness (MCEWH, 2001). Similarly, Bartlett (2005) engaged in talking circles with Métis women in Manitoba and found that participants did not perceive "disease" as an element of health or well-being. Consequently, a recommendation resulting from Barksdale et al.'s research was that "even broader definitions of health may be insufficient to capture all ethnic groups' definitions of health" (MCEWH, 2001, p. 2) and that more research is needed around perceptions of health in regard to Aboriginal women.

OBESITY PREVALENCE & SEX DIFFERENCES

According to the FNRHS, First Nations women have higher rates of obesity than non-Aboriginal women and these differences get more pronounced as BMI increases (Assembly of First Nations, 2007). First Nations men are more likely than their female counterparts to be overweight (41.8 percent versus 31.1 percent) while First Nations women are more likely than their male counterparts to be obese (34.3 percent versus 28.6 percent) (Assembly of First Nations, 2007; Nunavut Department of Health and Social Services, 2002). Comparatively, there tends to be no statistically significant difference between rates of obesity for women and men in samples of white Canadians or the Canadian population in general (Tjepkema, 2005) as shown in Figure 1[3].

Figure 1: Obesity Rates by Race and Sex



[3] Data for Figure 1 is taken from the 2004 CCHS and includes adults 18 years of age and older.

Prevalence Among Aboriginal Children & Youth

Obesity prevalence rates are disproportionately high among Aboriginal children and youth in Canada as well as adults. For instance, Cree children and adolescents in Quebec were five times more likely to be overweight than their non-Aboriginal peers (Lavallée & Robinson as cited in Bernard et al., 1995). Potvin et al. (1999) found similar results in Mohawk Nations in Quebec and Ontario, where Mohawk children were slightly heavier and had greater waist and hip circumferences than their non-Aboriginal peers[4]. These differences grew more pronounced as children aged starting at about age nine (Potvin et al., 1999). Preliminary results from the 2002/03 FNRHS estimated that 36 percent of First Nations youth aged 12 to 17 were obese (Assembly of First Nations, 2004). There is also evidence that there are higher rates of obesity among Aboriginal girls in certain populations as compared with their male peers. For instance, Bernard et al. (1995) found that 24 percent of Cree girls in the James Bay region of northern Québec were obese as compared with 9 percent of Cree boys. In northern Manitoba, Young, Dean, Flett and Wood-Steiman (2000) found that 40 percent of Ojibwa-Cree girls and 34 percent of Ojibwa-Cree boys aged 4 to 19 were obese indicating considerable regional variation in obesity among Aboriginal youth (Assembly of First Nations, 2007). Age is also a factor in variations in obesity rates as BMI has been found to be generally similar between girls and boys up to age 13 (among Sandy Lake First Nation youth in Ontario), after which time Aboriginal girls tend to have a higher BMI than their male peers (Hanley et al., 2000). Conversely, in the Canadian population in general, boys aged 12-17 were slightly more likely to be obese (11.1 percent) than their female peers of the same age range (7.4 percent) as measured in the 2004 CCHS (Shields, n.d.).

[4] Non-Aboriginal population measures for this study were derived from the US National Health and Nutrition Examination Survey (NHANES II) data collected between 1976 and 1980.

Research from the United States on ethnicity and childhood obesity tends to focus on Hispanic, Black and sometimes Asian populations with few studies specifically considering Native American children and youth. Eichner et al. (2008) confirm, "data on Native American children and adolescents are rarely reported along with other racial and ethnic groups" (p. 501). There is a lack of national data on the prevalence of overweight and obesity for Native American populations (Crawford, Story, W.C. Wang, Ritchie & Sabry, 2001), which presumably makes it challenging to engage in cross-ethnic comparisons. However, some researchers have worked with these difficulties and provided such cross-cultural comparisons for children in the United States. In their study comparing White, Hispanic, Black and Native American children ages 6 to 17 in a single school district, Eichner et al. found that Native American children had the highest rate of obesity of all ethnic groups at 28.4 percent. Notably, Zephier, Himes and Story's (1999) study comparing obesity rates for American Indian males and females aged 5-17 revealed that rates for males exceeded rates for females at many ages. Looking at age and sex correlates, Eichner et al. found that the obesity rate for Native American females was slightly higher than their male Native American peers at ages 6 to 11 (29.0 percent versus 27.7 percent); however, in youth aged 12-17, obesity rates for Native American females dropped to lower than those for Native American males (27.0 percent versus 30.0 percent). These studies contradict findings from Canada that indicate First Nations girls' obesity rates surpass those of their male peers around age 13 (Hanley et al., 2000).

Childhood obesity among indigenous peoples has also been identified as a significant health problem in New Zealand and Australia. Researchers have identified Maori and Pacific Island populations in New Zealand as having higher obesity rates than populations of European descent (Turnbull, Barry, Wickens & Crane, 2004; Tyrell et al., 2001). Congruent with findings

from New Zealand, O'Dea's (2008) wide scale study of schoolchildren in Australia found the highest prevalence of obesity among Pacific Island students. O'Dea also looked at perceptions of body image among students and found that "obese female adolescents from Aboriginal, Middle Eastern/Arabic and Pacific Islander backgrounds were less likely than their Caucasian or Asian peers to perceive themselves as 'too fat'" (p. 282). She concluded that "obesity is likely to be more prevalent, more culturally acceptable and perhaps more desirable among children and teens from low SES [socioeconomic status] communities and/or Middle Eastern and Pacific Islander backgrounds" (O'Dea, 2008, p. 282). Z. Wang, Hoy and McDonald (2000) compared BMI measurements of Aborigines in remote communities in Australia's Northern Territory with data from European Australian, white American, African American, and other indigenous Australian populations. They found that young Aboriginal women in remote communities had higher BMI measurements than their white American counterparts and this trend continued up to 45 years of age (Z. Wang et al., 2000). Interestingly, in Australia, obesity rates in the remote Aborigine community sample were found to be lower than those in the national sample of indigenous Australians (Z. Wang et al., 2000).

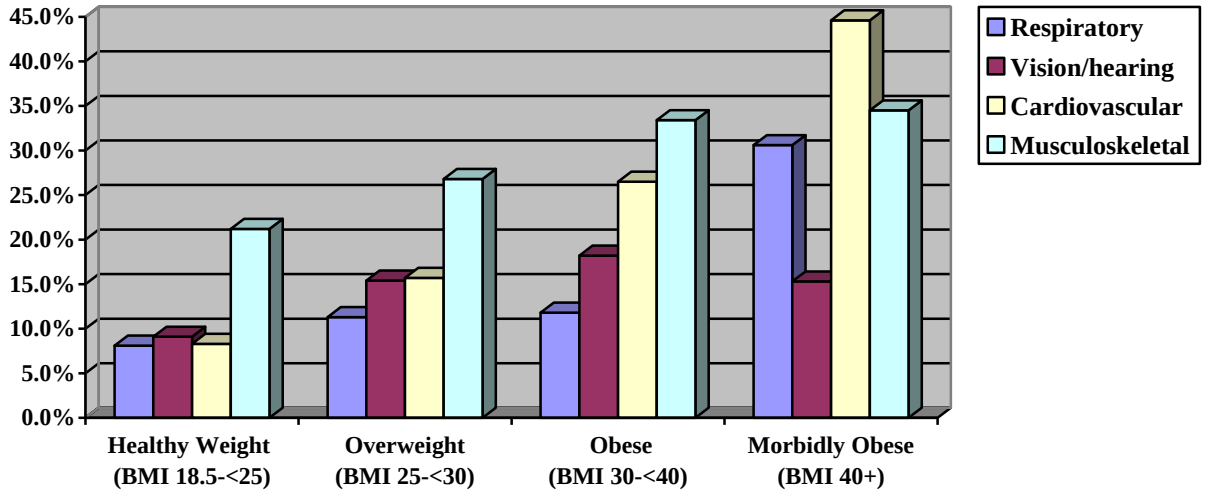
OBESITY-RELATED HEALTH RISKS

As the risk of developing health problems increases as BMI increases (Razak et al., 2007; Tjepkema, 2005), the disproportionately high rates of obesity among Aboriginal populations indicate that there is an increased risk of Aboriginal adults and youth developing a wide range of serious health problems (Assembly of First Nations, 2007). Associations between BMI, percent body fat and related health risks can vary across ethnic groups (Duncan et al., 2004) and impact women and men differently (Power & Schulkin, 2008). Research with Mohawk and Ojibwa First Nations peoples in Ontario and Quebec showed that these populations have a greater percentage

of subcutaneous fat and a more centralized distribution of body fat than those of European ancestry (Katzmarzyk & Malina, 1998, 1999; Potvin et al., 1999). This type of fat distribution has been associated with obesity-related health conditions such as diabetes and heart disease.

According to the FNRHS, 65.7 percent of obese First Nations adults reported at least one chronic health condition as compared with 43.1 percent of respondents within the normal weight range (Assembly of First Nations, 2007). A number of chronic health conditions correlated with obesity have been reported among First Nations populations (Assembly of First Nations, 2007). Figure 2 shows the prevalence of commonly reported chronic conditions among First Nations populations in Canada by level of obesity[5].

Figure 2: Chronic Conditions by Level of Obesity among First Nations Adults



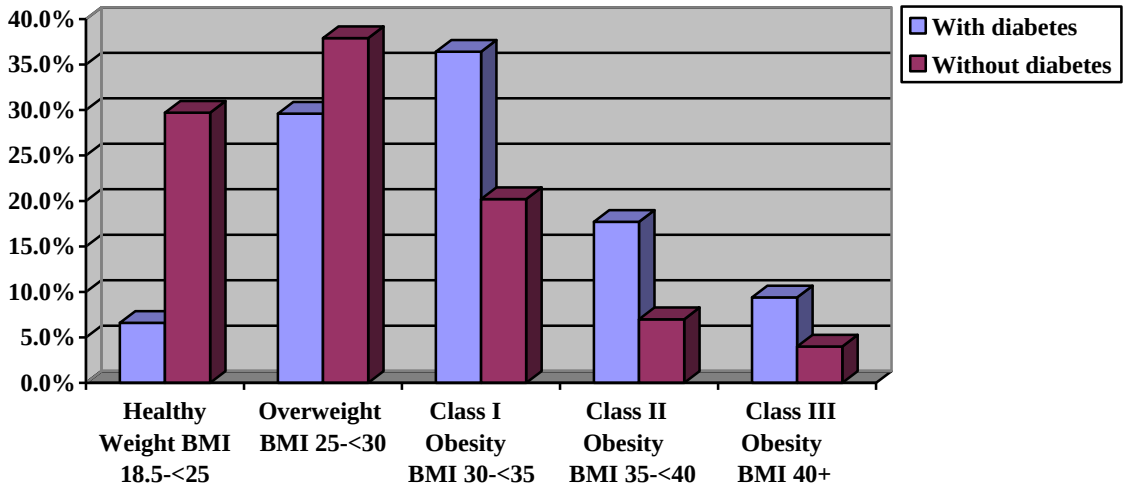
Based on the 2002/03 FNRHS, the most commonly reported obesity-related conditions were diabetes, vision and hearing impairments, respiratory disorders, cardiovascular problems, and musculoskeletal conditions, each of which are described in more detail in the following sections.

[5] Data for Figure 2 is from the 2002/03 FNRHS (Assembly of First Nations, 2007).

Diabetes

Overweight and obesity are significant risk factors for diabetes, a chronic disease that results from problems with the body's production of insulin resulting in an increase in blood glucose levels (Assembly of First Nations, 2007; Healey & Qayyum, n.d.; Nunavut Department of Health and Social Services, 2002). These elevated glucose levels can damage the kidneys, eyes, nerves, heart and blood vessels, and without treatment, these organs will eventually shut down (Healey & Qayyum, n.d.). A large majority (88.7 percent) of Aboriginal people living with diabetes experience at least some negative health consequences including heart disease, vision and circulatory problems, and infections (Assembly of First Nations, 2007). Diabetes can manifest as several types: Type 1, Type 2 and gestational diabetes. Type I diabetes occurs primarily in childhood or early adolescence and is relatively rare among Aboriginal populations (Assembly of First Nations, 2007; Health Canada, 2000). Type 2 diabetes results when the body develops a resistance to insulin and/or a defect that affects secretions in the pancreas (Health Canada, 2000). Gestational diabetes occurs during pregnancy as a result of elevated glucose levels resulting from hormone secretions (Health Canada, 2000). These higher glucose levels become problematic when women cannot produce enough insulin to regulate them, and may become diabetic during the pregnancy (Health Canada, 2000). Obesity has been shown to be a risk factor for both Type 2 and gestational diabetes (Kmetic, Reading & Estey, 2008). Therefore, use of the term 'diabetes' in this review refers to Type 2 diabetes mellitus. Gestational diabetes relevant to Aboriginal women is described in more detail in a later section. With regard to the relationship between obesity and diabetes, Figure 3 shows the proportion of First Nations peoples in Canada with diabetes and without diabetes across BMI ranges. It demonstrates that the majority of First Nations adults with diabetes fall within the obesity ranges.

Figure 3: Distribution of BMI among First Nations peoples in Canada with and without diabetes



Source: FNRHS 2002/03 (Assembly of First Nations, 2007).

Prevalence of Diabetes in Aboriginal Populations

Rates of diabetes have been found to be considerably higher in Aboriginal populations in Canada (Dyck, Klomp, Tan, Turnell & Boctor, 2002; Dyck, 2005; Kuhnlein, Chan, Egeland & Receveur, 2005; Ross, McKenna, Mozejko & Fick, 2007), the United States (Acton et al., 2002; Burrows, Geiss, Engelau & Acton, 2000), and Australia (Burke et al., 2007; Kondalsamy-Chennakesavan, Hoy, Z. Wang & Shaw, 2008) as compared to the non-Aboriginal population in those nations. According to the Assembly of First Nations (2007), the rate of diabetes for the First Nations population in Canada is three to five times greater than that for the general Canadian population. Studies in Ontario and Manitoba have shown that type 2 diabetes among young children is increasing dramatically with the rate for First Nations girls outnumbering that for boys by more than five to one (Health Canada, 2000). Diabetes rates are disproportionately high among adult First Nations women as well. Health Canada (2000) reports that "approximately 2/3 of the First Nations people diagnosed with diabetes are women" (Bobet as cited in Health Canada, 2000, p. 12). Conversely, in the non-Aboriginal population as whole,

diabetes rates tend to be higher among males than females. The high prevalence rates of diabetes among Aboriginal populations in Canada are concerning in and of themselves, but they also experience earlier onset of diabetes, greater severity at diagnosis, higher rates of complications, lack of accessible services, and increased prevalence of risk factors (Health Canada, 2000).

While diabetes rates are consistently high across Aboriginal populations, studies for specific sub-populations have revealed that rates vary between Aboriginal groups. Table 1 provides a detailed summary of the prevalence of diabetes in Canada by province and Aboriginal identity living off-reserve (Statistics Canada, 2003). Rates of diabetes were consistently higher among North American Indian identified persons except in British Columbia and the Northwest Territories where the Métis population was slightly more likely to report diabetes. Data were available for comparing only two Aboriginal groups in the Yukon and Nunavut Territories and prevalence rates were similar or the same between those respective groups. Sex-disaggregated statistics for diabetes prevalence according to Aboriginal group are not available.

Table 1: Percentage of Persons with Diabetes by Province and Aboriginal Group Identity[6]

	Aboriginal[7] (Includes First Nations)	North American Indian[8]	Métis	Inuit
Canada	7.1%	8.3%	5.9%	2.3%
Atlantic Provinces	5.9%	8.0%*	3.6%*	4.9%* (NL only)
Province of Québec	5.8%	6.9%*	5.2%*	2.4%*

[6] Table 1 is based on the 2001 Aboriginal Peoples Survey (APS) results reported by Statistics Canada (2003). All data is for off-reserve Aboriginal populations 15 years of age and older with the exception of the Northwest Territories which combines off- and on-reserve populations. Data indicated with a "*" should be interpreted with caution due to small sample size. Data replaced with an "X" have been suppressed due to confidentiality requirements of the *Statistics Act*. For the Inuit identity group, data are only available for Newfoundland and Labrador, Québec, Northwest Territories, and Nunavut.

[7] The APS Aboriginal population included those who self-identified as an Aboriginal person, and/or had Aboriginal ancestry, and/or First Nations membership and/or registration under the Indian Act.

[8] The North American Indian population includes those who self-identified as North American Indian (either as a single response or in combination with Métis and/or Inuit).

Ontario	9.4%	11.0%	6.0%*	N/A
Manitoba	7.6%	10.3%	5.8%	N/A
Saskatchewan	7.9%	8.7%	7.1%	N/A
Alberta	5.9%	6.4%	5.3%	N/A
British Columbia	6.5%	6.1%	6.7%	N/A
Northwest Territories	3.2%	3.1%	6.0%*	X
Yukon Territory	5.4%*	5.3%*	N/A	N/A
Nunavut Territory	1.8%*	N/A	N/A	1.8%*

There is considerably more data on diabetes available for First Nations populations allowing for more thorough gender and age comparisons. It is also significant that prevalence rates of diabetes vary depending on whether people were living on- or off-reserve. The 1991 Aboriginal Peoples Survey found higher rates of diabetes for Aboriginal peoples living on-reserve (8.5 percent) than for those living off-reserve (5.3 percent) (Health Canada, 2000). More recent data respecting this difference is needed.

When interpreting the meaning of prevalence statistics respecting rates of diabetes in First Nations, Métis, and Inuit populations, it is important to consider that the number of cases may in fact be underestimated because the definition of "diabetes" in many research studies is based on a doctor's diagnosis. Due to linguistic, cultural, and geographic barriers, Aboriginal people often do not have the same level of access to health services (Health Canada, 2000) and therefore may be less likely to be officially diagnosed. Some studies estimate that an accurate representation of prevalence in Arctic regions, for example, is likely two to three times the rate of diagnosed cases (Health Canada, 2000). Furthermore, prevalence rates only tell part of the story. Barton's (2008) narrative study exploring perspectives on diabetes with Bella Coola residents in British Columbia emphasized that "Aboriginal peoples' lived experience of diabetes

is always constructed within a social, cultural, and political context" (p. 18). Her in-depth, qualitative interviews showed that in this community, diabetes, like other chronic diseases, is not about weakness and sickness, but a process of healing and well-being, and balance in the universe (Barton, 2008). Barton further pointed out that cultural perceptions of diabetic identity vary among Aboriginal peoples and are specific to their nation, tribe and/or cultural community. It is important to be mindful when engaging in policy and treatment strategies for Aboriginal populations that "diabetes is, then, seen as a living thing, just as Aboriginal cultures must be viewed as living things" (Barton, 2008, p. 21).

Sex Differences in Diabetes Prevalence

Diabetes was one of four primary health concerns identified by Aboriginal women in Canada in a 2002 survey on women and housing (Centre for Equality Rights in Accommodation (CERA), 2002). Prevalence rates are particularly high among senior Aboriginal women with one in four reporting they had been diagnosed as diabetic as compared with one in 10 senior women in the general population (Health Council of Canada, 2005). For senior Aboriginal men, the rate was one in five as compared with one in seven for senior men in general (Health Council of Canada, 2005). These rates may also in fact under-represent the prevalence of diabetes among women in specific populations or communities. Harris, Gittelsohn, et al. (1997) found that four out of five Aboriginal women aged 50-64 living on the Sandy Lake Reserve in Ontario had diabetes. Results from the 1997 FNRHS pilot study indicated that the prevalence of diabetes at that time was higher among Aboriginal women than men; however, the full survey five years later showed that "there is no longer a difference in prevalence between men and women due to a large increase in diabetes in middle-aged men" (Assembly of First Nations, 2007, p. 69). Sex

differences related to diabetes prevalence also vary depending on the Aboriginal group being studied as shown in Table 2 below.

Table 2: Diabetes Rates in Canada by Aboriginal Group and Sex

	Overall	Male	Female
First Nations	**19.7%** FNRHS 2002/03[9] (on-reserve ages 18+)	**11.0%** FNRHS 1997 Report[10] (on-reserve ages 15+)	**17.0%** FNRHS 1997 Report (on-reserve ages 15+)
Métis	**5.9%** APS 2001[11] (off-reserve ages 15+)	**5.9%** APS 1991[12] (off-reserve ages 15+)	**10.8%** APS 1991 (off-reserve ages 15+)
Inuit	**2.3%** APS 2001 (off-reserve ages 15+)	**2.4%** APS 1991 (off-reserve ages 15+)	**3.5%** APS 1991 (off-reserve ages 15+)
General Canadian Population	**5.2%** CCHS 2000/01[13] (ages 12+)	**N/A**	**N/A**

Prevalence rates vary by age as well as sex. Aboriginal women are more likely to be diagnosed with diabetes at an earlier age than men (Fox, Harris & Whalen-Brough as cited in Grace, 2003). The consequences of diabetes are also potentially more severe for Aboriginal women than women in the general population. Aboriginal women living in Aboriginal communities were found to be five times more likely to die from the disease than women in the whole Canadian population in general (Mao, Moloughney, Semeneiw & Morrison as cited in Grace, 2003). Additionally, diabetes is one of the two most frequent diagnoses for which First Nations women are admitted for acute hospital care (Maguire as cited in Health Canada, 2000).

[9] Reference for the FNRHS 2002/03 data is Assembly of First Nations (2007).
[10] Data from the FNRHS 1997 report is cited in Health Canada (2000). This data is age standardized to allow comparisons to be made between populations which have different age structures.
[11] Reference for the APS 2001 data is Statistics Canada (2003).
[12] Reference for the APS 1991 data is Bruce, Kliewer, Young, Mayer & Wajda (2003). These rates are also age standardized. It should be noted that the more recent APS survey data does not include sex-disaggregated statistics free of charge.
[13] Data from the CCHS 2000/01 was reported by Assembly of First Nations (2007).

Gestational Diabetes and Aboriginal Women

Glucose tolerance deteriorates in all pregnant women and for a small percentage, drops to a level that satisfies the diagnostic criteria for gestational diabetes (Hod as cited in Kmetic et al., 2008; Whitaker et al. as cited in Kmetic et al., 2008). The growing fetus generates insulin in response to the elevated glucose levels of the diabetic mother, which acts as a fetal growth hormone (Pederson as cited in Kmetic et al., 2008). Consequently, gestational diabetes is a strong predictor of high birth weight (Godwin, Muirhead, Huynh, Helt & Grimmer, 1999; Harris, Gittelsohn, et al., 1997), which is associated with future obesity and/or the development of type 2 diabetes later in life (Kmetic et al., 2008). High birth weights have been linked to maternal diabetes during pregnancy in studies specific to First Nations children in Saskatchewan (Dyck, 2005; Dyck, Klomp & Tan, 2001). Therefore, Kmetic et al. (2008) consider obesity a "multigenerational risk factor for diabetes and its associated co-morbidities" (p. 67), including cardiovascular disease.

According to researchers at the University of Saskatchewan, overweight Aboriginal women were approximately five times more likely to develop gestational diabetes than overweight Canadian women in general (30 percent versus 5 percent respectively) (Dyck et al., 2002). This percentage is significantly higher than that found in studies conducted in the late 1990s with Aboriginal populations in Quebec and Ontario, which estimated that gestational diabetes affects up to 13 percent of pregnant Aboriginal women (Godwin et al., 1999; Harris, Caulfield, Sugamori, Whalen & Henning, 1997; Rodrigues, Robinson & Gray-Donald, 1999). This shift suggests that gestational diabetes is becoming more prevalent among First Nations, Métis, and/or Inuit populations; however, there are likely multiple variables contributing to the increase in gestational diabetes that have yet to be fully explored.

Accessibility of Care/Treatment

According to 1997 FNRHS, less than 40 percent of First Nations people living on-reserve with diabetes frequent diabetes clinics or receive diabetes education (Health Canada, 2000). Reasons for not attending a clinic or seeing someone for diabetes education were cost (6.2 percent), insufficient available information (4.7 percent), and the perception that services were culturally inappropriate or inadequate (3.3 percent) (Assembly of First Nations, 2007). Additionally, those with diabetes were more likely than other First Nations adults to report experiencing difficulty accessing medication, other medical supplies and hearing aids (Assembly of First Nations, 2007). Almost 90 percent of those diagnosed with diabetes used some form of treatment such as medication (68.0 percent), diet (65.5 percent), exercise (52.9 percent), insulin (16.7 percent), traditional medicines (12.9 percent) and seeing a traditional healer or taking part in traditional ceremonies (6.0 percent) (Assembly of First Nations, 2007). First Nations women were more likely than First Nations men to visit a diabetes clinic or see someone for diabetes education (47.5 percent as compared with 33.8 percent) although researchers did not find this difference to be statistically significant (NAHO, 2006). Adults with college education were more likely to use dietary treatment options than those with less formal education and adults under 40 years of age (66.2 percent) were more likely than adults over 60 years of age (43.6 percent) to control their diabetes with exercise. Traditional medicines were more often used by First Nations adults who understood or spoke a First Nations language or those living in smaller communities (less than 1,500 residents) (Assembly of First Nations, 2007). Diet was more likely to be used as a preferred treatment option among residents of First Nations communities where the health services were under the direct control of the community itself (Assembly of First Nations, 2007).

Vision and Hearing Conditions

Research shows that both vision and hearing loss can be related to obesity and/or other obesity-related illnesses such as diabetes (Berinstein, Stahn, Welty, Leonardson & Herlihy, 1997; Kaur, Maberley, Change & Hay, 2004) or hypertension (Wong et al., 2002; Yu, Mitchell, Berry, Li & J.J. Wang, 1998). Among First Nations respondents in the 2002/03 FNRHS, twice as many obese respondents reported a co-morbid chronic vision or hearing impairment (18.2 percent) as compared with respondents falling within a normal weight range (9.1 percent) (Assembly of First Nations, 2007). Each of these conditions is discussed in more detail below.

Vision Impairment

Some studies have shown a higher prevalence of diabetic retinopathy[14] in Aboriginal communities than in the general population (Brassard, Robinson & Dumont as cited in Kaur et al., 2004; Maberley, Walker, Koushik & Cruess, 2003). However, Berinstein et al. (1997) found that the prevalence of retinopathy among diabetic Sioux Indians in the United States (45.3 percent) was comparable to that in other diabetic Indian and non-Indian groups. They found no significant associations between diabetic retinopathy and age, sex, physical activity, cholesterol, blood pressure, stroke, alcohol consumption, smoking, or BMI (Berinstein et al., 1997). Kaur et al.'s (2004) study raises a concern that, regardless of the prevalence of diabetic retinopathy, Aboriginal peoples face additional barriers in accessing treatment. In a sample of First Nations people living on-reserve in British Columbia, Kaur et al. (2004) found that only 33 percent of individuals with diabetes received annual eye exams for diabetic retinopathy. There is a distinct gap in professional eye-care services for First Nations communities (Kaur et al.), which is problematic because regular and thorough screening decreases the possibility of vision loss

[14] Diabetic retinopathy refers to a specific vascular complication of chronic diabetes mellitus (Singer et al., 1992).

resulting from diabetic retinopathy (Maberley et al., 2003; Singer, Nathan, Fogel & Schachat, 1992).

Hearing Impairment

Recent studies have also explored the relationship between body weight, diabetes and hearing impairments. A study of Swedish men in military service revealed that BMI (either under- or over-weight) was a risk factor for developing hearing loss later in life (Barrenäs, Jonsson, Tuvemo, Hellstrom & Lundgren, 2005). In a cross-national European sample of both women and men, Fransen et al. (2008) confirmed that a high BMI was a risk factor for age-related hearing loss. Diabetes, a risk factor associated with BMI and obesity, can also impact hearing acuity. Physical changes resulting from diabetes can injure the neural system of the inner ear, or/and the blood vessels surrounding it, resulting in hearing deterioration (Bainbridge, Hoffman & Cowie, 2008). Maia and de Campos (2005) similarly observe that diabetic patients often show symptoms of dizziness, tinnitus, and hearing impairment, although there is still some controversy as to the cause-effect nature of these related conditions. Studies confirm that people with impaired hearing are more likely to report having diabetes, and these results are more likely to be statistically significant for sounds at higher frequencies (Bainbridge et al., 2008; Elamin, Fadlallah & Tuvemo, 2005; Vaughan, James, McDermott, Griest & Fausti, 2005). Frisina, Mapes, Kim, Frisina and Frisina (2006) observed that people with diabetes tended to have greater deterioration of hearing in the right ear, possibly because excess glucose levels that are characteristic of diabetes may prevent the cochlea (inner ear) from functioning properly. The researchers did not suggest any explanation for why this correlation was observed only for the right ear. More research is needed to explore this hypothesis. Diabetic-related hearing

impairments have been shown to affect both sexes equally (Elamin et al., 2005); however, the research related to hearing loss and diabetes neglects First Nations, Métis, and Inuit populations.

Respiratory Problems

Some authors consider obesity one of many risk factors for asthma, along with the environment, behaviour, and genetic pre-disposition for respiratory conditions (Brisbon, Plumb, Brawer & Paxman, 2005; Clerisme-Beaty & Rand, 2009). Respiratory problems such as asthma occur more frequently in First Nations populations as compared with the rest of Canada (Assembly of First Nations, 2007). Table 3 below provides a comparison of asthma rates for First Nations population and the general Canadian population by sex and shows that asthma is most prevalent among First Nations adult females.

Table 3: Asthma Rates for the First Nations Population in Canada and the General Population by Sex

	Overall	Male	Female
First Nations Population	**9.7%** FNRHS 2002/03[15] (on-reserve ages 18+)	**7.9%** FNRHS 2002/03 (on-reserve ages 18+)	**13.2%** FNRHS 2002/03 (on-reserve ages 18+)
General Canadian Population	**8.3%** CCHS 2005[16] (ages 12+ diagnosed)	**6.9%** CCHS 2005 (ages 12+ diagnosed)	**9.6%** CCHS 2005 (ages 12+ diagnosed)

As discussed earlier in this review, First Nations women are also more likely than non-First Nations women or First Nations men to be obese. Research with non-Aboriginal populations has found a significant correlation between obesity and asthma for women, but no such relationship for men (Carmago, Weiss, Zhang, Willett & Speizer, 1999; Chen, Dales, Tang & Krewski, 2002). Some studies imply this is a causal relationship (Brisbon, Plumb, Brawer & Paxman,

[15] Reference for the 2002/03 FNRHS data is Assembly of First Nations (2007).
[16] Reference for the 2005 CCHS is Statistics Canada (2007).

2005; Gold & Wright, 2005; Strunk, Ford & Taggart, 2002) while others dispute this and attribute the relationship to asthma-like symptoms, such as shortness of breath, resulting from excess body weight (E.S. Ford, 2005).

High birth weight has also been connected to obesity and respiratory problems such as asthma among Aboriginal children. According to Sin et al. (2004), "because obesity promotes inflammation and imposes mechanical constraints to the airways, a high birth weight may be a risk factor for asthma in childhood" (p. 60). Aboriginal children were more likely to have high birth weights and asthma-related emergency room visits than non-Aboriginal children (Sin et al., 2004). Sin et al. (2004) also found that asthma-related emergency room visits were more common for Aboriginal boys than girls, possibly because female infants typically have larger airways and therefore have greater respiratory capacity. Prevalence rates among First Nations, Métis or Inuit female and male infants are not available.

Cardiovascular Conditions

This review addresses two cardiovascular conditions that often co-exist with obesity and obesity-related health conditions such as diabetes: high blood pressure (hypertension) and heart disease. Each condition is discussed in more detail in the following sections.

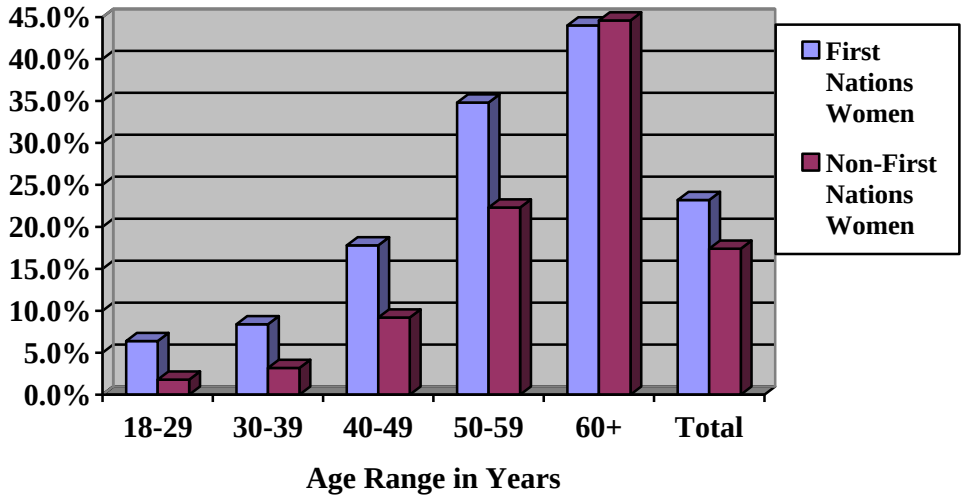
High Blood Pressure

High blood pressure or hypertension refers to heightened pressure in the arteries. It increases the risk of developing heart and/or kidney disease, hardened arteries, eye damage, and stroke (Assembly of First Nations, 2007) and is also a risk factor for developing diabetes. High blood pressure is approximately four times more common in First Nations adults with diabetes than those without diabetes (42.0 percent versus 10.3 percent) (Assembly of First Nations, 2007). Based on data from the 1997 FNRHS pilot study, Health Canada (2000) reported that high blood

pressure and related heart problems were three times more prevalent among First Nations men and women living on-reserve as compared with the general population. However, the 2002/03 FNRHS results showed the rate of high blood pressure among First Nations adults living on-reserve was only slightly higher than that for the Canadian population in general (20.4 percent as compared with 16.4 percent) (Assembly of First Nations, 2007). More longitudinal data is needed to explore these variations further.

First Nations women have a higher prevalence of hypertension than their non-First Nations counterparts (23.2 percent as compared with 17.4 percent) (Assembly of First Nations, 2007). A 1999 Health Canada study indicated that the prevalence of hypertension among First Nations and Labrador Inuit women combined (23 percent) is three times that of Canadian women in general (7 percent) (Stout et al., 2001). Differences in high blood pressure rates between First Nations women and Canadian women in general are much greater under 60 years of age as shown in Figure 4 below[17].

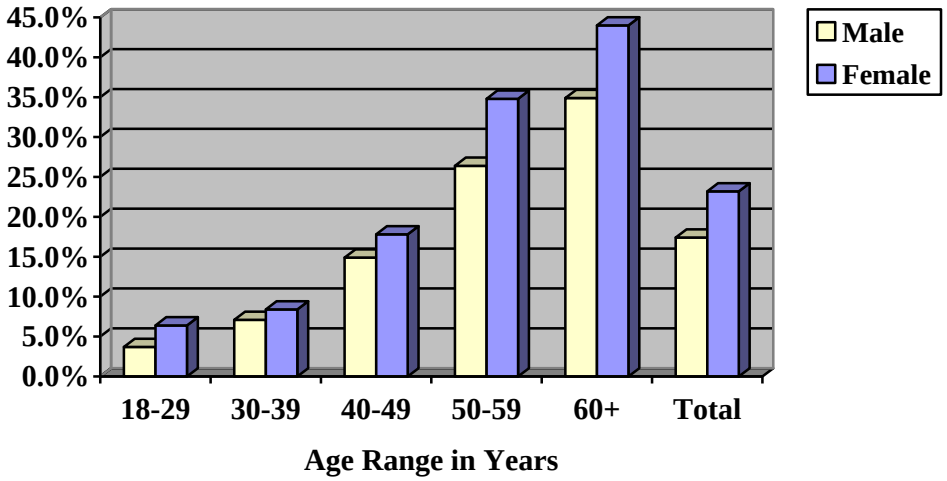
Figure 4: Rates of High Blood Pressure for First Nations Women and Non-First Nations Women in Canada by Age



[17] Figure 4 is based on data from the FNRHS 2002/03 (Assembly of First Nations, 2007). For the youngest age category, the age range for First Nations women was 18-29 while the age range for the comparison group was 20-29.

High blood pressure is also more common among First Nations women (23.2 percent) as compared with First Nations men (17.4 percent) (Assembly of First Nations, 2007) and rates of high blood pressure for First Nations males and females vary across the lifespan, becoming more pronounced with age as detailed in Figure 5 below[18].

Figure 5: Rates of High Blood Pressure by Age for First Nations Males and Females



Before 50 years of age, the differences in rates of high blood pressure between First Nations males and females are relatively slight, while in males and females over age 50, the differences become more substantial.

Cardiovascular (Heart) Disease

Cardiovascular disease refers to conditions that involve damage of the circulatory system including the heart and blood vessels. The symptoms of heart disease can manifest differently in women and men (Public Health Agency of Canada (PHAC), 2009). For example, chest pain is the most common presentation of heart attack in both women and men, but women are more likely to exhibit additional symptoms such as unusual fatigue, difficulty breathing, heartburn,

[18] Figure 5 is based on data from the FNRHS 2002/03 (Assembly of First Nations, 2007).

nausea, anxiety, and sweating (PHAC, 2009). These symptoms are often disregarded by women themselves and/or their health care providers and therefore women with cardiovascular conditions often do not receive necessary and timely treatment (PHAC, 2009). Risk factors for heart disease include age, genetics, male sex, smoking, high cholesterol, high blood pressure, physical inactivity, obesity, diabetes, stress, and excessive alcohol consumption (American Heart Association, 2009).

There is very little research that specifically explores the health consequences of heart disease for First Nations, Métis, and Inuit peoples, particularly regarding women. Statistics show that heart disease is only slightly more prevalent among on-reserve First Nations adults as compared with adults in the general population (7.6 percent and 5.6 percent respectively); however, this difference becomes more pronounced with age. For example, twice as many First Nations adults 50–59 years of age reported the condition (11.5 percent), as compared with a sample from the Canadian population of the same age range (5.5 percent) (Assembly of First Nations, 2007). Prevalence rates are highest among First Nations women at 8.0 percent as compared with both other Canadian women (5.1 percent) and First Nations men (7.3 percent) (Assembly of First Nations, 2007). First Nations women are more likely than other women in Canada to report both heart disease and stroke (Assembly of First Nations, 2007). Heart disease has also been found to be almost five times more prevalent among First Nations adults with diabetes than those without (14.9 percent versus 3.3 percent) (Assembly of First Nations, 2007). In a sample of Native American women from reservations in Minnesota and Wisconsin, Struthers, Baker and Savik (2006) found that women with cardiovascular disease tended to be older, have less formal education, lower rates of employment, higher blood pressure, and higher BMIs than other Native American women. Furthermore, the higher prevalence of cardiovascular

disease among First Nations women is only part of the picture. First Nations women are also more likely to die from cardiovascular disease than non-Aboriginal women in Canada (Shah, Hux & Zinman, 2000). Cardiovascular disease has been determined to be the third leading cause of mortality for Aboriginal women living in "Native communities"[19] in Canada (Grace, 2003).

While the literature generally supports a connection between obesity and cardiovascular disease, some research has revealed no significant links between BMI, waist circumference and cardiovascular disease or hypertension (Lear, Humphries, Frohlich & Birmingham, 2007). One study found that cardiovascular disease is more strongly predicted by lower percent body fat (Howard et al., 1999). One possible reason for this trend suggested by Howard et al. (1999) was that individuals with renal disease resulting from prolonged diabetes are at an increased risk for cardiovascular disease and also commonly experience pronounced weight loss. The researchers found this correlation between low percentage of body fat and cardiovascular disease for Native American women but not Native American men; however, no hypothesis explaining this sex difference was offered (Howard et al., 1999). The authors advocate further research exploring the potential ethnic and sex differences regarding the relationship between obesity and cardiovascular disease (Howard et al., 1999).

Musculoskeletal Conditions

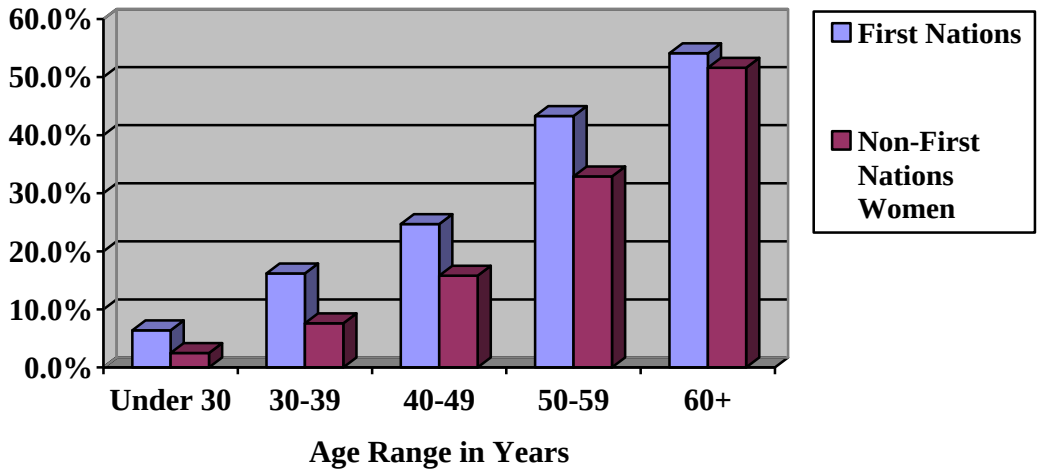
Musculoskeletal conditions encompass any condition involving the muscles and/or skeletal system, such as bursitis, scoliosis, arthritis, osteoporosis, and spinal diseases. Because arthritis is the most commonly reported musculoskeletal condition among First Nations populations (Assembly of First Nations, 2007), it is the focus of the following discussion. There are various causes and types of arthritis, ranging from osteoarthritis involving deterioration of cartilage, to rheumatoid arthritis, which results from inflammation of the body's joints

[19] Grace (2003) does not specify if these communities are on- or off-reserve.

(Assembly of First Nations, 2007). In the general population in Canada, individuals with arthritis are more likely to be overweight and report low income as compared with people with other chronic conditions (Lagacé, Perruccio, DesMeules & Badley, 2003). Research is needed that explores the potential relationships between arthritis, obesity, and income with First Nations, Métis, and Inuit populations.

There are significantly higher rates of rheumatoid arthritis among First Nations women than for Canadian women in general (30.1 percent compared with 17.4 percent) (Assembly of First Nations, 2007). These differences are most notable for women younger than 60 years of age (Arthritis Consumer Experts, 2006; Assembly of First Nations, 2007) as evident in Figure 6 below[20].

Figure 6: Rates of Arthritis for First Nations Women and Non-First Nations Women in Canada by Age



The prevalence of arthritis is also significantly higher among First Nations women (30.1 percent) as compared with First Nations men (20.3 percent). Table 4 provides a comparison of the

[20] Figure 6 is based on data from a 2002 National Aboriginal Health Organization (NAHO) study that included both on-reserve and off-reserve First Nations people across Canada reported in Arthritis Consumer Experts (2006).

arthritis prevalence for First Nations women and men with other women and men in Canada. The prevalence rate of arthritis for on-reserve First Nations populations was reported at 25.3 percent and Lagacé et al. (2003) estimated the arthritis prevalence among off-reserve Aboriginal populations to be similar at 26.5 percent.

Table 4: Rates of Arthritis for First Nations Populations and the General Population by Sex[21]

	Overall	Men	Women
First Nations Population	**25.3%** FNRHS 2002/03 (on-reserve ages 18+)	**20.3%** FNRHS 2002/03 (on-reserve ages 18+)	**30.1%** FNRHS 2002/03 (on-reserve ages 18+)
General Canadian Population[22]	**16.0%** CCHS 2000/01 (ages 12+)	**N/A**	**17.4%** CCHS 2000/01 (ages 12+)

Not only has arthritis been shown to be more prevalent among Aboriginal populations, Aboriginal people with arthritis are also disproportionately affected by the condition. Lagacé et al. (2003) noted that a larger proportion of the off-reserve Aboriginal population reported limitations to their household, work, school, or leisure activities due to their condition as compared with non-Aboriginal people with arthritis.

Despite the prevalence of the disease, there is a lack of research around arthritis and Aboriginal health (Arthritis Consumer Experts, 2006), particularly First Nations, Métis and Inuit women's health. Cañizares, Power, Perruccio and Badley (2008) considered the relationships between regional racial and cultural context, socioeconomic status, and arthritis and found that

[21] Data for Table 4 is taken from the FNRHS 2002/03 (Assembly of First Nations, 2007).
[22] The "Canadian population" refers to all Canadians represented in the sample for the purposes of the CCHS survey. The survey targeted adults over 18 years of age living in private occupied dwellings in the ten provinces. Excluded from the sampling frame were residents of the three territories, persons living on Indian reserves or Crown lands, persons living in institutions, full-time members of the Canadian Forces and residents of some remote regions. It should be noted that use of the "Canadian population" as a source of comparison includes Aboriginal persons living off-reserve in Canada.

off-reserve Aboriginal residents of socioeconomically deprived regions were more likely to report a diagnosis of arthritis than those living in wealthier regions. Interestingly, the researchers also noted that arthritis is more prevalent among Aboriginal persons living in Aboriginal communities in Canada (Cañizares et al., 2008). Access to treatment has also been identified as a concern for Aboriginal peoples in Canada living with arthritis. Accessing a rheumatologist in Canada is difficult in major urban centers and this difficulty increases exponentially in remote and rural areas, where many Aboriginal people live (Arthritis Consumer Experts, 2006).

RESEARCH AREAS

Researchers concerned with obesity in Aboriginal communities focus on at least one of five interrelated theories: biological, behavioural, environmental, social and cultural, and socio-political. The following sections outline the arguments and literature predominant in each of these areas.

Biological/Genetic Approaches

Biological or genetic approaches suggest an innate metabolic predisposition for obesity for Aboriginal peoples and/or the possibility of an "obesity gene" amongst Aboriginal peoples; however, few researchers examine or explain why this gene might be universally more common amongst all Aboriginal peoples. One genetic explanation involves a "metabolic syndrome" which refers to a "cluster of cardiovascular risk factors including central [abdominal] obesity, hypertension, glucose intolerance and dyslipidemia[23]" (Liu, Hanley, Young, Harris & Zinman, 2006, p. 669). This "metabolic syndrome" is generally agreed to include "finding the factors associated with body mass and fat distribution, measures of glucose and insulin, and lipids" (Liese, Mayer-Davis & Haffner, 1998, p. 157). Razak et al. (2005) compared the prevalence of

[23] Dyslipidemia refers to elevated levels of certain types of cholesterol and/or triglycerides and is thought to be caused by both genetic and environmental factors (Goldberg, 2008).

metabolic syndrome among different ethnic groups and found that Aboriginal populations had a significantly higher prevalence rate compared to the other ethnic populations studied (which included South Asian, Chinese, and European populations in Canada).

There is also literature connecting metabolic theories of obesity and gender, although none that directly relate to Aboriginal populations. According to Power and Schulkin (2008), "men and women differ in the patterns of fat deposition, fat mobilization, utilization of fat as a metabolic fuel, and the consequences of both excess and insufficient fat stores" (p. 932). They advance a genetic and evolutionary explanation of these metabolic differences based on the substantially higher reproductive cost in terms of expended energy, biological effort, and nutritional requirements, for women. In other words, the authors suggest that enhanced fat storage for women indicates evolutionary adaptability for the purposes of procreation (Power & Schulkin, 2008). However, Power and Schulkin note that obesity in women should not be considered adaptive as reproductive problems can result from the condition.

The theoretical basis for much of the research relying on a genetic explanation for the prevalence of obesity (and diabetes) in Aboriginal populations is the "thrifty genotype" hypothesis, first introduced by Neel in 1962. This hypothesis suggested that populations subject to periods of food abundance followed by food scarcity (typically nomadic peoples) developed a biological survival tool (the "thrifty genotype") that allowed for the heightened conservation of calories consumed during times of abundance in preparation for eventual famine (Dyck et al., 2001). Neel further supposed that the escalating prevalence of obesity and diabetes in Western, industrialized nations was evidence that this genetic advantage was becoming a liability as modern technological advances and conveniences led to diets consisting of processed and high caloric foods and more sedentary lifestyles. While Neel's hypothesis was proposed in the context

of European-descended populations, the feast-famine cycles characteristic of hunter-gatherer cultures has since been indiscriminately applied across Aboriginal populations, leading to an attitude of biological determinism respecting the epidemic of obesity and diabetes among these groups (Fee, 2006; Health Canada, 2000). It should be noted that the body of biological/genetic literature has been further criticized for portraying Aboriginal communities as one race (Fee, 2006; Pourdrier, 2007). In addressing this critique, some authors have acknowledged the rapid changes in environment and lifestyle experienced in many Aboriginal contexts (discussed in more detail in a later section), however, this acknowledgement most often identifies these shifts as triggers for the expression of the hypothetical obesity gene/metabolic condition (Andreassi, in press; Hegele et al., 2003; Weber & Narayan, 2008).

Some studies have shown that some Aboriginal populations incorporate the genetic theory of obesity and obesity-related illnesses in their conceptualization of health and wellness. Sunday, Eyles and Upshur (2001) interviewed Anishnaabe people in Ontario and found that some participants framed diabetes as "an inherent quality of individuals that will emerge under certain circumstances" (p. 74). The researchers found that Anishnaabe community members were more likely to emphasize genetic/hereditary explanations of diabetes (and related obesity) than health care providers who primarily focused on lifestyle choices and individual responsibility in their conceptualizations of these conditions. Sunday et al. further noted that a consequence of these perceptions among the Anishnaabe participants was a sense of inevitability and therefore powerlessness around diabetes. While they acknowledged a genetic component of the illness, Anishnaabe narratives, at the same time, tended to reflect understandings of diabetes as collectively impacting Anishnaabe people and situated in a historical, colonial context (Sunday et al., 2001).

Behavioural/Lifestyle Factors

Much of the literature respecting obesity in First Nations, Métis, and Inuit populations, as for other populations, focuses on health-related behaviours of individuals. The Assembly of First Nations (2007) FNRHS report states that the obesity epidemic facing Canada's indigenous peoples "is believed to be associated with the adoption of a diet high in fats and sugars and the rapid transition to a sedentary lifestyle" (p. 87). Of course, high-fat foods and decreased activity level have also contributed to the rise of obesity in Canada generally, but obesity and lifestyle trends among Aboriginal peoples have been attributed to an extreme acculturation process (Redwood et al., 2008). For instance, Dyck (as quoted in University of Saskatchewan, 2002) connected these lifestyle changes to the encroachment of dominant Western influences on Aboriginal life stating "as exposure to non-Aboriginal lifestyles increases, rates of obesity also increase… Genetics don't change in 50 years, or even over a century. Lifestyles change" (para. 12). While many researchers emphasize taking cultural and ethnic differences into consideration when developing programs aimed at increasing healthy behaviours (including food choice and physical activity) (Bryan, Tremblay, Pérez, Ardern & Katzmarzyk, 2006; Gracey et al., 2006; Rowley et al., 2000), an analysis that situates these behaviours and lifestyle changes historically and politically is conspicuously absent. Browne and Smye (2002) caution that discourse around "risk-factors" removed from their historical, colonial, social and economic contexts can reinforce negative stereotypes about marginalized populations e.g. they can be perceived as lacking willpower, ignorant, or morally deficient. Conspicuously absent in this literature is any analysis of First Nations, Métis, and Inuit women's relationships with food, both preparation and consumption, from a socio-cultural perspective and the role of food availability or scarcity in women's nutritional choices.

The two most commonly researched obesity-related behaviours in the literature respecting Aboriginal communities are physical activity levels and the consumption of high calorie foods, which are discussed in more detail below.

Physical Activity

North American trends indicate that not only are physical activity rates dropping, but sedentary behaviours that can contribute to obesity and overweight, such as television viewing and computer use[24], are increasing in Aboriginal populations as in the general population (Bernard et al., 1995; Critchley et al., 2006). Garriguet (2008) found that a small majority (56 percent) of both Aboriginal and non-Aboriginal adults ages 19 to 50 were "inactive"[25] during their leisure time and that inactivity was related to overweight and obesity regardless of ethnicity. However, this association seemed to be stronger for the Aboriginal population as 50 percent of Aboriginal people who were "inactive" were obese, compared with 23 percent of "inactive" non-Aboriginal people (Garriguet, 2008). Bryan et al. (2006) considered data from the 2000/01 cycle of the CCHS and found that while most ethnic populations (including on-reserve Aboriginal peoples) in Canada had activity levels lower than white Canadians, when results were adjusted for age, income, education and BMI, Aboriginal men in fact had the highest rate of physical activity. Similarly, Katmarzyk (2008) used 2004 CCHS data and concluded that "there were no ethnic differences in the prevalence of physical inactivity" (p. 184).

In the general Canadian population, girls are typically less physically active than boys – at five to 12 years of age, 30 percent of girls are physically active as compared with 50 percent of boys and the ratio drops to 25 percent and 40 percent respectively by ages 13 to 17 (Critchley et

[24] It is interesting to note that examinations of "sedentary behaviours" typically do not include reading.
[25] For the purposes of Garriguet's (2008) study, "inactivity" was defined according to a formula calculating total energy expenditure. The relative energy demand was assessed based on the reported frequency and duration of leisure time physical activities in the three months prior to the interview. Respondents characterized as "inactive" had energy expenditure less than 1.5 kilocalories per kilogram per day.

al., 2006). This trend has also been observed among First Nations and American Indian women, who report lower rates of physical activity than their male counterparts (Bryan et al., 2006; Coble & Rhodes, 2006; Thompson, Wolfe, Wilson, Pardilla & Pérez, 2003; Young & Katzmarzyk, 2007). It is important to consider that these gender differences are based on measurement of *leisure* activities only and did not assess degree of physical activity at work or school, in the home, or for transportation. As women continue to be primarily responsible for household duties, omission of these activities in particular could result in an underrepresentation of First Nations, Métis, and Inuit women's daily activity rates.

Results from the FNRHS indicate that there are apparent sex/gender differences for certain types of physical activities among First Nations youth as well. Both First Nations girls and boys were most likely to engage in walking (90.8 percent as compared with 85.1 percent) (Assembly of First Nations, 2007). For girls, dancing (48.0 percent) and berry picking or other food gathering activity (37.1 percent) were the next most common activities whereas boys more frequently engaged in running (77.4 percent) and bicycle riding (70.4 percent) (Assembly of First Nations, 2007).

Cultural identity is also a strong predictor of and/or contributing factor to physical activity (Redwood et al., 2008), particularly for women (Henderson & Ainsworth, 2000). Henderson and Ainsworth (2000) interviewed African American and American Indian women who identified having limited time for leisure activity of any kind and the lack of recreation facilities on reserve as barriers to engaging in physical activity. Gender roles also affected women's physical activity practices, as strong cultural expectations respecting child and/or grandchild rearing precluded additional recreation. Also, these household and care-giving responsibilities were perceived as less physical than male contributions to the family (i.e. hunting

and fishing) (Henderson & Ainsworth, 2000). While these gender differences can certainly be present in non-Aboriginal families, participants in Henderson and Ainsworth's study perceived that caretaking and paid work responsibilities were greater for both Indian American and African American women. Additionally, walking was not perceived as a leisure activity for pleasure or exercise, it was considered a primary method of getting around as other modes of transport were limited (Henderson & Ainsworth, 2000). Furthermore, women emphasized physical activity as a source of cultural pride as participating in ceremonies that involved dancing and/or continuous movement was seen to require a great deal of stamina (Henderson & Ainsworth, 2000).

The physical activity literature has been criticized for its lack of attention to cultural relevance. Redwood et al. (2008) noted that traditional food procurement activities and physical activity are connected for many Aboriginal people. They looked at data from interviews conducted with Native Alaska and American Indian populations in three regions of Alaska and found that close to 70 percent of respondents participated in at least one physical activity related to traditional harvesting practices (Redwood et al., 2008). Such activities included picking berries or greens, cutting or smoking fish or meat, and fishing. Participation in these activities was higher among men than women (with the exception of berry-picking) and was associated with tribal self-identification, speaking a Native language at home, using traditional healing remedies, and attending traditional events such as dances, potlatch feasts or sweats (Redwood et al., 2008). Men were also twice as likely as women to report participating in multiple physical harvesting activities (Redwood et al., 2008).

Bryan and Walsh (2004) clearly summarize relevant gaps in national survey data respecting physical activity and obesity in Canada:

> There is currently no surveillance system in Canada to monitor the level of physical activity among children, those performing activity at work, at school or in the home.

> There is a gap in the knowledge surrounding socio-cultural and ecological determinants of physical activity and obesity and the associations of these to chronic disease among women and minority populations (para. 3).

These gaps are likely due, at least in part, to the lack of culturally relevant research being conducted in this field. Henderson and Ainsworth (2000) note that measures of self-reported physical activity that rely on time may inaccurately represent activity levels in Aboriginal cultures that do not use watches or understand time differently than in European culture. Studies have shown that understandings of physical activity or exercise itself differ among ethnic groups and point out that most physical activity surveys neglect cultural activities such as dancing, spiritual celebrations or rituals (Bryan et al., 2006), activities often engaged in primarily by women. Sallis and Saelens (2000) note that measures of physical activity that rely on self-reporting have yet to be adequately validated and/or adapted in distinct demographic, ethnic or cultural populations.

Food Consumption

There is considerable evidence that First Nations, Métis, and Inuit women consume larger quantities of high calorie foods than both women in the general population and First Nations, Métis, and Inuit men. For example, Garriguet (2008) used data from the 2004 CCHS and found that off-reserve Aboriginal women, particularly those aged 19 to 30, consumed higher calorie meals and snacks than did their non-Aboriginal counterparts. This discrepancy was identified as a significant contributing factor to the higher rates of obesity among Aboriginal women (Garriguet, 2008). Garriguet also compared the types of foods consumed by Aboriginal and non-Aboriginal populations using the *Canada Food Guide's* four food groups: vegetables and fruits, grain products, milk products, and meats and alternatives. Foods outside these four categories (i.e. candy, soft drinks, oils, condiments) were classified as "other foods". Figure 7 provides an

overview of food consumption by food group for Aboriginal and non-Aboriginal women and men.

Figure 7: Food Consumption by Food Group for Aboriginal and Non-Aboriginal Women and Men

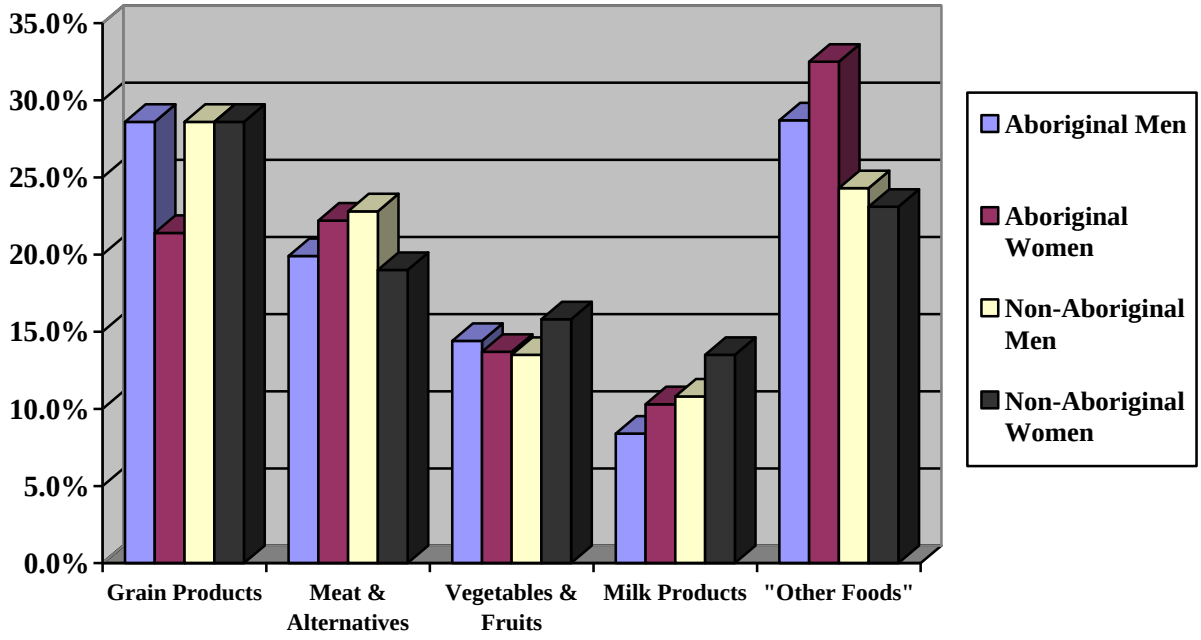


Figure 7 shows that off-reserve Aboriginal women consumed significantly less milk and grain products than non-Aboriginal women and significantly more "other foods" (Garriguet, 2008)[26]. The only food group that showed a significant difference in consumption between Aboriginal men (8.4 percent) and non-Aboriginal men (10.8 percent) was milk products (Garriguet, 2008).

Furthermore, Garriguet (2008) noted significantly higher consumption of soft drinks and "sandwiches" (including pizza, hamburgers, hot dogs, and submarines) among Aboriginal women off-reserve, particularly those ages 19 to 30. Between-meal eating habits also differed between Aboriginal women and non-Aboriginal women, particularly in the aforementioned age group, with Aboriginal women eating more frequently between meals and choosing higher

[26] Data for Figure 7 is from the 2004 CCHS as reported by Garriguet (2008). Calculations comparing the statistical significance of Aboriginal women's eating behaviours with those of Aboriginal men were not provided.

calorie foods than non-Aboriginal women (Garriguet, 2008). No significant differences were found in the snacking behaviours between Aboriginal and non-Aboriginal men. Aboriginal women aged 31 to 50 consumed less recommended daily intake of nutrients than non-Aboriginal women including fibre, magnesium, vitamin A and folic acid (Garriguet, 2008). Similarly, Vanasse, Demers, Hemiari and Courteau (2006) found that fruit and vegetable consumption was lower among residents in geographical regions in Canada with large numbers of Aboriginal populations.

One of the significant diet-related lifestyle changes identified by some researchers is a shift from relying on traditional/indigenous/"country" food sources (marine and land animals, fish, and plants) to market/processed foods, or foods shipped into Aboriginal communities, particularly in northern and/or remote Arctic areas (Kuhnlein, Receveur, Soueida & Egeland, 2004; Young, 1996). Kuhnlein and Receveur (2007) concluded that traditional animal food sources are important for nutrition in Arctic populations as sources of protein, vitamins B-6, D and E, iron, zinc, potassium, riboflavin, and potassium. Studies considering the cultural implications of this dietary shift have focused mainly on Arctic populations in Canada (Kuhnlein et al., 2004; Van Oostdam et al., 2005) and the United States (Redwood et al., 2008). In Métis and First Nations populations surveyed by Kuhnlein et al. (2004), males ages 20 to 40 were more likely to consume traditional foods than their female counterparts as were Inuit males ages 20 to 60. First Nations, Métis, and Inuit participants in Kuhnlein et al.'s (2004) study consumed foods significantly higher in carbohydrates, fats, and sugars on days when traditional food was not used. In addition to the links being made between obesity and non-traditional diet among First Nations, Métis, and Inuit populations, there are also links being made between traditional food consumption and cultural identification. For instance, some research indicates that older

Aboriginal people and those with higher degrees of involvement with traditional cultural practices were more likely to consume traditional foods (Kuhnlein et al., 2004; Redwood et al., 2008). There seems to be important links here between the effects of acculturation and obesity prevalence; however, these links were not explicitly made in any of the studies reviewed, which indicates a gap in the research.

Wein, Freeman and Makus (1996) studied the use of and preference for different types of traditional foods in one Inuit community and explored attitudes about what constitutes healthy eating. The vast majority of respondents noted that traditional foods (mostly seal or fish) were essential to health and strength while only four participants mentioned market foods such as vegetables, dairy, or bread as important for maintaining good health (Wein et al., 1996). Research has also revealed gender differences in traditional food use and preference among Inuit populations in Canada and Native populations in Alaska. Inuit men were more likely to report consumption of and preference for seal, polar bear, seal liver, wild birds, moose, hare, and caribou whereas women were more likely to consume or prefer seafood, berries, and shellfish (Redwood et al., 2008; Wein et al., 1996). Gender is a factor in developing these preferences as men are more likely to have tried seal liver, for example, as it is "customarily shared and eaten by hunters at the hunting site immediately after the animal has been obtained" (Wein et al., 1996, p. 262) and men continue to be the primary hunters in many Inuit communities (Chabot, 2003; Wein et al., 1996). Age has been found to interact with gender in influencing preference for and consumption of traditional foods as young women rated market foods higher on these measures than other age/gender groups (Wein et al., 1996). Gender clearly impacts use of, access to, and preference for different traditional foods and needs to be accounted for in relevant analyses. More research is needed to explore these relationships further using a gendered analysis.

The literature shows that the challenges of living with obesity and obesity-related conditions are heightened for Aboriginal populations who also struggle with food insecurity[27], the erosion of traditional indigenous lifestyles, and extreme social instability (Agriculture & Agri-Food Canada, 1998; Bjerregaard, Young, Dewailly & Ebbesson, 2004; Chabot, 2003; Young, 2003). However, this body of research generally does not situate changes in eating behaviours in a cultural or historical context. Research out of McGill University's Centre for Indigenous People's Nutrition and Environment[28] is one notable exception to this trend. One qualitative study by Chan et al. (2006) explored food security with Inuit populations in Nunavut and barriers to accessible, nutrient-rich foods. Focus group data indicated that levels of traditional food consumption were affected by income, traditional knowledge, changing social norms, government policies and programs, gender, and community size (Chan et al., 2006). For instance, many households lack active hunters and/or cannot rely on extended family for a reliable, consistent supply of traditional food (Chan et al., 2006). Duhaime, Chabot and Gaudreault (2001) similarly found that both the presence of a male head of household and a high income were significant predictors of greater consumption of traditional or country foods. It should be noted that the economic situation of an Inuit household was less of a determining factor in traditional food consumption than the presence of a male head of household (Duhaime et al., 2001). According to the authors, two-parent households where the female parent was the primary wage earner tended to consume more traditional foods than other households, presumably because the male parent could devote more time to traditional food procurement

[27] Countries at the World Food Summit in 1996 agreed upon the following definition of food security: "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (as cited in Agriculture & Agri-Food Canada, 1998, p. 9)

[28] See www.mcgill.ca/cine/

activities (i.e. hunting and fishing) (Duhaime et al., 2001). Furthermore, Duhaime et al. noted that

> A population's diet cannot be reduced to the quantities of foods ingested, because it also involves a series of practices, beliefs and habits. In Inuit society, country foods, especially meats from large mammals, are still greatly appreciated, but they also hold a very significant symbolic value (p. 113).

Chabot (2003) similarly observed that food production and the related economic considerations continue to be influenced by traditional gender roles among the Inuit in Nunavik – men continue to be the predominant hunters of big game and women are mostly involved with food processing and distribution. Kuhnlein et al. recommend that "policies and programs should be developed so that communities can maintain or improve, if possible, the availability and accessibility of nutrient-dense, excellent quality traditional Arctic foods" (p. 1451) noting that environmental protection initiatives are imperative for sustaining these food sources.

Environmental Approach

Environmental degradation affects the availability of traditional food sources, which in turn impacts dietary choices for First Nations, Métis, and Inuit populations (Guyot, Dickson, Paci, Furgal & Chan, 2006). Not only is the availability of these foods affected, but First Nations, Métis, and Inuit populations can be exposed to environmental contaminants both through contact in the environment itself and/or through the consumption of contaminated foods (Furgal, Powell & Myers, 2005). Traditional foods continue to be dietary staples for many First Nations, Métis, and Inuit populations and the heightened exposure means that these populations are at a higher risk of potential environmental contaminants present in indigenous marine, mammal, and plant life (Guyot et al., 2006; Van Oostdam et al., 2005). Van Oostdam et al. (2005) argue that the social, cultural, spiritual, nutritional and economic benefits of traditional/country foods need to be considered along with the potential environmental risks.

Furthermore, studies have shown that knowledge of environmental pollutants or contaminants does not necessarily impact decision-making around traditional food consumption among Inuit populations (Furgal et al., 2005; O'Neil, Elias & Yassi, 1997). Some northern Inuit populations report distrusting information from non-Aboriginal scientists and health officials regarding environmental contaminants because these advisories are often perceived as failing to consider Inuit ways of knowing relevant to the environment (O'Neil et al., 1997; Van Oostdam et al., 2005).

Some researchers emphasize that the health status of First Nations, Métis, and Inuit populations is shaped by the environment and the historical relationship with the land (Bernard et al., 1995). Climate changes have made it more difficult for First Nations, Métis, and Inuit, particularly in the Arctic, to hunt, gather and consume healthy traditional foods (J. Ford, 2005; Guyot et al., 2006). Inuit peoples have noted that species migration patterns and water levels are being dangerously impacted by global climate shifts and industrial developments, particularly in northern areas (Guyot et al., 2006; Wein et al., 1996). At the same time, increased urbanization and spread of consumer products have allowed easier access to highly processed, high calorie, high fat and convenience foods, leading to an increase in overweight, obesity, and obesity-related illnesses. In her research around Nuxalk First Nation stories of diabetes, Barton (2008) notes the intimate connections between diet and the environment for Aboriginal peoples:

> Human beings are reflections of the wellness of the universe. The healing process is not only making food choices within perceptions of a modern diet consisting largely of starch, refined carbohydrates, and fat, but also those steps taken to heal Mother Earth. Our consumption of her, just as with fresh fruit, vegetables, and traditional foods, has changed over time, due to a variety of factors (Barton, 2008, p. 22).

According to Barton, these factors include poverty, consumerism, and acculturation.

The scope of environmental literature in general tends to neglect a comprehensive gender analysis as well as cultural relevance, and this is also true of research detailing the connections between environmental degradation, traditional food availability, and obesity in First Nations, Métis, and Inuit communities. This omission persists even though environmental contamination and pollution have been shown to affect men and women in different ways physically, mentally, and socially (Kafarowski, 2008; Scott & Stiver, in press). There is a growing body of work that looks at the transfer of contaminants in utero; however, this research tends to focus on dangers to fetuses and newborns rather than the risks to the mothers as well. Looking at the gendered effects of environmental pollution is particularly relevant in First Nations, Métis, and Inuit communities where women are considered keepers of traditional knowledge and practices regarding water and the earth (Blackstock, 2001; Brewster, Herrmann, Bleisch & Pearl, 2006; Kafarowski, 2008). In Canada, as in other parts of the world, indigenous women are taking active leadership roles in implementing community and policy initiatives to address the impact of environmental contamination and degradation locally and globally.

Socio-cultural Perspectives

Many articles utilized sex-disaggregated data (see Garriguet, 2008; Katzmarzyk & Malina, 1998; Tremblay et al., 2005; Young, 1996); however, few studies specifically considered gender as a variable in the analyses. Those articles that did include a gender analysis focused mainly on cultural perceptions of health and healthy body image among First Nations, Métis, and Inuit women. For instance, in the Ojibwa-Cree community of the Sandy Lake Reserve in Northern Ontario, Gittelsohn et al. (1996) used a scale of drawn body images to measure respondents' self-perceived body size and shape, level of body satisfaction, and ideal healthy body shape. The researchers found that the First Nations women in this community desired a

significantly slimmer body shape than did men, a trend mirrored in the general population[29], but the Sandy Lake women indicated a larger average desired body shape than Canadian women in general (Gittelsohn et al., 1996). Gittelsohn et al. (1996) also found a correlation between the use of Oji-Cree language and the tendency to perceive larger body shapes as healthy. Women who primarily used their native language tended to be older and the authors noted that these characteristics were indicative of a low level of acculturation[30] (Gittelsohn et al., 1996). The researchers suggested that "acculturation influences regarding body shape have a greater effect on women than men" (Gittelsohn et al., 1996, p. 2999).

Similarly, Poudrier and Kennedy (2008) explored the meaning of the "healthy body" for First Nations (primarily Cree) women living in the rural Battleford Tribal Council region of Saskatchewan. Participants identified three key themes as critical for understanding a gendered perspective of the "healthy body": respect for Elder knowledge and traditional values in promoting community wellness; understanding family histories and the role of women; and the need for practical information about the purchase and preparation of healthy food (Poudrier & Kennedy, 2008). Researchers have concluded that it is imperative to consider cultural differences in body image when designing interventions in Aboriginal communities aimed at reducing obesity rates (Gittelsohn et al., 1996; Poudrier & Kennedy, 2008).

Gender expectations regarding parenting roles and responsibilities are also apparent in the literature. Kuperberg and Evers (2006) studied correlations between infant feeding patterns

[29] Comparisons with the general population in Gittelsohn et al.'s (1996) study were derived from research conducted primarily with undergraduate student populations in the United States that had been tested using the same body shape scale.

[30] Acculturation can be defined as the reciprocal influence of two or more cultural groups in interaction with one another (de la Peña, 2005). De la Peña (2005) notes that this definition fails to account for unequal power relationships that are structurally upheld through economic and political domination, control over the means of production, education, health, and communication services, and universal knowledge claims that characterize colonial interactions with indigenous peoples worldwide. What resulted was a distorted acculturation process that served to reinforce power differentials and facilitated an expectation of assimilation rather than mutuality (de la Peña, 2005).

and childhood obesity in the Walpole Island First Nation in southwestern Ontario. While the researchers specified conducting "parent" interviews, their variables included *maternal* weight and height (to calculate BMI), age, education, and smoking rates as well as breastfeeding patterns. No paternal variables were considered, which neglects the potential role of fathers in childhood feeding and presumes maternal responsibility for rates of obesity in infancy and early childhood. Kuperberg and Evers recommended that "mothers need to be encouraged to follow current infant feeding recommendations" as a strategy for reducing rates of child and ultimately adult obesity in First Nations communities. This recommendation was proposed despite finding no significant correlation between breastfeeding duration or solid food introduction and childhood obesity. It should be noted that children in a "single parent"[31] household were less likely to be obese regardless of maternal obesity (Kuperberg & Evers, 2006). This finding suggests that environmental, lifestyle, and or socio-economic factors can mitigate any assumed maternal "responsibility" for childhood obesity.

Socio-political Analysis

Few researchers explicitly consider the impact of social determinants on the prevalence of obesity and obesity-related conditions in First Nations, Métis, and Inuit communities in Canada; however, it is essential to explore political and economic considerations in understanding this phenomenon (Adelson, 2005; Kmetic et al., 2008). Analysis of these influences needs to consider the political context of the unequal power relations embedded in dominant medical systems and interventions (Browne & Smye, 2002). Browne and Smye (2002) emphasize that "inequities in health and social indicators cannot be glossed over as lifestyle, behavioural or cultural issues – rather, they are manifestations of the complex interplay of

[31] It is important to note that the majority of sole parents are women both in Aboriginal communities (Daly & Smith, 1996) as well as in non-Aboriginal populations.

historical, socioeconomic and political conditions that influence health status and access to equitable health care" (p. 29). Historical and sociopolitical conditions impact access to health care and are also indicative of health disparities and inequities among First Nations, Métis, and Inuit populations (Adelson, 2005; Browne & Smye, 2002). This section of the review looks at literature that considers the impact of the legacy of colonialism and socio-economic factors on First Nations, Métis, and Inuit women in Canada and the implications for understanding obesity in these populations.

Legacy of Colonialism

Since colonization, First Nations, Métis, and Inuit populations in Canada have had limited autonomy in determining and addressing their own health needs (Newbold, 1998). This legacy, characterized by the loss of land, forced relocation, imposed residential school system, and historic economic and political marginalization experienced by First Nations, Métis, and Inuit peoples in Canada continues to impact health in Aboriginal communities today. Fears and skepticism respecting non-Aboriginal health authorities are common (Hodgson, 1982) and many diseases (such as diabetes) are seen as "introduced to indigenous cultures by outsiders" (Barton, 2008, p. 23). The currently operating federal *Health Transfer Policy* aimed at integrating Aboriginal healthcare into the existing system has been criticized for reproducing colonial dynamics and fostering dependency because control over health services is still not a recognized treaty right (except when explicitly negotiated as such as with the James Bay Cree Nation in Québec) (Adelson, 2005). Glaring health disparities continue both between First Nations, Métis, and Inuit populations and the general population and between on-reserve and off-reserve Aboriginal communities, the full extent of which is difficult to determine due to the relative scarcity of data for off-reserve populations (Adelson, 2005).

For First Nations, Métis, and Inuit women, intersecting issues of gender, race and class create distinct institutional barriers and discrimination (Browne & Fiske, 2001). The legacy of colonialism impacts the health of First Nations, Métis, and Inuit women emotionally, spiritually, psychologically, and physically (Kmetic et al., 2008) and both contributes to and is sustained by ineffective, inappropriate and under-funded programs and services for First Nations, Métis, and Inuit peoples in Canada (Adelson, 2005). For instance, health initiatives that focus on prevention, while important and well-intentioned, often fail in First Nations, Métis, and Inuit communities as "prevention" is not a meaningful concept for many women in these communities as their perceptions of health and well-being are more holistic and based in balance and wellness rather than avoiding illness (Hislop as cited in Browne & Smye, 2002). Furthermore, Culley (1996) points out that different preventive health practices are more likely to result from socio-economic and educational disadvantages than from cultural differences alone.

Socio-economic Status

Some research focuses on or includes a component that addresses socio-economic disparities relevant to the prevalence of obesity among First Nations, Métis, and Inuit populations. As a whole, Aboriginal peoples in Canada are the poorest minority group in the country, and First Nations, Métis, and Inuit women are even more economically disadvantaged than their male counterparts (Health Council of Canada, 2005). In 1996, almost half (43 percent) of Aboriginal women in Canada had an income level below the low income cutoff as compared with 35 percent of Aboriginal men and 20 percent of Canadian women in general (CERA, 2002). For single Aboriginal mothers, approximately three quarters (73 percent) were living below the poverty line in 1996 (CERA, 2002). "Social disadvantage" (as measured on an index that combines social and economic factors such as age, gender, race, ethnicity and income into a

single measure) was found to be a predictive factor for obesity and cardiovascular disease as well as smoking (Anand et al., 2006). Based on the 2004 cycle of the CCHS, Garriguet (2008) reported that the associations between education, income and obesity differed for Aboriginal and non-Aboriginal populations. Obesity was more common in non-Aboriginal households where no members had graduated from high school, but less prevalent in lower-education Aboriginal households (Garriguet, 2008). Members of low-income Aboriginal households, on the other hand, were more likely to be obese, but no relationship was found between obesity and household income for non-Aboriginal people (Garriguet, 2008).

Daly and Smith (1996) looked at the socio-economic status of indigenous families in Australia and found that indigenous families experienced greater economic burdens than did other Australian families and these burdens took different forms. Based on 1991 national census data, indigenous families tend to place greater importance on women-centred kin networks, which contributed to shared child-care responsibilities and greater economic stability (Daly & Smith, 1996). Older generations of women would often remain part of extended families and grandmothers frequently assumed primary care of children in the household (Daly & Smith, 1996). Daly and Smith (1996) noted that policy restrictions can impede the economic efficacy of these family arrangements as welfare support is attached to mothers, and not children or primary caregivers. Historically, these family structures were not recognized by the state and were subjected to ongoing government surveillance resulting in the removal of children from these extended family homes on the basis of perceived neglect (Daly & Smith, 1996). Sole parents in indigenous Australian households tend to be younger, have lower education status, are less likely to be employed and have more dependent children than their non-Aboriginal counterparts (Daly & Smith, 1996). They are also more likely to live outside major urban centres and have lower

mean household incomes than single parent families in the general Australian population (Daly & Smith, 1996). Daly and Smith maintain that these factors make for unique economic challenges and additional fiscal caring costs for indigenous families. The extent and impact of these economic considerations on First Nations, Métis, and Inuit women in Canada and the consequent health challenges related to obesity have yet to be fully and comprehensively explored.

High food costs in the North are well-documented (Haas, 2002; Northern Food Prices Project Steering Committee, 2003; Wein et al., 1996). For instance, Bird, Wiles, Okalik, Kilabuk and Egeland (2008) observed that in a small rural Arctic community on Baffin Island, fresh produce was three times the price of that in a southern, urban centre (Montreal). Additionally, Haas (2002) reports that junk food tends to be lighter in weight than more nutritious food such as flour, butter and potatoes and lighter food is cheaper food in isolated communities where food is shipped in. Based on price surveys from Indian and Northern Affairs Canada (INAC) (2008) from 2006-2008, the cost of the Revised Northern Food Basket (RNFB)[32] typically ranged between $360 and $450 whereas the same basket cost between $200 and $250 at food entry points and southern urban centres. RNFB prices were lowest in Labrador where provincial government subsidies partially cover food mail expenses and highest in the Peawanuck Nation in northern Ontario ($518), Old Crow Nation in the Yukon ($496), and Colville Lake Nation in the Northwest Territories ($492). Each of the latter three communities is inaccessible by road for a significant portion of the year. The RNFB includes a priority perishable food component with items like milk, cheese, yogurt, eggs, fruits and vegetables, and juices. In September 2008, the

[32] The RNFB is calculated based on the average cost of feeding a family of four based on standardized nutritional guidelines (Minister of Public Works and Government Services Canada, 2007). The 2007 revised version of the Basket takes into account recent revisions to Canada's Food Guide, the Aboriginal version of the Food Guide, and food consumption patterns of northern residents (Minister of Public Works and Government Services Canada, 2007).

priority perishable portion of the RNFB cost approximately $181 in the Kitikmeot region in Nunavut as compared with $93 in Yellowknife (the food entry point for communities in that region) and $83 in Edmonton (INAC, 2008). Concern regarding these price discrepancies is often expressed in terms of the nutritional health of pregnant and/or lactating women or women of "child-bearing age" (Haas, 2002) indicating again a focus on the health of fetuses and infants rather than on the health of the women themselves.

ECONOMIC COSTS OF OBESITY AND OBESITY-RELATED ILLNESS

As national and international rates of obesity continue to increase researchers are considering the large economic toll obesity has on the public health care system. Obesity is an independent risk factor for many chronic diseases, which translates into substantial increases in medical costs for obese people (Colditz, 1992; Colman, 2000; Hughes & McGuire, 1997; Kortt, Langley & Cox, 1998; Thorpe, Florence, Howard & Joski, 2004; Thompson, Edelsber, Graham, Bird & Oster, 1999; Vanasse, Demers, Hemiari & Courteau, 2006). Research continually demonstrates the correlation of increased disease risk/increased body mass index with increased economic expenditures (Birmingham, Muller, Palepu, Spinelli & Anis, 1999; Colditz, 1992; Finkelstein, Riebelkorn & G. Wang, 2003; Goel, 2006; Hughes & McGuire, 1997; Katzmarzyk & Janssen 2004; Starky, 2005; Thompson, et al., 1999; Thompson & Wolf, 2001). Finkelstein et al. (2003) and Thorpe et al. (2004) found that obese American adults incur annual medical expenditures that are 37 percent higher than those of normal weight. Furthermore, obesity and obesity-related illnesses disproportionately affect low-income populations in the United States (Zhang & Y. Wang, 2004). As Colditz and Y. Wang (2008) note, "This trend implies that obesity's overall burden might be greatest for people who are least able to afford it" (p. 263).

Researchers believe that the obesity rates have reached epidemic proportions and are greatly concerned about the threat to public health as the direct cost of obesity is on par with the direct costs of smoking (Finkelstein et al., 2003; Goel, 2006). Economic costing research is currently used by policy makers and practitioners to create priorities within tight health care budgets (Thompson & Wolf, 2001). A majority of the economic costing literature uses a cost-of-illness approach, which seeks to estimate the impact of an illness in monetary terms (Starky, 2005) and the amount of resources used in treating a disease over a certain period of time (Hughes & McGuire, 1997). This section of the literature review considers the two components of economic burden costing frequently discussed in the literature, namely, direct and indirect costs. There are two methodological approaches that are commonly used to determine these figures: prevalence-based and incidence-based studies. The analysis of the economic costing of obesity presented in this review also addresses methodological challenges and gaps in the existing literature.

Components of the Economic Burden of Obesity

Direct Costs

The direct costs of an economic costing analysis refer to the amount of health care resources expended such as hospital care, radiological or laboratory tests, ambulatory services, physician services, services by other health professionals, medications, and nursing home care (Birmingham et al., 1999; Colditz, 1992; Colditz & Y. Wang, 2008; Starky, 2005). According to the literature, the direct medical costs attributable to adult obesity in Canada were estimated at $1.8 billion in 1997, or 2.4 percent of total direct medical costs (Birmingham et al., 1999; Katzmarzyk, 2002; Thompson & Wolf, 2001). Globally, in the United States, France, Australia,

New Zealand and the Netherlands, the direct medical costs attributable to obesity range from 2 to 7 percent of total direct medical costs (Birmingham et al., 1999; Thompson & Wolf, 2001).

Andreyeva, Sturm and Ringel's (2004) research indicates the importance of factoring in the degree of obesity when considering direct costs. Predictably, individuals in higher weight categories experienced increased medical costs and health service utilization – compared to individuals of normal weight, expenditures were 100% higher for persons with a BMI over 40, 50% higher for persons with a BMI of 35 to 40, and 25% higher for persons with a BMI of 30 to 35 (Andreyeva et al., 2004). The researchers noted that the prevalence of severe obesity (BMI 35 to 40) is increasing at a much faster rate than that of moderate obesity (BMI 30 to 35) and therefore estimates of the economic costs of obesity that average across weight categories "obscure real consequences for individuals, physician practices, hospitals, and health plans" (Andreyeva et al., 2004, p. 1936).

Indirect Costs

Indirect costs include the economic output lost because of work absenteeism due to illness, disability pensions, early retirement, or premature death (Colditz, 1992; Colditz & Y. Wang, 2008; Katzmarzyk & Janssen, 2004; Starky, 2005). Simply put, indirect costs refer to lost resources due to a particular illness (as opposed to direct costs which are costs incurred as a result of that illness) (Rice as cited in Starky, 2005). For example, Gorstein and Grosse's (1994) found that overweight workers were more frequently absent from work, used more sick time, and were more likely to apply for disability pensions. While very few studies include indirect costs in their economic costing, it is estimated that the magnitude of indirect costs likely exceeds direct costs (Popkin, Kim, Rusev, Du & Zizza, 2006).

Katzmarzyk and Janssen (2004) calculated the economic cost of obesity to be $4.3 billion in 2001 – $1.6 billion in direct costs and $2.7 billion in indirect costs (Katzmarzyk & Janssen, 2004). Using a ratio of direct to indirect costs given in Health Canada's *Economic Burden of Illness in Canada* (1993) (as cited in Colman, 2000), Colman and colleagues estimated that obesity costs the Nova Scotia economy $140 million per year in lost productivity. Unfortunately, there is still limited research on the fiscal costs of obesity, particularly the indirect costs of obesity. While obesity is known to reduce quality of life, increase morbidity and lead to premature death (Birmingham et al., 1999; Colditz, 1992; Hughes & McGuire, 1997), there is little known about the indirect economic impact of an increasingly obese population.

Methods of Quantifying Economic Costs

Prevalence-based Approach

A prevalence-based approach estimates the costs incurred during a given year by an individual (Colditz, 1992; Starky, 2005). Most of the economic costing literature uses a prevalence-based approach to calculate direct costs. There are two major types of prevalence-based cost-of-illness studies (Colditz & Y. Wang, 2008). The first type involves listing co-morbid conditions and estimating the proportion of treatment costs attributable to obesity. For instance, in Nova Scotia, Colman (2000) calculated the cost of obesity-related illness to be $68.2 million, or 3.9 percent of the provincial health budget in 1999-2000. These calculations were made using a population attributable fraction (PAF)[33], a number that estimates the extent to which the prevalence of a disease is specifically attributable to obesity (Colman, 2000). In order to calculate the PAF, researchers need to determine the relative risk of each co-morbid disease (usually using cohort studies in the literature) and obtain prevalence of a particular disease in the

[33] PAF is also sometimes referred to as population attributable risk (PAR), the etiological fraction, or the preventive fraction (Hu, 2008).

population along with the prevalence of overweight and obesity (generally drawn from population-based surveys) (Colman, 2000; Hu, 2008). The second type of prevalence-based cost-of-illness studies involves looking at differences in annual medical expenditure between obese and non-obese individuals. The first type involving the PAF calculation developed by Colditz (1992) is considerably more common in the literature and is most often used to estimate the direct economic costs of obesity.

Incidence-based Approach

An incidence-based approach estimates the lifetime costs of cases of an illness first diagnosed in a given year (Starky, 2005). This methodology often relies on health service utilization data obtained over time regarding a particular population (Colditz & Y. Wang, 2008). For example, Daviglus et al. (2004) calculated the total Medicare charges for adults in the United States aged 65 to 83 and found that the total cumulative costs for inpatient and outpatient care were between $30,000 and $100,000 higher among overweight or obese women than for normal weight women and between $9,000 and $76,000 higher among overweight or obese men than for normal weight men. One of the drawbacks of the incidence-based approach is that it is very data intensive (Colditz & Y. Wang, 2008). Furthermore, Colditz and Y. Wang (2008) note that cohort studies, which are often used in this type of analysis, are usually too short to provide adequate information regarding the prospective lifetime costs of obesity. Alternatively, some researchers may use estimated future incidence rates for certain illnesses and associated projected costs.

Methodological Challenges of Economic Costing

One critique of cost-of-illness approaches is that they do not qualify the long-term consequences of the disease and fail to take into account various stages of the disease (Colditz, 1992). Similarly, while it is known that there is age related increase in body weight and BMI,

few studies incorporate correlations between age and BMI, which could lead to misrepresented cost-analysis (Thompson & Wolf, 2001). Furthermore, Colman notes that "these costs of obesity-related illness do not include the actual costs of treating obesity itself, including diet pills and weight loss programs, because provincial health care systems do not fund the treatment of obesity alone" (p. 15).

Another issue with economic costings of obesity is that they commonly include only about 10 diseases that are well established as comorbidities for obesity namely, hypertension, Type 2 diabetes, coronary artery disease, gallbladder disease, stroke, hyperlipidemia, pulmonary embolism, colorectal cancer, postmenopausal breast cancer, and endometrial cancer (Birmingham et al., 1999; Colditz & Y. Wang, 2008; Colman, 2000; Thompson & Wolf, 2001). Rational for including these particular conditions in the economic costing process is that the relationship between obesity and each of these conditions is well-established in the medical literature and they all have specified diagnostic categories (Colman, 2000). However, limiting economic costing to these select conditions yields conservative estimates of the economic burden of obesity (Colditz & Y. Wang, 2008; Colman, 2000). Obesity is also causally linked to other illnesses and/or conditions such as musculoskeletal disorders, gout, asthma, back problems, thyroid problems, repetitive strain injuries, hormonal disorders, sleep apnea, infertility, and impaired immune function (Colditz & Y. Wang, 2008; Colman, 2000). Inclusion of these diseases would significantly raise the estimated prevalence-based costs of obesity. For instance, in Colman's (2000) study estimating the direct economic costs of obesity in Nova Scotia, factoring in the cost of osteoarthritis in the province would add another $18.4 million to the direct costs of obesity.

What's Missing?

Economic Costing and First Nations, Métis, and Inuit Populations

There is minimal research on the economic costing of obesity in First Nations, Métis, and Inuit communities. Lavoie and Foget (2008) researched hospital costs and the cost of prevalent health concerns in Aboriginal communities and found that registered First Nations people have twice the hospitalization rate of non-First Nations Manitobans. Per-person costs for hospital care are 70 percent higher for First Nations Manitobans than non-First Nations Manitobans. If the number of days spent in hospital by registered First Nations people in Manitoba could be reduced to the equivalent as non-First Nations the Manitoba Health could save $989 per person, $113 million in 2004 (Lavoie & Forget, 2008). Of the research that is being conducted, there is no data specific to the economic costs of obesity to Aboriginal people, although there is economic costing research on specific diseases in Aboriginal communities discussed further below.

There is more literature that details the economic costs of obesity-related conditions such as Type 2 diabetes. For instance, Simpson, Corabian, Jacobs and Johnson (2003) estimated the cost of diabetes in Canada at $9 billion. Lavoie & Forget (2006) estimated the cost of diabetes and its complications to the Manitoba health care system to be $193 million per year, or 18 percent of the total health care budget. The Assembly of First Nations (2007) reports that there is a higher prevalence of diabetes among Aboriginal populations than non-Aboriginal communities, which places a higher public health burden on Aboriginal communities. Green, Blanchard, Young and Griffith (2003) estimated that diabetes expenditures for First Nations people will increase from 2.4 percent of Manitoba's health budget in 1996, to a projected 7.0 percent of the provincial health budget in 2016. Jacobs et al. (2000) estimated the per-person annual cost for

status Indians with diabetes in Manitoba at $3,657 compared with $2,169 for the Canadian population in general. For status Indians without diabetes, the health cost was estimated at $1,359 per-person per year (Jacobs et al., 2000). The cost differences were attributed to higher prevalence and high hospitalization costs for status Indians with diabetes, many of which were associated with diabetic complications. Costs of diabetes are projected to increase by 130 percent for all Manitobans and by 330 percent for Registered First Nation people by 2025 (Jacobs, Blanchard, James & Depew, 2000; Lavoie & Forget, 2006).

Psychological Toll and Diminished Quality of Life

In the calculations required for an economic costing analysis, the experience of individuals with the condition often gets overlooked. Colman (2000) notes several psychological and social consequences that need to be considered as elements of indirect costing such as negative peer attitudes and self-image, limited social, educational, and professional opportunities, and job discrimination. He argues that all of these factors have an economic impact as they contribute to the loss of productivity due to obesity and obesity-related illnesses (Colman, 2000). The difficulty in including such factors in economic costing is that they are not readily quantifiable. As Colditz and Y. Wang (2008) state, "Unlike direct and indirect costs that are relatively easier to quantify in monetary terms, obesity also has serious psychosocial consequences and negative impacts on general well-being that are less straightforward to tally in an economic framework" (p. 263). More work is needed in the economic costing field toward methods that acknowledge the hidden costs of the disease.

Obesity as a Growth Industry

It is important to note that while obesity is costly in terms of health care systems, weight related programs and products are also part of a booming economic industry. According to

Gardiner and Halweil (as cited in Colman, 2000), Americans spend $33 million a year on diet drugs and weight loss programs contributing to the gross domestic product (GDP) and economic growth rates. Fast food advertising, much of which promotes high-fat foods, contributes $30 billion to the American GDP (Colman, 2000). Accordingly, Colman (2000) advances an alternative measure of progress referred to as the genuine progress index (GPI), which would include "population health, natural resources, unpaid work, educational attainment and other quality of life indicators in our core measures of progress" (p. 2), as opposed to solely economic measures.

SUMMARY

While obesity rates vary both between and among First Nations, Métis, and Inuit populations, the rate of obesity for First Nations, Métis, and Inuit women is consistently higher than that for both their male counterparts, and women in the general Canadian population. The obesity rate is also higher among First Nations youth than among youth in the general population in Canada; however, sex differences seem to vary depending on age group, region, and First Nations identity. Similarly, data among indigenous populations in the United States, New Zealand, and Australia shows marked variability in obesity prevalence for children and adolescents, although in these countries as in Canada, indigenous populations overall are more likely to be obese than their counterparts in other ethnic and/or racial groups.

Obesity-related health risks such as diabetes and cardiovascular conditions increase as BMI increases. As in the general population in Canada, obese First Nations adults report more chronic health conditions than First Nations persons who are not obese. For instance, diabetes is more prevalent among indigenous populations worldwide than among non-indigenous peoples and in Canada, is more common among First Nations, Métis, and Inuit women, particularly

senior women. Gestational diabetes among First Nations, Métis, and Inuit women in Canada seems to be increasing, but more longitudinal data is needed.

Obese First Nations peoples are also more likely to report vision and hearing impairments than First Nations adults who are not obese. Much of the research exploring vision impairments focuses on the lack of appropriate eye-care services in many First Nations communities. No research regarding the relationship between hearing impairments and obesity was found specific to First Nations, Métis, or Inuit populations. Obesity is also a significant risk factor for respiratory conditions such as asthma. Some research in this field shows a correlation between obesity and asthma for women in the general population, but further study is needed to explore this potential relationship among First Nations, Métis, and Inuit women. First Nations women also have higher rates of high blood pressure and cardiovascular disease than Canadian women in general and First Nations men. Furthermore, cardiovascular disease mortality rates are higher among First Nations women than women in the general population. Additionally, First Nations women are more likely to suffer from rheumatoid arthritis, and show symptoms of the disease earlier than Canadian women in general. Access to care and treatment for all of these obesity-related conditions is a concern in many First Nations, Métis, and Inuit communities; however, research indicates that, like women in the general population, First Nations, Métis, and Inuit women seek out health care services more often than their male counterparts.

Research on obesity in First Nations, Métis, and Inuit populations generally falls under at least one of the following themes: biological/genetic approaches, lifestyle and behavioural factors, environmental perspectives, social and/or cultural considerations, and socio-political analysis. Some researchers explore these areas in isolation, while others consider a combination of approaches, but very little research provided any historical or political context for the issue.

The bio-genetic research is focused on finding a metabolic and/or genetic explanation for the disproportionately high rates of obesity in First Nations, Métis, and Inuit populations.

The two most commonly cited lifestyle factors contributing to obesity in First Nations, Métis, and Inuit populations are low rates of physical activity and consumption of high-calorie foods. Overall, the research suggests that First Nations, Métis, and Inuit peoples are generally "inactive", but these studies are most often culturally and gender biased neglecting work, household, and ceremonial activities. Research also concludes that First Nations, Métis, and Inuit women consume larger quantities of high-calorie foods and fewer essential nutrients than both First Nations, Métis, and Inuit men and women in the general population. More study is needed that addresses the role of income and availability of traditional (from-the-land) food versus market (shipped in) food in women's food consumption choices. The availability of traditional food sources is also tied to environmental considerations as climate changes are impacting seasonal hunting, gathering, and fishing in First Nations, Métis, and Inuit communities. Currently, there is a lack of research that directly addresses the implications of these impacts on women in these communities as well as sex differences related to environmental contaminants.

The socio-cultural considerations reviewed here included conceptualizations of healthy body image as determined by various populations of indigenous women as well as the influence of gender expectations around parenting and maternal responsibility. More qualitative data is needed to explore these relationships further. Also relevant are socio-political perspectives, which consider the lasting impacts of colonialism on First Nations, Métis, and Inuit people in Canada as well as socio-economic considerations. Overall, Aboriginal women in Canada are the poorest social group and more research is needed exploring the relationships between obesity, gender, income, and education specific to First Nations, Métis, and Inuit women.

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