The Impact of Food Insecurity and Diet on Obesity among Métis and Off-Reserve First Nations Children in Canada

by

Jasmin Bhawra

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Objective: Aboriginal children are disproportionately affected by obesity, as they are twice as likely to be classified as obese compared to their non-Aboriginal Canadian counterparts. Research indicates that income, food insecurity, and diet quality are important predictors of weight status, however these factors are not well explored among Aboriginal children living off reserve. This study aims to identify associations between food insecurity and diet on obesity status among off-reserve First Nations and Métis children.

Methods: This study used both quantitative and qualitative research methods. Data from the *2006 Aboriginal Peoples Survey (APS) – Children and Youth* component were analyzed using binary logistic regression and the proportional odds model to assess relationships between food insecurity, diet, and body mass index (BMI). Fruit and vegetable intake, as well as junk food consumption, were used as proxy measures for children's diet quality. Additional analyses involving income instead of food insecurity, as well as food insecurity interaction terms, were also explored. Focus groups were conducted with caregivers of Métis and off-reserve First Nations children in Midland-Penetanguishene and London, Ontario, respectively. The focus groups were planned and carried out in partnership with the Métis Nation of Ontario (MNO) and the Southwest Ontario Aboriginal Health Access Centre (SOAHAC). A thematic analysis was conducted with the qualitative data, and the focus group discussions provided important contextual information to complement the statistical results.

Results: Approximately 11% of First Nations and 6.8% of Métis children were food insecure according to the 2006 APS. The quantitative analysis did not find a significant association between food insecurity and diet, or food insecurity and BMI for First Nations or Métis children. Income was a better predictor of weight status than food insecurity. For First Nations children, having a household income higher than $60,000 decreased the risk of being overweight/obese. For Métis children, a household income of less

than $20,000 increased the risk of overweight/obesity. Food insecurity was only significant as an interaction with parental education for First Nations children, and with parental education and number of people living in the household for Métis children. The proportional odds model produced similar results to the binary logistic regression procedure, and food insecurity remained insignificant in the analyses. Contrary to the quantitative findings, the focus group discussions indicated that caregivers perceived a positive relationship between low income and food insecurity, as well as adverse impacts on their children's diets. While caregivers did not use the term "food insecurity" explicitly, conversations about not having enough food or money for food, as well as coping strategies for when these situations occurred, suggested that food insecurity manifests itself in different ways. Caregivers mentioned decreased variety of foods, compromised fruit and vegetable intake, as well as decreased traditional food consumption as examples of how families' food consumption and purchasing patterns changed when food insecure. Food insecurity negatively impacted children's diets, and many caregivers attributed the rise in overweight and obesity to poor diet quality. Some of the key barriers to children eating healthfully were unaffordability and limited access to healthy foods. Caregivers also discussed the role of various programs for improving child health within their communities.

Conclusions: While food insecurity was not significantly associated with obesity in the quantitative analyses, discussions with caregivers of First Nations and Métis children identified food insecurity and low income as important predictors of poor diet, and consequently decreased well-being. Several limitations associated with the 2006 APS design may have prevented food insecurity from being significantly associated with obesity risk; however, it is clear from both the quantitative and qualitative components of this study that income consistently affects diet and child obesity risk. Findings from this study can inform necessary improvements to existing programs, interventions, and policies targeting obesity and health of Aboriginal children.

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Dedication

For Dad and Mom.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction and Overview

1.1 Statement of the Problem

Obesity is the most common nutrition-related condition in Canada and is increasingly manifest in young children (Lau et al., 2007; PHAC, 2011; Shields, 2005). Marginalized, low-income groups, including Aboriginal peoples, are at the greatest risk of developing obesity (Drewnowski & Specter, 2004; Willows, 2005; Willows, Hanley, & Delormier, 2012). In 2004, an estimated 20% of off-reserve Aboriginal children aged 6 to 12 years were obese, compared to 8% of other Canadian children (Shields, 2005). Childhood obesity is of particular concern as it negatively impacts physical and psychosocial health, and increases the risk of chronic diseases in the long-term (Drewnowski & Specter, 2004; PHAC, 2011). While diet, physical inactivity, and early life events are important predictors of child obesity, they cannot fully explain the higher prevalence of obesity among Aboriginal children (Willows, 2005; Willows et al., 2012).

Health outcomes are "embedded in the larger ecology of people's lives" (Willows et al., 2012, p.2), hence an understanding of the relevant social determinants of health is essential for unpacking the obesity epidemic (Loppie & Wien, 2009; Richmond & Ross, 2009; Willows et al., 2012). These determinants include proximal factors such as individual behaviors and lifestyle choices, as well as more distal factors such as built environment (Drewnowski & Specter, 2004; Richmond & Ross, 2009; WHO, 2008; Willows, 2005; Willows et al., 2012). Two factors that warrant special attention for understanding obesity among Aboriginal children are food insecurity and diet.

Food insecurity is defined as "access by all people at all times to enough food for an active, healthy life and includes at minimum: a) the ready availability of nutritionally adequate and safe foods, b) assured ability to acquire acceptable food in socially acceptable ways (e.g. without resorting to emergency food supplies, scavenging, stealing, and other coping strategies)" (Anderson, 1990, p. 1560). Poverty, a fundamental social determinant of health, is positively associated with food insecurity (Drewnowski & Specter, 2004; Willows, 2005). Aboriginal Canadians are disproportionately affected by poverty, thus

food insecurity is a pressing problem for children within low-income households (Willows, 2005). The 2007 to 2008 Canadian Community Health Survey (CCHS) found that 20.9% of all Aboriginal households (off reserve) experienced food insecurity, compared to 7.2% of non-Aboriginal households (Health Canada, 2012).

Food insecurity adversely impacts health and increases obesity risk, although the mechanisms are unclear (Dubois et al., 2006; Jyoti et al., 2005; Tarasuk, 2001; Willows et al., 2012). A putative explanation, according to previous research, is that food insecurity influences diet quality by limiting consumption and access to nutritionally adequate foods (Drewnowski & Specter, 2004). While diet is an independent predictor of obesity, food insecurity may also influence diet quality to affect weight status (Drewnowski & Specter, 2004). Food insecure households are more likely to purchase low cost food items, which tend to be energy-dense and nutrient-poor (Drewnowski & Specter, 2004; Tanumihardjo et al., 2007). These energy-dense foods may be chosen to maintain overall dietary energy, however the consumption of energy-dense foods high in sugar and fat often leads to a state of over-nutrition, thereby increasing the risk of becoming obese (Drewnowski & Specter, 2004; Tanumihardjo et al., 2007). This phenomenon has been termed the 'malnutrition paradox' (Tanumihardjo et al., 2007).

1.2 Study Rationale and Contributions

To date, studies with Aboriginal populations have largely focused on diet and physical inactivity as predictors of obesity for children living on First Nations reserves. While there has been increased interest in the social determinants of Aboriginal peoples' health over time, many of these factors and their impacts on specific health problems are still not well understood. The literature indicates associations between socioeconomic status (SES), food insecurity, diet quality, and obesity, although the relationships between food insecurity and the latter two variables – especially among Aboriginal children – are less clear. There is also little information on the coping mechanisms employed by off-reserve Aboriginal families living with food insecurity (Willows et al., 2009).

According to the National Household Survey (NHS), 1.4 million Canadians reported having an Aboriginal identity in 2011 (Statistics Canada, 2013a). Aboriginal peoples currently represent 4.3% of Canada's population (Statistics Canada, 2013a). Approximately 61% of Aboriginal Canadians are First Nations with 51% living off reserve, and 32% identify as Métis (Statistics Canada, 2013a). There is a lack of information on predictors of obesity among off-reserve First Nations and Métis people. These groups require greater research attention especially given that the Aboriginal population is growing in Canada, particularly in cities and other non-remote areas.

Additionally, 28% of Aboriginal people were under 14 years of age in 2011, compared to 16.5% of non-Aboriginal Canadians (Statistics Canada, 2013a). Childhood and adolescence are periods of critical development which largely influence the likelihood of obesity in later life (Janssen et al., 2005; Loppie & Wien, 2009). Therefore it is imperative that obesity prevention efforts focus on the pediatric population because of their demographic significance and the potential to improve health over the long-term (Willows et al., 2012).

This study bridges some of the research gaps outlined above by focusing on Métis and off-reserve First Nations people. Uncovering the relationships between food insecurity, diet, and obesity will further enhance our understanding of the obesity epidemic, and can inform necessary improvements to existing programs, interventions, and policies targeting Aboriginal children.

1.3 Objectives and Research Questions

The overall objective of this study was to investigate the relationships between food insecurity and diet on obesity status among off-reserve First Nations and Métis children. More specifically, this study aimed to answer the following questions:

1. Is there an association between food insecurity and child obesity among off-reserve First Nations and Métis children?
2. Is food insecurity associated with children's fruit and vegetable and/or junk food intake?
3. Does food insecurity act through diet to affect children's obesity risk?

4. What are some of the barriers and facilitators to healthy eating in Métis and off-reserve First Nations communities, as well as other potential predictors of child obesity?

1.4 Study Components

In order to answer the outlined research questions, this study employed both quantitative and qualitative methods. Data from the *2006 Aboriginal Peoples Survey* (APS) – *Children and Youth* component were analyzed in order to assess the relationships between food insecurity, diet, and body mass index (BMI) among First Nations and Métis children aged 6 to 14 years. Binary logistic regression and proportional odds models were used to identify significant relationships and control for potential confounders. Focus groups were conducted in Midland-Penetanguishene and London, Ontario with parents and caregivers of First Nations and Métis children. The qualitative data included rich descriptions of food insecurity, and provided important contextual information from families' lived experiences to complement the statistical results.

1.5 Organization

This thesis begins with a review of the current body of literature in Chapter 2, and provides an overview of Aboriginal health, obesity, and determinants of pediatric obesity including food insecurity. Chapter 3 discusses the research methods and data analysis procedures used in this study. The quantitative results are then presented in Chapter 4, followed by the qualitative findings in Chapter 5. Chapter 6 provides an interpretation of these results, and discusses the contributions of this study, associated limitations, as well as directions for future research.

Chapter 2: Literature Review

2.1 Background

2.1.1 Aboriginal Peoples in Canada

Aboriginal peoples were the first inhabitants of Canada (AANDC, 2011; Waldram, Herring, & Young, 1995). In the 1600s, French and British colonies came to North America in search of resources and wealth of the "New World," and began trading goods with the native peoples (AANDC, 2011; Waldram et al., 1995). Starting in the 1820s, the European colonies attempted to change the way Aboriginal people lived, which involved cultural assimilation and later the introduction of reserves and residential schools systems run by the Christian church (AANDC, 2011; Cottam, 1997). Forced assimilation stripped Aboriginal peoples of their rights, culture, and traditional uses of land (AANDC, 2011; Cottam, 1997). During their interaction with the European colonies, Aboriginal peoples were introduced to foreign diseases and alcohol, and many children endured physical and mental abuse within residential schools (Waldram et al., 1995). The experiences of colonization, particularly acculturation and residential schooling, continue to affect Aboriginal peoples today, as the social and psychosocial impacts have been passed down through generations (Waldram et al., 1995).

The *Constitution Act, 1982* recognizes three distinct groups as Aboriginal peoples (AANDC, 2011). These include North American Indians or First Nations, Métis, and Inuit (AANDC, 2011). First Nations and Inuit were the first inhabitants, and their tribes were spread out across Canada with Inuit people mainly concentrated in the arctic and subarctic regions (AANDC, 2011). Today there are over 600 First Nations communities across Canada (AANDC, 2011). Métis people have a unique Aboriginal culture resulting from the historical mixing of First Nations and European cultures and languages, and are also settled in regions across Canada (AANDC, 2011). Each group has a unique culture, language, beliefs, and customs (AANDC, 2011).

Over time, the Aboriginal population in Canada has grown substantially. In the 2011 NHS, over 1.4 million Canadians reported an Aboriginal identity (Statistics Canada, 2013a). Approximately 61% of the Aboriginal population identified as First Nations, and 32% as Métis (Statistics Canada, 2013a).

Relative to non-Aboriginal Canadians, the Aboriginal population is young. In 2011, First Nations and Métis people had median ages of 26 and 31, respectively, compared to 41 for the non-Aboriginal population (Statistics Canada, 2013a).

According to the 2011 NHS, 21.5% of all Aboriginal Canadians live in Ontario. Approximately 23.6% of First Nations people lived in Ontario, followed by 18.2% in British Columbia, 13.7% in Alberta, and the remainder in the other provinces and territories (Statistics Canada, 2013a). Approximately 21.4% of Métis people lived in Alberta, followed by 19% in Ontario, 17.4% in Manitoba, 15.4% in British Columbia, and 11.6% in Saskatchewan (Statistics Canada, 2013a).

2.1.2 The Health of Aboriginal Canadians

The health of Aboriginal Canadians is significantly worse than non-Aboriginal Canadians on average (Garner et al., 2010; Métis Centre, 2010; Stephens et al., 2006; Tjepkema et al., 2009). Aboriginal peoples' health is largely affected by a history of colonization and discrimination (AANDC, 2011; Waldram et al., 1995). First Nations and Métis people experience poorer health than non-Aboriginal Canadians on numerous indicators, including shorter life expectancies, higher infant and age-standardized mortality rates, and poorer self-reported health (Garner et al., 2010; Janz, Seto, & Turner, 2009; Tjepkema et al., 2009). With respect to chronic conditions, First Nations and Métis adults are significantly more likely to have arthritis, hypertension, asthma, stomach or intestinal ulcers, diabetes, heart problems, cancer, and emphysema than non-Aboriginal Canadians (Garner et al., 2010).

According to the 2006 Aboriginal Children's Survey (ACS), which explored the health of off-reserve First Nations and Métis children under the age of six, Aboriginal children were more likely than non-Aboriginal children to experience accidental death, sudden infant death syndrome, and injury (Findlay & Janz, 2012). Aboriginal children were also significantly more likely to get chronic ear

infections, to have dental issues, to be hospitalized due to asthma, to have respiratory tract infections, and to be obese (Findlay & Janz, 2012).

Some of the health disparities Aboriginal peoples face have been attributed to low SES, as Aboriginal people are more likely to have lower than a high school education and household incomes less than $20,000 per year (Garner et al., 2010). However lower income and education cannot fully explain the poorer health status of Aboriginal peoples compared to non-Aboriginal Canadians (Garner et al., 2010).

2.2 Obesity

2.2.1 Measuring Obesity

The World Health Organization (WHO) defines obesity as the accumulation of excess fat to the point where it has adverse impacts on health (WHO, 2013a). Many methods can be used to estimate an individual's total body fat or adipose tissue (Heymsfield et al., 2005; Wells & Fewtrell, 2006). Imaging techniques, including computed axial tomography (CT) and magnetic resonance imaging (MRI), allow for an accurate quantification of adipose tissue in the body (Heymsfield et al., 2005). Dual-energy X-ray absorptiometry (DXA) provides a reliable measurement of total percent body fat and is less expensive than CT and MRI (Heymsfield et al., 2005; Wells & Fewtrell, 2006). Other, less sophisticated, measures of body fat include skinfold measurements and waist and hip circumferences, which may provide an indication of overweight or obesity, but do not allow body mass or fat-free versus fat mass indices to be determined (Heymsfield et al., 2005).

Due to the time and financial resources that would be required to measure body composition at a population level, many researchers use proxy measures to obtain an estimate of body fat. BMI is a commonly used weight classification system which is easily calculated by taking a person's weight in kilograms and dividing it by their height in metres squared (Heymsfield et al., 2005; WHO, 2013a). It is a commonly used measure and a good indicator of body fat (Heymsfield et al., 2005). BMI values correspond with different weight classifications.

The International Obesity Task Force (IOTF) developed age and sex specific BMI cut-offs for children (Cole et al., 2000). The IOTF established these cut-offs after obtaining the heights and weights of children 2 to 18 years of age from six different countries including Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States (Cole et al., 2000). Centile curves for BMI were created, and these illustrated patterns of growth as well as average BMIs for boys and girls at different ages (Cole et al., 2000). Children who fell into the 85th centile were considered overweight, and those in the 95th centile as obese (Cole et al., 2000). These centiles correspond to BMI values $\geq 25 kg/m^2$ for overweight, and $\geq 30 kg/m^2$ for obese (Cole et al., 2000). BMI has been found to be relatively accurate compared to national reference data and waist circumference measurements for diagnosing obesity and cardiometabolic risk factors for children (Reilly, Kelly & Wilson, 2010). The specificity and sensitivity of the BMI measure was also similar to national reference data and waist circumference measures (Reilly et al., 2010). "Sensitivity" refers to whether or not children who fall into the obese weight category are correctly being identified as such (Reilly et al., 2000). For example, the percentage of obese children being classified as obese by the measure being used (Reilly et al., 2000). Sensitivity similarly refers to whether children who are non-obese are being classified as non-obese (Reilly et al., 2000). Janssen et al. (2005) also found that the IOTF BMI cut-off points were good predictors of risk factors for coronary heart disease and obesity in young adulthood (Janssen et al., 2005).

Some limitations associated with BMI as a measure are that it cannot distinguish between fat and muscle weight, hence some individuals may be incorrectly classified as overweight or obese based on the relative distribution of these tissues (Heymsfield et al., 2005). A few studies have also found BMI to have good "specificity" but not sensitivity for detecting obesity among children. The IOTF BMI measures have been found to be less sensitive than direct measures, and this sensitivity differs between boys and girls; however BMI was found to have high specificity (Reilly et al., 2000). Moreover, ethnic differences in stature and body fat distribution, such as between Aboriginal and non-Aboriginal Canadians, are not accounted for by the current BMI thresholds (Galloway, Young, & Egeland, 2011; Hopping et al., 2010; Katzmarzyk & Malina, 1998; 1999). There is a need for further research on ethnicity-specific BMI

thresholds, as well as validity studies comparing the IOTF age and sex specific BMI cut-offs with more precise measurement techniques.

Despite the fact that BMI has some limitations, it is still a useful measure of obesity for children. BMI is one of the most widely used methods for identifying weight status, and using it in this study will allow for comparisons with other studies as well.

2.2.2 Prevalence of Child Obesity in Canada

According to the 2009 to 2011 Canadian Health Measures Survey (CHMS), close to one-third of children between the ages of 5 and 17 were overweight or obese in 2011 (Roberts et al., 2012). Boys were more likely to be obese than girls, as 7.1% of girls between 5 and 17 years were classified as obese compared to 9.5% of boys (Roberts et al., 2012). Updated statistics for Aboriginal children under the age of 12 are not yet available from Statistics Canada, however parental reports of height and weight in the 2006 APS indicated that 20% of First Nations children between 6 and 14 years of age fell into the obese BMI category, with approximately 21% of boys and 19% of girls classified as obese (PHAC, 2011). Approximately 17% of Métis children between 6 and 14 years were classified as obese, including 19% of boys and 15% of girls (PHAC, 2011).

2.2.3 Health Concerns Related to Child Obesity

Child obesity is a pressing health concern as it is associated with numerous co-morbidities in both the short term and into adulthood (Roberts et al., 2012; WHO, 2013a). Studies have found that obese children experience chronic stress related to weight, which can affect sleeping patterns, immune function, and risk of upper respiratory infections (Nieman & LeBlanc, 2012). They are also at higher risk for elevated blood pressure, dyslipidemia, and insulin resistance leading to Type 2 Diabetes (T2D) (Kaufman, 2003). Early onset of T2D has been found to increase the severity of potential complications, including cardiovascular disease (CVD), vision problems, and renal disorders, to name a few (Amschler, 2002). Obesity is also associated with social and psychological issues. Many children experience low self-

esteem, engage emotional eating, and are bullied about their weight (Nieman & LeBlanc, 2012). Mental health disorders, including anxiety and depression, are also increasingly common and can further compromise immune system function (Nieman & LeBlanc, 2012). Moreover, obesity in childhood is predictive of obesity in later adulthood (Janssen et al., 2005).

Among adults, obesity accounts for 80 to 90 percent of all T2D cases (Astrup & Finer, 2000). Over the long term, obesity decreases life expectancy and increases the risk of hypertension, hyperlipidemia, CVD, metabolic disorders, sleep apnea, as well as some cancers (Fontaine & Barofsky, 2001; Pi-Sunyer, 1993; WHO, 2013a). Obesity has also been found to reduce health-related quality of life (HRQL), which refers to the "emotional, physical, social, and subjective feelings of well-being which reflect an individual's subjective evaluation and reaction to health or illness" (Fontaine & Barofsky, 2001, p. 174). HRQL is used to identify the impact of different diseases on an individual's functional abilities and overall well-being (Fontaine & Barofsky, 2001). Overweight and obesity are associated with a decline in HRQL and greater functional impairments among adults (Fontaine & Barofsky, 2001).

2.3 Determinants of Pediatric Obesity

A plethora of literature explores the etiology of pediatric obesity. Over the past decade, Aboriginal children have received increased attention in research since they are twice as likely to be obese compared to their non-Aboriginal Canadian counterparts (PHAC, 2011; Shields, 2005). Numerous variables have been identified as risk factors for obesity, ranging from individual-level determinants such as diet and physical activity, to broader social determinants like family structure. Many of these factors play an important role in the obesity epidemic among Aboriginal peoples, although the literature indicates that they operate uniquely in this population and must be considered alongside more culture-specific variables (Loppie & Wein, 2009; Willows et al., 2012).

Willows et al. (2012) developed an ecological model outlining the multiple causes of childhood obesity in Aboriginal populations (Willows et al., 2012). A revised version of this model was created to include other major contributors to pediatric obesity. **Figure 1** illustrates the multitude of factors that

guide our research questions and present literature review. These factors are categorized as either proximal or social determinants and are sub-classified based on level of analysis.

This section commences with an overview of the proximal determinants of obesity, and then moves on to a discussion of the relevant social determinants of health. Emphasis is placed on research exploring the impacts of SES and food insecurity on obesity risk.

Figure 1: Determinants of Pediatric Obesity Among Aboriginal Children

Adapted from Willows et al. (2012) ecological model for childhood obesity.
Sources: Birch, 1999; Blanchette & Brug, 2005; Downs et al., 2009; Ho et al., 2008; Loppie & Wein, 2009; O'Dea, 2003; Oliver & Hayes, 2005; Power, 2008; Richmond & Ross, 2009; Tanumihardjo et al., 2007; WHO, 2008; Willows et al., 2012

2.3.1 Proximal-level Factors

Proximal-level factors refer to determinants that have a direct impact on an individual's likelihood of becoming obese (Loppie & Wein, 2009). While some interpersonal and community-level factors, such as SES, have a direct relationship with the risk of pediatric obesity, many studies emphasize individual-level factors as the most significant, proximal variables (Kutchman et al., 2009; Loppie and Wein, 2009; Willows et al., 2012).

At the individual level, obesity is the consequence of sustained energy imbalance, whereby energy intake exceeds expenditure (Kutchman et al., 2009; Rocandio et al, 2001; Willows et al., 2012). Energy intake and energy expenditure must be in equilibrium otherwise weight gain may result (Kutchman et al., 2009; Rolls, Ello-Martin, & Tohill, 2004). Studies with both children and adults find that diet quality is at least as important as overall quantity for determining weight status. An additional consideration among Aboriginal children is the relatively recent transition away from traditional foods to a diet rich in processed, market foods (Kuhnlein & Receveur, 1996; Power, 2008; Willows, 2005). Physical activity also plays a role in obesity status among Aboriginal and non-Aboriginal children alike (Chaput et al., 2012; Katzymaryzk, 2008). This section discusses the behavioural and lifestyle factors associated with obesity before moving on to the relevant social determinants.

2.3.1.2 Dietary Factors

Diet is one of the main proximate factors in the etiology of obesity. Numerous studies have looked at the quality and quantity of foods in children's diets, energy density of those foods, and traditional versus market food composition of the diet. These criteria have consequences for nutrition as well as weight status and are discussed in more detail below.

Diet Quality and Quantity

In a study with First Nations children aged 9 to 12 years from Kahnawake, Quebec, Receveur et al. (2008) investigated whether the amount and type of food children consumed was related to their

weight status (Receveur et al., 2008). Based on measured BMI and 24-hour dietary recalls, the authors found that certain foods were associated with the presence of overweight in elementary school children. Overweight children consumed potato chips more frequently, crackers less frequently, and larger French fry portions than normal-weight children in the study. However there were not significant differences in overall percent fat, energy density, energy intake, or diet diversity between the different BMI categories (Receveur et al., 2008).

Nicklas et al. (2003) conducted a similar study with 10-year-old children from the Bogalusa Heart Study in Louisiana. According to 24-hr dietary recall interviews, consuming sweetened beverages (i.e., soft drinks, fruit flavoured drinks), sweets (i.e., desserts, candy), and meat were positively associated with being overweight. A variety of eating patterns were linked to overweight status, although consumption of snack food, in particular, had the most significant impact (Nicklas et al., 2003).

A key limitation of these studies is the 24-hr dietary recall method, since children's diets may not have significantly differed from one another on a single day, but may have differed over time. The authors also note that overweight children are more likely to underreport dietary intake, which could have affected the results (Receveur et al., 2008). Validation studies have found that children tend to have poor knowledge of portion size, ingredients used in prepared meals, and a generally limited ability to recall with accuracy until the ages of 8 to 10 (Baxter et al., 2009; Livingstone, Robson, & Wallace, 2004). Even for older children, only 24-hour recalls are feasible as compared to more extensive food frequency questionnaires (Livingstone et al., 2004).

Bandini et al. (1999) also set out to determine if there was a difference in the types of foods consumed by obese versus non-obese adolescents (n=43) using 14-day food diaries. Energy intake was underreported in both groups, however the overall percentage of energy intake (defined as the ratio of reported energy intake to measured energy expenditure) was significantly higher in the non-obese compared to the obese group (Bandini et al., 1999). Potato chip and soft drink consumption were similar between the two groups, and non-obese children were found to have significantly higher energy intakes from high calorie foods as compared to the obese group (617 ± 356 kcal/day vs. 362 ± 223 kcal/day,

$p<0.01$). This study indicates that adolescents obtain a significant proportion of their daily energy intake from high calorie foods irrespective of weight status, and obese adolescents are not necessarily eating more junk food as commonly assumed (Bandini et al., 1999).

Rocandio, Ansotegui & Arroyo (2001) conducted a cross-sectional study with 11-year-olds (n=32) to determine if diet quality and overall food intake differed among children based on overweight status (Rocandio et al., 2001). Like Bandini et al. (1999), the authors found that overweight children did not have energy intakes greater than non-overweight children. Interestingly, the total energy intake was significantly lower in the overweight compared to the non-overweight group (8948.7kj/day vs. 9590kj/day, $p < 0.01$). Carbohydrate intake was significantly greater for non-overweight children as compared to overweight children in the sample (250.9g/day ± 58.8g/day vs. 222.1 ± 77.4g/day, $p < 0.01$). There were no significant differences in micronutrient intake between the two groups, however non-overweight children consumed significantly more fibre in their diets (Rocandio et al., 2001). Rocandio et al. (2001), as well as Receveur et al. (2008) and Niklas et al. (2003), did not record children's physical activity, hence energy expenditure, an important part of energy balance, was not accounted for in these studies (Niklas et al., 2003; Receveur et al., 2008; Rocandio et al., 2001).

Energy density

Energy density, the energy content in a given weight of food (kcal/g or kj/g), is an integral component of a food's nutritional and caloric value (Ledikwe et al., 2006; Rolls et al., 2004). A food's energy density is a consequence of the amount of water and fibre it contains (Ledikwe et al., 2006; Rolls et al., 2004). Fruits and vegetables (F&V) are examples of nutrient-rich, low energy density foods, because the high fibre and water content increases their weight without increasing energy content (Rolls et al., 2004). Studies indicate that people tend to consume the same weight or volume of food, irrespective of the energy density (Ledikwe et al., 2006). Hence for weight management, health professionals often recommend consuming low energy density foods to decrease total energy intake and promote satiety (Drewnowski, Darmon & Briend, 2004; Ledikwe et al., 2006; Rolls et al., 2004).

According to cross-sectional studies in Aboriginal communities, nutritionally poor, energy-dense, market foods (i.e., sugary drinks and snacks) were the largest component of children's diets (Downs et al., 2009; Stroehla, Malcoe & Velie, 2005). Downs et al. (2009) found that only 68% of children aged 9 to 13 years (n=201) reported having F&V at home often, and 98% had fewer than five servings of F&V daily (Canada's Food Guide for First Nations, Métis and Inuit recommends five to six servings per day) (Downs et al., 2009; Health Canada, 2007a). F&V included fruits excluding juices, and vegetables excluding French fries and fried potatoes (Downs et al., 2009). While only a few studies have looked at the role of energy density in children specifically, it is clear that diet quality is compromised when energy-dense, nutrient-poor foods are consumed in excess.

Market Versus Traditional Food

The Western diet, which includes many nutrient-poor market foods, has largely replaced traditional Aboriginal diets among children (Downs et al., 2009; Pigford & Willows, 2010; Stroehla et al., 2005; Willows et al., 2012). Market foods are often low in many micronutrients and vitamins, and are high in sugar, fat, and sodium (Kuhnlein et al., 2004; Nakano et al., 2005; Willows et al., 2012). As a result, many health problems associated with poor diet are increasingly found in Aboriginal populations (Willows, 2005).

Kuhnlein et al. (2004) explored the associations between traditional versus market food diets and obesity among three cultural groups aged 20 years and older in the Canadian arctic: Yukon First Nations, Dene/Métis, and Inuit peoples (Kuhnlein et al., 2004). Traditional food referred to animals and plants obtained from the local environment, whereas market foods, such as sugar, were imported and could only be purchased from stores (Kuhnlein & Receveur, 1996). Using 24-hour dietary recalls, food frequency interviews, and 7-day food records, the authors found that traditional Aboriginal foods contained an abundance of essential nutrients, and were lower in fat, carbohydrates and sugar as compared to market foods (Kuhnlein et al., 2004). Adults from all three cultural groups studied were more likely to consume

traditional diets than the younger generations. Overall, 10 to 36% of the study population's dietary energy came from traditional food sources (Kuhnlein et al., 2004).

In a study with 222 Dene/Métis and Yukon children aged 10 to 12 years, Nakano et al. (2005) found that market foods also constituted the majority of children's diets (Nakano et al., 2005). Traditional foods made up only 4 to 5% of children's diets over the two seasons (November to January and August to October) that the authors administered 24-hour dietary recall questionnaires to participants. The four major food groups from Canada's Food Guide contributed to less than half of children's total energy intakes, while junk foods composed the bulk of children's diets. Children who consumed traditional foods had more protein and essential micronutrients in their diets than those who had no traditional food at all (Nakano et al., 2005). While Kuhnlein et al. (2004) and Nakano et al. (2005) did not assess the relationship between traditional foods and obesity, the authors found that traditional foods contain important nutrients that are not found in processed, market foods (Kuhnlein et al., 2004; Nakano et al., 2005; Willows et al., 2012).

Khalil, Johnson-Down, & Egeland (2010) conducted a study with 125, 9 to18 year-old Cree youth to investigate if a similar pattern of decreasing traditional food consumption existed in Northern Quebec (Khalil et al., 2010). Food frequency questionnaires and 24-hour dietary recalls indicated that approximately 97% of youth obtained over 40% of their total daily energy from fat. Additionally, over 25% of their energy intake came from sugar-dense foods and beverages (Khalil et al., 2010). An estimated 65% of the study population were consuming fewer than the daily, recommended F&V by Canada's Food Guide. The majority of this population was either at risk of being overweight or overweight, although youth who consumed traditional foods at least once a week, as well as F&V often, had a lower BMI than those who had traditional food and F&V less frequently (Khalil et al., 2010).

The literature on dietary factors and obesity indicate that the type and quality of foods consumed are important for determining obesity risk. Interestingly, research is inconclusive regarding the relationship between total energy intake and obesity, since several studies show that non-obese children actually have higher self-reported energy intakes than obese children (Bandini et al., 1999; Rocandio et

al., 2001). The energy density of food influences its nutritional composition and satiety value. Moreover, the consumption of traditional versus market foods among Aboriginal children has major health consequences because diets high in market foods lack many nutrients essential to good health. F&V versus junk food consumption, as well as market versus traditional foods, appear to be important but are not well studied among Aboriginal children living off reserve. Hence more research is required to uncover these relationships and associated mechanisms.

2.3.1.3 Physical Activity and Sedentary Behaviour

In addition to dietary predictors of obesity, physical activity is also an important factor in the energy balance equation. Physical activity directly contributes to increased energy expenditure, and is believed to also regulate energy intake (Saunders, 2011). As a result, physical activity has a positive impact on energy balance and is necessary for weight control (Saunders, 2011). The Canadian Society for Exercise Physiology (CSEP) recommends that children between the ages of 5 and 11 get 60 minutes of moderate-to-vigorous physical activity (MVPA) at least three days per week (CSEP, 2013). Children are also recommended to limit their sedentary behaviour, particularly screen time, to less than two hours per day, and to minimize sitting and indoor time (CSEP, 2011). The benefits of regular physical activity include weight management, improved confidence and academic performance, as well as reduced risk of chronic disease (CSEP, 2013; Kutchman et al., 2009). On the other hand, sedentary behaviour has been associated with increased risk of obesity in children and adults since it involves little to no energy expenditure and may also displace physical activity (Saunders, 2011).

Chaput et al. (2012) conducted a study with children aged 8 to 10 years (n=550) using objective measures of physical activity (accelerometer for seven days) and adiposity (percent body fat measure obtained via DXA and waist-to-height ratio). They found that increased MVPA led to decreased percent body fat and waist-to-height ratios in children, independent of sedentary behaviour (Chaput et al., 2012). Children who had less than the recommended daily 60 minutes of MVPA experienced a greater likelihood of being overweight or obese (Chaput et al., 2012). The effects of sedentary behaviour are less clear, as

there was no difference in the likelihood of being overweight or obese versus normal weight for children who met the recommendation for less than two hours per day of screen-time. In contrast, Tremblay et al. (2011) and Kutchman et al. (2009) found a positive association between TV time greater than two hours daily and overweight status in children and youth aged 5 to 17 years (Kutchman et al., 2009; Tremblay et al., 2011).

Research on Aboriginal children has found the effects of physical activity and sedentary behaviour to be similar to those found in other Canadian children (Katzmaryzk, 2008). A study by Ng, Marshall, & Willows (2006) with Cree children aged 9 to 12 years (n=82) in Northern Quebec found that 90% of children scored below the 20th percentile in 20-metre shuttle-run-tests (SRT) compared to age and gender-matched data from other Quebec children (Ng et al., 2006). Pedometer scores indicated that only 49% of all children met the daily recommendations for physical activity (Ng. et al., 2006). Thirty-three percent of children were overweight and 28% were classified as obese (Ng et al., 2006). These results are similar to the study conducted by Hanley et al. (2000) with First Nations children from Sandy Lake in Northern Ontario, in which children with the lowest fitness scores were most likely to be overweight (Hanley et al., 2000).

Overall, the literature on physical activity and obesity in children appears to be inconclusive. Cross-sectional studies tend to report physical activity levels in normal weight children as higher relative to overweight children, whereas the bulk of longitudinal studies find only small associations between high physical activity levels and normal BMI (Must & Tybor, 2005; Saunders, 2011; Strong et al., 2005). The data are also inconsistent among Aboriginal peoples. A study by Findlay (2011) looking at off-reserve First Nations, Métis, and Inuit people 12 years and older found that First Nations and Métis people had more active lifestyles than non-Aboriginal Canadians 12 years and older (Findlay, 2011). Individuals with an active lifestyle were more likely to report good or excellent physical and mental health, although BMI as an outcome was not indicated (Findlay, 2011).

Katzmaryzk (2008) explored differences in physical activity and obesity between Aboriginal and non-Aboriginal Canadians using the 2004 CCHS, and he found no differences between the two groups for

children and youth aged 2 to 17 years. However sedentary behaviour was always significantly associated with obesity (Katzmaryzk, 2008).

Other Proximal Factors

In addition to diet and exercise, there are numerous other proximal factors that influence the risk of obesity in children. These include genetics, family history, pre-natal environment, breastfeeding, and parenting, among others presented in **Figure 1** (Kutchman et al., 2009; Willows et al., 2012). The literature confirms these proximal determinants as relevant for Aboriginal children, however they cannot fully explain why obesity is exacerbated in Aboriginal populations. Instead, the social determinants of health fill the gaps in our understanding of pediatric obesity and elucidate the broader community and societal-level variables involved.

2.3.2 Social Determinants of Health

The health disparities between Aboriginal and non-Aboriginal people suggest that factors beyond the proximal determinants outlined also play an important role in obesity. The social determinants of health have the potential to explain the higher prevalence of obesity observed in Aboriginal children.

Many of the individual-level factors that may lead to obesity are influenced by the broader social determinants, which act on the community, neighbourhood, and societal levels (WHO, 2008; Willows et al., 2012). Recognizing the collective influence of the social determinants of health is especially necessary when studying Aboriginal populations, because the Indigenous approach to health is also holistic and comprises physical, mental, spiritual and emotional well-being (Loppie & Wien, 2009; Métis Centre, 2010). The social determinants of health affect all individuals, however certain factors are more relevant depending on ethnic background.

Among Aboriginal peoples, some of the more significant predictors of health are cultural beliefs and practices, SES, access and availability of social and material resources, as well as a history of discrimination and colonization (Loppie & Wien, 2009; Richmond & Ross, 2009; Willows et al., 2012).

With respect to pediatric obesity, culture influences food choices and preferences on the individual level, as well as social ideals of beauty and body size (Willows, 2005). Higher rates of poverty, food insecurity, and household overcrowding among Aboriginal Canadians also adversely impact health and obesity risk (Downs et al., 2009; Loppie & Wien, 2009; Shields, 2005; Willows et al., 2012).

Colonization and systemic discrimination have had profound effects on Aboriginal peoples' health, largely due to loss of land, which may have been used to acquire traditional food, and assimilation policies that forced Aboriginal communities to conform to the Western lifestyle (Loppie & Wien, 2009; Richmond & Ross, 2009; Willows et al., 2012). Despite increased social support, programs, and policies to help Aboriginal peoples, the residual effects of a history of disadvantage can be seen in the high unemployment rates, poor housing situations, and lower income and education among Aboriginal Canadians (Loppie & Wien, 2009; Waldram et al., 1995).

The following sections will discuss the prevalence of food insecurity in Aboriginal households, and how this potentially influences both diet quality and obesity status.

2.3.2.1 Food Insecurity

Defining Food Insecurity

Food security exists when "all people at all times have physical and economic access to sufficient, safe, and nutritious foods to meet their dietary needs and food preferences for an active and healthy life" (FAO, 2013). Food insecurity refers to a situation in which availability or access to nutritionally adequate food is limited or uncertain (Anderson, 1990; WHO, 2013b; Willows, 2005). The WHO identified three main components of food security, including food availability, access, and use (WHO, 2013b). Availability refers to having "sufficient quantities of food available on a consistent basis," and access is defined as "sufficient resources to obtain appropriate foods for a nutritious diet" (WHO, 2013b). Food use means "appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation" (WHO, 2013b). Access to culturally acceptable food is also

increasingly being recognized as an important facet of food security (Lambden, Receveur, & Kuhnlein, 2007; Power, 2008; Tarasuk, 2001).

Measuring Food Insecurity

Food insecurity is traditionally categorized at the individual or household level, but is also recognized at the level of the community or nation (Tarasuk, 2001; WHO, 2013b). The measurement of food insecurity depends largely on the unit of analysis. At the individual level, food insecurity is characterized by insufficient intake, nutritional inadequacy, feelings of deprivation, lack of choice or variety, as well as disrupted eating patterns (Radimer, Olson & Campbell, 1990; Radimer et al. 1992). Household food insecurity is characterized by household or family members' anxiety around obtaining or accessing food, food depletion, not having suitable food, or food acquisition in socially unacceptable ways (Radimer et al., 1990). Aboriginal peoples have unique considerations for food insecurity, including traditional food consumption, community feasts and sharing, as well as traditional food acquisition practices such as harvesting and hunting (Lambden et al., 2007; Power, 2008). As such, these factors need to be considered in the definition of food security for Aboriginal peoples (Lambden et al., 2007; Power, 2008).

Tarasuk (2001) importantly notes that food security status is not static, and can be defined based on the frequency with which it occurs, severity, as well as the duration (Tarasuk, 2001). The progression of food insecurity involves moving from a state of food anxiety, to compromises in diet quality, followed by decreased food intake at the moderate stages (Tarasuk, 2001). As an individual approaches severe food insecurity, hunger and then ultimately starvation would occur in the latest stages (Tarasuk, 2001). The definition of food insecurity, as well as this process, was used to develop the *Household Food Security Survey Module* (HFSSM) which has been used in national surveys such as the CCHS and Survey of Household Spending (SHS) since 2004 (Health Canada, 2007b; Tarasuk, 2001).

The HFSSM is an 18-question validated survey for the measurement of household food insecurity (Health Canada, 2007b). It includes 10 adult- and 8 child-specific multiple choice questions on food

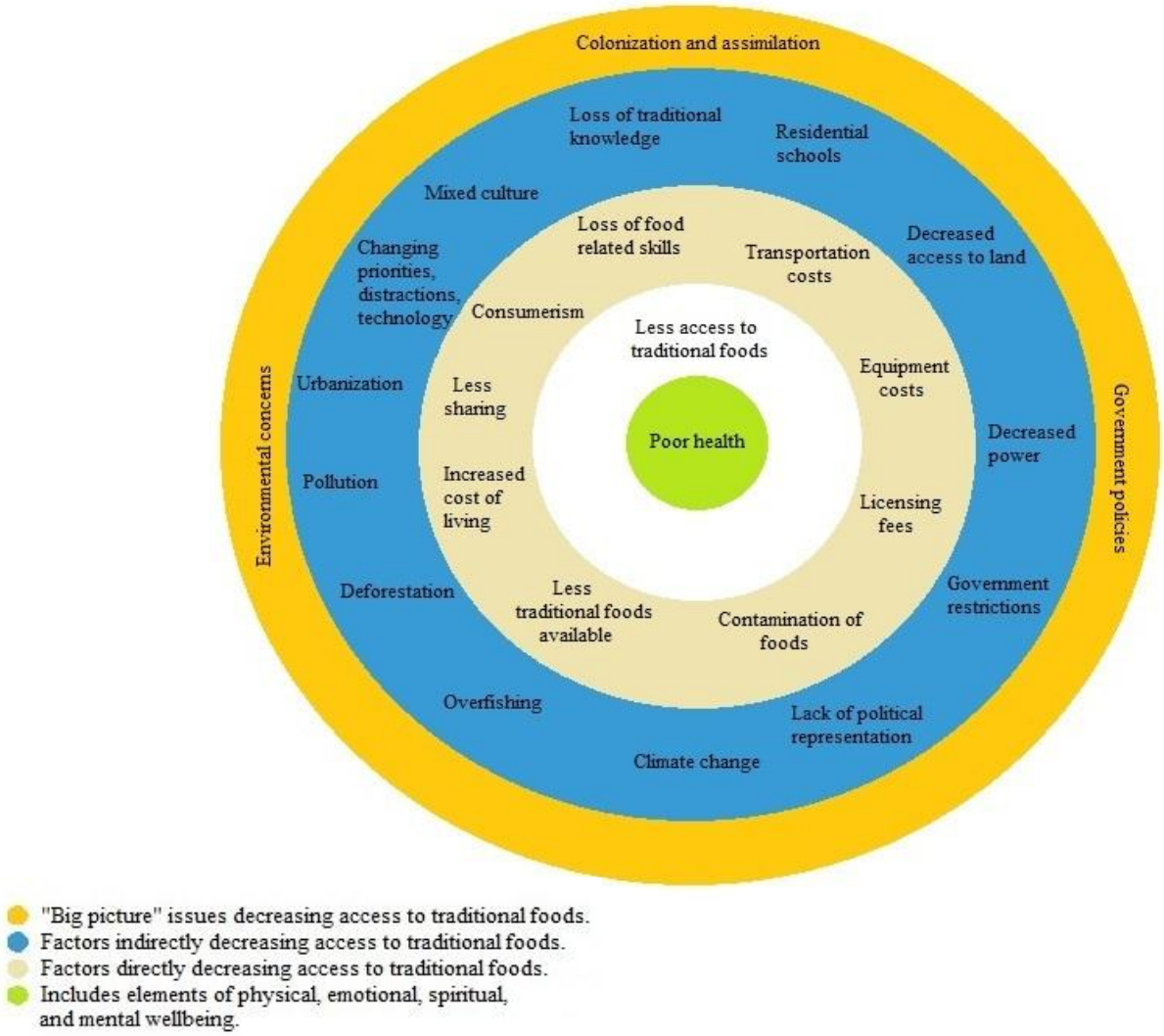
insecurity (Health Canada, 2007b). The HFSSM asks about the household food situation over the past 12 months, and explores perceived food variety and quantity, concern or worry about food or money for food, coping strategies, and frequency and severity of food insecurity (Health Canada, 2007b). Household food insecurity survey modules include a component about individual food insecurity, particularly for children because their experiences tend to differ from other members of the household (Collins, 2009; Tarasuk, 2001). Sometimes surveys and 24-hour dietary recall questionnaires will have questions about food insecurity and sufficiency, and refer to food charity use (i.e., food banks) as a proxy indicator of food security status (Collins, 2009; Tarasuk, 2001).

Predictors of Food Insecurity

Income is the most significant predictor of food security status, as low income households are most likely to be food insecure (Anderson, 1990; Che & Chen, 2001; Rychetnik et al., 2003). In addition to income, marginalized populations and people with special needs are at a higher risk of being food insecure (Rychetnik et al., 2003). This includes people living with disabilities, mental illness, drug and alcohol dependency, as well as those living in geographically remote areas that makes accessing food or supermarkets a challenge (Rychetnik et al., 2003). Oftentimes these predisposing factors occur in combination with one another, thereby significantly increasing the risk and sometimes the severity of food insecurity (Rychetnik et al., 2003). Some determinants of food security as outlined by Rychetnik et al. (2003) are the food supply within a community, as well as the resources and capacity that members of a community have to obtain and use food (Rychetnik et al., 2003). Components of the local food supply include the location of food stores, availability of food within these stores, as well as the cost, quality and variety of food offered (Rychetnik et al., 2003). Resources and capacity refer to financial resources, social support, distance and transportation to food stores, time and mobility, nutrition knowledge and food skills, as well as cooking and storage facilities (Rychetnik et al., 2003). Rychetnik et al. (2003) summarize the factors that limit access to traditional foods in the city in **Figure 2** on the next page. Additionally, broader social determinants of health such as household crowding, lone parent status,

having children in the household, and parental education also impact food security status (Anderson, 1990; Collins, 2009; Health Canada, 2007b; Willows et al., 2009). According to Statistics Canada reports, one-quarter of female lone-parent households in Canada are food insecure, and an alarming 53% of Aboriginal female lone-parent households are food insecure (Health Canada, 2007b). Households with children were slightly more likely to be food insecure at 10.4% compared to 8.6% food insecurity in households without children (Health Canada, 2007b).

Figure 2: Factors Limiting Access to Traditional Foods in the City



Adapted from Elliot et al. (2012), p. 4.

Food Insecurity in Canada

According to the 2007 to 2008 CCHS, 20.9% of Aboriginal households were food insecure in 2007 to 2008, compared to 7.2% of non-Aboriginal households (Health Canada, 2012). Approximately 8.4% of Aboriginal households were severely food insecure compared to 2.5% of non-Aboriginal households (Health Canada, 2012). Severe food insecurity can result in a reduction in food intake and disrupted eating patterns, whereas moderate food insecurity is commonly characterized by changes in quantity or quality of food intake (Health Canada, 2012). Aboriginal households are more likely to experience sociodemographic risk factors for food insecurity, such as having three or more children (14% of Aboriginal families have more than three children versus only 5% in non-Aboriginal families), being a lone parent (21% versus 5% respectively), not being home owners (52% versus 31% respectively), having less than secondary school education (43% versus 26% respectively), obtaining income from sources that are not salaries or wages (38% versus 29%), and belonging to the lowest income category (33% versus 12%) (Willows et al., 2009). Regardless of reserve, off reserve, rural, or urban residence, Aboriginal peoples also have poorer access to food and resources necessary for acquiring food, such as a reliable means of transportation (Elliot et al., 2012; Power, 2008).

Health Consequences of Food Insecurity

Food insecurity adversely impacts health; however the independent effects are difficult to measure since food security status is linked to income, which affects health in other ways (Tarasuk, 2001). Hence the health consequences most directly linked to food insecurity are discussed here, and those related to poverty are covered in Section 2.3.2.3, though there may be some overlap.

Both the quantity and quality of food consumed in food insecure households is poorer than food secure households (Hamelin, Beaudry, & Habicht, 2002; Tarasuk, 2001). Food intake also depends on the severity of food insecurity, as severely food insecure households are likely to experience the greatest compromises (Tarasuk, 2001). Hamelin et al. (2002) conducted individual and group interviews with residents of low-income households in urban and rural areas in Quebec, and found that food insecurity

resulted in a decreased variety of food consumed (Hamelin et al., 2002). Tarasuk (2009) found that both food insecure adults and children decreased fruit, vegetable, and milk intake, in particular, and this resulted in an increased likelihood of nutritional inadequacy for protein, fibre, vitamins A, C, B6, B12, folate, and minerals such as magnesium, phosphorus, zinc and iron (Tarasuk, 2009).

Dietary compromises as a result of food insecurity have negative impacts on physical health, as food insecure individuals often report fatigue or not having enough energy to work, and are at an increased risk for heart disease, obesity, hypertension, and diabetes (Che & Chen, 2001; Collins, 2009; Drewnowski & Specter, 2004; Hamelin et al., 2002).

There are also adverse effects on mental health. The study by Hamelin et al. (2002) found that food insecure individuals felt a lack of control over their food situation, and this resulted in feelings of guilt, embarrassment, shame, and alienation from the rest of society (Hamelin et al., 2002). This was exacerbated by the perceived need to hide their lack of control over the situation, because many people were afraid of being labelled or judged by members of their community (Hamelin et al., 2002). The preoccupation with an insufficient quantity of food was stressful, and this stress also influenced physical well-being (Hamelin et al., 2002; Tarasuk, 2001). The impacts of food insecurity on mental health can be seen among caregivers as they report higher stress levels, irritability, anxiety, social isolation, depression, and even impaired cognitive function (Che & Chen, 2001; Collins, 2009; Hamelin et al., 2002; Tarasuk, 2001). Caregivers often make compromises to their own diets to protect their children from the effects of food insecurity (Collins, 2009; Tarasuk, 2009). The stress of having to employ numerous coping strategies has a negative impact on parent-child relationships, as parents were found to be more stressed and irritable in these conditions (Collins, 2009).

Among children, similar effects on psychological health have been reported. Food insecurity among adolescents has been linked to depression and suicidal thoughts (Alaimo, Olson, & Frongillo, 2002). Casey et al. (2005) found that children between the ages of 3 and 8 had a poorer HRQL with food insecurity (Casey et al., 2005). Food insecurity has also been found to negatively affect academic performance and social skills from kindergarten to grade three (Jyoti et al., 2005).

Food insecurity affects physical, mental, and emotional well-being far beyond the immediate dietary compromises that have to be made. This issue needs to be recognized as a social and public health issue in order to be adequately addressed.

Food Insecurity and Obesity

Within the literature, there are mixed results about the relationship of food insecurity with obesity. Several studies have found that food insecurity is positively linked to the presence of overweight and obesity. Using the Longitudinal Study of Child Development (1998 to 2002), Dubois et al. (2006) looked at the impact of family food insecurity status on the BMI of preschool children (Dubois et al., 2006). Family food security status was obtained twice during the study, first when the child was 0 to 1.5 years, and again when they were 1.5 to 4.5 years old (Dubois et al., 2006). Children from food insecure families had a higher BMI, even when controlling for birth weight, and parental education and BMI (Dubois et al., 2006). Food insecurity during a child's preschool years (at 4.5 years of age) tripled the odds of having an obese BMI classification (Dubois et al., 2006).

Similarly, Jyoti et al. (2005) looked at the impact of food insecurity on BMI for children in kindergarten to grade three using the Early Childhood Longitudinal Study (ECLS-K) (Jyoti et al., 2005). Children who were persistently food insecure during the study had a BMI that was 0.35kg/m^2 greater ($p < 0.028$), and experienced a 0.65kg increase in weight ($p < 0.026$) compared to children from persistently food secure households (Jyoti et al., 2005). However it may be difficult to ascertain whether these numbers represent a significant increase in weight, especially among children whose bodies continue to change as they mature.

Casey et al. (2006) looked at the relationship between food insecurity and child obesity using the National Health and Nutrition Examination Survey (NHANES) for children between 3 and 17 years of age (Casey et al., 2006). This study looked at the impacts of both household and individual food security using the 18-question US Food Security Scale, and found that children who were food insecure were

significantly more likely to be overweight (Casey et al., 2006). Normal weight children were more likely to live in food secure households (Casey et al., 2006).

Metallinos-Katsuras, Must & Gorman (2012) conducted a longitudinal study using data from visits with the Special Supplemental Nutrition Program for Women, Infants and Children over a period of five years (Metallinos-Katsuras et al., 2012). Children between 2 and 5 years of age who experienced household food insecurity without hunger were 22% more likely to be obese compared to children from food secure households (Metallinos-Katsuras et al., 2012).

Several studies found no relationship between food insecurity and obesity. A study by Martin & Ferris (2007) found that food insecurity was only associated with a greater likelihood of obesity for adults and not children aged 2 to 12 years (Martin & Ferris, 2007). Kaiser et al. (2002) explored the relationships between food security and weight among Mexican American children aged 3 to 6 years (Kaiser et al., 2002). They found that the percentage of overweight and obese children was highest among Mexican American households that were food insecure, however this association was not statistically significant (Kaiser et al., 2002). Gunderson et al. (2008) found no relationship between food insecurity and obesity for 10 to 15 year-olds, however it was clear that food insecurity and overweight coexisted to some extent, since 25% of food insecure children in the sample were obese (Gunderson et al., 2008). Alaimo et al. (2001) looked at children aged 2 to 7 and 8 to 16 years in the NHANES III, and found that the relationship between obesity and household food insecurity was not statistically significant (Alaimo et al., 2001). However the authors acknowledge that the results may have been different if the data were not cross sectional, as longitudinal studies are needed to explore and better understand these relationships (Alaimo et al., 2001). Bhargava, Jolliffe, & Howard (2008) used longitudinal data from the ECLS-K to look at the food insecurity-obesity relationship among American children in the first, third, and fifth grades (Bhargava et al., 2008). They found that household food insecurity was not significantly associated with body weight (Bhargava et al., 2008).

Some studies found a negative relationship between food insecurity and obesity. Rose & Bodor (2005) also looked at the ECLS-K and found that children from food insecure households were 20% more

likely to be overweight than food secure children (Rose & Bodor, 2005). In a study with 5-year-old Hispanic children, Matheson et al. (2002) found that food secure children were significantly heavier than food insecure children (Matheson et al., 2002). Food insecure children reported significantly lower energy and meat intakes as pay day approached and families were running out of money (Matheson et al., 2002). Jimenez-Cruz, Bacardi-Gascon, & Spindler (2003) found that Mexican-Indian migrant children in grades three and five demonstrated the coexistence of hunger, undernutrition, and obesity (Jimenez-Cruz et al., 2003). Some limitations associated with this study include the fact that it does not assess food insecurity in the full sense of its definition, as it only looks at hunger, which is at an extreme end (Jimenez-Cruz et al., 2003).

The literature on food insecurity and child obesity has found positive, negative, and null associations between these conditions. The mechanism by which food insecurity affects weight status is not well explored in the literature, however some potential pathways are discussed in Section 2.3.2.4.

2.3.2.3 Socioeconomic Status and Health

Aboriginal peoples in Canada experience poorer health than non-Aboriginal Canadians largely due to socioeconomic disadvantage. In 2011, 48.4% of Aboriginal people aged 25 to 64 had postsecondary education compared to 64.7% of their non-Aboriginal counterparts (Statistics Canada, 2013b). Younger Aboriginal people were more educated than the older population, as 68% of people between the ages of 35 to 44 had completed high school compared to 58.7% of 55 to 64 year-olds (Statistics Canada, 2013b). The 2011 NHS does not provide differences in household income by ethnicity, however studies have found that an income gap persists between Aboriginal and non-Aboriginal Canadians (Wilson & Macdonald, 2010).

Children from low SES families are more likely to have a low birth weight, growth retardation, inadequate prenatal care and poor maternal nutrition (Bradley & Corwyn, 2002). All of these conditions are associated with poor health outcomes and increase the risk of numerous diseases in the long term

(Bradley & Corwyn, 2002). Low SES also negatively impacts children's cognitive development as demonstrated by lower academic performance (Bradley & Corwyn, 2002).

Several other studies have found that income is linked to poor self-reported health but not necessarily to chronic conditions (Auger & Alix, 2009; Ross, 2004). Low income is associated with an increased risk of low birth weight, developmental problems, and injury-related mortality for children (Auger & Alix, 2009). The duration of poverty is an important factor as sustained low income has worse effects on health, however the relationship between income and health is nonlinear (Auger & Alix, 2009). Several hypotheses have emerged as explanations for the poverty and health relationship (Ross, 2004). Lower income households are believed to be spatially isolated from employment and other opportunities, and poorer areas have less access to resources that may be important to health (Ross, 2004). There is also a decline in social capital when lower income groups are geographically isolated (Ross, 2004).

Income is associated with physical and social health for children and adults. Education as an independent predictor was not discussed here, although it must be taken into account when assessing the income-health relationship as a potential confounding factor. The relationships of SES with obesity are explored in the following section.

2.3.2.4 Socioeconomic Status, Diet Quality and Obesity

Diet quality is strongly affected by socioeconomic status (Darmon & Drewnowski, 2008; Ricciuto & Tarasuk, 2007). Individuals belonging to higher income or SES groups are more likely to have better quality diets consisting of nutrient dense foods, like F&V, than people of lower income or SES groups (Darmon & Drewnowksi, 2008; Ledikwe et al., 2006; Ricciuto & Tarasuk, 2007; Riediger, Shooshtari, & Mogadasian, 2007). As a result, SES may act through diet quality to affect weight status.

Using data from the Family Food Expenditure Surveys (1986 to 2001) conducted in Canadian households, Ricciuto & Tarasuk (2007) assessed the relationships between household income and the nutritional quality of food purchases (Ricciuto & Tarasuk, 2007). Higher SES households were more likely to consume greater quantities and varieties of F&V, and this relationship persisted over time

(Ricciuto & Tarasuk, 2007). Individuals from lower SES households tend to consume diets characterized by fewer F&V, as well as higher fat and energy-dense foods of poorer nutritional quality (Darmon & Drewnowski, 2008; Kirby et al., 1995; Ricciuto & Tarasuk, 2007; Xie et al., 2003).

Riediger et al. (2007) similarly found that 12 to 19 year-old adolescents' household education level and total household income significantly impacted F&V consumption, with F&V intake increasing progressively with total family income (Riediger et al., 2007). Only 38% of Canadian adolescents sampled from the 2004 CCHS consumed F&V within the daily, recommended range of 5 to 10 servings (Riediger et al., 2007).

The literature suggests that one of the most important mechanisms responsible for the association between SES and diet quality is the cost associated with nutrient dense foods (Aggarwal et al., 2011; Darmon & Drewnowski, 2008; Drewnowski et al., 2004; Ledikwe et al., 2006). Nutrient dense foods such as F&V, lean meats, and fish, tend to be priced higher than high-fat or high-sugar foods (Drewnowski et al., 2004; Drewnowski & Specter, 2004). SES determines the amount of money that households have to spend on food (Aggarwal et al., 2011; Ricciuto & Tarasuk, 2007). Low SES families tend to purchase lower cost items, or foods that have a lower energy cost (dollar per mega joule [$/MJ]), which tend to be foods with the least nutritional value (i.e., junk foods) because diets of higher quality are associated with increased costs (Aggarwal et al., 2011; Darmon & Drewnowski, 2008; Drewnowski et al., 2004).

Overall, lower income households are more likely to purchase less expensive food items and a lesser variety in order to maintain overall dietary intake (Drewnowski & Specter, 2004). As the cost of food decreases, the energy density tends to increase, thus increasing the likelihood of high total energy intakes among low-income families (Drewnowski & Specter, 2004). Studies indicate that only under the circumstances of severe food insecurity would households actually decrease dietary energy intake to the point of deprivation or hunger (Drewnowski & Specter, 2004). High energy density foods are linked to the increased prevalence of overweight and obesity among children, as discussed in Section 2.3.1.2.

Other potential mediators of the relationship between food insecurity and obesity include gender, marital status, and food stamp program participation (Franklin et al., 2012). For example, food insecure

adults participating in food stamp programs have been found to have higher BMIs than food insecure adults not using food aid (Franklin et al., 2012). Other factors that may be acting in the food insecurity-obesity pathway are not well studied and there is a dearth of literature on children in particular. However, other potential variables are not discussed in the Literature Review as they are beyond the scope of this study.

The literature indicates that the predictors of pediatric obesity among Aboriginal populations are varied and complex. Acting both alone and in concert with other determinants of health, these factors influence obesity risk in children. It is clear that special attention should be given to SES and food insecurity because of the major impact these variables have on shaping the health and well-being of Aboriginal peoples. Studies also point to the role of diet as both an independent and mediating factor, hence research needs to address the gaps outlined especially in this population.

Chapter 3: Methods

3.1 Overview

This study was carried out as part of an existing CIHR Operating Grant, and made use of both quantitative and qualitative methods. The quantitative component used the Public Use Microdata File (PUMF) from Statistics Canada's *2006 Aboriginal Peoples Survey (APS) – Children and Youth* component, accessed through the Ontario Documentation Extraction Service and Infrastructure (ODESI) digital repository. The qualitative focus group data, collected in partnership with the Métis Nation of Ontario (MNO) and Southwest Ontario Aboriginal Health Access Centre (SOAHAC), explored parents' and caregivers' perceptions of the social and economic environments affecting their children's health.

3.2 Quantitative Data – 2006 Aboriginal Peoples Survey

The *2006 APS – Children and Youth* component is a post-censal survey that interviewed 13,238 parents or caregivers (also termed "Persons Most Knowledgeable" [PMK]) of Aboriginal children aged 6 to 14 years. The PMKs answered 222 questions about their children's health and related activities. The survey data uses population weights to ensure that the APS sample is representative of the target population (Statistics Canada, 2009a). Sampling and non-response rates vary based on demographic characteristics as well as by sampling stratum, hence survey weights allow over and under representation of different groups to be taken into consideration in the data analysis (Statistics Canada, 2009a). Bootstrap weights were not used because the PUMF only provides population weights (Statistics Canada, 2009a).

3.2.1 Sample

The APS sample was selected from the 2006 Census sample using a two-phase sampling method. In the first phase, a sample of households were chosen based on reported Aboriginal identity, followed by

the selection of individuals in the second phase. A total of 1,538 households were removed from the APS to avoid overlap with other surveys. Of the 61,041 individuals chosen for the APS, 13,238 were children (6 to 14 years old).

This study focused on only First Nations and Métis children aged 6 to 14 years. Inuit people were excluded because their unique BMI profiles and body fat distribution would need to be separately accounted for in the analysis (Galloway et al., 2011; Hopping et al., 2010). Inuit people typically have shorter legs and high "trunk-to-stature proportions" which render the European BMI thresholds especially inapplicable to this population (Galloway et al., 2011). Moreover, the study focus is on Aboriginal peoples living off reserve, and the majority of Inuit people live in northern Canada where the factors impacting food security and access are dramatically different (Hopping et al., 2010; PHAC, 2011). Also, southwestern Ontario has much larger Métis and First Nations populations as compared to Inuit, thereby making the focus group and quantitative results more comparable (Statistics Canada, 2009b).

3.2.2 Data Collection

APS data were collected by Statistics Canada via telephone interviews with PMKs of Aboriginal children aged 6 to 14 years. Children 12 to 14 years old could complete the telephone survey themselves with parental permission. Personal interviews were conducted with PMKs in Labrador, the Northwest Territories (excluding Yellowknife), and Inuit regions, or if participants were unable to do the telephone interview (Statistics Canada, 2009b).

3.2.3 Measurements

Data for a wide range of social, economic, and health-related variables were collected by the APS. The outcome of interest in this study was overweight or obese BMI classification, while the predictors of interest were food insecurity, F&V intake, and junk food intake. Several other variables

were analyzed in this study as potential confounders of either weight status or food insecurity. These variables are listed in Section 3.2.3.3.

3.2.3.1 Dependent Variable

The dependent variable, BMI category, was determined using PMK-reported height and weight. The APS asked, "How tall is _____ without shoes on? *(Best estimate)*" and "How much does _____ weigh? *(Best estimate),*" in order to calculate BMI. The APS includes two measures of BMI: the Centers for Disease Control and Prevention (CDC) cut-offs and the IOTF's age- and sex-specific cut-off points for obesity in children and adolescents. IOTF cut-offs are internationally recognized and based on BMI centile curve data from six countries, unlike the CDC cut-offs, which are based solely on American data (Cole et al., 2000). Hence this study used IOTF cut-offs, which classified children as being "underweight or normal," "overweight," or "obese." In the statistical analysis, BMI was coded as either a dichotomous variable (overweight/obese versus normal/underweight) or as having three response levels (obese, obese or overweight, obese or overweight or normal/underweight) depending on the statistical procedure. Statistical analyses are discussed in Section 3.2.4.

3.2.3.2 Independent Variables

The key independent variables of interest were children's food security status, F&V intake, and junk food intake. The APS measures food insecurity at the individual level rather than the household level. Food insecurity was determined by asking the question: "Has _____ ever experienced being hungry because the family has run out of food or money to buy food?" The limitations associated with the food insecurity measure are discussed in Section 6.2.

Studies indicate that there is not a clear consensus on what is considered a fruit, vegetable, or junk food, as these definitions vary depending on food preparation and processing, cultural perceptions, or an individual's familiarity with the food (Roark & Niederhauser, 2012; Thompson et al., 2011). In this

study, fruits refers to "the seeds and surrounding tissues of a plant […] that have a sweet or tart taste," and vegetables are the "edible plant parts including stems and stalks, tubers, bulbs, leaves, flowers, some fruits (cucumber, pumpkin, tomato), and seeds" (Pennington & Fisher, 2009). Junk food includes foods that are energy-dense and nutrient-poor (i.e., candy, soft drinks), as well as some F&V that are prepared in ways that significantly alter the food's nutrient profile and energy density (i.e., potatoes to French fries) (Pennington & Fisher, 2009; Roark & Niederhauser, 2012; Thompson et al., 2011). Using these definitions as a guide, responses for the following foods in the APS were analyzed: "Fruit (not fruit juices)," "Green salad," "Potatoes," "Other vegetables," "French fries, potato chips and pretzels," and "Candy, soft drinks, cakes, pies, etc." Fruit, green salad, potatoes, and other vegetables formed the F&V category. French fries, potato chips and pretzels, and candy, soft drinks, cakes, and pies were put in the junk food category. Studies have associated F&V and junk food consumption with obesity outcomes; hence these food groups formed the focus of the analysis.

In order to determine the frequency with which children consumed particular foods, PMKs were asked: "Last week, on how many days did _____ consume the following foods and beverages?" The following response options were provided: Everyday, 5 or 6 days per week, 3 or 4 days per week, 1 or 2 days per week, and Never. These five response categories were also included in the statistical analyses to avoid losing information by creating arbitrary categories such as "high," "medium," and" low" intake. Overall diet quality could not be assessed given the limitations of the APS data, which are discussed further in Section 6.6.

3.2.3.3 Control Variables

Potential confounders of either food insecurity or obesity were identified based on a review of previous literature. Age, gender, region, lone parent status, number of people living in the household, household income, PMK education, birth weight, breastfeeding, sports activities or lessons attended per week, and number of hours per day spent watching TV, playing on the computer, or playing video games

were controlled for in the analysis. Census Metropolitan Area (CMA) is defined as an "area consisting of one or more neighbouring municipalities situated around a core" (Statistics Canada, 2012). The CMA must have a population of at least 100,000, and 50,000 or more of these residents living in the core (Statistics Canada, 2012). All APS response categories were for these variables were kept intact for the analysis, with the exception of physical activity and sedentary behaviour variables. A new variable called "sports" was created to represent the frequency with which children played sports every week. The variables TV watching, computer time, and video gaming were combined to create the variable "sedentary." Reading was not included as a sedentary variable for several reasons. Shields & Tremblay (2008) found that reading was not associated with obesity for adults, partially because most people did not spend large amounts of time reading per week (Shields & Tremblay, 2008). While there are currently no child-specific studies on reading and sedentary behaviour as a predictor of obesity, other behaviours such as screen time are a greater concern since children spend much more time engaging these activities. Also, the way the reading question was structured in the APS would not have allowed it to be incorporated into the sedentary behaviour variable. The frequency response options were categorized as times a child read per week or month, as opposed to number of hours per day. **Table 1** shows all of the response and predictor variables used in the statistical analysis, as well as the respective reference categories used when entering these dummy variables into the regression models. The majority of the reference categories were chosen based on ease of interpretation, with the exception of the references for region, household income, and PMK education, were the highest frequency categories in the sample were chosen. Different reference categories were used for the diet variables for First Nations and Métis children to avoid using relatively unpopulated categories as references.

Table 1: Response and Predictor Variables

Variable	Response Categories
BMI category	Binary Logistic Regression: • Overweight/Obese • Underweight/Normal* Proportional Odds Model: • Obese • Obese or overweight* • Obese or overweight or normal/underweight*
Food insecurity	• Food insecure • Not food insecure
Fruit and vegetable intake[a]	• Everyday* • 5 or 6 days per week • 3 or 4 days per week • 1 or 2 days per week • Never*
Junk food intake[b]	• Everyday* • 5 or 6 days per week • 3 or 4 days per week • 1 or 2 days per week • Never*
Gender	• Male* • Female
Age	• 6 to 8 years* • 9 to 11 years • 12 to 14 years
Region	• Census Metropolitan Area* • Other urban • Other rural • Arctic (deleted from analysis)
Lone parent status	• Lone parent household • Not lone parent household*
Number of people living in the household	• 2 people* • 3 people • 4 people • 5 people • 6 people • 7 people or more

Table 1 continued.

Variable	Response Categories
Household income	• Less than $20,000 • $20,000 to $39,999* • $40,000 to $59,999 • $60,000 to $79,999 • $80,000 to $99,999 • $100,000 and over
PMK education	• Lower than high school • High school diploma* • Certificate or diploma lower than university • University certificate or diploma below a Bachelor's • University completed, at least a Bachelor's • Other
Birth weight	• Less than 2267 grams* • Between 2267 and 3174 grams • Between 3174 and 4081 grams • 4081 grams and over
Breastfeeding	• Never* • 6 months or less • 7 to 12 months • More than 13 months • Breastfed, but length unknown • Unknown
Sports	• Never* • Less than once a week • 1 to 3 times per week • 4 or more times per week
Sedentary activity (Video gaming, TV or computer time)	• None* • 1 hour per day • 2 hours per day • 3 hours per day • 4 hours per day • 5 hours per day

**The asterisk refers to the categories which were used as reference groups.*
[a] The reference categories for fruit and vegetable intake were different for First Nations and Métis children. For First Nations children, the reference category was "Never," and for Métis children the reference was "Everyday."
[b] Similarly, the reference categories for junk food intake were "Never" and "Everyday" for First Nations and Métis children, respectively.

3.2.3.4 Additional Variables of Interest

Frequency of experience with food insecurity as well as coping strategies were not used in the regression analyses, however the sample distribution was reviewed in order to better understand the severity of food insecurity in the populations studied. PMKs who answered "Yes" to the food insecurity question were further asked, "How often?" with the following response options: "More often than the end of each month," "Regularly, end of the month," "Every few months," "Occasionally, not a regular occurrence," "Don't know," and "Refused." Additionally, those who answered, "Yes," to their children experiencing hunger were also asked: "How do you cope with feeding _____ when this happens?" PMKs were provided a list of options and asked to check all that applied: "Parent/guardian skips meals or eats less," "Children skip meals or eat less," "Cut down on variety of food family usually eats," "Seek help from relatives," "Seek help from friends," "Seek help from social worker/government office," "Seek help from food bank (emergency food program)," "Use school meal program," "Other," "Don't know," and "Refused."

3.2.4 Statistical Analysis

Statistical analysis was carried out using Statistical Analysis System (SAS), Version 9.2 (SAS Institute, Cary, NC, USA). Descriptive sample characteristics were obtained using frequency procedures and chi-square tests were used to assess bivariate associations. A total of six models were created and are summarized in **Table 2**. Models 1 through 5 represent different control variables, and included demographic, sociodemographic, socioeconomic, early life events, and physical activity and sedentary behaviour variables, respectively.

Table 2: Summary of APS Models for Quantitative Analysis

Model	Variable Type	Variables Included
	Key independent variables	• Food insecurity • Fruit and vegetable intake • Junk food intake
1	Demographic	• Child's age • Child's gender
2	Sociodemographic	• Lone parent status • Number of people in household • Residence in other urban, other rural, or Census Metropolitan Area
3	Socioeconomic	• Household income • PMK education level
4	Early life events	• Breastfeeding • Birth weight
5	Physical activity and sedentary behaviour	• Sports • Video gaming, TV, and computer time
6	All (full model)	• All variables above

The binary logistic regression (BLR) procedure was used to test the likelihood of a child being normal/underweight versus overweight/obese under various conditions. The analyses were stratified by Aboriginal identity group, hence the results for First Nations and Métis cannot be compared to one another. The regression procedure was also run using the income variable in lieu of food insecurity to assess the distinct impacts of household income on weight, and on diet's relationship with weight status. Several interaction terms were tested in the BLR procedure to investigate if the effect of food insecurity changed when combined with other independent variables. The following interaction terms were tested: food insecurity x (household income, gender, age, region, lone parent status, number of people living in the household, and PMK education level).

Several model fit characteristics are reported including degrees of freedom, -2logL, and the C-statistic. Degrees of freedom refer to the number of independent parameters available for fitting a model

to data (Hosmer & Lemeshow, 2000). The -2logL value was used to calculate the likelihood ratio statistic which tests that at least one of the predictors' regression coefficients is not equal to zero in the model (Kleinbaum & Klein, 2010). In order to determine which model is a better fit for the data, the -2logL of the fitted model was subtracted from the -2logL of the null model to see if adding certain variables improved the model fit (Kleinbaum & Klein, 2010). The difference is assumed to be distributed as chi-square, and was used to test the significance of the improvement in model fit as a result of the addition of (k-1) degrees of freedom (Hosmer & Lemeshow, 2000; Kleinbaum & Klein, 2010). The C-statistic or area under the receiver operating characteristic (ROC) curve, was also used to compare the goodness of fit between regression models and tests whether the probability of predicting a given outcome was better than chance (Hosmer & Lemeshow, 2000). The C-statistic takes on values between 0.5 and 1, with 0.5 indicating the model was no better than chance, and 1 indicating the model as predicting the outcome better than chance (Hosmer & Lemeshow, 2000). C-statistic values around 0.7 are considered reasonable, and 0.8 and above as demonstrative of the model strongly predicting the outcome better than chance (Hosmer & Lemeshow, 2000).

A proportional odds model (POM) was also estimated for Model 6 to see if the key independent variables of interest behaved differently when the response was three levels rather than two. Odds ratios (OR) are reported, and indicate the likelihood of an event occurring relative to the reference category or comparator (Kleinbaum & Klein, 2010). An OR greater than 1 indicates an increased likelihood of overweight or obesity, whereas an OR less than 1 is a decreased likelihood relative to the reference category (Kleinbaum & Klein, 2010).

Model diagnostics were performed to ensure that the underlying assumptions for the regression analyses were met. Residual plots and Cook's distance were checked to identify any outliers, and correlations were assessed to ensure that the variables were independent and not strongly associated in ways that could be affecting the study results (Hosmer & Lemeshow, 2000; Kleinbaum & Klein, 2010). Survey questions that were responded to with "Don't know" or "Refused" were treated as missing values and excluded from the analysis. Details on the distribution of missing values are reported in Section 4.1.

The data were weighted according to the APS guidelines. Food insecurity, F&V intake, and junk food intake were added to the demographic model to assess the influence of each variable on the odds of overweight/obesity for Métis and First Nations children. The other control variable groups were then added, starting with sociodemographic variables, socioeconomic variables, early life event variables, and lastly the physical activity and sedentary behaviour variables to create a full model. This nested model approach shows whether certain variables contribute additional information about the relationships between food insecurity and diet with obesity.

3.2.5 Rationale for Selection of Control Variables

Métis and First Nations people are culturally similar, but also distinct in many ways. They speak different languages, have unique cultures and customs, and different experiences of colonialism and historical disadvantage (Métis Centre, 2010). Métis people tend to have higher average SES than First Nations, and the health issues these groups face are affected by different social and environmental factors (Loppie & Wien, 2009; Métis Centre, 2010). For example, while Métis people are recognized in the *Constitution* as Aboriginal peoples, they do not have the same medical coverage as registered First Nations people. As a result, it was important to stratify analyses based on identity group (Métis Centre, 2010).

Children who are raised in households with a single parent, more than three children, or in the lower income groups, are at increased risk of obesity in childhood and adulthood (Loppie & Wien, 2009; McIntyre et al., 2003; Willows et al., 2012). Parental education, a component of SES, is also independently associated with obesity and compromised diet quality among children and adolescents (Cullen et al., 2002; Loppie & Wien, 2009; Riediger et al., 2007; Willows et al., 2012). Hence lone parent status, number of people living in the household, household income, and PMK education were controlled for in the analysis.

Some studies indicate that children who engage in regular physical activity are less likely to be obese, while others lend importance to the amount of time spent doing sedentary activities like watching

television (Kutchman et al., 2009; Saunders, 2011). Physical activity and sedentary behaviours were therefore controlled for in the analysis because of their impact on overall energy balance and expenditure.

Studies show that babies who are bottle-fed as opposed to breastfed are significantly more likely to become overweight later in life (62.5% versus 23.3%, respectively) (Scaglioni et al., 2000). Breastfeeding decreases the risk of child obesity, however only some studies have found a relationship between duration and weight status (Dewey, 2003). The WHO recommends that mothers exclusively breastfeed for the first six months as this is associated with health benefits for the child and mother (WHO, 2013c). Furthermore, some studies have found that low birth weight is associated with obesity risk in childhood (Singhal et al., 2003; Yu et al., 2011). Normal birth weight is between 2500 and 4000g (Yu et al., 2011). Yu et al., (2011) found that high birth weight babies (>4000g) were at an increased risk of obesity compared to normal birth weight babies (Yu et al., 2011). Low birth weight (<2500g) was associated with a decreased risk of obesity in this study (Yu et al., 2011). Hence breastfeeding and weight at birth are variables that were also controlled for in the analysis (Dubois et al., 2006; Hinkle et al., 2012; Singhal et al., 2003).

3.3 Qualitative Methods – Focus Groups

A total of four focus groups were conducted with First Nations and Métis caregivers in London and Midland-Penetanguishene, Ontario, respectively. Two focus groups were held in Midland-Penetanguishene in partnership with the MNO, and the latter two focus groups took place London in collaboration with SOAHAC. These discussions were led by an experienced Indigenous facilitator, and provided rich descriptions of challenges to healthy eating, including food insecurity.

3.3.1 Sample

The focus groups discussions involved a total of 32 people, with each focus group ranging from five to eleven people. Caregivers, as opposed to only parents, were included because Aboriginal children often live in intergenerational households, so parents may not be the primary guardians (O'Donnell &

Wallace, 2011; Statistics Canada, 2013a). Service providers from the MNO and SOAHAC were included in the focus groups if they chose to participate. Service providers were often also parents or caregivers and participated in the focus groups in this capacity. While separating service providers from the other participants may be desirable, it is apparent from the first focus group that their participation improved trust and comfort in the focus group setting.

In Midland-Penetanguishene, the sample selection criteria were parents or caregivers of Métis children under the age of 18. Similarly, in London, Ontario, participants were parents or caregivers of First Nations children under 18 years of age.

3.3.2 Recruitment

Participants in Midland-Penetanguishene were recruited using an advertisement in a local newspaper (**Appendix A**). The MNO also employed purposive, convenience sampling and personally contacted community members to participate in the focus groups. Recruitment was similarly conducted in London using a promotional flyer (**Appendix B**) with the aid of SOAHAC service providers. Using the Aboriginal organizations as liaisons to reach out to participants avoided issues of time and establishing rapport and trust. The recruitment materials were created by Dr. Cooke and the MNO or SOAHAC for the focus groups in Midland-Penetanguishene and London, respectively.

Focus group participants were provided several incentives for their participation, including: coffee, snacks or a traditional dinner, $20 grocery gift card, reimbursement for transportation if necessary, and licensed childcare during the focus groups.

3.3.3 Setting

The first two focus groups in Midland-Penetanguishene took place at the Georgian Bay Recreation Centre. The latter two focus groups in London were held at the Centre Branch YMCA of Western Ontario. These settings were chosen since they were familiar to participants and easily accessible.

3.3.4 Procedure

A semi-structured interview was conducted with focus group participants. Each focus group was scheduled for 90 minutes, and involved parents and caregivers, an Elder or Spiritual Leader who opened the focus group discussion, an Indigenous facilitator (Little Brown Bear), myself as a recorder/transcriber (for the focus groups in London only), three members of our research team (Dr. Cooke, a service provider from the MNO or SOAHAC, and Terri Morrow, a First Nations Registered Dietitian who was present for the sessions in Midland-Penetanguishene only).

The interview script was written and reviewed by our research team and the MNO (for the focus groups in Midland-Penetanguishene) and SOAHAC (for the focus groups in London), and aimed to obtain a better understanding of the barriers and facilitators to healthy eating, as well as the relationships between food insecurity, diet, and child obesity in these communities. The MNO and SOAHAC were partners throughout the entire process, as they helped design the questionnaires and interview script, conducted recruitment, and organized all of the focus group meetings. The same questions were asked during all focus groups, however the scripts for the focus groups in Midland-Penetanguishene and London differed slightly based on the revisions suggested by the MNO and SOAHAC, respectively (refer to **Appendix C** and **D** for scripts 1 and 2**,** respectively).

At the beginning of each focus group, an Elder or Spiritual Leader opened the discussion. The facilitator then provided an overview of the information contained in the Participant Information Form (**Appendix E** and **F** for Midland-Penetanguishene and London, respectively), the Consent Form (**Appendix G** and **H**), explained why audio recording was necessary, and set ground rules for the discussion. Once consent forms were returned and checked, audio-recorders were turned on. Participants were then administered a Background Questionnaire **(Appendix I** and **J**) following the focus group in order to collect personal, demographic information. A debriefing with the facilitator, service providers, and research team took place following the focus groups. Audio recordings were professionally transcribed.

3.3.5 Data Analysis

3.3.5.1 Procedure

Following the focus group sessions, the transcripts were read in full and questions were analyzed using NVivo qualitative data analysis software (QSR International Pty Ltd. Version 10, 2012). A thematic analysis was conducted, which involved sorting individual quotes into major topic or question categories (Crabtree & Miller, 1999; Fereday & Muir-Cochrane, 2006). This process allowed for reoccurring, prominent themes to be identified and examined within and across focus groups (Krueger & Casey, 2000). The experiences of food insecurity, coping strategies, as well as barriers and facilitators to healthy eating were themes of particular interest.

The coding process involved several stages. Codes were created for every distinct idea that emerged from the discussion, and sub-codes were created for related thoughts or tangents. If new codes emerged during the development of the coding manual, the transcripts were reread and codes were reassigned as appropriate. The codes in the manual were then reorganized by the theme to have some logical organization. The manual was initially organized based on the a priori research questions and concepts, however was modified based on the content of the focus group discussions (Crabtree & Miller, 1999; Fereday & Muir-Cochrane, 2006).

The next step involved testing the reliability of these codes, whereby two coders were provided with a copy of the Coding Manual (refer to **Appendix K**) and asked to code all of the transcripts (Crabtree & Miller, 1999; Fereday & Muir-Cochrane, 2006). If a particular segment of text was missing a code or was assigned an inappropriate code, the second coders were asked to create a new code and add it to the manual. After debriefing with the second coders about the manual and transcript coding, a consensus was reached on all codes, and these were then input into NVivo. In some studies, second coders will create a new manual and compare this to the original created by the researcher. However, both the method outlined and creating a new manual are used in qualitative research (Crabtree & Miller, 1999;

Fereday & Muir-Cochrane, 2006). Codes were later sorted and clustered so that themes could be readily identified.

A reliability check was also conducted with the second coders' feedback. This process is described in the following section on qualitative rigor. Next, the transcripts were uploaded into NVivo, and the codes from the manual were entered as nodes into the program. Organizing nodes within the software allowed for easy identification of similarities and differences between each focus group and setting. After reviewing the organized output, a set of themes were created from the codes, which involved clustering ideas into more concise phrases or terms. While some codes were also themes, not all codes later became themes. As mentioned, the codes were exhaustive to ensure nothing was left out; however, not all codes were relevant to the discussion. The themes reflected the key ideas from the study questions as well as unique concepts that came up during the discussions. The coding process was reviewed to ensure that the themes were representative of the Coding Manual, research questions, as well as the broader contexts in which these ideas were discussed in the focus groups (Crabtree & Miller, 1999; Fereday & Muir-Cochrane, 2006). While the data analysis was guided by the research questions, the findings were not categorized based on "a priori expectations or models" (Thomas, 2006). The research questions provided a focus for conducting the analysis instead of a specific set of expectations for the findings (Thomas, 2006).

3.3.5.2 Qualitative Rigor

Rigor is defined as "demonstrating integrity and competence within a study" (Fereday & Muir-Cochrane, 2006). Several key components of qualitative rigor include credibility, transferability and dependability (Appleton, 1995; Baxter & Eyles, 1996; Kurasaki, 2000). Credibility refers to whether or not the data represents the true or authentic experience of the participant (Appleton, 1995; Baxter & Eyles, 1996). Transferability is when study results or situations are applicable to other contexts and settings (Baxter & Eyles, 1996). Dependability of study results refers to minimizing subjectivity and variations based on researchers' own interpretations (Appleton, 1995; Baxter & Eyles, 1996). Purposive

sampling was employed to ensure that the participants recruited for the focus groups would be representative of First Nations and Métis experiences with the phenomena of interest (Baxter & Eyles, 1996). The key recruitment criteria were: living in Midland-Penetanguishene or London, and having children under the age of 18. While these criteria did not have specific indicators for income level, food insecurity, or child weight status, the recruitment criteria were left open to enable inclusivity and to capture of a broad range of community member experiences, as opposed to limited feedback to personal stories. Having children within the household indicated that these caregivers had some experience or exposure to the issues discussed. Additionally, results were shared with the MNO and SOAHAC and their feedback was used to ensure that the Métis and First Nations people in these communities were appropriately represented (Appleton, 1995; Baxter & Eyles, 1996). The redundancy of the focus group themes by the last session also suggests that an authentic representation of caregivers' lived experiences was captured (Baxter & Eyles, 1996). Purposive sampling and rich descriptions of the results also increases transferability.

Dependability was addressed in several ways. First, debriefing occurred following each focus group, which allowed for sharing of ideas and interpretations among members of the research team. Following the creation of the coding manual and prior to creating any themes during the analysis phase, a second set of coders reviewed and coded the transcripts (Appleton, 1995; Baxter & Eyles, 1996; Crabtree & Miller, 1999; Fereday & Muir-Cochrane, 2006). Inter-rater reliability (IRR) is defined as "a measure of agreement between multiple coders about how they apply codes to the data" (Kurasaki, 2000) and is a standard practice for testing the dependability of a qualitative study (Baxter & Eyles, 1996; Miles & Huberman, 1994). It allows coders to determine the degree of agreement they have for coding a particular set of transcripts (Kurasaki, 2000; Miles & Huberman, 1994). For this study, second coders reviewed the coding manual and coded two out of the four transcripts (one from each setting). The coded transcripts were then reviewed, and the number of agreements and disagreements were tabulated. The IRR calculation for one focus group was as follows:

$$\frac{\text{Number of agreements}}{\text{Number of agreements + disagreements}} \times 100$$

For the first focus group in Midland-Penetanguishene, the IRR was 87.86%. In London, the IRR for one focus group was 85.71%. An IRR of 70% is considered the minimum score to pass the reliability test (Miles & Huberman, 1994). A debrief meeting was then set up with the second coders to go through all of the disagreements. The majority of disagreements were a result of the second coders not being able to locate the appropriate code in a very lengthy manual. During the meeting, a consensus was quickly reached on all codes to obtain a revised IRR of 100% for the two focus groups analyzed. The final IRR was 93.39% and was calculated as follows:

$$\frac{\text{(IRR Midland-Penetanguishene) + (IRR London) + (Revised IRRs)}}{\text{4 (total number of IRRs)}} \times 100$$

Several measures were taken to improve the qualitative rigor of this study. The focus groups and data analysis were conducted such that credibility, transferability, and dependability were maximized under the given conditions.

3.4 Ethics

Ethics approval was obtained from the Ethics Board at University of Waterloo to conduct focus groups in Midland-Penetanguishene and London. Focus groups were audio-recorded with the permission of all participants and transcribed verbatim.

Aboriginal peoples are a marginalized group who have a history of discrimination in Canada, hence there are special concerns for conducting research with this population (CIHR, NSERC, & SSHRC, 2010; Kingfisher, 2007; Willows, 2005; Willows et al., 2012). As researchers, culturally sensitive analysis is necessary since study results have the potential to further influence society's perception of the

population (i.e., food insecurity and poverty is an issue, hence we want to avoid reinforcing stereotypes) (CIHR et al., 2010; Kemmis & McTaggart, 2000; Kingfisher, 2007; Ladson-Billings, 2000). In order to address these concerns, the qualitative aspect of this study was conducted in collaboration with the MNO and SOAHAC, who revised the focus groups scripts and actively participated in recruitment and execution of the focus group discussions (CIHR et al., 2010). Moreover, results and reports from both the quantitative and qualitative analyses were shared with these organizations to help with initiatives in the Aboriginal communities under study, and to ensure that the portrayal of Métis and First Nations people was culturally acceptable (CIHR et al., 2010).

Chapter 4: Quantitative Results

4.1 Sample Characteristics

A total of 11,935 First Nations and Métis children were in the APS. After deleting missing cases, 3,731 Métis and 4,313 First Nations children living off reserve were analyzed in the regression procedures. **Table 3** summarizes the percent of missing cases for each variable by Aboriginal identity group. In **Table 4**, an overview of demographic, economic, and health-related characteristics of the sample is presented. Frequency of food insecurity and coping strategies for when there was not enough food or money for food are also outlined.

Table 3: Distribution of Missing Cases by Variable Type

Variable	% First Nations	% Métis
BMI	12.2	10.1
Food Insecurity	0.9	0.5
Fruit and Vegetable Intake	1.6	0.7
Junk Food Intake	1.9	1.1
Lone Parent Status	1.3	0.7
Number of People Living in the Household	1.4	0.8
Household Income	0.9	0.6
PMK Education Level	3.8	1.4
Breastfeeding	0.2	0.3
Birth Weight	11.4	6.4
Sports	1.5	0.9
Sedentary Behaviour	1.2	0.8

Note: Percent missing for each variable was calculated based on total number of First Nations and Métis children in the sample, respectively.

Table 4: Characteristics of Sample of First Nations and Métis children aged 6 to 14, and Bivariate Associations with BMI Status

	First Nations (N = 5367)						Métis (N = 3956)					
	N	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**	**N**	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**
BMI Category												
Obese	943	17.6	…	…	…	…	604	15.3	…	…	…	…
Overweight	1107	20.6	…	…	…	…	868	21.9	…	…	…	…
Normal/Underweight	2660	49.6	…	…	…	…	2093	52.9	…	…	…	…
Unknown or missing data	656	12.2	…	…	…	…	401	10.1	…	…	…	…
Gender												
Female	2566	47.8	27.8	11.5	9.0	0.0919	2000	50.6	27.3	12.73	9.44	**<0.0001**
Male	2801	52.2	28.7	12.0	11.0		1956	49.5	31.4	11.6	7.5	
Age												
Age group 6-8	1654	30.8	12.7	5.7	10.0	**<0.0001**	1233	31.2	14.3	6.5	8.4	**<0.0001**
Age group 9-11	1871	34.9	19.1	9.3	6.3		1360	34.4	19.23	9.25	5.75	
Age group 12-14	1843	34.3	24.7	8.5	3.7		1363	34.4	25.2	8.6	2.8	
Food Insecurity												
Food insecure	577	10.8	5.7	2.3	2.4	0.2789	267	6.8	3.62	1.62	1.08	0.8684
Not food insecure	4744	88.4	50.8	21.2	17.7		3668	92.7	55.1	22.7	15.9	
Unknown or missing data	46	0.9	0.4	0.1	0.2		21	0.5	0.33	0.11	0.07	
Frequency of Food Insecurity*												
More often than the end of each month	71	12.3	6.0	3.5	4.2	0.3753	35	13.1	7.0	4.3	1.9	0.5638
Regularly, end of the month	106	18.4	11.1	4.6	4.8		38	14.2	7.5	2.4	2.2	
Every few months	52	9.0	6.4	2.7	1.5		20	7.5	4.8	4.0	0.6	
Occasionally, not a regular occurrence	280	48.5	32.0	10.6	12.7		158	59.2	38.8	15.9	10.6	
Unknown or missing data	68	11.8	…	…	…		16	6.0	…	…	…	

Table 4 continued.

	First Nations (N = 5367)						Metis (N = 3956)					
	N	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**	**N**	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**
Food Insecurity Coping Strategies*												
Parent skips meals or eats less	77	14.4	…	…	…	…	45	17.8	…	…	…	…
Children skip meals or eat less	25	4.6	…	…	…	…	8	3.2	…	…	…	…
Cut down on variety of food	79	14.7	…	…	…	…	29	11.8	…	…	…	…
Seek help from relatives	259	48.1	…	…	…	…	100	40.0	…	…	…	…
Seek help from friends	85	15.8	…	…	…	…	42	16.8	…	…	…	…
Seek help from social worker	19	3.5	…	…	…	…	4	1.5	…	…	…	…
Seek help from food bank	189	39.6	…	…	…	…	86	37.3	…	…	…	…
Use school meal program	24	4.6	…	…	…	…	5	2.1	…	…	…	…
Other coping methods	53	9.9	…	…	…	…	35	14.1	…	…	…	…
Fruit and Vegetable Intake												
Never	68	1.3	0.7	0.2	0.4	**0.0050**	48	1.2	0.4	0.4	0.2	**0.0023**
1 or 2 days per week	68	1.3	0.6	0.4	0.3		51	1.3	0.7	0.5	0.2	
3 or 4 days per week	918	17.1	10.6	4.1	2.9		697	17.6	10.9	4.2	2.9	
5 or 6 days per week	2307	43.0	23.7	10.5	9.3		1918	48.5	30.2	11.3	7.7	
Everyday	1921	35.8	20.3	7.8	7.0		1213	30.7	16.25	7.7	5.9	
Unknown or missing data	85	1.6	0.7	0.6	0.2		29	0.7	0.3	0.2	0.2	
Junk Food Intake												
Never	268	5.0	2.8	1.2	0.9	**0.0231**	141	3.6	1.8	0.6	0.7	**0.0081**
1 or 2 days per week	197	3.7	2.0	1.2	0.7		164	4.1	2.4	1.0	0.9	
3 or 4 days per week	1274	23.7	12.9	5.9	5.1		843	21.3	12.0	5.2	4.4	
5 or 6 days per week	2484	46.3	26.9	10.6	9.1		1986	50.2	29.8	12.5	7.7	
Everyday	1040	19.4	11.1	4.0	2.1		779	19.7	12.2	4.7	3.0	
Unknown or missing data	103	1.9	0.8	0.64	0.2		43	1.1	0.48	0.4	0.2	

Table 4 continued.

	First Nations (N = 5367)						Metis (N = 3956)					
	N	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**	**N**	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**
Lone Parent Status												
Lone parent household	2091	39.0	21.6	8.4	8.3	**0.0313**	1129	28.5	14.6	7.2	5.9	**<0.0001**
Not lone parent household	3276	61.0	34.9	15.1	11.7		2827	71.5	44.1	17.1	11.1	
Number of People Living in the Household												
Two	318	5.9	3.3	1.5	1.2	0.5731	203	5.1	2.8	0.9	1.2	**0.0002**
Three	996	18.6	11.0	4.5	3.5		647	16.3	10.0	3.9	2.6	
Four	1644	30.6	17.7	7.0	6.3		1499	37.9	23.11	9.6	5.8	
Five	1155	21.5	12.3	5.3	4.0		950	24.0	14.5	5.2	4.5	
Six	616	11.5	6.1	2.6	2.3		379	9.6	4.9	2.9	1.5	
Seven or more	566	10.5	5.4	2.5	2.5		247	6.2	3.0	1.6	1.3	
Unknown or missing data	73	1.4	0.7	0.2	0.3		32	0.8	0.4	0.3	0.1	
Region												
Census Metropolitan Area	2570	47.9	28.7	10.6	8.8	**0.0006**	1718	43.4	27.5	9.8	6.1	**<0.0001**
Other urban	1647	30.7	16.2	7.9	6.7		1147	29.0	16.5	7.0	5.6	
Other rural	1150	21.4	11.5	4.9	4.6		1090	27.6	14.7	7.5	5.3	
Household Income												
Less than $20,000	817	15.2	8.4	3.4	3.1	**<0.0001**	347	8.8	4.1	2.5	1.9	**<0.0001**
$20,000 to $39,999	1551	28.9	14.3	6.9	6.8		838	21.2	11.1	4.8	4.4	
$40,000 to $59,999	1048	19.5	10.8	4.8	4.0		788	19.9	11.3	4.8	3.8	
$60,000 to $79,999	727	13.5	7.8	3.4	2.7		667	16.9	10.6	4.4	2.1	
$80,000 to $99,999	527	9.8	6.8	2.2	1.1		526	13.3	8.9	3.0	2.0	
$100,000 and above	649	12.1	8.1	2.7	2.0		764	19.3	12.5	4.6	2.5	
Unknown or missing data	49	0.9	0.3	0.3	0.3		25	0.6	0.3	0.1	0.2	

Table 4 continued.

	First Nations (N = 5367)						Metis (N = 3956)					
	N	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**	**N**	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**
PMK Education Level												
Lower than high school	1323	24.6	12.4	5.8	5.3	**0.0002**	793	20.1	9.1	4.8	4.5	**<0.0001**
High school diploma	1801	33.6	18.5	8.9	6.6		1366	34.5	20.6	9.3	5.5	
Certificate or diploma lower than university	1263	23.5	15.3	5.5	5.2		1208	30.5	19.4	6.8	5.4	
University certificate or diploma below a Bachelor's	198	3.7	2.4	0.7	0.7		126	3.2	2.2	0.7	0.3	
University completed, at least a Bachelor's	521	9.7	6.5	2.1	1.6		375	9.5	6.31	2.16	0.85	
Other	57	1.1	0.6	0.2	0.3		34	0.9	0.36	0.27	0.21	
Unknown or missing data	205	3.8	0.8	0.4	0.5		54	1.4	0.8	0.3	0.2	
Length of Time Breastfed												
Never	1657	30.9	16.2	7.4	6.3	0.4431	1210	30.6	16.89	7.24	5.59	0.0466
6 months or less	1811	33.7	19.9	8.0	7.1		1531	38.7	22.43	10.39	6.77	
7 to 12 months	900	16.8	10.1	3.5	3.2		712	18.0	11.66	3.93	2.63	
More than 13 months	615	11.5	6.2	2.8	2.3		333	8.4	5.3	1.88	1.18	
Breastfed, but length unknown	124	2.3	1.3	0.5	0.4		87	2.2	1.32	0.45	0.43	
Unknown	247	4.6	2.8	1.2	0.8		73	1.8	1.11	0.45	0.33	
Missing data	13	0.2					11	0.3				
Birth weight												
Less than 2267 grams	167	3.1	1.7	0.7	0.9	**0.0007**	110	2.8	1.4	1.0	0.5	**0.0029**
Between 2267 and 3174 grams	1090	20.3	12.6	4.3	3.8		924	23.4	14.0	6.2	3.5	
Between 3174 and 4081 grams	2752	51.3	29.6	12.4	10.1		2195	55.5	33.4	12.8	9.6	
4081 grams and over	747	13.9	6.7	3.8	3.2		476	12.0	6.3	3.2	2.4	
Unknown	611	11.4	6.0	2.4	2.1		251	6.4	3.6	1.1	1.0	

Table 4 continued.

	First Nations (N = 5367)						Metis (N = 3956)					
	N	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**	**N**	**%**	**% Normal/ Underweight**	**% Overweight**	**% Obese**	**P-value**
Physical Activity: Sports												
Never played sports	1141	21.3	13.8	5.6	4.8	**<0.0001**	895	22.6	11.2	5.4	4.3	**<0.0001**
Played sports less than once a week	2374	44.2	3.6	2.1	2.1		1903	48.1	3.8	1.8	1.3	
Played sports 1 to 3 times per week	431	8.0	25.3	10.4	9.1		273	6.9	28.6	11.3	8.6	
Played sports 4 or more times per week	1338	24.9	13.2	5.1	3.6		851	21.5	14.6	5.8	2.7	
Unknown or missing data	83	1.5	0.6	0.2	0.4		34	0.9	0.5	0.1	0.2	
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games												
One	431	8.0	4.87	1.79	1.47	**0.0002**	387	9.8	5.9	2.7	1.5	0.2789
Two	795	14.8	8.61	3.44	2.73		589	14.9	8.5	3.8	2.8	
Three	509	9.5	5.22	2.87	1.75		388	9.8	5.4	2.4	1.9	
Four	234	4.4	2.0	1.6	0.9		148	3.7	2.3	1.0	0.6	
Five	204	3.8	1.9	0.7	1.0		99	2.5	1.3	0.6	0.7	
Never	3129	58.3	33.3	12.8	11.9		2306	58.3	34.9	13.7	9.4	
Unknown or missing data	64	1.2	0.5	0.3	0.3		31	0.8	0.4	0.2	0.1	

Data: 2006 Aboriginal Peoples Survey, Children and Youth public use file.

Notes: Percentages were calculated using sample weights, and with the total numbers for First Nations and Métis children as opposed to the full sample. Significance was assessed using chi-square test of independence of the independent variables and obesity status. Significant p-values ($p < 0.05$) are bolded.
*Only respondents who were food insecure answered questions about frequency and coping strategies.

4.1.1 First Nations and Métis Children

As outlined in **Table 3**, cases missing respondents made up a small proportion of the sample for most variables, with the exception of BMI and birth weight. BMI had the greatest number of missing cases, as 12.2% and 10.1% of First Nations and Métis children were not placed in a BMI category, respectively. For birth weight, 11.4% of cases were missing for First Nations, and 6.4% for Métis children. According to the 2006 APS, approximately 21% of First Nations children were classified as overweight, and 18% as obese in the sample. The majority of children were either normal or underweight. Twenty-two percent of Métis children were classified as overweight, and 15% fell into the obese BMI category. Overall, the sample was evenly split with almost equal proportions of males and females, and an even spread across the age groups.

Food insecurity affected 577 First Nations children which represented 11% of all First Nations children in the sample. Frequency of food insecurity and food insecurity coping strategies were only reported as a percent of the total number of people who responded "Yes" to children being food insecure (N = 577 for First Nations, N = 267 for Métis). Almost half of First Nations children who were food insecure were reported as experiencing food insecurity occasionally. Approximately 18% were regularly food insecure, and 12% reported as food insecure more often than the end of each month. Families of First Nations children used several different strategies to cope with food insecurity. Forty-eight percent reported seeking help from family. Food banks were also commonly used, as 40% of caregivers said they had visited a food bank to deal with food insecurity for their children. Seeking help from friends, and parents cutting down on food intake were also used coping strategies by approximately 16% and 14% of caregivers, respectively.

Food insecurity affected 267 Métis children which represented 6.8% of the Métis sample. The majority of food insecure Métis children reported food insecurity as an occasional occurrence (59.2%), however 14% were food insecure regularly and 13% more often than the end of each month. In order to

cope with food insecurity, caregivers most commonly reported seeking help from family (40%) or visiting food banks (37.3%). Approximately 18% of caregivers would resort to skipping meals, 17% sought help from friends, and 12% cut down on the variety of food they consumed.

Most First Nations children were reported to eat F&V five or six days per week. Interestingly, the majority of First Nations children also had junk food five or six days per week, although a larger proportion had F&V every day (35.8%) compared to junk food everyday (19.4%). Approximately half of Métis children were eating F&V five or six days per week and 31% every day. Half of Métis children also consumed junk food five or six days per week, and 21.3% and 19.7% ate junk food three or four days per week or every day, respectively.

Close to 40% of First Nations children lived in lone parent households. Approximately half of children lived in households with four or five members. Almost half of the population lived in a CMA. Over one quarter of Métis children lived in lone parent households, although the majority lived in either four or five member households. Over 40% of children lived in a CMA, with 29% from other urban, and 28% from other rural settings.

Approximately 30% of First Nations children came from households whose income was between $20,000 and $39,999 per year, and 15% of PMKs had more than a high school diploma. However the majority of PMKs had completed high school only (34%) and one quarter had less than a high school education. Approximately 21% of Métis children came from households whose income was between $20,000 and $39,999, and 20% had a household income of $40,000 to $59,999. Close to 20% of Métis children also came from households with incomes of $100,000 and above. One third of PMKs completed high school only, and approximately 31% of PMKs had a certificate or diploma lower than university. Twenty percent of PMKs had not completed high school.

One-third of First Nations children had been breastfed for six months or less, and close to one-third of children were never breast-fed. Half of First Nations children had a birth weight between 3174 grams and 4081 grams. Approximately 40% of Métis children had been breastfed for six months or less,

followed by 31% who were never breastfed. With respect to birth weight, over half of Métis children were between 3174 and 4081 grams, and almost a quarter were between 2267 and 3174 grams at birth.

The majority of First Nations children played sports less than once a week (44%), however a quarter played sports or attended lessons four or more times per week. Data on sedentary behaviour indicated that a surprising majority of First Nations children never watched TV, played on the computer, or played video games (58.3%), and close to 15% engaged at least one of these sedentary behaviours for two hours per day. Most Métis children played sports less than once a week. Twenty-three percent never played sports, and 22% played four or more times per week. In terms of sedentary behaviour, approximately 58% never watched TV, played on the computer, or played video games, however 15% engaged at least one of these activities for two hours per day. One possible explanation for the unexpected numbers for sedentary behaviour could be that parents were unaware of their children's daily screen time.

According to the chi-square tests, First Nations children aged 9 to 11 and 12 to 14 were slightly more likely to be overweight, but less likely to be obese compared to children aged 6 to 8 years. Children who ate F&V five or six days per week or everyday were more likely to fall into the normal/underweight BMI category, and children who ate junk food five or six days per week were more likely to be obese compared to children who ate junk food less frequently. However the majority of children who ate junk food frequently were in the normal/underweight BMI category. Fewer First Nations children coming from lone parent households were normal/underweight than children from households not led by a lone parent. Children from lone parent households were slightly more likely to be overweight, but less likely to be obese. Children from CMAs were more likely to be overweight and obese, however a larger percentage of children from CMAs fell into the normal/underweight category compared to children from other urban or rural settings. Prevalence of overweight and obesity decreased with increasing income, although the differences between income categories were slight. Moreover, lower PMK education also appears to be associated with overweight and obesity status. Lastly, First Nations children with a birth weight between 3174 and 4081 grams are more likely to be normal/underweight, however this weight category also had the largest proportion of the sample in the overweight and obese categories as well. Children who never

play sports and those who play four or more times per week are almost equally as likely to be normal/underweight, and children who never engage sedentary behaviours are most likely to be normal/underweight.

With respect to Métis children, the chi-square tests of independence indicated that females were more likely to be overweight and obese compared to males, and obesity prevalence declined with age. Métis children who ate F&V four or five days per week were more likely to be normal/underweight, and junk food had a similar relationship. Children not from lone parent household were more likely to be overweight and obese than children from lone parent households. After four people in the household, the likelihood of having a normal/underweight BMI decreases for Métis children. There are not vast differences in weight status by region, however the association is statistically significant for children from other urban and rural settings to be less likely to be overweight or obese than children from CMAs. The likelihood of obesity decreases with increasing household income, however the relationship is not so clear for overweight status. Normal/underweight, overweight, and obesity risk for children decreases after PMK education of a certificate or diploma below a Bachelor's, although these results may be due to the small sample size in the latter PMK education categories. Similar to the pattern seen in First Nations children, the majority of Métis children fell between the 3174 to 4081 grams birth weight, and the majority are normal/underweight. Children who never play sports are only slightly less likely to be normal/underweight compared to children who play sports four or more times per week, however they are more likely to be obese.

4.2 Binary Logistic Regression Models

Using sequential regression models, the association between numerous variables and their effects on children's weight status were investigated. **Tables 5** and **6** display the results of the binary logistic regression procedures with First Nations and Métis children, respectively. Adjusted OR and 95% confidence intervals (CI) are indicated in the columns, and statistically significant variables ($p < 0.05$) are

illustrated by the bolded OR. It is important to note that the results for First Nations and Métis children are not comparable since the models were stratified.

Table 5: Binary Logistic Regression Model Predicting Overweight/Obesity among First Nations Children aged 6 to 14

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Demographic Variables							
Female	0.913 (0.807, 1.032)	0.914 (0.808, 1.033)	0.921 (0.814, 1.041)	0.921 (0.813, 1.042)	0.917 (0.809, 1.039)	0.944 (0.833, 1.071)	0.951 (0.836, 1.081)
Male	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 6-8	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 9-11	**0.666 (0.572, 0.775)**	**0.666 (0.572, 0.776)**	**0.663 (0.570, 0.773)**	**0.656 (0.563, 0.765)**	**0.664 (0.568, 0.775)**	**0.670 (0.573, 0.782)**	**0.658 (0.562, 0.770)**
Age group 12-14	**0.403 (0.345, 0.469)**	**0.402 (0.345, 0.469)**	**0.388 (0.332, 0.453)**	**0.384 (0.329, 0.449)**	**0.391 (0.334, 0.458)**	**0.389 (0.332, 0.456)**	**0.371 (0.316, 0.437)**
Key Independent Variables							
Food insecure	…	1.082 (0.886, 1.320)	1.051 (0.860, 1.284)	1.020 (0.832, 1.252)	0.954 (0.775, 1.173)	0.943 (0.766, 1.162)	0.934 (0.757, 1.152)
Not food insecure	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Fruit and Vegetable Intake							
Never	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
1 or 2 days per week	…	…	1.077 (0.942, 1.231)	1.088 (0.951, 1.244)	1.108 (0.967, 1.268)	1.108 (0.967, 1.270)	1.104 (0.963, 1.266)
3 or 4 days per week	…	…	1.071 (0.936, 1.227)	1.068 (0.932, 1.224)	1.055 (0.919, 1.210)	1.055 (0.920, 1.211)	1.055 (0.919, 1.212)
5 or 6 days per week	…	…	0.896 (0.777, 1.033)	0.902 (0.782, 1.041)	0.908 (0.786, 1.049)	0.913 (0.789, 1.055)	0.915 (0.790, 1.058)
Everyday	…	…	**0.829 (0.718, 0.957)**	**0.844 (0.731, 0.976)**	0.862 (0.745, 0.997)	0.880 (0.760, 1.018)	0.897 (0.773, 1.040)
Junk Food Intake							
Never	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
1 or 2 days per week	…	…	0.888 (0.762, 1.036)	0.896 (0.767, 1.046)	0.911 (0.780, 1.065)	0.907 (0.776, 1.061)	0.901 (0.769, 1.054)
3 or 4 days per week	…	…	1.074 (0.935, 1.234)	1.081 (0.941, 1.243)	1.082 (0.940, 1.245)	1.081 (0.939, 1.245)	1.050 (0.910, 1.211)

Table 5 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Junk Food Intake Continued							
5 or 6 days per week	…	…	1.317 (1.066, 1.626)	**1.335 (1.080, 1.650)**	**1.325 (1.070, 1.641)**	**1.321 (1.066, 1.637)**	**1.188 (1.038, 1.599)**
Everyday	…	…	0.971 (0.825, 1.142)	0.990 (0.841, 1.166)	0.989 (0.839, 1.165)	0.967 (0.819, 1.141)	0.950 (0.803, 1.123)
Sociodemographic Variables							
Lone parent household	…	…	…	0.993 (0.860, 1.146)	**0.850 (0.727, 0.994)**	**0.851 (0.727, 0.996)**	**0.841 (0.718, 0.986)**
Not lone parent household	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Number of People Living in the Household							
Two	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Three	…	…	…	0.903 (0.682, 1.195)	0.898 (0.677, 1.191)	0.916 (0.690, 1.216)	0.924 (0.695, 1.229)
Four	…	…	…	0.851 (0.645, 1.124)	0.861 (0.650, 1.140)	0.870 (0.656, 1.154)	0.886 (0.667, 1.176)
Five	…	…	…	0.874 (0.653, 1.169)	0.875 (0.652, 1.175)	0.892 (0.664, 1.200)	0.912 (0.678, 1.228)
Six	…	…	…	0.908 (0.662, 1.247)	0.861 (0.624, 1.187)	0.869 (0.630, 1.200)	0.881 (0.637, 1.218)
Seven or more	…	…	…	1.081 (0.784, 1.492)	1.009 (0.727, 1.400)	1.016 (0.731, 1.413)	1.026 (0.736, 1.428)
Region							
CMA	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Other urban	…	…	…	**1.299 (1.127, 1.498)**	**1.271 (1.101, 1.468)**	**1.275 (1.104, 1.473)**	**1.265 (1.094, 1.463)**
Other rural	…	…	…	**1.226 (1.042, 1.443)**	**1.184 (1.004, 1.396)**	**1.187 (1.006, 1.401)**	**1.194 (1.011, 1.410)**
Socioeconomic Variables							
Household Income							
Less than $20,000	…	…	…	…	0.867 (0.710, 1.058)	0.868 (0.710, 1.060)	0.866 (0.708, 1.059)
$20,000 to $39,999	…	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)

Table 5 continued.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
	Odds Ratios (95% CI)	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**
Household Income Continued							
$40,000 to $59,999	…	…	…	…	0.838 (0.695, 1.010)	0.83 (0.688, 1.002)	0.84 (0.696, 1.015)
$60,000 to $79,999	…	…	…	…	**0.794 (0.641, 0.984)**	**0.776 (0.626, 0.962)**	**0.777 (0.626, 0.965)**
$80,000 to $99,999	…	…	…	…	**0.552 (0.432, 0.705)**	**0.544 (0.424, 0.696)**	**0.544 (0.425, 0.698)**
$100,000 & above	…	…	…	…	**0.637 (0.507, 0.801)**	**0.626 (0.498, 0.788)**	**0.647 (0.513, 0.816)**
PMK Education Level							
Lower than HS	…	…	…	…	0.988 (0.836, 1.168)	0.975 (0.823, 1.154)	0.926 (0.780, 1.098)
HS diploma	…	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)
Certificate/diploma below university	…	…	…	…	**0.819 (0.697, 0.961)**	**0.820 (0.698, 0.964)**	**0.835 (0.710, 0.982)**
University certificate/diploma below a Bachelor's	…	…	…	…	0.721 (0.509, 1.021)	0.733 (0.516, 1.040)	0.757 (0.532, 1.077)
University completed, at least a Bachelor's	…	…	…	…	**0.735 (0.585, 0.922)**	**0.733 (0.583, 0.921)**	**0.757 (0.602, 0.954)**
Other	…	…	…	…	0.663 (0.339, 1.299)	0.677 (0.345, 1.332)	0.678 (0.343, 1.343)
Early Life Events Variables							
Length of Time Breastfed							
Never	…	…	…	…	…	1.00 (--)	1.00 (--)
6 months or less	…	…	…	…	…	0.874 (0.747, 1.023)	0.882 (0.753, 1.033)
7 to 12 months	…	…	…	…	…	**0.793 (0.652, 0.965)**	0.821 (0.674, 1.000)

Table 5 continued.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
	Odds Ratios (95% CI)	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**
Breastfed Continued							
More than 13 months	…	…	…	…	…	0.924 (0.742, 1.152)	0.936 (0.751, 1.168)
Breastfed, but length unknown	…	…	…	…	…	0.887 (0.571, 1.378)	0.912 (0.586, 1.420)
Unknown	…	…	…	…	…	0.807 (0.572, 1.140)	0.819 (0.579, 1.160)
Birth weight							
Less than 2267g	…	…	…	…	…	1.00 (--)	1.00 (--)
Between 2267 & 3174g	…	…	…	…	…	0.784 (0.616, 0.998)	**0.775 (0.608, 0.988)**
Between 3174 & 4081g	…	…	…	…	…	0.937 (0.754, 1.166)	0.932 (0.748, 1.161)
4081 grams & over	…	…	…	…	…	**1.330 (1.023, 1.729)**	**1.311 (1.006, 1.708)**
Physical Activity and Sedentary Behaviour Variables							
Physical Activity: Sports							
Never played sports	…	…	…	…	…	…	1.00 (--)
Played sports less than once a week	…	…	…	…	…	…	**1.652 (1.279, 2.135)**
Played sports 1 to 3 times per week	…	…	…	…	…	…	1.065 (0.907, 1.250)
Played sports 4 or more times per week	…	…	…	…	…	…	1.011 (0.836, 1.222)

Table 5 continued.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
	Odds Ratios (95% CI)	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**	**Odds Ratios (95% CI)**
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games							
One	…	…	…	…	…	…	0.938 (0.801, 1.099)
Two	…	…	…	…	…	…	1.059 (0.923, 1.215)
Three	…	…	…	…	…	…	**1.297 (1.100, 1.530)**
Four	…	…	…	…	…	…	**1.280 (1.035, 1.583)**
Five	…	…	…	…	…	…	1.146 (0.891, 1.475)
Never	…	…	…	…	…	…	1.00 (--)
Select Model Fit Characteristics							
N	4313	4313	4313	4313	4313	4313	4313
df	3	4	12	20	30	38	46
(-2logL)	5761.772	5761.179	5732.699	5712.218	5660.693	5631.693	5597.74
C-statistic	0.602	0.602	0.615	0.622	0.635	0.642	0.648

Data: 2006 Aboriginal Peoples Survey, Children and Youth public use file.
Notes: Data are weighted using scaled weights. Bolded values are significant at $p < 0.05$. HS = High School. CMA = Census Metropolitan Area. g = grams.

4.2.1 First Nations Children

Demographic Variables

As summarized in **Table 5**, Gender was not significantly associated with weight status among First Nations children. Children in the age groups 9 to 11 and 12 to 14 were significantly less likely to be overweight or obese compared to First Nations children between the ages of 6 to 8 years in all of the models.

Key Independent Variables

Food insecurity was never a significant predictor of overweight or obesity. When looking at the diet variables, children who ate F&V everyday were less likely to be overweight or obese than children who never ate F&V, however this association was only significant when controlling for demographic and sociodemographic variables (Steps 3 and 4). Children who ate junk food four or five days per week were significantly more likely to be overweight or obese as compared to children who never ate junk food (OR = 1.28, p = 0.0214 in the full model).

Sociodemographic Variables

Perhaps somewhat unexpectedly, children coming from lone parent households were less likely to be overweight or obese as compared to those who were not (OR = 0.84, p = 0.0329 in the full model). Household crowding did not appear to have an effect on First Nations children's weight. Children living in "other urban" or "other rural" settings in Canada were more likely to be overweight or obese as compared to children from CMAs (OR = 1.26, p = 0.0015; OR = 1.19, p = 0.0364 in the full model, respectively).

Socioeconomic Variables

Household income appeared to have a protective effect, as First Nations children with household incomes of $60,000 or greater were less likely to be overweight or obese compared to children whose household incomes were between $20,000 and $39,999. The effect was strongest for children in the $80,000 and above income categories. PMK education level also had a protective effect, as children whose PMKs had a certificate or diploma (OR = 0.84, p = 0.0293), or a Bachelor's degree (OR = 0.76, p = 0.0182 in the full models), were significantly less likely to be overweight or obese compared to children whose PMKs had a high school diploma.

Early Life Event Variables

Children who had been breastfed for 7 to 12 months were less likely to be overweight or obese compared to children who were never breastfed, but only before controlling for physical activity and sedentary behaviour variables in Step 7 (OR = 0.79, p =0.0207). Breastfeeding longer than 12 months did not appear to confer any additional benefits for weight status among First Nations children. Birth weight was also significantly associated with weight in childhood, as children who were between 2267 and 3174 grams were less likely to be overweight or obese in the full model (OR = 0.78, p = 0.0396). Children who weighed 4081 grams or more at birth were significantly more likely to be overweight or obese than children who had a birth weight of less than 2267 grams (OR = 1.31, p = 0.0448).

Physical Activity and Sedentary Behaviour Variables

From the physical activity variables, only one frequency category was significant in the full model. Children who played sports less than once a week were more likely to be overweight or obese compared to children who never played sports. Interestingly, more frequent physical activity was not associated with weight status. Watching TV, playing on the computer, or playing video games for either three (OR = 1.30, p =0.0020) or four (OR 1.28, p = 0.0226) hours per day significantly increased the risk

of overweight and obesity for First Nations children. It is possible that the higher frequencies of sedentary behaviour were not significantly associated with weight due to small sample sizes in these categories.

Summary

For First Nations children, age, specific diet categories, lone parent status, region, income, PMK education, breastfeeding, birth weight and sports were significantly associated with obesity risk in the full model (Step 7). Overall, food insecurity was not a significant predictor of weight status for First Nations children. While a few diet categories were significantly associated with weight under different conditions, their relationship with obesity was not a result of food security status.

Model Fit Characteristics

When assessing the likelihood ratio statistic using the reported -2logL values, it appears that controlling for additional confounders improved the model fit. The C-statistic value stayed between 0.60 and 0.65 across the models, and increased slightly with the additional of more variables into the model, thereby indicating that all of the models only moderately improved the probability of predicting overweight or obesity than predictions by chance.

Table 6: Binary Logistic Regression Model Predicting Overweight/Obesity among Métis Children aged 6 to 14

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Demographic Variables							
Female	**0.754 (0.661, 0.861)**	**0.754 (0.661, 0.861)**	**0.764 (0.668, 0.873)**	**0.780 (0.681, 0.892)**	**0.766 (0.668, 0.878)**	**0.773 (0.674, 0.887)**	**0.769 (0.669, 0.884)**
Male	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 6-8	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 9-11	**0.763 (0.649, 0.898)**	**0.761 (0.647, 0.895)**	**0.763 (0.648, 0.898)**	**0.739 (0.627, 0.872)**	**0.743 (0.629, 0.878)**	**0.743 (0.629, 0.879)**	**0.741 (0.625, 0.878)**
Age group 12-14	**0.451 (0.383, 0.532)**	**0.449 (0.381, 0.530)**	**0.449 (0.380, 0.531)**	**0.441 (0.372, 0.522)**	**0.430 (0.362, 0.510)**	**0.428 (0.360, 0.508)**	**0.408 (0.341, 0.487)**
Key Independent Variables							
Food insecure	…	1.148 (0.876, 1.503)	1.155 (0.880, 1.514)	1.017 (0.770, 1.344)	0.934 (0.703, 1.240)	0.928 (0.697, 1.234)	0.924 (0.693, 1.232)
Not food insecure	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Fruit and Vegetable Intake							
Never	…	…	1.131 (0.973, 1.315)	1.141 (0.890, 1.329)	1.143 (0.890, 1.333)	1.142 (0.978, 1.332)	1.097 (0.939, 1.282)
1 or 2 days per week	…	…	0.862 (0.744, 0.999)	0.887 (0.764, 1.030)	0.904 (0.778, 1.051)	0.897 (0.771,1.043)	0.874 (0.750, 1.018)
3 or 4 days per week	…	…	0.935 (0.804, 1.086)	0.920 (0.790, 1.071)	0.936 (0.803, 1.092)	0.938 (0.804, 1.094)	0.927 (0.794, 1.082)
5 or 6 days per week	…	…	0.957 (0.818, 1.119)	0.959 (0.818, 1.124)	0.965 (0.822, 1.133)	0.969 (0.825, 1.138)	0.971 (0.826, 1.141)
Everyday	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Junk Food Intake							
Never	…	…	**0.820 (0.682, 0.986)**	**0.812 (0.674, 0.979)**	**0.816 (0.676, 0.985)**	0.826 (0.684, 0.998)	0.860 (0.710, 1.042)
1 or 2 days per week	…	…	0.881 (0.749, 1.037)	0.895 (0.759, 1.056)	0.924 (0.782, 1.091)	0.924 (0.782, 1.092)	0.954 (0.806, 1.130)
3 or 4 days per week	…	…	1.079 (0.921, 1.264)	1.085 (0.924, 1.274)	1.091 (0.928, 1.283)	1.083 (0.921, 1.274)	1.075 (0.913, 1.266)

Table 6 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Junk Food Intake continued							
5 or 6 days per week	…	…	0.924 (0.737, 1.160)	0.921 (0.732, 1.158)	0.943 (0.748, 1.189)	0.957 (0.758, 1.208)	0.949 (0.751, 1.199)
Everyday	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Sociodemographic Variables							
Lone parent household	…	…	…	**1.645 (1.386, 1.954)**	**1.431 (1.189, 1.721)**	**1.431 (1.189, 1.723)**	**1.432 (1.188, 1.724)**
Not lone parent household	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Number of People Living in the Household							
Two	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Three	…	…	…	1.004 (0.716, 1.408)	1.062 (0.755, 1.496)	1.044 (0.741, 1.470)	1.040 (0.738, 1.467)
Four	…	…	…	1.148 (0.824, 1.600)	1.251 (0.892, 1.754)	1.249 (0.891, 1.752)	1.253 (0.892, 1.761)
Five	…	…	…	1.159 (0.820, 1.637)	1.219 (0.8.57, 1.733)	1.222 (0.859, 1.738)	1.219 (0.856, 1.737)
Six	…	…	…	**1.498 (1.020, 2.200)**	**1.586 (1.073, 2.344)**	**1.583 (1.070, 2.342)**	**1.562 (1.054, 2.314)**
Seven or more	…	…	…	**1.804 (1.185, 2.745)**	**1.776 (1.159, 2.724)**	**1.829 (1.191, 2.807)**	**1.813 (1.179, 2.789)**
Region							
CMA	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Other urban	…	…	…	**1.341 (1.141, 1.576)**	**1.313 (1.115, 1.546)**	**1.304 (1.107, 1.536)**	**1.305 (1.107, 1.538)**
Other rural	…	…	…	**1.580 (1.340, 1.864)**	**1.506 (1.274, 1.780)**	**1.499 (1.268, 1.774)**	**1.517 (1.282, 1.796)**
Socioeconomic Variables							
Household Income							
Less than $20,000	…	…	…	…	**1.357 (1.031, 1.785)**	**1.366 (1.038, 1.799)**	**1.346 (1.020, 1.775)**
$20,000 to $39,999	…	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)

Table 6 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Household Income Continued							
$40,000 to $59,999	…	…	…	…	0.961 (0.774, 1.193)	0.963 (0.775, 1.196)	0.968 (0.778, 1.205)
$60,000 to $79,999	…	…	…	…	0.849 (0.675, 1.070)	0.847 (0.672, 1.068)	0.854 (0.677, 1.078)
$80,000 to $99,999	…	…	…	…	0.830 (0.647, 1.064)	0.828 (0.645, 1.062)	0.846 (0.658, 1.087)
$100,000 & above	…	…	…	…	0.889 (0.704, 1.123)	0.892 (0.705, 1.128)	0.922 (0.727, 1.168)
PMK Education Level							
Lower than HS	…	…	…	…	**1.398 (1.150, 1.700)**	**1.388 (1.139, 1.690)**	**1.349 (1.105, 1.646)**
HS diploma	…	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)
Certificate/diploma lower than university	…	…	…	…	0.903 (0.766, 1.064)	0.913 (0.773, 1.077)	0.926 (0.784, 1.094)
University certificate/diploma less than a Bachelor's	…	…	…	…	0.669 (0.446, 1.004)	0.683 (0.454, 1.027)	0.694 (0.461, 1.046)
University completed, at least a Bachelor's	…	…	…	…	**0.713 (0.550, 0.926)**	**0.739 (0.567, 0.962)**	0.769 (0.589, 1.003)
Other	…	…	…	…	1.877 (0.910, 3.872)	1.901 (0.920, 3.929)	1.911 (0.922, 3.964)
Early Life Events Variables							
Length of Time Breastfed							
Never	…	…	…	…	…	1.00 (--)	1.00 (--)
6 months or less	…	…	…	…	…	1.080 (0.914, 1.277)	1.099 (0.929, 1.301)
7 to 12 months	…	…	…	…	…	0.823 (0.667, 1.014)	0.841 (0.681, 1.038)
More than 13 months	…	…	…	…	…	0.832 (0.632, 1.095)	0.839 (0.637, 1.105)
Breastfed, but length unknown	…	…	…	…	…	1.029 (0.632, 1.675)	1.058 (0.648, 1.728)
Unknown	…	…	…	…	…	0.944 (0.529, 1.686)	0.950 (0.530, 1.704)

Table 6 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Birth weight							
Less than 2267g	…	…	…	…	…	1.00 (--)	1.00 (--)
Between 2267 & 3174g	…	…	…	…	…	1.009 (0.755, 1.348)	1.021 (0.763, 1.366)
Between 3174 & 4081g	…	…	…	…	…	0.957 (0.730, 1.255)	0.963 (0.734, 1.264)
4081g & over	…	…	…	…	…	1.360 (0.985, 1.878)	1.373 (0.993, 1.899)
Physical Activity and Sedentary Behaviour Variables							
Physical Activity: Sports							
Never played sports	…	…	…	…	…	…	1.00 (--)
Played sports less than once a week	…	…	…	…	…	…	0.959 (0.712, 1.292)
Played sports 1 to 3 times per week	…	…	…	…	…	…	0.853 (0.711, 1.023)
Played sports 4 or more times per week	…	…	…	…	…	…	**0.758 (0.612, 0.939)**
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games							
One	…	…	…	…	…	…	**1.213 (1.008, 1.459)**
Two	…	…	…	…	…	…	1.144 (0.987, 1.326)
Three	…	…	…	…	…	…	**1.218 (1.016, 1.461)**
Four	…	…	…	…	…	…	**1.523 (1.181, 1.965)**
Five	…	…	…	…	…	…	1.210 (0.872, 1.680)
Never	…	…	…	…	…	…	1.00 (--)
Select Model Fit Characteristics							
N	3731	3731	3731	3731	3731	3731	3731
df	3	4	12	20	30	38	46
(-2logL)	4944.344	4943.35	4924.083	4849.937	4798.002	4778.839	4754.795
C-statistic	0.591	0.592	0.606	0.63	0.644	0.649	0.653

Data: 2006 Aboriginal Peoples Survey, Children and Youth public use file.

Notes: Data are weighted using scaled weights. Bolded values are significant at $p < 0.05$. HS = High School. CMA = Census Metropolitan Area. g = grams.

4.2.2 Métis Children

Demographic Variables

As reported in **Table 6**, gender was consistently a significant predictor of weight status for Métis children, as girls were less likely than boys to be overweight or obese (OR = 0.77, p = 0.0002 in the full model). Children in the 9 to 11 and 12 to 14 age groups were less likely to be overweight or obese compared to children between 6 and 8 years old.

Key Independent Variables

Food insecurity was not significantly associated with weight status in any of the models. F&V intake was also not predictive of children's weights, however children who never ate junk food were less likely to be overweight or obese compared to children who ate junk food every day before controlling for early life events and physical activity and sedentary behaviour in Steps 6 and 7.

Sociodemographic Variables

For Métis children, lone parent status was significantly associated with an increased risk of overweight or obesity (OR = 1.43, p = 0.0002 in the full model). Children living in households with six or seven people were significantly more likely to be overweight or obese (OR = 1.31, p = 0.0263; OR = 1.52, p = 0.0067 in the full model for six and seven people, respectively) than children living in households with only two members. Children from "other urban" or "other rural" regions were also more likely to be overweight or obese compared to children from CMAs.

Socioeconomic Variables

Interestingly, higher household incomes were not protective against overweight or obesity. However, belonging to the lowest household income category, less than $20,000, was associated with a significantly higher risk of overweight or obesity among children (OR = 1.35, p = 0.0355 in the full

model). PMKs with less than a high school education were more likely to have children that were overweight or obese (OR = 1.35, p = 0.0032 in the full model) than PMKs with a high school diploma. On the contrary, PMKs with a Bachelor's degree were less likely to have overweight or obese children compared to children whose PMKs had a high school diploma (OR = 0.74, p = 0.0244 in Step 6).

Early Life Events Variables

Breastfeeding and birth weight were not significantly associated with weight status for Métis children.

Physical Activity and Sedentary Behaviour Variables

Children who played sports four or more times per week were significantly less likely to be overweight or obese compared to children who never played sports (OR = 0.76, p =0.0112). Children who watched TV, played on the computer, or played video games for either one, three, or four hours per day were significantly more likely to be overweight or obese compared to children who never engaged these sedentary behaviours.

Summary

Among Métis children, gender, age, junk food intake, lone parent status, number of people living in the household, region, household income, PMK education, and sports were significantly associated with weight status in the full model (Step 7). Food insecurity was not associated with Métis children's BMI. Junk food was the only diet category significantly associated with weight status, however its relationship with obesity was not related to food security status since this variable was never significant.

Model Fit Characteristics

The likelihood ratio statistics calculated using the reported -2logL values indicate that controlling for additional confounders improves the model fit. The C-statistic value ranged between 0.59 and 0.65

across the models, hence the larger models appear to better predict overweight or obesity than the smaller models. However, a C-statistic of 0.65 is still only considered a reasonable value in terms of the full model being able to predict the response variable better than chance.

4.3 Income as a key predictor variable

As discussed in the literature review in Chapter 2, income is an important predictor of health and food security status, in particular. Since food insecurity was never a significant predictor of BMI in this study, regression analyses were also run with income to see its independent effects, and if it was related to children's diets. The results of these analyses are summarized in **Tables 7** and **8** for First Nations and Métis children, respectively. Adjusted OR, 95% CIs, and statistical significance of the variables assessed are reported in the tables.

Table 7: Binary Logistic Regression Model Predicting Overweight/Obesity among First Nations Children aged 6 to 14 using Income

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Demographic Variables							
Female	0.913 (0.807, 1.032)	0.912 (0.807, 1.032)	0.918 (0.811, 1.039)	0.919 (0.812, 1.041)	0.918 (0.810, 1.039)	0.945 (0.833 1.072)	0.952 (0.837, 1.082)
Male	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 6-8	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 9-11	**0.666 (0.572, 0.775)**	**0.676 (0.580, 0.788)**	**0.673 (0.577, 0.785)**	**0.670 (0.574, 0.782)**	**0.664 (0.569, 0.775)**	**0.670 (0.573, 0.783)**	**0.658 (0.562, 0.771)**
Age group 12-14	**0.403 (0.345, 0.469)**	**0.408 (0.349, 0.476)**	**0.394 (0.338, 0.461)**	**0.393 (0.336, 0.460)**	**0.391 (0.334, 0.458)**	**0.389 (0.332, 0.456)**	**0.371 (0.315, 0.436)**
Key Independent Variables							
Household Income							
Less than $20,000	…	0.832 (0.684, 1.012)	0.839 (0.689, 1.021)	0.861 (0.706, 1.051)	0.866 (0.709, 1.057)	0.866 (0.709, 1.058)	0.865 (0.707, 1.058)
$20,000 to $39,999	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
$40,000 to $59,999	…	0.845 (0.707, 1.010)	0.852 (0.712, 1.019)	**0.812 (0.675, 0.977)**	0.840 (0.697, 1.012)	0.833 (0.690, 1.004)	0.843 (0.698, 1.018)
$60,000 to $79,999	…	**0.805 (0.659, 0.984)**	**0.803 (0.657, 0.982)**	**0.763 (0.619, 0.942)**	**0.797 (0.644, 0.986)**	**0.779 (0.629, 0.965)**	**0.780 (0.629, 0.968)**
$80,000 to $99,999	…	**0.541 (0.429, 0.681)**	**0.557 (0.442, 0.702)**	**0.529 (0.415, 0.674)**	**0.554 (0.434, 0.708)**	**0.547 (0.428, 0.699)**	**0.547 (0.427, 0.701)**
$100,000 and above	…	**0.613 (0.497, 0.755)**	**0.625 (0.507, 0.771)**	**0.591 (0.474, 0.739)**	**0.640 (0.509, 0.803)**	**0.629 (0.501, 0.791)**	**0.651 (0.516, 0.820)**
Fruit and Vegetable Intake							
Never	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
1 or 2 days per week	…	…	1.086 (0.950, 1.242)	1.105 (0.965, 1.265)	1.108 (0.968, 1.269)	1.109 (0.968, 1.271)	1.105 (0.964, 1.267)
3 or 4 days per week	…	…	1.069 (0.933, 1.225)	1.064 (0.928, 1.220)	1.055 (0.920, 1.210)	1.056 (0.920, 1.212)	1.056 (0.919, 1.212)
5 or 6 days per week	…	…	0.903 (0.782, 1.042)	0.908 (0.786, 1.048)	0.909 (0.787, 1.050)	0.914 (0.790, 1.056)	0.916 (0.791, 1.059)
Everyday	…	…	**0.850 (0.736, 0.982)**	**0.862 (0.745, 0.996)**	0.863 (0.746, 0.998)	0.880 (0.760, 1.056)	0.897 (0.774, 1.040)
Junk Food Intake							
Never	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
1 or 2 days per week	…	…	0.901 (0.772, 1.052)	0.901 (0.771, 1.052)	0.912 (0.780, 1.065)	0.908 (0.776, 1.062)	0.901 (0.770, 1.055)

Table 7 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Junk Food Intake Continued							
3 or 4 days per week	…	…	1.077 (0.936, 1.238)	1.083 (0.942, 1.246)	1.082 (0.940, 1.245)	1.081 (0.939, 1.245)	1.050 (0.910, 1.211)
5 or 6 days per week	…	…	**1.313 (1.062, 1.623)**	**1.321 (1.068, 1.634)**	**1.323 (1.068, 1.637)**	**1.318 (1.064, 1.633)**	**1.285 (1.036, 1.595)**
Everyday	…	…	0.975 (0.828, 1.148)	0.992 (0.842, 1.169)	0.990 (0.840, 1.167)	0.968 0.820, 1.142)	0.951 (0.805, 1.125)
Sociodemographic Variables							
Lone parent household	…	…	…	**0.844 (0.722, 0.986)**	**0.847 (0.725, 0.991)**	**0.847 (0.724, 0.991)**	**0.838 (0.715, 0.981)**
Not lone parent household	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Number of People Living in the Household							
Two	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Three	…	…	…	0.906 (0.684, 1.200)	0.897 (0.677, 1.190)	0.914 (0.689, 1.214)	0.922 (0.694, 1.226)
Four	…	…	…	0.864 (0.653, 1.143)	0.860 (0.649, 1.139)	0.869 (0.655, 1.153)	0.884 (0.666, 1.174)
Five	…	…	…	0.883 (0.659, 1.184)	0.873 (0.650, 1.172)	0.889 (0.662, 1.195)	0.909 (0.675, 1.224)
Six	…	…	…	0.881 (0.641, 1.212)	0.858 (0.622, 1.183)	0.866 (0.627, 1.195)	0.877 (0.635, 1.213)
Seven or more	…	…	…	1.031 (0.746, 1.426)	1.004 (0.724, 1.392)	1.010 (0.727, 1.402)	1.018 (0.732, 1.417)
Region							
CMA	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Other urban	…	…	…	**1.280 (1.109, 1.476)**	**1.270 (1.100, 1.465)**	**1.273 (1.102, 1.471)**	**1.263 1.092, 1.460)**
Other rural	…	…	…	**1.212 (1.029, 1.428)**	**1.184 (1.004, 1.396)**	**1.188 (1.007, 1.402)**	**1.195 (1.012, 1.411)**
Socioeconomic Variables							
PMK Education Level							
Lower than HS	…	…	…	…	0.987 (0.835, 1.167)	0.973 (0.822, 1.152)	0.924 (0.779, 1.096)
HS diploma	…	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)
Certificate/diploma below university	…	…	…	…	**0.819 (0.697, 0.961)**	**0.820 (0.698, 0.964)**	**0.835 (0.710, 0.982)**

Table 7 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
PMK Education Level Continued							
University certificate/ diploma below a Bachelor's	…	…	…	…	0.719 (0.508, 1.018)	0.731 (0.515, 1.037)	0.755 (0.530, 1.073)
University completed, at least a Bachelor's	…	…	…	…	**0.735 (0.586, 0.923)**	**0.734 (0.584, 0.922)**	**0.758 (0.602, 0.955)**
Other	…	…	…	…	0.664 (0.339, 1.301)	0.679 (0.345, 1.335)	0.680 (0.343, 1.347)
Early Life Events Variables							
Length of Time Breastfed							
Never	…	…	…	…	…	1.00 (--)	1.00 (--)
6 months or less	…	…	…	…	…	0.873 (0.746, 1.022)	0.881 (0.752, 1.032)
7 to 12 months	…	…	…	…	…	**0.793 (0.652, 0.964)**	0.820 (0.673, 0.999)
More than 13 months	…	…	…	…	…	0.922 (0.740, 1.148)	0.933 (0.748, 1.164)
Breastfed, but length unknown	…	…	…	…	…	0.890 (0.573, 1.382)	0.916 (0.589, 1.425)
Unknown	…	…	…	…	…	0.806 (0.571, 1.138)	0.818 (0.578, 1.157)
Birth weight							
Less than 2267g	…	…	…	…	…	1.00 (--)	1.00 (--)
Between 2267 & 3174g	…	…	…	…	…	0.785 (0.617, 0.999)	0.776 (0.609, 0.989)
Between 3174 & 4081g	…	…	…	…	…	0.938 (0.754, 1.167)	0.933 (0.749, 1.162)
4081g & over	…	…	…	…	…	**1.329 (1.022, 1.729)**	**1.310 (1.006, 1.707)**
Physical Activity and Sedentary Behaviour Variables							
Physical Activity: Sports							
Never played sports	…	…	…	…	…	…	1.00 (--)
Played sports less than once a week	…	…	…	…	…	…	**1.654 (1.280, 2.137)**
Played sports 1 to 3 times per week	…	…	…	…	…	…	1.067 (0.909, 1.253)
Played sports 4 or more times per week	…	…	…	…	…	…	1.011 (0.836, 1.223)

Table 7 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games							
One	…	…	…	…	…	…	0.940 (0.802, 1.101)
Two	…	…	…	…	…	…	1.059 (0.923, 1.215)
Three	…	…	…	…	…	…	**1.298 (1.101, 1.531)**
Four	…	…	…	…	…	…	**1.277 (1.033, 1.579)**
Five	…	…	…	…	…	…	1.146 (0.891, 1.1474)
Never	…	…	…	…	…	…	1.00 (--)
Select Model Fit Characteristics							
N	4313	4313	4313	4313	4313	4313	4313
df	3	8	16	24	29	37	46
(-2logL)	5761.772	5721.996	5697.16	5675.089	5660.895	5631.995	5597.74
C-statistic	0.602	0.616	0.624	0.631	0.635	0.642	0.648

Data: 2006 Aboriginal Peoples Survey, Children and Youth public use file.

Notes: Data are weighted using scaled weights. Bolded values are significant at $p < 0.05$. HS = High School. CMA = Census Metropolitan Area. g = grams.

4.3.1 First Nations Children

Demographic Variables

As indicated in **Table 7**, gender was not a significant predictor of weight for First Nations children in this analysis. Children between the ages of 9 and 11 and 12 and 14 were less likely to be overweight or obese compared to children who were 6 to 8 years old.

Key Independent Variables

Having a household income of $60,000 or greater was protective against overweight and obesity, as children from the three highest income categories were significantly less likely to be overweight or obese compared to children whose household incomes were between $20,000 and $39,999. In most models, F&V intake was not significantly associated with weight status, although F&V intake every day was sometimes associated with a lower odds of overweight and obesity (Steps 3 and 4). However children who had junk food four or five days per week were more likely to be overweight or obese compared to children who never had junk food (OR = 1.29, p = 0.0226 in the full model).

Sociodemographic Variables

Children from lone parent households were less likely to be overweight or obese, as seen in the initial regression results (OR = 0.84, p = 0.0280 in the full model). Number of people living in the household did not affect First Nations children's weight status. Living in "other urban" or "other rural" settings was associated with an increased risk of overweight or obesity compared to residence in a CMA.

Socioeconomic Variables

The effect of household income is discussed above under the key independent variables. PMK education appeared to have a protective effect, as children of PMKs with a certificate or diploma and

PMKs with a Bachelor's degree were less likely to be overweight or obese compared to children whose PMKs had a high school diploma (OR = 0.84, p =0.0289; OR = 0.76, p =0.0187 in the full model).

Early Life Events Variables

Children who were breastfed for 7 to 12 months were less likely to be overweight or obese compared to children who were never breastfed before controlling for physical activity and sedentary behaviour variables (OR = 0.79, p =0.0203). Children whose birth weights were 4081 grams and over were more likely to be classified as overweight or obese (OR = 1.31, p = 0.0338).

Physical Activity and Sedentary Behaviour Variables

Children who played sports less than once a week were more likely to be overweight or obese compared to children who never played sports (OR = 1.54, p = 0.0001). Children who watched TV, played on the computer or with video games for three or four hours per day were significantly more likely to be overweight or obese compared to children who never participated in these activities.

Summary

The relationships between the independent and response variables were similar when the sequential regression analyses were conducted with income instead of food insecurity. Overall, having a household income above $60,000 was predictor of high BMI for children. There is weak evidence for a relationship between income and diet in this analysis.

Model Fit Characteristics

When assessing the likelihood ratio statistics across models, it appears that controlling for additional confounders improves the model fit. The C-statistic values were between 0.60 and 0.65 across models, thereby indicating that all models only moderately improved the probability of predicting overweight or obesity than predictions by chance.

Table 8: Binary Logistic Regression Model Predicting Overweight/Obesity among Métis Children aged 6 to 14 using Income

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Demographic Variables							
Female	**0.754**	**0.749**	**0.758**	**0.774**	**0.766**	**0.773**	**0.769**
	(0.661, 0.861)	**(0.656, 0.856)**	**(0.663, 0.867)**	**(0.676, 0.887)**	**(0.668, 0.878)**	**(0.673, 0.887)**	**(0.669, 0.884)**
Male	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 6-8	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Age group 9-11	**0.763**	**0.766**	**0.768**	**0.747 (**	**0.742**	**0.742**	**0.740**
	(0.649, 0.898)	**(0.651, 0.902)**	**(0.652, 0.905)**	**0.633, 0.882)**	**(0.628, 0.877)**	**(0.628, 0.878)**	**(0.624, 0.876)**
Age group 12-14	**0.451**	**0.452**	**0.451**	**0.443**	**0.429**	**0.427**	**0.407**
	(0.383, 0.532)	**(0.383, 0.534)**	**(0.382, 0.533)**	**(0.374, 0.525)**	**(0.362, 0.509)**	**(0.360, 0.507)**	**(0.340, 0.486)**
Key Independent Variables							
Household Income							
Less than $20,000	…	1.311	1.308	**1.372**	**1.357**	**1.367**	**1.347**
		(1.004, 1.712)	(1.001, 1.709)	**(1.044, 1.803)**	**(1.031, 1.786)**	**(1.038, 1.800)**	**(1.021, 1.776)**
$20,000 to $39,999	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
$40,000 to $59,999	…	0.913	0.910	0.948	0.964	0.965	0.971
		(0.743, 1.122)	(0.740, 1.119)	(0.765, 1.175)	(0.776, 1.196)	(0.777, 1.199)	(0.780, 1.207)
$60,000 to $79,999	…	**0.744**	**0.748**	0.815	0.853	0.851	0.858
		(0.599, 0.924)	**(0.602, 0.930)**	(0.649, 1.023)	(0.678, 1.074)	(0.676, 1.072)	(0.680, 1.083)
$80,000 to $99,999	…	**0.686**	**0.687**	0.781	0.833	0.832	0.850
		(0.544, 0.864)	**(0.545, 0.867)**	(0.611, 0.998)	(0.650, 1.068)	(0.648, 1.066)	(0.662, 1.091)
$100,000 and above	…	**0.687**	**0.691**	**0.793**	0.894	0.897	0.927
		(0.556, 0.848)	**(0.559, 0.853)**	**(0.632, 0.994)**	(0.708, 1.128)	(0.710, 1.133)	(0.732, 1.173)
Fruit and Vegetable Intake							
Never	…	…	1.120	1.137	1.142	1.141	1.097
			(0.963, 1.303)	(0.976, 1.325)	(0.980, 1.332)	(0.978, 1.332)	(0.939, 1.282)
1 or 2 days per week	…	…	0.871	0.895	0.903	0.896	0.873
			(0.752, 1.010)	(0.770, 1.039)	(0.777, 1.050)	(0.771, 1.042)	(0.750, 1.016)
3 or 4 days per week	…	…	0.955	0.936	0.937	0.938	0.927
			(0.821, 1.111)	(0.803, 1.090)	(0.803, 1.092)	(0.804, 1.094)	(0.794, 1.083)
5 or 6 days per week	…	…	0.958	0.958	0.966	0.971	0.972
			(0.818, 1.122)	(0.817, 1.124)	(0.823, 1.134)	(0.826, 1.140)	(0.827, 1.143)
Everyday	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Junk Food Intake							
Never	…	…	**0.810**	**0.806**	0.816	0.826	0.860
			(0.673, 0.976)	**(0.669, 0.973)**	(0.676, 0.985)	(0.683, 0.998)	(0.710, 1.042)
1 or 2 days per week	…	…	0.894	0.903	**0.923**	0.923 (	0.953
			(0.759, 1.053)	(0.766, 1.066)	**(0.782, 1.090)**	0.781, 1.091)	(0.805, 1.129)

Table 8 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Junk Food Intake Continued							
3 or 4 days per week	…	…	1.081 (0.922, 1.268)	1.082 (0.922, 1.272)	1.091 (0.928, 1.282)	1.083 (0.920, 1.274)	1.074 (0.912, 1.265)
5 or 6 days per week	…	…	0.938 (0.747, 1.178)	0.932 (0.740, 1.173)	0.941 (0.747, 1.187)	0.955 (0.757, 1.205)	0.947 (0.750, 1.197)
Everyday	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Sociodemographic Variables							
Lone parent household	…	…	…	**1.471 (1.226, 1.765)**	**1.424 (1.185, 1.711)**	**1.424 (1.184, 1.712)**	**1.424 (1.183, 1.713)**
Not lone parent household	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Number of People Living in the Household							
Two	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Three	…	…	…	1.060 (0.755, 1.489)	1.060 (0.753, 1.492)	1.041 (0.739, 1.467)	1.038 (0.736, 1.463)
Four	…	…	…	1.255 (0.897, 1.755)	1.246 (0.889, 1.745)	1.243 (0.887, 1.743)	1.247 (0.888, 1.751)
Five	…	…	…	1.256 (0.887, 1.780)	1.212 (0.853, 1.721)	1.214 (0.854, 1.725)	1.211 (0.851, 1.724)
Six	…	…	…	**1.616 (1.096, 2.381)**	**1.577 (1.068, 2.329)**	**1.573 (1.064, 2.326)**	**1.552 (1.048, 2.299)**
Seven or more	…	…	…	**1.934 (1.268, 2.949)**	**1.762 (1.151, 2.698)**	**1.812 (1.182, 2.778)**	**1.797 (1.170, 2.760)**
Region							
CMA	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Other urban	…	…	…	**1.348 (1.146, 1.586)**	**1.314 (1.116, 1.547)**	**1.305 (1.108, 1.538)**	**1.306 (1.108, 1.539)**
Other rural	…	…	…	**1.569 (1.329, 1.852)**	**1.508 (1.275, 1.782)**	**1.501 (1.269, 1.776)**	**1.519 (1.283, 1.789)**
Socioeconomic Variables							
PMK Education Level							
Lower than HS	…	…	…	…	**1.393 (1.146, 1.694)**	**1.382 (1.135, 1.683)**	**1.344 (1.102, 1.639)**
HS diploma	…	…	…	…	1.00 (--)	1.00 (--)	1.00 (--)
Certificate/diploma below university	…	…	…	…	0.902 (0.765, 1.063)	0.911 (0.772, 1.076)	0.925 (0.783, 1.092)

Table 8 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
PMK Education Level Continued							
University certificate/ diploma below a Bachelor's	…	…	…	…	0.669 (0.446, 1.004)	0.684 (0.455, 1.028)	0.696 (0.462, 1.048)
University completed, at least a Bachelor's	…	…	…	…	**0.712 (0.549, 0.924)**	**0.737 (0.566, 0.960)**	0.767 (0.588, 1.001)
Other	…	…	…	…	1.879 (0.911, 3.878)	1.903 (0.921, 3.934)	1.914 (0.923, 3.970)
Early Life Events Variables							
Length of Time Breastfed							
Never	…	…	…	…	…	1.00 (--)	1.00 (--)
6 months or less	…	…	…	…	…	1.078 (0.912, 1.274)	1.063 (0.927, 1.297)
7 to 12 months	…	…	…	…	…	0.822 (0.667, 1.013)	0.840 (0.681, 1.037)
More than 13 months	…	…	…	…	…	0.829 (0.630, 1.090)	0.835 (0.634, 1.100)
Breastfed, but length unknown	…	…	…	…	…	1.030 (0.633, 1.676)	1.059 (0.649, 1.730)
Unknown	…	…	…	…	…	0.939 (0.526, 1.676)	0.944 (0.527, 1.692)
Birth weight							
Less than 2267g	…	…	…	…	…	1.00 (--)	1.00 (--)
Between 2267 & 3174g	…	…	…	…	…	1.008 (0.755, 1.347)	1.021 (0.763, 1.366)
Between 3174 & 4081g	…	…	…	…	…	0.959 (0.731, 1.257)	0.964 (0.735, 1.266)
4081g & over	…	…	…	…	…	1.362 (0.986, 1.880)	1.375 (0.994, 1.902)
Physical Activity and Sedentary Behaviour Variables							
Physical Activity: Sports							
Never played sports	…	…	…	…	…	…	1.00 (--)
Played sports less than once a week	…	…	…	…	…	…	0.959 (0.712, 1.291)
Played sports 1 to 3 times per week	…	…	…	…	…	…	0.853 (0.711, 1.023)
Played sports 4 or more times per week	…	…	…	…	…	…	**0.759 (0.612, 0.939)**

Table 8 continued.

	Step 1 Odds Ratios (95% CI)	Step 2 Odds Ratios (95% CI)	Step 3 Odds Ratios (95% CI)	Step 4 Odds Ratios (95% CI)	Step 5 Odds Ratios (95% CI)	Step 6 Odds Ratios (95% CI)	Step 7 Odds Ratios (95% CI)
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games							
One	…	…	…	…	…	…	**1.216 (1.012, 1.463)**
Two	…	…	…	…	…	…	1.145 (0.988, 1.327)
Three	…	…	…	…	…	…	**1.217 (1.015, 1.459)**
Four	…	…	…	…	…	…	**1.523 (1.181, 1.965)**
Five	…	…	…	…	…	…	1.208 (0.871, 1.965)
Never	…	…	…	…	…	…	1.00 (--)
Select Model Fit Characteristics							
N	3731	3731	3731	3731	3731	3731	3731
df	3	8	16	24	29	37	45
(-2logL)	4944.344	4908.495	4890.685	4831.425	4798.228	4779.106	4755.087
C-statistic	0.591	0.609	0.618	0.633	0.644	0.649	0.653

Data: 2006 Aboriginal Peoples Survey, Children and Youth public use file.

Notes: Data are weighted using scaled weights. Bolded values are significant at $p < 0.05$. HS = High School. CMA = Census Metropolitan Area. g = grams.

4.3.2 Métis Children

Demographic Variables

As reported in **Table 8**, girls were significantly less likely to be overweight or obese compared to boys after adjusting for the effects of various potential confounders (OR = 0.77, p = 0.0002 in the full model). Children in the age groups of 9 years and older were less likely to be overweight or obese compared to 6 to 8 year olds.

Key Independent Variables

Having a household income of less than $20,000 was significantly associated with an increased risk of overweight or obesity compared to a household income of $20,000 to $39,999 (OR = 1.35, p = 0.0351 in the full model). F&V intake was not significantly associated with BMI status, however children who never ate junk food were less likely to be overweight or obese in a few of the models.

Sociodemographic Variables

Lone parent status was predictive of overweight or obese status among Métis children (OR = 1.42, p = 0.0002 in the full model), as was having six people living in the household (OR = 1.55, p = 0.0282 in the full model), and seven or more people within the household (OR = 1.80, p = 0.0074 in the full model). Living in an "other urban" or "other rural" setting was also associated with an increased likelihood of overweight or obesity for Métis children as compared to living in a CMA.

Socioeconomic Variables

Compared to children whose PMKs had a high school diploma, PMKs who completed less than high school were more likely to have children that were overweight or obese (OR = 1.34, p = 0.0035 in the full model). PMKs with a Bachelor's degree were less likely to have children that were overweight or obese before controlling sedentary behaviour variables (OR = 0.73, p = 0.0235 in Step 6).

Early Life Events Variables

Breastfeeding and birth weight were not significantly associated with BMI.

Physical Activity and Sedentary Behaviour Variables

Children who played sports four or more times per week were significantly less likely to be overweight or obese compared to children who never played sports (OR = 0.76, p = 0.0113). Children who watched TV, played video games or on the computer for one, three, or four hours per day had a higher likelihood of overweight or obesity compared to children who never participated in these sedentary activities.

Summary

It appears that household income is a better predictor of weight status compared to food insecurity. The higher income categories were consistently associated with decreased odds of overweight or obesity, and junk food was the only diet category significantly associated with BMI.

Model Fit Characteristics

The likelihood ratio statistics when comparing models indicate that controlling for additional confounders improves the model fit. The C-statistic value ranged between 0.59 and 0.65; hence the largest model appears to better predict overweight or obesity than the smaller models. However, a C-statistic of 0.65 is still only considered a reasonable value for being able to predict the response variable better than chance.

4.4 Food Insecurity Interaction Models

4.4.1 First Nations Children

Given that food insecurity was not found to be significantly associated with BMI, several interaction terms were tested to see if this variable changed its behaviour under different conditions. Among First Nations children, only the food insecurity and PMK education interaction terms were significant. The parameter estimates, standard errors, and p-values are presented in **Table 9** where the interaction terms were added to the full model (Step 7). Food insecure children with PMKs whose highest education was a university certificate or diploma, and food insecure children with PMKs possessing a Bachelor's degree from a university, were at a significantly higher risk of being overweight or obese.

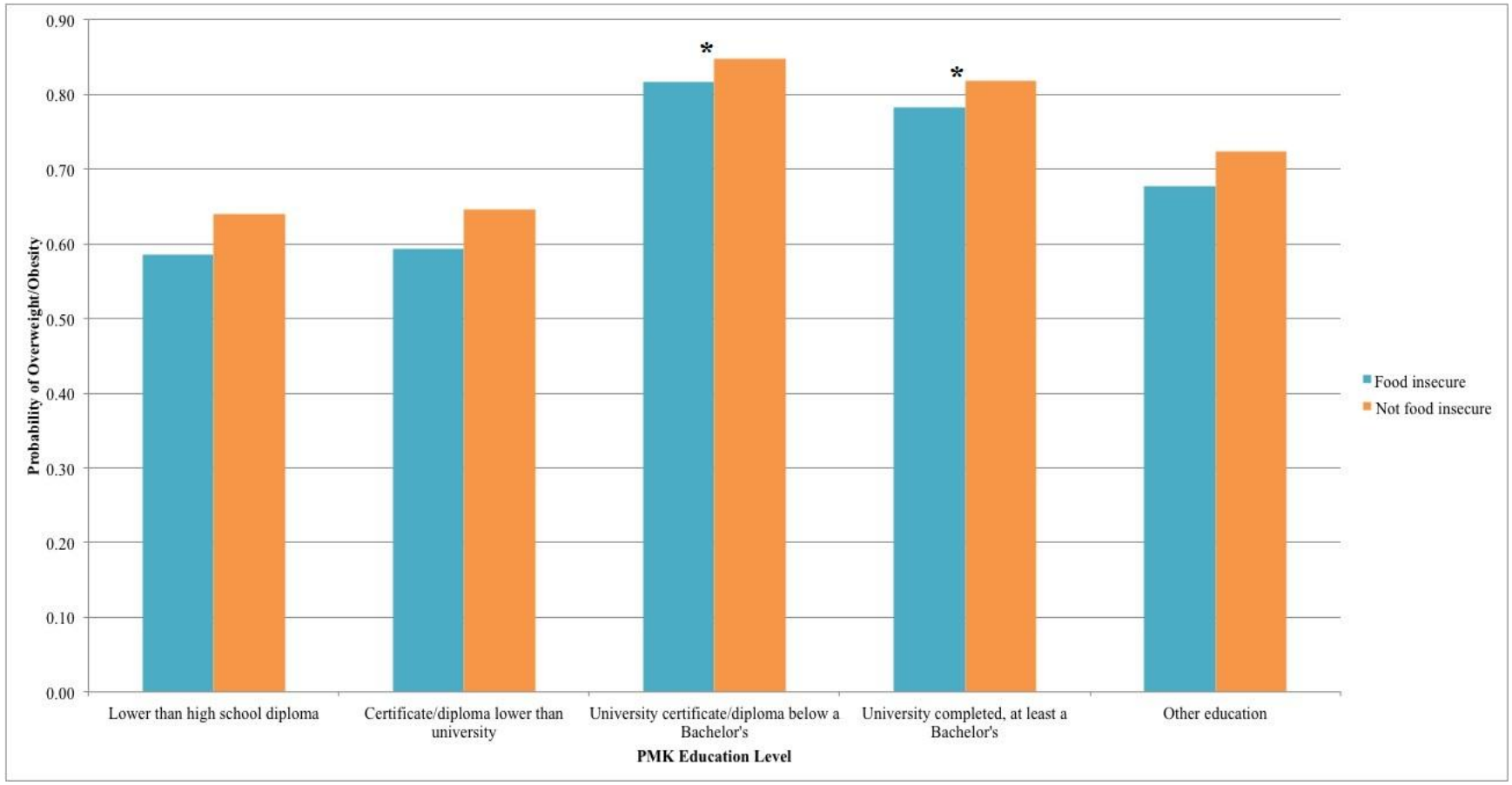
Figure 3 presents the food insecurity by PMK education interaction terms as probabilities which were calculated from the parameter estimates in **Table 9**. According to this graph, children who are food insecure are less likely than not food insecure children to be overweight or obese across all PMK education levels when controlling for demographic, sociodemographic, socioeconomic, early life events, and physical activity and sedentary behaviour variables. The higher PMK education levels are associated with an increased risk of overweight and obesity for First Nations children who are both food insecure and not food insecure as compared to the lower education categories.

Table 9: Logistic Regression Model including Food Insecurity and PMK Education Interaction Term predicting Overweight/Obesity among First Nations Children aged 6 to 14

	β	SE	P-value
Intercept	0.670	0.254	0.0084
Interaction Term: Food Insecurity x PMK education			
Food insecurity*Lower than high school	-0.037	0.260	0.8881
Food insecurity* Certificate/diploma lower than university	0.125	0.282	0.6577
Food insecurity* University certificate/ diploma below a Bachelor's	1.548	0.538	**0.0040**
Food insecurity* University completed, at least a Bachelor's	1.187	0.493	**0.0160**
Food insecurity*Other	0.738	1.338	0.5812
Food insecurity	-0.225	0.183	0.2204
Demographic Variables			
Female	-0.049	0.254	0.4583
Age group 9-11	-0.418	0.081	**<0.0001**
Age group 12-14	-0.991	0.083	**<0.0001**
Diet Variables			
Fruit and Vegetable Intake			
1 or 2 days per week	0.097	0.070	0.1646
3 or 4 days per week	0.054	0.071	0.4449
5 or 6 days per week	-0.079	0.075	0.2933
Everyday	-0.100	0.076	0.1846
Junk Food Intake			
1 or 2 days per week	-0.100	0.081	0.2134
3 or 4 days per week	0.048	0.073	0.5090
5 or 6 days per week	0.263	0.110	**0.0170**
Everyday	-0.057	0.086	0.5053
Sociodemographic Variables			
Lone parent household	-0.1739	0.081	**0.0320**
Number of People Living in the Household			
Three	-0.092	0.146	0.5276
Four	-0.146	0.145	0.3160
Five	-0.116	0.152	0.4455
Six	-0.152	0.166	0.3588
Seven or more	-0.003	0.170	0.9863
Region			
Other urban	0.236	0.074	**0.0015**
Other rural	0.180	0.085	**0.0345**
Socioeconomic Variables			
Household Income			
Less than $20,000	-0.148	0.103	0.1512
$40,000 to $59,999	-0.163	0.097	0.0917
$60,000 to $79,999	-0.248	0.111	**0.0249**
$80,000 to $99,999	-0.605	0.127	**<0.0001**
$100,000 and above	-0.421	0.119	**0.0004**
PMK Education Level			
Lower than high school	-0.061	0.093	0.5172
Certificate/diploma lower than university	-0.193	0.087	**0.0266**
University certificate/ diploma below a Bachelor's	-0.500	0.199	**0.0120**
University completed, at least a Bachelor's	-0.350	0.122	**0.0041**
Other	-0.444	0.366	0.2250
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	-0.129	0.081	0.1103
7 to 12 months	-0.195	0.101	0.0536
More than 13 months	-0.056	0.113	0.6217
Breastfed, but length unknown	-0.090	0.226	0.6892
Unknown	-0.193	0.178	0.2780
Birth weight			
Between 2267 & 3174g	-0.235	0.124	0.0589
Between 3174 & 4081g	-0.061	0.113	0.5878
4081g & over	0.285	0.135	**0.0356**
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	0.474	0.132	**0.0003**
Played sports 1 to 3 times per week	0.058	0.082	0.4787
Played sports 4 or more times per week	0.005	0.097	0.9584
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	-0.067	0.081	0.4070
Two	0.058	0.070	0.4083
Three	0.266	0.084	**0.0016**
Four	0.249	0.108	**0.0219**
Five	0.148	0.129	0.2520

Notes: Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. β = parameter estimate. SE = standard error. g = grams.

Figure 3: Predicted Probability of Overweight/Obesity including Food Insecurity and PMK Education Interaction Terms among First Nations Children aged 6 to 14



Notes: Predicted probabilities were calculated from the parameter estimates in Table 9. PMK education categories and reference categories were made equal to zero. This graph displays the probability of overweight/obesity when controlling for demographic, sociodemographic, socioeconomic, early life events, and physical activity and sedentary behaviour variables.
* denotes significance at $p < 0.05$

4.4.2 Métis Children

Food insecurity and PMK education, as well as food insecurity and number of people living in the household, were both significant interaction terms. More specifically, PMKs with a certificate or diploma lower than university with food insecure children were more likely to be overweight or obese when controlling for demographic, sociodemographic, socioeconomic, and early life events variables, but not in the full model as displayed in **Table 10**. Interestingly, food insecurity was significant with the PMK education-food insecurity interaction terms present in Steps 5 through 7, and demonstrated a negative relationship with overweight/obesity.

Figure 4 displays the probability of overweight or obesity as calculated from the parameter estimate values in **Table 10**. Children whose PMKs had completed a university certificate/diploma or a Bachelor's degree were at a decreased risk of overweight or obesity compared to children whose PMKs only finished high school. Children with PMKs who had less than a high school education were at the highest risk of overweight/obesity.

As summarized in **Table 11**, children who were food insecure and came from households with six members were more likely to be overweight and obese. **Figure 5** shows the predicted probability of overweight or obesity as calculated from the parameter estimates in **Table 11**. Household crowding appears to affect child weight status, as children from households with six or more people are significantly more likely to be overweight or obese. Having seven or more members increases the risk or overweight/obesity, but not as substantially as having six members. Not food insecure children continue to demonstrate a higher risk of overweight/obesity than food insecure children.

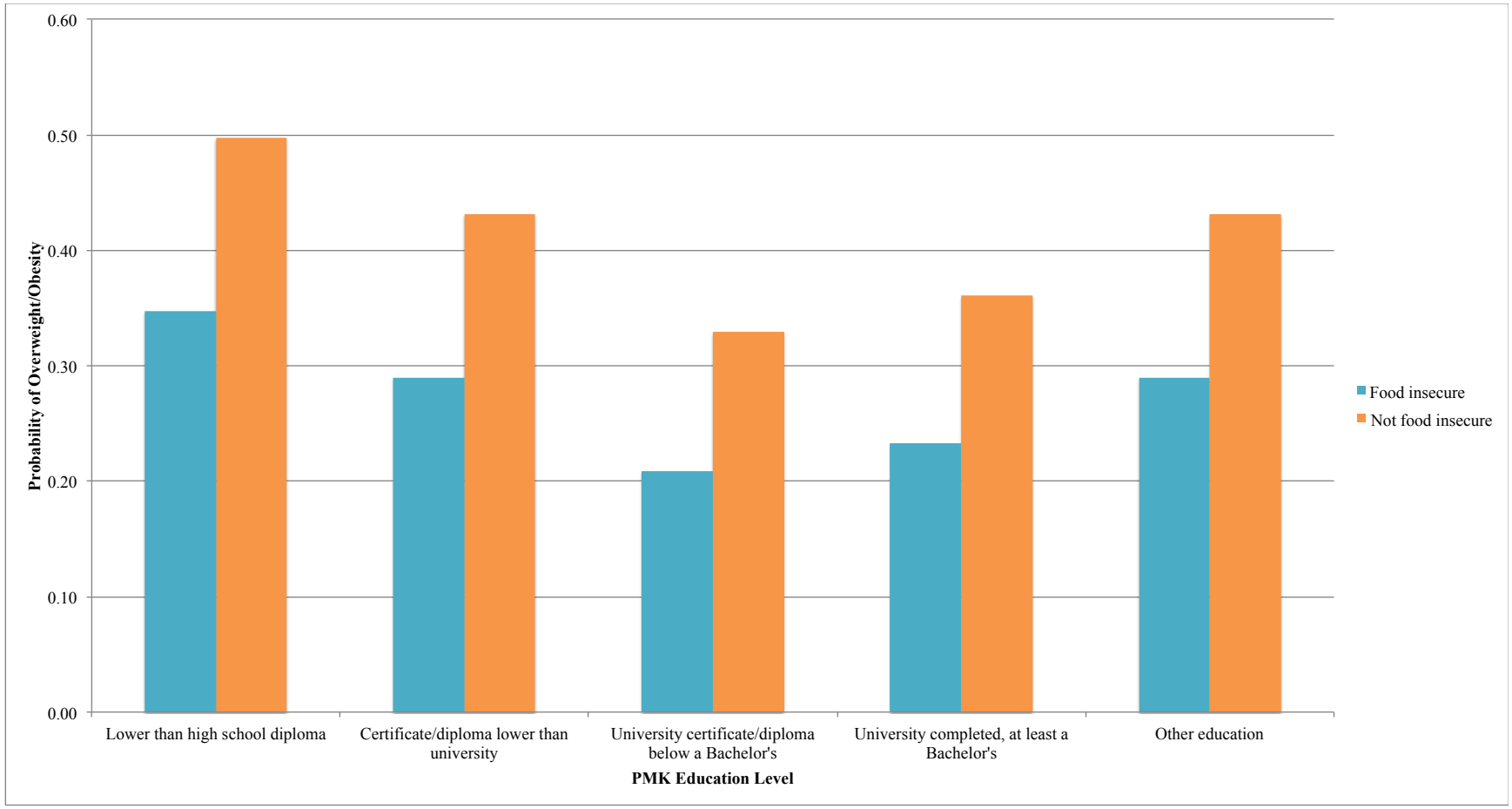
Table 10: Logistic Regression Model including Food Insecurity and PMK Education Interaction Terms predicting Overweight/Obesity among Métis Children aged 6 to 14

	β	SE	P-value
Intercept	-0.275	0.307	0.3703
Interaction Term: Food Insecurity x PMK education			
Food insecurity*Lower than high school	0.625	0.387	0.1063
Food insecurity*Certificate or diploma lower than university	0.762	0.387	**0.0490**
Food insecurity*University certificate or diploma below a Bachelor's	1.904	1.046	0.0689
Food insecurity*University completed, at least a Bachelor's	0.675	0.600	0.2609
Food insecurity*Other	10.987	223.8	0.9608
Food insecurity	-0.620	0.295	**0.0357**
Demographic Variables			
Female	-0.256	0.071	**0.0003**
Age group 9-11	-0.299	0.087	**0.0006**
Age group 12-14	-0.902	0.091	**<.0001**
Diet Variables			
Fruit and Vegetable Intake			
Never	0.095	0.080	0.2316
1 or 2 days per week	-0.136	0.078	0.0819
3 or 4 days per week	-0.078	0.079	0.3273
5 or 6 days per week	-0.033	0.083	0.6933
Junk Food Intake			
Never	-0.147	0.098	0.1345
1 or 2 days per week	-0.046	0.087	0.5968
3 or 4 days per week	0.073	0.084	0.3798
5 or 6 days per week	-0.050	0.120	0.6757
Sociodemographic Variables			
Lone parent household	0.362	0.095	**0.0001**
Number of People Living in the Household			
Three	0.053	0.176	0.7627
Four	0.228	0.174	0.1891
Five	0.207	0.181	0.2533
Six	0.452	0.201	**0.0246**
Seven or more	0.607	0.220	**0.0058**
Region			
Other urban	0.269	0.084	**0.0014**
Other rural	0.419	0.086	**<.0001**

	β	SE	P-value
Socioeconomic Variables			
Household Income			
Less than $20,000	0.297	0.142	**0.0356**
$40,000 to $59,999	-0.033	0.112	0.7701
$60,000 to $79,999	-0.156	0.119	0.1913
$80,000 to $99,999	-0.171	0.128	0.1819
$100,000 and above	-0.079	0.121	0.5131
PMK Education Level			
Lower than high school	0.265	0.106	**0.0127**
Certificate or diploma lower than university	-0.115	0.087	0.1896
University certificate or diploma below a Bachelor's	-0.435	0.213	**0.0415**
University completed, at least a Bachelor's	-0.295	0.139	**0.0344**
Other	0.570	0.378	0.1316
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	0.098	0.086	0.2560
7 to 12 months	-0.175	0.108	0.1029
More than 13 months	-0.180	0.141	0.2008
Breastfed, but length unknown	0.054	0.251	0.8294
Unknown	-0.038	0.299	0.9000
Birth weight			
Between 2267 & 3174g	0.020	0.149	0.8960
Between 3174 & 4081g	-0.039	0.139	0.7815
4081g and over	0.316	0.166	0.0563
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	-0.048	0.152	0.7541
Played sports 1 to 3 times per week	-0.159	0.093	0.0876
Played sports 4 or more times per week	-0.271	0.109	**0.0132**
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	0.197	0.095	**0.0374**
Two	0.139	0.075	0.0646
Three	0.195	0.093	**0.0351**
Four	0.428	0.130	**0.0010**
Five	0.180	0.167	0.2815

Notes: Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. β = parameter estimate. SE = standard error. g = grams.

Figure 4: Predicted Probability of Overweight/Obesity including Food Insecurity and PMK Education Interaction Terms among Métis Children aged 6 to 14



Notes: Predicted probabilities were calculated from the parameter estimates in Table 10. All non-significant interaction terms, PMK education categories, and reference categories were made equal to zero. This graph displays the probability of overweight/obesity when controlling for demographic, sociodemographic, socioeconomic, early life events, and physical activity and sedentary behaviour variables.

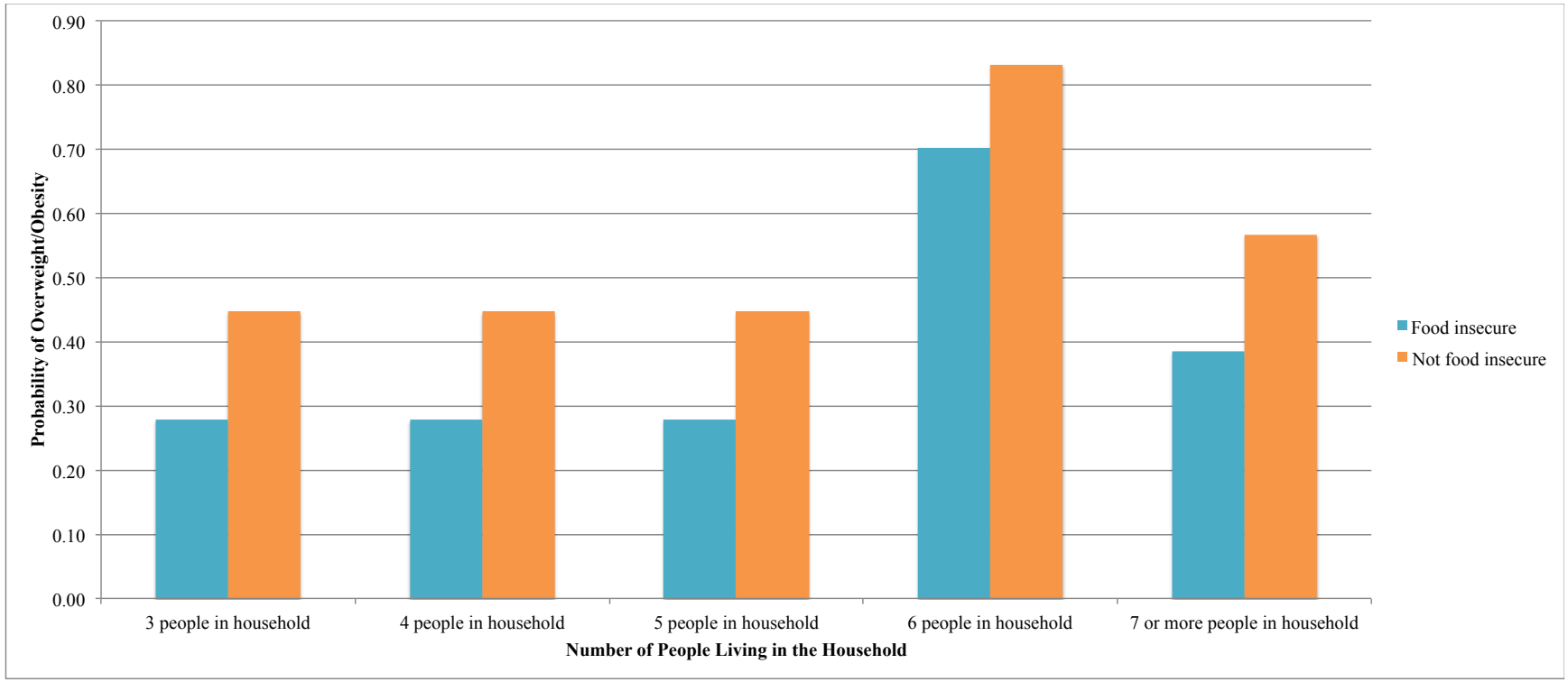
Table 11: Logistic Regression Model including Food Insecurity and Number of People in Household Interaction Terms predicting Overweight/Obesity among Métis Children aged 6 to 14

	β	SE	P-value
Intercept	-0.213	0.311	0.4940
Interaction Term: Food Insecurity x Number of People Living in the Household			
Food insecurity*3 people	0.496	0.722	0.4920
Food insecurity*4 people	0.720	0.675	0.2860
Food insecurity*5 people	0.123	0.685	0.8572
Food insecurity*6 people	1.812	0.780	**0.0202**
Food insecurity*7 or more people	1.375	0.776	0.0763
Food insecurity	-0.739	0.624	0.2360
Demographic Variables			
Female	-0.262	0.071	**0.0002**
Age group 9-11	-0.304	0.087	**0.0005**
Age group 12-14	-0.908	0.091	**<.0001**
Diet Variables			
Fruit and Vegetable Intake			
Never	0.091	0.080	0.2532
1 or 2 days per week	-0.140	0.078	0.0724
3 or 4 days per week	-0.075	0.079	0.3425
5 or 6 days per week	-0.029	0.083	0.7230
Junk Food Intake			
Never	-0.159	0.098	0.1060
1 or 2 days per week	-0.046	0.087	0.5991
3 or 4 days per week	0.077	0.084	0.3593
5 or 6 days per week	-0.058	0.120	0.6268
Sociodemographic Variables			
Lone parent household	0.371	0.095	**0.0001**
Number of People Living in the Household			
Three	0.012	0.181	0.9486
Four	0.190	0.179	0.2889
Five	0.204	0.187	0.2750
Six	0.335	0.207	0.1058
Seven or more	0.483	0.229	**0.0349**
Region			
Other urban	0.264	0.084	**0.0017**
Other rural	0.421	0.086	**<.0001**

	β	SE	P-value
Socioeconomic Variables			
Household Income			
Less than $20,000	0.300	0.142	**0.0353**
$40,000 to $59,999	-0.032	0.112	0.7746
$60,000 to $79,999	-0.163	0.119	0.1725
$80,000 to $99,999	-0.175	0.128	0.1738
$100,000 and above	-0.081	0.121	0.5056
PMK Education Level			
Lower than high school	0.299	0.102	**0.0033**
Certificate or diploma lower than university	-0.078	0.085	0.3616
University certificate or diploma below a Bachelor's	-0.366	0.209	**0.0800**
University completed, at least a Bachelor's	-0.273	0.136	**0.0443**
Other	0.646	0.373	0.0834
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	0.099	0.086	0.2503
7 to 12 months	-0.173	0.108	0.1070
More than 13 months	-0.167	0.142	0.2385
Breastfed, but length unknown	0.056	0.251	0.8241
Unknown	-0.128	0.301	0.6712
Birth weight			
Between 2267 & 3174g	0.002	0.149	0.9876
Between 3174 & 4081g	-0.049	0.139	0.7243
4081g & over	0.307	0.166	0.0640
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	-0.042	0.152	0.7841
Played sports 1 to 3 times per week	-0.170	0.093	0.0675
Played sports 4 or more times per week	-0.288	0.110	**0.0087**
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	0.183	0.095	0.0537
Two	0.134	0.076	0.0761
Three	0.190	0.093	**0.0413**
Four	0.441	0.130	**0.0007**
Five	0.167	0.168	0.3206

Notes: Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. β = parameter estimate. SE = standard error. g = grams.

Figure 5: Predicted Probability of Overweight/Obesity including Food Insecurity and Number of People in Household Interaction Terms among Métis Children aged 6 to 14



Notes: Predicted probabilities were calculated from the parameter estimates in Table 11. All non-significant interaction terms, PMK education categories, and reference categories were made equal to zero. This graph displays the probability of overweight/obesity when controlling for demographic, sociodemographic, socioeconomic, early life events, and physical activity and sedentary behaviour variables.

4.5 Proportional Odds Models

Analyses using the POM were conducted to see if the association between food insecurity and BMI status changed when the response was three categories instead of two.

4.5.1 First Nations Children

Food insecurity remained insignificant in the POM analysis. F&V intake remained insignificant in the full model, and junk food consumption four or five days per week was associated with a slight increase in risk of overweight or obesity, similar to the BLR.

Interestingly, different interaction terms were significant in the POM analysis. Results from the analysis using interaction terms are displayed in **Tables 12** and **13**. The two food insecurity and PMK education level interaction terms from the BLR procedure remained significant. The food insecurity by age interaction term became significant within the POM analyses. In particular, children who were food insecure and between the ages of 12 and 14 were less likely to be overweight or obese ($p = 0.0435$).

Table 12: Proportional Odds Model predicting Obesity among First Nations children aged 6 to 14 using Food Insecurity and PMK Education Interaction Terms

	β	SE	P-value
Intercept 2	-0.441	0.240	0.0669
Intercept 1	0.776	0.241	0.0013
Interaction Term: Food Insecurity x PMK education			
Food insecurity*Lower than high school	-0.097	0.247	0.6931
Food insecurity*Certificate or diploma lower than university	0.051	0.269	0.8508
Food insecurity*University certificate or diploma below a Bachelor's	1.604	0.480	**0.0008**
Food insecurity*University completed, at least a Bachelor's	1.166	0.445	**0.0087**
Food insecurity*Other	1.224	1.234	0.3211
Food insecurity	-0.152	0.174	0.3816
Demographic Variables			
Female	-0.079	0.062	0.2050
Age group 9-11	-0.607	0.075	**<.0001**
Age group 12-14	-1.200	0.079	**<.0001**
Diet Variables			
Fruit and Vegetable Intake			
1 or 2 days per week	0.103	0.067	0.1208
3 or 4 days per week	0.051	0.067	0.4526
5 or 6 days per week	-0.056	0.071	0.4290
Everyday	-0.023	0.072	0.7493
Junk Food Intake			
1 or 2 days per week	-0.101	0.077	0.1856
3 or 4 days per week	0.056	0.069	0.4183
5 or 6 days per week	0.203	0.104	0.0504
Everyday	-0.080	0.082	0.3254
Sociodemographic Variables			
Lone parent household	-0.083	0.077	0.2812
Number of People Living in the Household			
Three	-0.093	0.138	0.5014
Four	-0.082	0.137	0.5485
Five	-0.089	0.144	0.5356
Six	-0.114	0.157	0.4670
Seven or more	0.070	0.160	0.6638
Region			
Other urban	0.216	0.071	**0.0022**
Other rural	0.211	0.081	**0.0088**
Socioeconomic Variables			
Household Income			
Less than $20,000	-0.133	0.097	0.1710
$40,000 to $59,999	-0.144	0.091	0.1143
$60,000 to $79,999	-0.225	0.105	**0.0310**
$80,000 to $99,999	-0.609	0.123	**<.0001**
$100,000 and above	-0.368	0.113	**0.0011**

	β	SE	P-value
PMK Education Level			
Lower than high school	-0.018	0.088	0.8382
Certificate or diploma lower than university	-0.127	0.083	0.1255
University certificate or diploma below a Bachelor's	-0.437	0.193	**0.0234**
University completed, at least a Bachelor's	-0.318	0.118	**0.0070**
Other	-0.448	0.357	0.2098
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	-0.127	0.077	0.0983
7 to 12 months	-0.178	0.096	0.0642
More than 13 months	-0.094	0.107	0.3815
Breastfed, but length unknown	-0.137	0.216	0.5267
Unknown	-0.256	0.170	0.1314
Birth weight			
Between 2267 & 3174g	-0.249	0.118	**0.0342**
Between 3174 & 4081g	-0.116	0.106	0.2746
4081g & over	0.184	0.127	0.1482
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	0.459	0.122	**0.0002**
Played sports 1 to 3 times per week	0.062	0.078	0.4275
Played sports 4 or more times per week	0.008	0.093	0.9352
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	-0.140	0.076	0.0673
Two	0.035	0.067	0.6007
Three	0.235	0.080	**0.0032**
Four	0.237	0.102	**0.0203**
Five	0.264	0.121	**0.0285**

Note: β = parameter estimate. SE = standard error. g = grams. Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. The dependent variable included three levels: obese, obese or overweight, and obese or overweight or normal/underweight.

Table 13: Proportional Odds Model predicting Obesity among First Nations children aged 6 to 14 using Food Insecurity and Age Interaction Terms

	β	SE	P-value
Intercept 2	-0.453	0.240	0.0594
Intercept 1	0.761	0.240	0.0015
Interaction Term: Food Insecurity x PMK education			
Food insecurity*9 to 11 years old	0.098	0.248	0.6917
Food insecurity*12 to 14 years old	-0.492	0.244	**0.0435**
Food insecurity	0.134	0.178	0.4513
Demographic Variables			
Female	-0.083	0.062	0.1802
Age group 9-11	-0.619	0.079	**<.0001**
Age group 12-14	-1.145	0.083	**<.0001**
Diet Variables			
Fruit and Vegetable Intake			
1 or 2 days per week	0.107	0.066	0.1087
3 or 4 days per week	0.055	0.067	0.4168
5 or 6 days per week	-0.069	0.071	0.3315
Everyday	-0.029	0.072	0.6833
Junk Food Intake			
1 or 2 days per week	-0.098	0.076	0.2012
3 or 4 days per week	0.064	0.069	0.3577
5 or 6 days per week	0.202	0.104	0.0513
Everyday	-0.079	0.082	0.3360
Sociodemographic Variables			
Lone parent household	-0.084	0.077	0.2715
Number of People Living in the Household			
Three	-0.082	0.138	0.5519
Four	-0.063	0.137	0.6450
Five	-0.067	0.144	0.6436
Six	-0.093	0.157	0.5539
Seven or more	0.094	0.160	0.5548
Region			
Other urban	0.217	0.070	**0.0021**
Other rural	0.210	0.081	**0.0093**
Socioeconomic Variables			
Household Income			
Less than $20,000	-0.138	0.097	0.1572
$40,000 to $59,999	-0.153	0.091	0.0921
$60,000 to $79,999	-0.236	0.104	**0.0239**
$80,000 to $99,999	-0.612	0.123	**<.0001**
$100,000 and above	-0.385	0.113	**0.0006**
PMK Education Level			
Lower than high school	-0.054	0.083	0.5142
Certificate or diploma lower than university	-0.125	0.079	0.1135
University certificate or diploma below a Bachelor's	-0.205	0.173	0.2355
University completed, at least a Bachelor's	-0.246	0.113	**0.0299**
Other	-0.365	0.335	0.2752
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	-0.127	0.077	0.0982
7 to 12 months	-0.178	0.096	0.0628
More than 13 months	-0.106	0.107	0.3221
Breastfed, but length unknown	-0.132	0.216	0.5408
Unknown	-0.267	0.169	0.1146
Birth weight			
Between 2267 & 3174g	-0.277	0.117	**0.0184**
Between 3174 & 4081g	-0.127	0.106	0.2310
4081g & over	0.158	0.127	0.2131
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	0.475	0.122	**<.0001**
Played sports 1 to 3 times per week	0.060	0.078	0.4388
Played sports 4 or more times per week	0.009	0.093	0.9218
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	-0.140	0.076	0.0672
Two	0.031	0.067	0.6428
Three	0.238	0.080	**0.0029**
Four	0.237	0.102	**0.0206**
Five	0.251	0.120	**0.0373**

Note: β = parameter estimate. SE = standard error. g = grams. Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. The dependent variable included three levels: obese, obese or overweight, and obese or overweight or normal/underweight.

4.5.2 Métis Children

Among Métis children, the POM analyses produced results comparable to the BLR. Neither F&V nor junk food intake were significant in the full model. The same food insecurity by PMK education level and number of people living in the household interaction terms from the BLR were significant in the POM analyses.

Results using the food insecurity interaction terms are summarized in **Tables 14** and **15**. PMKs with a certificate/diploma lower than university with food insecure children were only more likely to be overweight or obese when controlling for demographic, sociodemographic, socioeconomic, and early life events variables, not in the full model. Food insecurity, which was significant in the PMK education interaction model in the BLR procedure, was not significantly associated with children's weight status using POM. Children who were food insecure and had six members in the household also demonstrated a significantly higher risk of overweight and obesity using the POM procedure.

Table 14: Proportional Odds Model predicting Obesity among Métis children aged 6 to 14 using Food Insecurity and PMK Education Interaction Terms

	β	SE	P-value
Intercept 2	-1.339	0.293	<.0001
Intercept 1	0.008	0.292	0.9770
Interaction Term: Food Insecurity x PMK education			
Food insecurity*Lower than high school	0.300	0.367	0.4135
Food insecurity* Certificate or diploma lower than university	0.722	0.370	0.0509
Food insecurity *University certificate or diploma below a Bachelor's	1.786	0.997	0.0733
Food insecurity* University completed, at least a Bachelor's	0.502	0.589	0.3940
Food insecurity*Other	1.337	1.813	0.4608
Food insecurity	-0.498	0.285	0.0804
Demographic Variables			
Female	-0.263	0.068	**0.0001**
Age group 9-11	-0.439	0.081	**<.0001**
Age group 12-14	-1.091	0.087	**<.0001**
Diet Variables			
Fruit and Vegetable Intake			
Never	0.109	0.076	0.1504
1 or 2 days per week	-0.101	0.074	0.1740
3 or 4 days per week	-0.044	0.075	0.5566
5 or 6 days per week	-0.011	0.079	0.8916
Junk Food Intake			
Never	-0.152	0.094	0.1051
1 or 2 days per week	-0.114	0.082	0.1662
3 or 4 days per week	0.056	0.079	0.4795
5 or 6 days per week	-0.021	0.114	0.8516
Sociodemographic Variables			
Lone parent household	0.329	0.090	**0.0002**
Number of People Living in the Household			
Three	-0.047	0.166	0.7772
Four	0.094	0.163	0.5644
Five	0.125	0.170	0.4635
Six	0.218	0.190	0.2497
Seven or more	0.484	0.206	**0.0186**
Region			
Other urban	0.270	0.080	**0.0008**
Other rural	0.390	0.082	**<.0001**
Socioeconomic Variables			
Household Income			
Less than $20,000	0.224	0.131	0.0885
$40,000 to $59,999	-0.053	0.106	0.6172
$60,000 to $79,999	-0.239	0.114	**0.0353**
$80,000 to $99,999	-0.187	0.122	0.1275
$100,000 and above	-0.136	0.116	0.2397
PMK Education Level			
Lower than high school	0.348	0.099	**0.0005**
Certificate or diploma lower than university	-0.042	0.084	0.6198
University certificate or diploma below a Bachelor's	-0.401	0.208	0.0543
University completed, at least a Bachelor's	-0.296	0.136	0.0293
Other	0.548	0.348	0.1156
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	0.037	0.082	0.6530
7 to 12 months	-0.196	0.103	0.0572
More than 13 months	-0.225	0.135	0.0955
Breastfed, but length unknown	0.130	0.236	0.5814
Unknown	-0.111	0.289	0.7021
Birth weight			
Between 2267 & 3174g	-0.004	0.142	0.9748
Between 3174 & 4081g	-0.005	0.132	0.9703
4081g & over	0.306	0.157	0.0509
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	-0.072	0.143	0.6173
Played sports 1 to 3 times per week	-0.175	0.088	**0.0458**
Played sports 4 or more times per week	-0.331	0.104	**0.0015**
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	0.192	0.090	**0.0327**
Two	0.181	0.072	**0.0120**
Three	0.221	0.088	**0.0120**
Four	0.385	0.122	**0.0016**
Five	0.249	0.157	0.1135

Note: β = parameter estimate. SE = standard error. g = grams. Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. The dependent variable included three levels: obese, obese or overweight, and obese or overweight or normal/underweight.

Table 15: Proportional Odds Model predicting Obesity among Métis children aged 6 to 14 using Food Insecurity and Number of People in Household Interaction Terms

	β	SE	P-value
Intercept 2	-1.275	0.296	<.0001
Intercept 1	0.074	0.295	0.8011
Interaction Term: Food Insecurity x Number of People Living in the Household			
Food insecurity*3 people	0.687	0.703	0.3286
Food insecurity*4 people	0.961	0.658	0.1443
Food insecurity*5 people	0.206	0.670	0.7591
Food insecurity*6 people	1.504	0.738	**0.0416**
Food insecurity*7 or more people	0.881	0.740	0.2337
Food insecurity	-0.826	0.613	0.1775
Demographic Variables			
Female	-0.269	0.068	**<.0001**
Age group 9-11	-0.444	0.081	**<.0001**
Age group 12-14	-1.092	0.087	**<.0001**
Diet Variables			
Fruit and Vegetable Intake			
Never	0.107	0.076	0.1582
1 or 2 days per week	-0.107	0.074	0.1474
3 or 4 days per week	-0.041	0.076	0.5863
5 or 6 days per week	-0.007	0.079	0.9311
Junk Food Intake			
Never	-0.167	0.094	0.0755
1 or 2 days per week	-0.116	0.082	0.1573
3 or 4 days per week	0.054	0.079	0.4983
5 or 6 days per week	-0.026	0.114	0.8177
Sociodemographic Variables			
Lone parent household	0.332	0.090	**0.0002**
Number of People Living in the Household			
Three	-0.092	0.171	0.5898
Four	0.048	0.168	0.7752
Five	0.121	0.175	0.4917
Six	0.120	0.195	0.5377
Seven or more	0.412	0.214	0.0541
Region			
Other urban	0.262	0.080	**0.0011**
Other rural	0.391	0.082	**<.0001**
Socioeconomic Variables			
Household Income			
Less than $20,000	0.229	0.132	0.0831
$40,000 to $59,999	-0.050	0.106	0.6382
$60,000 to $79,999	-0.244	0.114	**0.0322**
$80,000 to $99,999	-0.190	0.122	0.1215
$100,000 and above	-0.140	0.116	0.225
PMK Education Level			
Lower than high school	0.354	0.095	**0.0002**
Certificate or diploma lower than university	-0.008	0.082	0.9206
University certificate or diploma below a Bachelor's	-0.339	0.204	0.0961
University completed, at least a Bachelor's	-0.280	0.133	**0.0347**
Other	0.604	0.340	0.0757
Early Life Events Variables			
Length of Time Breastfed			
6 months or less	0.034	0.082	0.6808
7 to 12 months	-0.196	0.103	0.0573
More than 13 months	-0.213	0.135	0.1156
Breastfed, but length unknown	0.130	0.236	0.5825
Unknown	-0.196	0.290	0.5004
Birth weight			
Between 2267 & 3174g	-0.017	0.142	0.9022
Between 3174 & 4081g	-0.014	0.132	0.9171
4081g & over	0.300	0.157	0.0552
Physical Activity and Sedentary Behaviour Variables			
Physical Activity: Sports			
Played sports less than once a week	-0.066	0.143	0.6478
Played sports 1 to 3 times per week	-0.184	0.088	**0.0358**
Played sports 4 or more times per week	-0.341	0.104	**0.0011**
Sedentary Behaviour: Number of Hours Watching TV, Playing on the Computer, or Playing Video Games			
One	0.184	0.090	**0.0409**
Two	0.177	0.072	**0.0142**
Three	0.213	0.088	**0.0158**
Four	0.395	0.122	**0.0012**
Five	0.244	0.158	0.1220

Note: β = parameter estimate. SE = standard error. g = grams. Significant variables ($p < 0.05$) are bolded. Reference categories for each variable have been omitted from this table. The dependent variable included three levels: obese, obese or overweight, and obese or overweight or normal/underweight.

4.6 Model Diagnostics

Model diagnostics were performed to ensure that the underlying assumptions of the BLR and POM procedures were met. Residual plots and Cook's distance were assessed. While there were several outliers identified by Cook's distance, the influence plots indicated that these cases did not appear to have a major effect on the model fit, hence they were retained in the model.

Chapter 5: Focus Group Results

5.1 Overview

The following section covers the results of the qualitative component of this study. The focus group discussions explored families' lived experiences of food insecurity and the coping strategies that were employed when there was not enough food or money for food. Caregivers also outlined numerous barriers and facilitators to healthy eating for Métis and First Nations children within their communities.

5.2 Participant Profile

A total of 32 parents and caregivers participated in four focus group discussions. Twenty-three caregivers of Métis children from Midland-Penetanguishene and nine caregivers of First Nations children from London took part in the focus groups. Service providers also took part in the focus group discussions in Midland-Penetanguishene. **Tables 16** and **17** display the participant profiles and demographic characteristics for Midland-Penetanguishene and London, respectively.

Table 16: Midland-Penetanguishene Participant Profiles and Demographic Characteristics

	Number	Percent
Male	5	22%
Female	18	78%
Total participants	*23*	100%
Years in the community		
Less than 1	2	9%
1 to 5	2	9%
6 to 10	2	9%
11 to 20	2	9%
20 to 25	2	9%
30 to 34	6	26%
35 to 39	2	9%
40 +	5	22%
Total Participants	*23*	100%

	Number	Percent
Number of children in the household		
One	6	30%
Two	5	25%
Three	3	15%
None/no response	6	30%
Total Households	*20*	100%
Ages of children in the household		
1 to four	5	19%
Five to 9	3	12%
10 to 13	5	19%
14 to 16	7	27%
17 to 23	6	23%
Total children	*26*	100%

Note: The 25 to 30 year category for total number of years in the community is missing.

Table 17: London Participant Profiles and Demographic Characteristics

	Number	Percent
Male	1	11%
Female	8	89%
Total participants	9	100%
Years in the community		
Less than 1	0	0%
1 to 5	2	22%
6 to 10	1	11%
11 to 19	1	11%
20 to 25	1	11%
30 to 34	2	22%
35 to 39	0	0%
40 +	1	11%
Total Participants	8*	100%*
Children at Home		
Yes	7	78%
No	2	22%
Total Households	8	100%

Notes: The background questionnaire in London was slightly revised by SOAHAC, hence does not include questions about number of children living in the household. Only a few participants answered the question about children's ages, hence this question was omitted in the table as well. The 25 to 30 year category for total number of years in the community is missing.
*One participant was living on reserve just outside of London.

5.3 Focus Group Themes

A total of six different topics were discussed in the focus groups, including: the health of children in the community, diet and nutrition, physical activity, neighbourhoods, families, and programs and solutions. Upon reviewing the focus group transcripts, 14 overarching themes were identified and are outlined in the Coding Manual (**Appendix K**). Several of the focus group themes covered in this section reflect topics from the Interview Guide, however not all of these topics will be discussed here. The themes of particular relevance to this study were: healthy child attributes, family practices, health concerns for children in the community, children's diet quality, barriers to healthy eating, facilitators to healthy eating, community programming, and coping strategies. The following sections explore the key themes and their sub-themes in greater detail.

5.3.1 Healthy Child Attributes

The focus group discussions were opened by asking caregivers what attributes they considered indicative of a healthy child. The majority of respondents felt that being physically active or energetic were characteristics important to children's health. In addition, having a good appetite, eating "healthy" foods, having a rosy complexion, and being happy and mentally healthy were other indicators of good health. Some caregivers also mentioned self confidence, communication skills, and a proportional weight for height to be important features. Most caregivers agreed that a healthy child must have a combination of these characteristics to be considered healthy. A caregiver from London explained the importance of balance to a child's health:

> *I think everything, like the physical, mental, emotional, and spiritual should all be in balance and when it's in balance, they're healthy. But if they're not physical, then that circle kind of goes like an egg and then they're not in balance. Or if you're missing your spirituality. Everything is important equally*.

When asked to distinguish between a healthy Métis or First Nations child and non-Aboriginal child, almost all caregivers felt that there was no difference between the two. A few caregivers mentioned

that a greater appreciation of their culture, increased independence, and less shyness would be characteristics of a healthy Aboriginal child in particular. A caregiver of a First Nations child stated:

> *... I found that when I worked with the children in London, even [...] if [children] grew up in the city, they had very little identity of who they really were as Native people.*

A caregiver from Midland-Penetanguishene similarly touched on the importance of a child acknowledging their cultural identity:

> *...Not feeling any shame, not, not having any, you know, not being ashamed of who they are. And understanding what Métis is all about. That the child is special.*

Caregivers described a healthy child as possessing a range of positive mental and physical characteristics. In addition to these attributes, the majority of caregivers believed that a strong affiliation with an Aboriginal identity was a key distinguishing factor between healthy Aboriginal and non-Aboriginal children.

5.3.2 Family Practices

Family practices were an overarching theme that was discussed in various contexts throughout the focus groups. Caregivers often contrasted current family practices with their own experiences while growing up. The traditional family practices described in these sessions included behaviours and customs around food preparation and consumption, as well as caregivers' attitudes towards parenting. Some of the traditional practices mentioned were eating and preparing meals together as a family, harvesting or gardening food, hunting, and parents instilling cultural pride in their children. One First Nations parent described hunting and sharing food as a family custom:

> *I used to see it all the time. Like when my family would go out hunting, we would go and give all the Elders their meat and then it would be divided up into the family after that. I don't see that. I see more people trying to sell their meat to the Elders than just give it away. I used to see it all the time. My grandpa would just go out and he'd get a couple deer and he'd just divide up the meat between his grandparents and all that and all the older people and then he divided amongst his family, and if there was anything left, it'd be for him. If not, he'd go out and get one for his family.*

A Métis caregiver also discussed the importance of harvesting for imparting an appreciation for food among children:

[Children were] involved in harvesting, […] from the beginning to the end with, you know, you need time to do gardening in spring. It's time to turn the garden, it's time to put everything together. It's not only family time but you appreciate where it comes from much more.

Current family practices were believed to have moved towards a faster paced lifestyle that resulted in families no longer eating or preparing meals together. Several caregivers from Midland-Penetanguishene felt that eating in front of the television instead of at the dining table reflected a shift in family values:

***Caregiver A**: People might just throw their tables away because they all eat in front of the television.*

***Caregiver B**: Or in front of Xbox.*

***Caregiver A**: You're thinking about going and watching TV or playing a game or something like that. Whereas the fact that it was something that you look forward to, to sit down and eat all together as one, right?*

The shift in family values was also apparent in the lack of communication between children and their parents. Communication issues were identified by caregivers in London as stemming from a history of colonization and residential schooling in Canada:

I think it goes way back, too, from a long time ago when the parents were brought up to not talk and stuff, so that's how they raised their kids and the residential schools and all that, when the parents or grandparents were near, and they don't say much or nothing so that's how they are with their kids. So their kids are going to learn from them.

Caregivers also discussed how Aboriginal peoples' history of being discriminated against has led to children growing up ashamed of their First Nations or Métis heritage. Caregivers or their elders were brought up during a time where having Aboriginal ancestry meant being treated differently from other Canadians. This shame was described as being passed down by the elder generation to children even though the current cultural and social landscape has changed in many ways. Caregivers from Midland-Penetanguishene commented:

***Caregiver A**: I know my Auntie, until today, until this day, she says, don't ever tell anybody that you're Indian, or part Indian, you know, don't tell anybody. But that's still her mindset today.*

***Caregiver B**: That is a lot of peoples.*

***Caregiver C**: They had it pounded into them, that's why.*

Caregiver D: *They were discriminated if they did admit it back then. Right?*

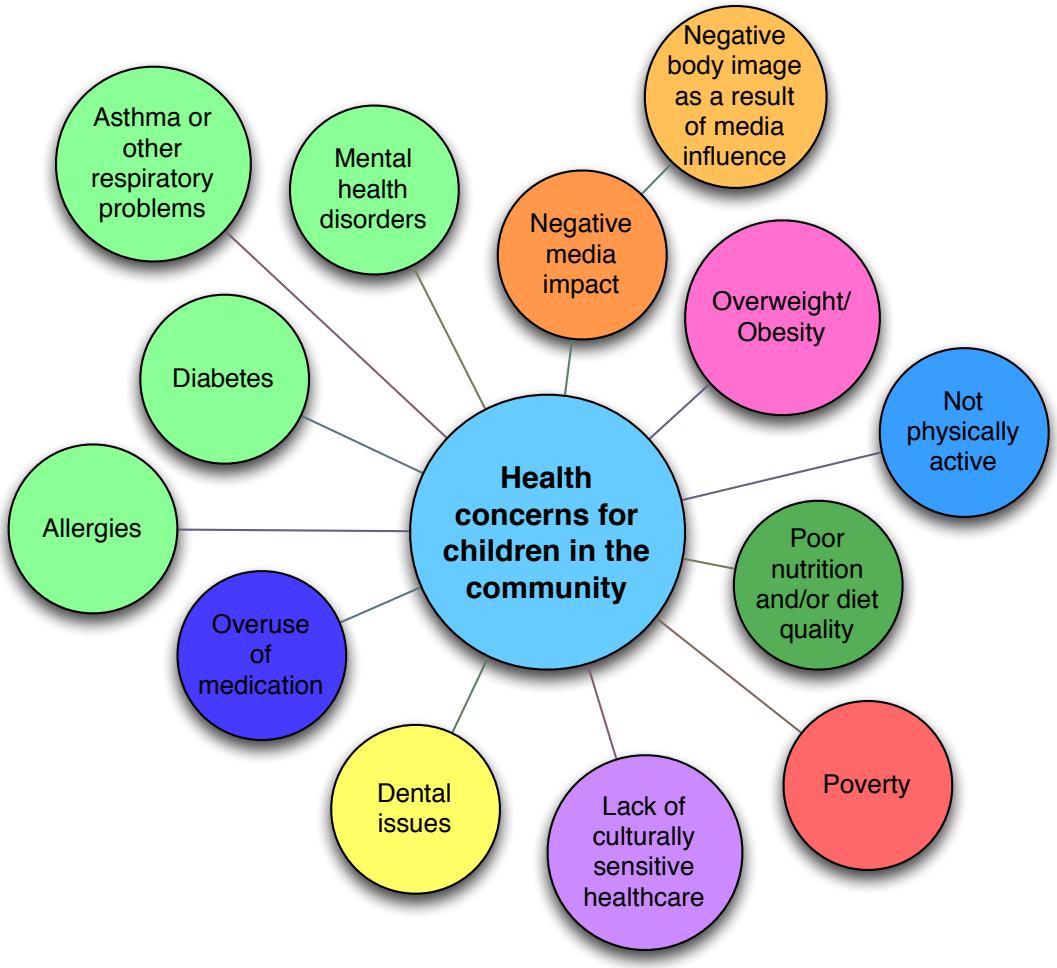
Family practices shape the context in which children live and develop. Caregivers discussed the shift away from traditional values towards a more disconnected family environment as having a negative impact on children's health. Specific cultural practices and their effects are discussed in greater detail in the following sections.

5.3.3 Health Concerns for Children in the Community

Caregivers were asked questions about the general health of Aboriginal children in their communities, as well as what they considered to be the most pressing health issues. They discussed a range of health concerns for Métis and First Nations children, which are displayed in **Figure 6** on the next page**.**

The bubble diagrams presented in the following sections reflect the brainstorming that took place during the focus group discussions. The lines represent a connection between the core theme (centermost bubble) being discussed and the different answers (peripheral bubbles) caregivers came up with. There were several sub-themes for the topics discussed, and these are indicated with another line stemming from the original theme. The bubbles are color-coded to emphasize the diversity of responses, and sub-themes share the same color as their parent bubbles. The responses are presented in no particular hierarchy or order as each theme was an important aspect of the focus group discussions.

Figure 6: Health Concerns for First Nations and Métis Children



The most frequent and urgent health concern discussed was the rise of overweight and obesity among Aboriginal children. Obesity was considered a touchy subject because it is a condition prevalent among children and adults alike. In London, one caregiver commented about the rise in obesity among First Nations children:

> *You're hearing more kids being obese and now they're saying that the children now are going to have shorter life spans than their parents or their grandparents because they don't get enough exercise and they're watching TV and playing video games and eating junk food, eating pizza.*

Similarly, Métis children in Midland-Penetanguishene were discussed as being overweight:

> *We notice that we have obesity problems here and you go to the park, you know, the majority of the children are not even running around. They are heavy-set, and I am heavy too, I mean. You know, I do notice that…*

Children's weight status was attributed to numerous factors, several of which are included in **Figure 6**, including poor diet, lack of physical activity, poverty, and negative media impact. Other prominent health issues that were mentioned were increased prevalence of allergies, respiratory problems, diabetes, mental health disorders, and dental issues among children. These issues, as well as broader health concerns like lack of culturally sensitive healthcare, were not covered in detail in the focus groups and are also not discussed here since they were beyond the scope of this project.

5.3.4 Children's Diet Quality

Caregivers felt that there was vast room for improvement to children's diets. The majority of children's diets were described as high in processed or fast foods, and lacking fresh foods like fruits and vegetables. Poor diet was discussed as a primary cause of many health problems including obesity and diabetes. A caregiver from London commented:

> *I think that's why a lot of kids or even adults have diabetes now because they're not eating the same kind of foods as before when the women or the men had to go hunting and stuff. Now it's all processed foods and stuff, which ain't very good for people, so that brings on diabetes and difficulties with their health and everything. So it's so different, like the patterns of eating from before now.*

Another First Nations caregiver added:

> *Yeah, because we never had all these diseases back then. We never had diabetes and our system was made for what we used to eat, not for all this junk food and fried foods and stuff. Genetically we're not built to eat that.*

A few parents felt that their children were eating healthfully, but the majority of these parents were speaking on behalf of younger children under the age of 5. Some households were still consuming traditional Aboriginal foods, however caregivers recognized that these foods were not common in children's diets and were usually consumed during cultural celebrations.

5.3.5 Barriers to Healthy Eating

Caregivers discussed a wide range of barriers to healthy eating for Métis and First Nations children. These barriers included individual, family, and environmental factors, and are illustrated in **Figure 7**.

Figure 7: **Barriers to Healthy Eating**

5.3.5.1 Individual-level Barriers

Caregivers identified several barriers to children eating healthy foods that were related to individual behaviours and characteristics. These included nutrition and food knowledge, personal food preferences and behaviours, food allergies, as well as lack of motivation to be eating healthy.

Lack of education was discussed as an important barrier to healthy eating on numerous levels. With respect to nutrition education, several Métis caregivers felt that they were not knowledgeable about good nutrition practices or foods for their children:

> *…But the parents… the school, they're trying to teach the kids how to eat properly and good food but the parents are the ones who have to be trained.*

Caregivers also felt there was room for improvement in the school curriculum to improve children's knowledge about nutrition.

In addition to nutrition education, lack of cooking knowledge for both children and caregivers was a major hindrance to eating healthy foods. Caregivers discussed how, despite knowing about healthy food options and nutrition information, they were never taught in schools or at home how to prepare these foods. A Métis caregiver commented:

> *On the education front […] I was never taught how to cook good homemade meals. So you know, having the education for parents to cook those meals from scratch [inaudible]. Not like cooking class but educational class on how to cook healthy for the children because I was never taught how to.*

A lot of the attention on healthy eating from health professionals and the media was on nutrition and not food preparation, and sometimes the abundance of information was confusing rather than helpful. A caregiver from Midland-Penetanguishene stated:

> *When we go to the doctors, and they said its diabetes and then we go to a nutritionist and she tells you […] and then you go to the dietician clinic [and] we get all this information […] everyone is telling you something different, so where do you start? If I am someone who is going to that and I don't know where to start, how is the person really in that situation that is stress out, and then, you know, the words: diet, calories.*

In addition to lack of cooking knowledge and confusion around nutrition information, caregivers consistently spoke about not having time to make homemade meals. Lack of meal preparation time was categorized as a family-level issue since caregivers were preparing food for their children, however these time constraints had important effects on children's eating behaviours and food preferences. Both children and caregivers in London were considered to be living fast-paced lifestyles that left little time for family meals or food preparation:

> *Because with the younger people that is, like you see a lot of that, eh? They don't have the time to go home and cook, so they're going to pick something up on their way home. You see a lot of them doing that, too. So nutrition is out, really, when you look at it.*

As a result, families were increasingly relying on fast, convenient foods and eating outside of the home. Children have also developed a taste for unhealthy food options that reinforced poor diet choices. Certain behaviours such as snacking and overeating were considered common among Métis children and especially detrimental to their mental and physical health:

> *The psychological and psychosocial effects, you can have on that population. Like, you know, if you don't, I find especially a lot of, if you don't look a certain way. If you do look a certain way then the impact it's going to have on them – children can get active, children can lose weight. They'll build mental issues that will last with them a long time and the effect that that has on them long-term. And some of them, like, you know, they will just eat their troubles away like most people do, that's their crutch.*

Métis caregivers also identified unhealthy food options as the most popular among their children. Peer pressure encouraged children to be bringing certain processed snacks or lunches to school in order to fit in with others:

> *My friends eating, you know, pizza pops and stuff, and I'd want pizza pops like. And I tell my mom, well, you know, pizza pops are cheaper, might as well make the kid happy, right?*

While caregivers did not speak in detail about food allergies or motivation, these factors were mentioned as a few of the many barriers to children eating healthy foods. Food allergies were identified as a hindrance to healthy eating because sometimes children were not allowed to bring certain foods containing potential allergens to school. Caregivers believed that children were also increasingly developing new food allergies that placed restrictions on their dietary intake. Lack of motivation was also discussed as a barrier, since many children were not compelled to make an effort to be eating healthier. Overall, caregivers felt that education and food behaviours were the most important individual-level barriers preventing children in the community from consuming healthier diets.

5.3.5.2 Family-level Barriers

The majority of barriers to healthy eating were reported at the family level. These included issues with food accessibility, families' shift away from traditional food consumption, the unaffordability of healthy foods, as well as the home situation not being conducive to healthy eating.

Accessibility issues posed a major challenge for caregivers to obtain healthy food options for their households. Limited access to healthy food and nutrition programs within Midland-Penetanguishene and London negatively impacted caregivers' and children's food choices and consumption. For example, while residents of Midland-Penetanguishene had a Food Box program in their community, the inconvenient location of this program and inflexible food pick-up times resulted in decreased program use. Another accessibility issue discussed was limited or inconvenient public transit to grocery stores. Many participants relied on public transportation to do grocery shopping, and sometimes grocery stores were located in areas that were difficult to access by public transit. One First Nations caregiver mentioned that inconvenient access to grocery stores impacted the frequency of her shopping trips:

> *Yeah, that's what we do because we don't have a car so we go, like my mom will drive me to the grocery store once a month and then if it goes bad, it goes bad and we just have to wait until next month.*

Less frequent grocery shopping also affected food-purchasing behaviour. Oftentimes non-perishable food items were a more economical choice since these foods lasted longer than fresher options. Caregivers acknowledged that non-perishable items tended to be the least nutritious. A caregiver from London stated:

> *I think it's because sometimes when you buy fruits and vegetables, they tend to, like the shelf-life is not as long as the other foods. We just recently moved to the reserve and you need a vehicle to get to town and buy those foods like every so often days, and a lot of people that live on the reserve, they go grocery shopping maybe once or twice a month, so they're not able to continuously get fruits and vegetables.*

In addition to accessibility concerns, fresh food was often not available in grocery stores where the caregivers lived. Produce was particularly difficult to find within local supermarkets in London:

> *If you go to any of the stores where I'm from, they don't have that stuff because they're worried about how long that's going to, like if it's going to waste on their shelf and stuff, so they're usually carrying canned food and stuff like that.*

Traditional foods were also identified as being too expensive or simply unavailable within the community, hence introducing Aboriginal foods at home became a challenge. One Métis caregiver said:

> *You can get it, but it's expensive. And not all of the traditional foods are easy to get, like wild game, is not easy to get.*

Children were also believed to be shifting away from traditional food consumption. First Nations caregivers attributed this shift to children preferring more "Western" food compared to Aboriginal dishes:

> *Like, you still have some of the children that doesn't like venison or anything like that. They don't like the wild meats, so they're not even going to try it. But it's there; we have a lot of families that are still eating our traditional way, but we have some families that don't even want to try any of that, the meats especially.*

An overarching barrier that affected the majority of participants' families was the unaffordability of healthy food. Healthy food options were considered to be too costly, especially as compared to processed or junk foods that were at a lower cost. Healthy foods including produce and milk, for example, have a shorter shelf life compared to processed foods, so some families had to make a choice based on what was most economical. A caregiver from Midland-Penetanguishene said:

> *So, you know, the lower fattier foods are the lowest price and they go a lot further. So, you're going to see obesity in that stereotypical low-income/one income family. And if you take a two-income family, yes, you know what, there's more money coming in. So, yes, they can get the fresh fruits, they can get the fresh vegetables, they can buy the milk, they can, you know, they don't have to live on Kraft Dinner and soup.*

A caregiver from London similarly commented on the difficulty with purchasing F&V on a budget:

> *I think it's because sometimes when you buy fruits and vegetables, they tend to, like the shelf-life is not as long as the other foods. We just recently moved to the reserve and you need a vehicle to get to town and buy those foods like every so often days, and a lot of people that live on the reserve, they go grocery shopping maybe once or twice a month, so they're not able to continuously get fruits and vegetables.*

For some families, the issue was not necessarily healthy food costs, rather food in general was considered to be unaffordable. Unaffordability was linked to low household income or income insufficient to support the family as mentioned by a First Nations caregiver:

> *So yeah, it depends on the parents, if they're working they can afford more food for their kids and then they buy both food, like the health food and the junk food at the same time.*

In addition to income, a child's household situation contributed to whether or not the home environment was conducive to healthy eating. One participant discussed caregiver drug issues as impacting the household finances and quality of care children received. Single parent families were also mentioned as experiencing the burden of low income as well as lack of time for meal preparation by a caregiver in London:

> *And then it's a single parent and she has to work, then that's another factor too because then they get too tired to cook, so it's got to be Kraft Dinner, something quick, you know? […] Or fast foods*.

Another barrier that caregivers spoke about was lack of positive role modeling for healthy eating within the household. While some children had a preference for unhealthy foods, these choices were often reinforced in the home when caregivers demonstrated unhealthy diets by purchasing and consuming processed or fast foods. Caregivers in London commented:

> ***Caregiver A:*** *Parents are the role models, and if we're not eating right, how can they eat right?*
>
> ***Caregiver B:*** *Yeah, and then they're the ones that buy the food, bring the food into the house*. *So if the parents have a sweet tooth, buys a couple bags of cookies, that's what the kids are going to want*.

While each home situation was unique, lack of family support due to substance abuse or lone parenthood were consistently identified as having a negative impact on children's diets. Accessibility and affordability were key barriers which determined availability of healthy foods within the household.

5.3.5.3 Environmental Barriers

Environmental factors including contamination or pollution, media and corporate sponsorship targeting children, as well as an obesogenic food environment were identified as barriers to children eating healthy foods.

As discussed in Section 5.3.5.2, traditional foods were considered healthier than the current Western diet that children were consuming, since they included more whole food options like fruits, vegetables, and wild meat, as opposed to high energy-density, low-nutrient foods. However caregivers expressed concern regarding traditional food consumption due to environmental contamination and

pollution. Caregivers in London discussed how the physical environment was sometimes unsafe for hunting or fishing due to pollutants:

> ***Caregiver A:*** *The river isn't very good, I don't think. The fish have sores and stuff.*
>
> ***Caregiver B:*** *I don't know about mercury, but blemishes or some people say they got all stuff, they just, they won't eat it. They like fishing, but they won't eat it.*

Another significant hurdle to eating healthy was the obesogenic food environment that children were exposed to. Neighbourhoods in Midland-Penetanguishene were described as encouraging unhealthy eating because of the abundance of fast food chains and retailers that sold energy-dense, processed foods.

> ***Caregiver A:*** *They put a little bit of healthy food in the cafeteria, meanwhile there's 90 percent of the stuff in the cafeteria and other stuff is just garbage.*
>
> ***Caregiver B:*** *I also find also the accessibility to junk. It's way too easy.*

Some Métis caregivers also mentioned how the family was part of creating an obesogenic environment by encouraging unhealthy food consumption:

> *I also think you have to watch for those grandparents, um my daughter in law, I really appreciate that fact that she only allows the children to eat healthy food but when they come to my place [laughing], a friend of mine is sneaking them a glass of Coke or something, cause they are not allowed to drink this, and they will say oh were not allowed to drink this at home, she goes, "well are you at home? No." [laughing].*

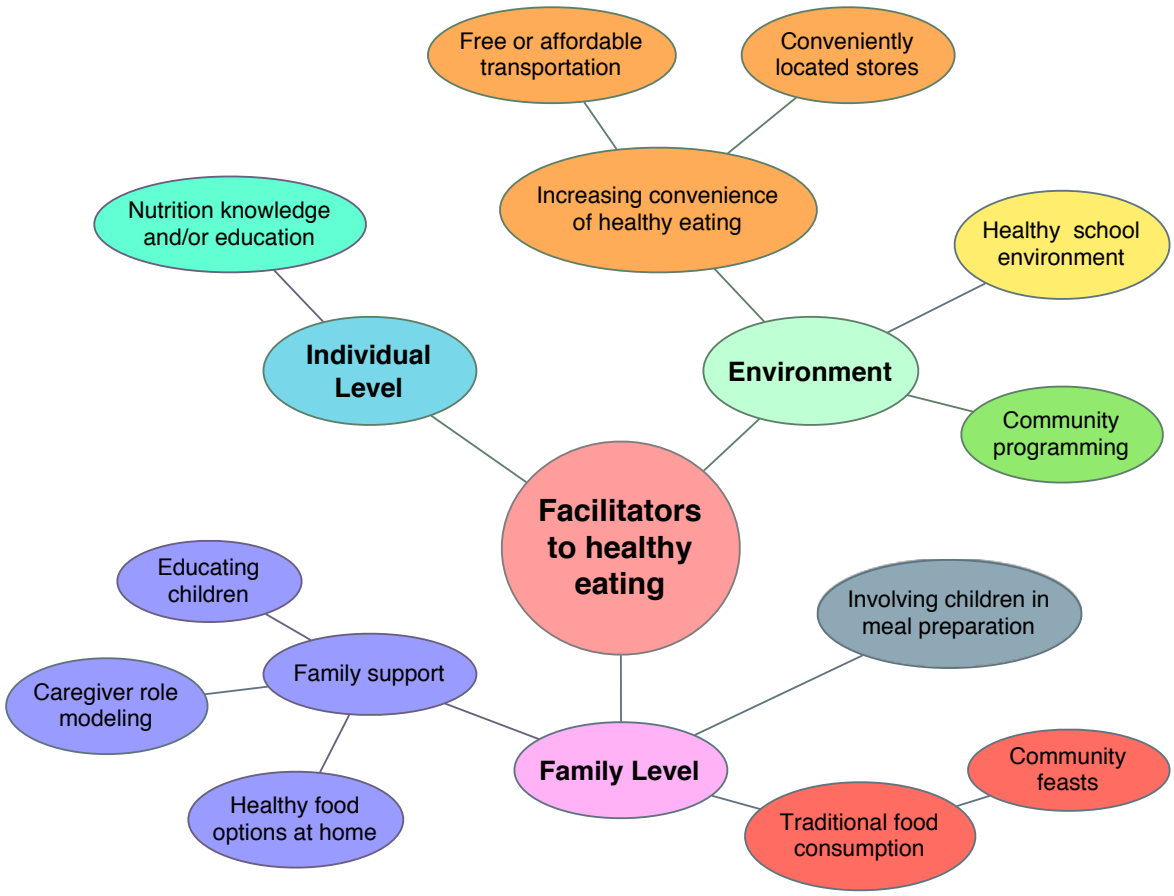
Several other barriers to healthy eating that were discussed by caregivers were the negative influence of media and advertising on children's body image and food preferences, and corporate sponsorship from schools. Advertisements promoting unrealistic body images, as well as food promotions targeting children, were seen as having a negative impact on children's attitudes towards food and their bodies.

Overall, caregivers identified numerous barriers faced by children to obtaining and consuming healthy foods. Some of these barriers were exacerbated by underlying problems such as low income within the household, which strongly impacted accessibility and food purchasing options. An understanding of these barriers is essential for identifying potential strategies for improving children's diets.

5.3.6 Facilitators of Healthy Eating

While numerous barriers to healthy eating were discussed, caregivers also identified many factors that enabled healthier diets among children. These facilitators are also categorized at the level of the individual, family, and environment, and are outlined in **Figure 8**.

Figure 8: **Facilitators of Healthy Eating**



5.3.6.1 Individual-level Facilitators

In addition to barriers, caregivers also identified several facilitators of healthy eating at the individual, family, and environment-level. On the individual-level, caregivers felt that the key facilitator

to healthy eating was nutrition education and knowledge for both children and their families. A caregiver from London commented on the importance of education to improving children's health:

> *A lot of the parents or even grandparents now have a lot of health issues now and they're teaching now because there just something they need to do to change their eating. Diabetes for one thing, that just say the kids are going to grandma's and grandma knows she has to eat a certain way, so she's teaching the kids now because her ways because of diabetes. I think it's more taught now about eating healthy because of the elders are teaching the younger kids to eat right.*

Lack of education was discussed as a barrier to healthy eating, but education was also considered a facilitator for First Nations families who possessed and applied nutrition knowledge in their own lives:

> *Because if they learn when they're young about how to eat healthy and the choices that they make to eat a healthy meal and stuff and effects in the long run that if they don't eat right then this is what's going to happen later on down the road, like diabetes or heart disease or whatever.*

Another caregiver added:

> *I think probably the most important thing is education. As long as they know what they should be eating and stuff, then even, like because with my nephew, they must have learned something in health class about nutrition and stuff, and I don't know what their mom was trying to make them eat, but he was like, "We can't eat that. That doesn't have enough vegetables." And that kind of thing like that. So they do remember that kind of stuff. I guess educate the parents, too.*

Caregivers identified knowledge of nutrition and food skills as an important facilitator of healthy eating among children. Education could take place in the home or at school, and was considered a necessary component for improving children's diets.

5.3.6.2 Family-level Facilitators

Caregivers felt that families played an integral role in providing a support system for improving children's diets. Introducing healthy foods in the home, including traditional foods, as well as involving children in meal preparation, were factors that caregivers discussed as facilitators to healthy eating.

Caregivers from Midland-Penetanguishene discussed how introducing healthy food options in the home and educating their children were important for creating a healthy food environment:

> ***Caregiver A:*** *Their tastes for foods change. You know, if we get them away from processed foods in the first place. Right there, that's the culprit.*

Caregiver B: *…Kids will like associate vegetables with just like, like just raw, you know what I mean? Like, but there's so many things that you can do with it that, like, they don't know about. And they're not going to try it because they know it's vegetables, right? Like, but, if they were to, like, learn different, like, different recipes and stuff like that, they might be more, like, from a younger age at least, right? Like, they're helping and doing it, more fun for them, you know what I mean? And, like, they will look forward to having the finished product kind of, right?*

Traditional food consumption was considered a facilitator to healthy eating when traditional foods were a key component of Métis children's diets:

Getting back to some of our old, um, ways. I know when I grew up, it wasn't that long ago and my, uh, (laughter). And my mother [would] tell me later, she made it, because she couldn't afford the processed meat. It was cheaper back then but should have realized it was healthier. Anyways, […] it's funny how it's all coming back around.

Caregiver role modeling is also a component of the home environment. Oftentimes caregivers felt knowledgeable about nutrition and tried introducing healthier foods to children, but were not exemplifying this behaviour themselves. Setting an example was discussed as an important strategy for improving Métis children's diets:

Setting an example and make sure they're following through with the activities that you're actually teaching them, properly, eating properly and being active. Being a role model so they follow you.

Another strategy for making children more interested in healthier eating was involving them in meal preparation. First Nations caregivers felt that when children were more invested in the outcome, they were more likely to consume the foods that were prepared:

Maybe learning how to cook healthy meals with getting everything, like vegetables and everything, because I know with my child when he was younger, when we made spaghetti, we'd put a handful of mixed vegetables in it. And one time my son, he's grown up now, invited us for dinner and that's how he cooked it. He remembered how I made it and he put some vegetables right in the spaghetti just so he'd eat it, his vegetables. So I guess learning how to cook nutritious foods…

Related to meal preparation was the more traditional practice of gardening and harvesting food. This practice also empowered Métis children by providing them some responsibility for their own diets:

I think one thing that would help, um, kids eat healthier is they got to go and pick their own vegetables and stuff like that. You know, if you went to a pick your or even grew your own. It's not expensive to grow your own vegetables. But if they got to go and pick the carrots they're going to eat, not the carrots you want them to eat, right? If they went and picked, you know, their

tomato and their, you know what I mean? They're in control, so they'd be, like, you know. If you give the kids a bit of control and they think that they're on top of the world, right?

Caregivers discussed family-level factors as some of the most important facilitators to children eating healthfully. Family-level factors were believed to have the greatest impact on diet since they shaped individual preferences and behaviours, as well as the home environment.

5.3.6.3 Environmental Facilitators

In addition to the home environment, providing healthy options in schools, increasing the convenience of food access, as well as community programming, were seen as important facilitators to children eating healthy foods.

Caregivers in London noted how cafeterias and vending machines in schools no longer served highly processed, "junk" foods:

Well, even in schools now I think they're changing a lot of the, like the cafeteria style, I think they're putting more healthy nutrition foods in them now, because a lot of them used to go to, again, McDonald's or Harvey's or somewhere like that even in the schools there, but now they've changed that, or they're working on changing it.

Schools on reserve were also recognized for shifting towards healthier options:

They're starting to incorporate them into the schools on the reserves, so when they have lunch at school, they're prepared and they're getting dieticians and the cooks prepare healthy meals and snacks for the kids. So even if it's not at home, they're still getting a little bit of that healthy, so they can go back home and say well this is what we were eating at school, they want to try it at home and they can maybe influence their parents to try it.

Transportation, which was a major barrier to accessing fresh foods, was also considered a facilitator when caregivers had access to a car or free public transit. Since money was an overarching barrier to healthy diets, free public transit was considered more helpful than access to public transit alone. Conveniently located grocery stores further encouraged healthier eating because of the influence location had on fresh food purchases.

Healthy food programming within the community was an important facilitator to healthy eating among Métis and First Nations children. Where transportation and money were barriers, community

programming could supplement these issues by offering free or affordable options to obtain healthy foods. These programs are discussed in the following section.

5.3.7 Community Programming

There were many different food programs offered within the communities studied, including food box programs, food banks, soup kitchens, school breakfast or lunch programs, church meal programs, community kitchens, community gardens, pre-natal nutrition programs, as well as programs on reserve that were used by some off-reserve residents of London. Caregivers often resorted to these programs if there was not enough money for food or not enough food at home, and sometimes for obtaining healthy food options.

However participants identified numerous barriers to programming that either hindered their participation or the program's effectiveness. Caregivers specifically spoke about the Food Box and food banks within their communities. These programs often had food of poor quality that was either near or had passed its expiration date. In addition to subpar food options, many caregivers from Midland-Penetanguishene recalled feeling discriminated by volunteers at the food banks:

> *It takes a lot to swallow your pride to access these resources, and if you're gonna go there and be judged by the person that's there that's supposed to be helping you, you know, it's gonna be harder to swallow your pride next time. And we are a small community we know people, and you walk through a door and your neighbours are sitting there at the table volunteering.*

The feelings of judgment exacerbated the stigma caregivers already felt were associated with receiving food charity. A caregiver from London commented:

> *I think a lot of people take advantage of that, too, the free stuff, the free food and everything. The way I see it is a lot of the drug users and alcoholics, they can just use their cheque and blow it because they're going to get free stuff. That's the way I see it because it seems like there's like, I don't know a lot of people think that, or talk about it in a way that it's just the people that use drugs or alcoholics that go to these free things all the time, but it's not. But then when people talk about it, that's the way they talk about things.*

As discussed under the barriers to healthy eating in Section 5.3.5, not knowing how to cook or prepare meals once food was received from the food bank or Food Box program also hindered healthy food consumption within First Nations households:

She didn't know what to do with it. And some people wouldn't know how to cook […] so it's that sort of mindset as well that you're not used to having these sorts of foods that you don't know what to do with them.

In order to improve the effectiveness of nutrition programs within their communities, Métis caregivers suggested taking a more family-targeted approach rather than placing sole emphasis on children.

I think a lot of focus is put into child health here and there whatever, but if more focus was put on […] the family, promoting more family unit type activities where all took part, whatever their abilities are. I think that would make good, positive change.

Caregivers also felt that programs with more of an Aboriginal cultural component would be healthy for children:

I think we need more, um, I dunno, Aboriginal days for example, that when you go there everybody in the community is welcome, not only Métis people. We might not feel comfortable going to something that is mainstream, but mainstream people may not necessarily […] it's that education part again. If we have more community/family things that we have multiple opportunities to try different foods that are healthy and engage with different people.

Part of an Aboriginal program would be a more holistic approach to health, rather than focusing on a single problem like obesity. Addressing healthy living in general was discussed as having the potential to affect a wide range of health problems for children in the community. In addition to education, some components of effective programming that were discussed were self-esteem and life skills classes, as well as more hands-on learning opportunities. With respect to diet, one First Nations caregiver said:

I'd probably try to do […] budgeting and life skills, how to preserve the foods when they do buy them and stuff, how to use them, cook them.

While there were many areas of improvement for existing community programs, it is clear that these programs played an important role in facilitating healthy eating by making nutritious options more accessible and affordable for families.

5.3.8 Coping Strategies

Caregivers spoke of several different coping strategies during times when their household or other community members experienced food insecurity. Some First Nations caregivers mentioned borrowing money or sharing food as options for when there was not enough food or money for food, however the more commonly used strategies were relying on family and community programming.

> ***Caregiver A:*** *I learned how to cook from, by my mom because her mom cooked. So I was raised like, we always had food on the table and, well there was one part in my past when my mom and dad split up but then we, he just left and we did go hungry for a little while. But then we went to stay with my other family and everything was ok. But I've been raised in a family where there's a lot of cooks.*

> ***Caregiver B:*** *Yeah, I used to call my church in my old neighbourhood, because I just moved recently, and I would go there and they would help me out with a grocery card. You're allowed to go there every three months, but I would go there about maybe once or twice a year when I needed to.*

While most caregivers did not discuss the conditions under which they required food aid, many drew from their own experience as they talked about obtaining help to provide food for their children. Coping strategies were often used if there was not enough money for food, however the severity of food insecurity and dietary compromises were not explored in depth due to the sensitive nature of this topic as well as the focus group setting. Overall, family and community programming helped many caregivers from Midland-Penetanguishene and London cope with food insecurity.

The focus group discussions indicate a positive relationship between low income and food insecurity, as well as an adverse impact on children's diets. Children's current diet practices were believed to be an important part of the increased problem with obesity among First Nations and Métis children. While caregivers did not use the language of "food insecurity," conversations about not having enough food or money for food, as well as coping strategies for when these situations occurred, suggest that food insecurity was present and manifests itself in different ways. Caregivers discussed decreased variety of foods, compromised F&V intake, as well as decreased traditional food consumption as examples of how food consumption and purchasing patterns changed with food security status. Food insecurity had a negative impact on children's diets, and many caregivers attributed the rise in overweight

and obesity among children to poor diet quality. The wide range of barriers and facilitators to healthy eating and community programming, illustrate potential areas of improvement and opportunities for intervention.

Chapter 6: Discussion

6.1 Obesity and Diet Among Aboriginal Children

Aboriginal children are disproportionately affected by obesity, and this condition is associated with adverse health outcomes in both the short and long terms. This study set out to investigate potential predictors of weight status among two Aboriginal identity groups that have not been well explored in the literature: Métis and off-reserve First Nations children. In particular, associations between food insecurity, diet, and obesity status were assessed using both quantitative and qualitative research methods. BLR and POM analyses were conducted with data from the *2006 APS – Children and Youth* component, and focus groups were carried out with parents and caregivers of First Nations and Métis children.

The present study reiterated that weight issues were prevalent for both First Nations and Métis children. According to the 2006 APS, 21% of First Nations children between the ages of 6 and 14 were overweight, and 18% were obese. Approximately 22% of Métis children were overweight, and 15% were obese. Hence during the focus groups, it was expected that obesity would be a concern for members of the communities studied.

While fruits, vegetables, and junk food are only a few of the broad food categories that composed children's diets, they act as proxy measures for children's diet quality. Descriptive statistics from the APS analysis indicate that First Nations and Métis children consume foods from the F&V and junk food categories at similar frequencies. More children ate F&V everyday compared to junk food everyday (35.8% of First Nations children ate F&V everyday and 19.4% ate junk food everyday; 30.7% of Métis children ate F&V everyday and 19.7% had junk food everyday), however 40 to 50% of First Nations and Métis children had both F&V and junk food five or six days per week.

Certain PMK-reported F&V and junk food frequency categories were significantly associated with obesity. For First Nations children, having junk food five or six days per week was consistently associated with an increased risk of overweight or obesity when controlling for numerous factors. For Métis children, the relationship of diet to weight status was less clear, as only children who never had

junk food were less likely to be overweight or obese, but not under all control conditions. Other studies have found similar associations between F&V intake and weight status. A study conducted using the 2004 CCHS found that children who ate F&V five or more times per day were significantly less likely to be overweight or obese than those who ate F&V less frequently (Shields, 2005). Lin & Morrison (2002) found that children of different weights consumed different amounts of fruit, however the differences for vegetable consumption and weight were not statistically significant (Lin & Morrison, 2002). Overweight children between the ages of 5 and 12 ate less fruit than children with BMIs indicative of healthy weights, although this relationship was not the same for vegetable intake (Lin & Morrison, 2002). Some tentative explanations of this include that vegetables can be prepared in ways that render them unhealthy or high fat, such as deep-frying. Fruits, on the other hand, are more commonly consumed raw or as juices, and are more likely to be eaten as snacks or desserts where other unhealthy foods could have been eaten (Lin & Morrison, 2002). While the present study did not distinguish between F&V, it is important to consider that different relationships may have emerged had these categories been separated. More research is certainly needed to explore this area in greater detail.

With respect to junk food intake, Rosenheck (2008) found that while eating junk food increased overall energy intake, it did not always correspond with an increase in BMI for children as it did for adults (Rosenheck, 2008). This may be due to the fact that children tend to be more active than adults; hence increased energy expenditure may balance out high energy intakes (Rosenheck, 2008). However high energy intakes and junk food consumption put children at risk for obesity, and many dietary habits and preferences are formed in childhood (Birch, 1999; Rosenheck, 2008). Also, the relationship between F&V or junk food with BMI is not expected to be clear cut since these food groups are only a few of the many components of a complete diet. The relationships between the diet variables and obesity in this study were perhaps also not as concrete in this analysis due to problems with how diet was measured.

The APS does not use a standardized Food Frequency Questionnaire (FFQ) (Hu et al., 1999; Roark & Niederhauser, 2011; Rockett, Wolf & Colidtz, 1995). The food frequency categories offered (Everyday, 5 to 6 days per week, etc.) do not include serving size or total number of servings per day as

the Shields (2005) study had, thus conclusions could not be made about whether or not a child was consuming too many or too few foods from a particular food group. Moreover, overall conclusions about diet quality could not be drawn since details about food brands or preparation were not provided (Hu et al., 1999; Rockett et al., 1995). In order to work around these limitations, we made tentative conclusions about diet quality, and only frequency of consumption as categorized in the APS are reported.

Despite this survey limitation, it was clear from the focus group discussions that parents and caregivers had significant concerns about children's diets. First Nations and Métis caregivers spoke extensively about how children's diets were high in processed foods, and this was expected to be linked to the increased prevalence of obesity, in addition to many other co-morbidities such as T2D. While the descriptive statistics from the quantitative analysis indicate that Métis and First Nations children are eating F&V more frequently than they eat junk food, the focus groups placed emphasis on the fact that many children were consuming both healthy and unhealthy foods at the same time. Overall, children's preference for junk foods was linked to the increased prevalence of overweight in the communities studied.

6.2 Food Insecurity

Food insecurity was not a significant predictor of obesity and did not affect the frequency of children's F&V or junk food consumption in the APS analysis. However this may be due to issues with the measurement of food insecurity in the survey itself. The APS measured individual rather than household food security status.

Validated survey tools have been developed to identify food security status within the household, such as the HFSSM, however this module was not part of the APS. The APS asks about frequency of food insecurity and coping strategies, although coping strategies are usually employed at the household or family level. For these reasons, household-level measures are usually more appropriate than individual-level measures. Although an important consideration as identified by the literature is that child food insecurity is challenging to capture since it is not usually the same as the household's food security status.

Children are to some extent protected from severe food insecurity by caregivers making dietary compromises. In some ways, the APS avoided this issue by asking caregivers directly about their children. However other issues are presented by the primary food insecurity question, as it fails to address the full range of experiences of food insecurity on the individual level.

An individual-level measure of food insecurity would measure if there were sufficient food intake, nutritional adequacy, and feelings of deprivation or worry about food to provide a picture of eating patterns and compromises over a given period of time. Cultural acceptability of food may also be a factor depending on where dietary compromises were being made. The APS only taps into one aspect, deprivation, as it asks caregivers if their children have ever felt "hungry," therefore it does not capture the other components of the food insecurity definition on the individual level. Moreover, the APS only asked PMKs who answered "Yes," to their children experiencing food insecurity to provide feedback on the different coping strategies used. Hence the survey inherently assumes that other caregivers or children do not use the strategies listed. It is possible that certain food acquisition or coping strategies such as sharing food with family or friends were used by PMKs or their children, but were not captured due to restrictions in the survey design. Many families may have used coping strategies to avoid hunger or feelings of deprivation, but did not answer this follow-up question if they did not identify with the term "hunger" in the original question. Families were also not culturally food secure, as traditional foods were either unaffordable or inaccessible in the communities studied.

In both the APS and focus group analysis, both First Nations and Métis caregivers most commonly reported seeking help from family or food banks when there was not enough food or money for food. While relationships between experiencing food insecurity and obesity were not directly made in the focus group discussions, caregivers spoke extensively about how low income compromised diet quality (an indicator of moderate food insecurity) and how poor diet made children overweight. This association is explored in greater detail in Section 6.3.

Within the literature, the relationship between food insecurity and obesity has been inconclusive. However, these studies consistently used validated survey tools for measuring household food insecurity

such as the HFSSM or the United States Department of Agriculture's (USDA) Core Food Security Module (Health Canada, 2007b; Jyoti et al., 2005; Martin & Ferris, 2007; Rose & Bodor, 2005)

Many of the common predictors of food insecurity, including lone parent status and household crowding, were found to be significantly associated with obesity as well. Among Métis children, having a lone parent was associated with an increased odds of overweight or obesity. According to data from the ECLS – Birth Cohort, Augustine & Kimbro (2013) found that children from lone parent families were almost twice as likely to be obese than children from two-parent households (Augustine & Kimbro, 2013). Interestingly, the opposite relationship was seen among First Nations children in this study, as they were significantly less likely to be overweight or obese if they had a lone parent. This may be due to dietary compromises of quantity in addition to quality, which could result in more severe manifestations of food insecurity such as hunger (McIntyre, Connor & Warren, 2000). Hunger is unlikely to be associated with obesity, and research indicates that children of single parents, particularly Aboriginal children off reserve, are more likely to be hungry than their two-parent counterparts (McIntyre et al., 2000). Household crowding or the presence of extended family are also factors which could potentially affect the lone parent-obesity relationship.

In the focus group discussions, caregivers discussed a fast-paced lifestyle and lack of time as being major challenges for lone parents. Lone parents had less time to cook or purchase healthy food, hence the increased reliance on unhealthy convenience or fast foods. Single parents also have a smaller household income, which impacts the ability to purchase food in general. The effects of income are discussed in the following section.

6.3 Socioeconomic Status

Income and education were significant predictors of obesity in the APS analysis as expected. For First Nations children, having a household income of over $60,000, as well as certain PMK education levels above a high school diploma, were associated with a decreased risk of overweight or obesity. For Métis children, having a household income less than $20,000 and PMK education less than high school

were associated with an increased risk of overweight or obesity. These findings are consistent with the literature, as children from lower SES households are more likely to experience poor health outcomes including obesity, whereas higher SES is protective (Bradley & Corwyn, 2002; Shields, 2005). Shields (2005) found that children from households where caregivers had no more than a high school diploma were more likely to be overweight or obese compared to households where postsecondary was the highest level of education (Shields, 2005).

Within the focus groups, caregivers identified low income and unaffordability as factors which largely compromised access to food as well as diet quality. While direct links to obesity were not made, it was clear in the discussions about affordability of healthy food, that food insecurity compromised diet quality. Caregivers often made decisions about which foods to purchase based on cost, whether it meant which food items were most affordable (the least healthy foods were cheaper than the healthier options like F&V) or would last longer (issues of accessibility meant nonperishable, nutrient-poor food items were a more economical choice). Other explanations for the SES-obesity relationship in the literature look beyond diet, and point to a relationship between knowledge and awareness of healthy behaviours among different SES groups (McArthur, Pena, & Holbert, 2001). Adolescents from higher income households have been found to have a greater knowledge of nutrition, obesity, and health, which could potentially improve health behaviours (McArthur et al., 2011). In contrast, adolescents from lower income households had poorer health knowledge and access to resources within the community (McArthur et al., 2011). Given that Aboriginal peoples have lower SES relative to non-Aboriginal Canadians, health knowledge as well as access to resources likely also play a role in the child obesity epidemic (Auger & Alix, 2009).

6.4 Other Barriers and Facilitators to Healthy Eating

It was somewhat unexpected that accessibility of grocery stores would be a major barrier to healthy eating in the communities studied. Accessibility is often discussed in the literature as a barrier for

families living in geographically remote settings or on reserve (Elliot et al. 2012; Willows, 2005). In both Midland-Penetanguishene and London, caregivers spoke about difficulties accessing public transit as well as grocery stores being inconveniently located. However it is important to note that convenience and location were not the main hindrances to healthy food access, rather it was low income that made accessing grocery stores so inconvenient. Many caregivers relied on public transit because they could not afford a car, hence the length or distance of the trips to grocery stores were affected as a result.

A number of programs and interventions in Canada place strong emphasis on educating children about healthy eating and nutrition in order to improve their health and weight status. However, little attention is paid to the applied skills that are necessary for eating healthy, such as meal preparation, harvesting, and cooking. It was interesting, albeit unsurprising, that caregivers in the focus groups expressed the need for more hands-on programs, as well as programs that educated and involved parents. They also discussed the importance of Aboriginal-specific programs which inherently took a more holistic approach to health.

There have been several Aboriginal-specific community health interventions which have proven to be effective. Two examples include the Kahnawake Schools Diabetes Prevention Project (KSDPP) and the Sandy Lake Health and Diabetes Project (SLHDP). Starting in 1994, the KSDPP aimed to reduce child obesity and prevent T2D in a First Nations community in Kahnawake, Quebec (KSDPP, 2011; Willows et al., 2012). The intervention took a community-based approach, and implemented a health education curriculum for children, school nutrition policies to support healthy eating, classroom and school activities for parents and children, as well as numerous programs within the community including walking clubs, cooking courses, and community gardens (KSDPP, 2011; Paradis et al., 2005; Willows et al., 2012). While an evaluation of the KSDPP found that children's BMIs did not decrease over time, this may have been because the follow-up period was not long enough to observe changes in BMI. Additionally, and the individual and family-level factors being addressed by the community initiatives are only part of the obesogenic environment children were exposed to (KSDPP, 2011; Paradis et al., 2005; Willows et al., 2012). The SLHDP was developed in 1991 in a remote First Nations community in

northern Ontario, and aimed to address high obesity and T2D prevalence rates as well (SLHDP, 2006; Willows et al., 2012). This project introduced educational radio programming about healthy lifestyles and activities in the community, healthy food labeling in local grocery stores, health promotion at community events and home visits, as well as walking clubs, to name a few activities (SLHDP, 2006). In 1998 to 1999, a school-based prevention program was developed which introduced a culturally sensitive curriculum as well as a family component to involve parents as well (SLHDP, 2006). An evaluation of the school-based program found that children were more knowledgeable about nutrition and health, and had decreased the total fat in their diets overall (Saksvig et al., 2005; SLHDP, 2006). However this evaluation also did not reveal any changes to BMI or body fat percentage during the yearlong study period. Nonetheless, this study also indicates that community-based, culture-specific programs have the potential to be more effective than other programming and have positive impacts on health behaviours (Saksvig et al., 2005; SLHDP, 2006).

One mechanism through which family-oriented programs are believed to be more effective is that family involvement allows the opportunity for role modeling. Caregivers' behaviours shape the family environment and can reinforce either healthy or unhealthy eating and related activities (Golan & Weizman, 2001). During the focus groups, caregivers discussed role modeling healthy behaviours as an important facilitator of children eating and living healthy.

Also consistent with the literature was caregivers' perception of traditional Aboriginal diets being healthier than market foods. In a study by Haman et al. (2010), traditional diets were identified as more nutritious than Western diets because of the focus on local, high protein foods, and absence of processed foods (Haman et al., 2010). Traditional methods of food acquisition including harvesting and hunting are also healthy behaviours because of the increased energy expenditure associated with these activities, as well as engagement with Aboriginal culture (Haman et al., 2010). While traditional foods were not explored in the APS analysis, First Nations and Métis caregivers spoke at length about the challenges they faced with getting their children to eat traditional foods. Some of the barriers to traditional food consumption were children's preferences for Western food, as well as difficulty accessing or affording

traditional food options. As a result, children were often not introduced to traditional foods, which removed the opportunity to develop a taste for them. In a study with First Nations people living on reserve in northern Ontario, researchers found that the key barriers to traditional food consumption were food preparation and harvesting knowledge, the affordability of market foods and relative unaffordability of traditional foods, as well as access to lands where hunting was allowed (Haman et al., 2010). Interestingly, all of these issues were discussed as barriers to children's healthy food consumption, including traditional food consumption, by off-reserve First Nations and Métis caregivers. Another interesting point with respect to traditional food acquisition strategies was the issue of environmental contamination. Northern First Nations communities in Ontario have expressed similar concerns as several bodies of water within Canada have found contaminated fish (Haman et al., 2010). In most cases, the fear of risky environments are unwarranted, however it has resulted in decreased hunting and harvesting in areas that are suspected to be affected (Haman et al., 2010). While Midland-Penetanguishene and London are located in southern Ontario, contamination concerns as perpetuated by the media has also affected traditional food acquisition activities here as well. Irrespective of whether or not an issue actually exists, the perception is most important as it influences caregivers' behaviours and families' diets.

Research has also established links between obesogenic food environments and children's weight status. He et al. (2012) found that living in a neighbourhood that is in close proximity to convenience and fast food stores was associated with low Healthy Eating Index (HEI) scores among elementary school students (He et al., 2012). The HEI assesses diet based on the energy density of foods and provides a score out of 100, with higher numbers being associated with more healthful eating (He et al., 2012). Students who lived greater than one kilometer away from a convenience store or at least one kilometer away from three or more fast food outlets had significantly higher HEI scores than students who lived closer (He et al., 2012). Within the focus groups, the large numbers of fast food and convenience stores, as well as easy access of junk foods were discussed as important hindrances to healthy eating for children.

Interestingly, caregivers in this study also considered family or home environment to be part of the obesogenic context, as having grandparents who spoiled children with junk foods was seen as

contributing to the obesity epidemic. Hence in addition to being role models, caregivers also sometimes play a role in creating an obesogenic environment (Golan & Weizman, 2001).

Community programs were an important strategy for improving children's health, as well as coping with food insecurity. However caregivers felt that there were several barriers associated with the programming, that if addressed, would increase the potential for these programs' effectiveness and outreach. Many caregivers in Midland-Penetanguishene and London visited food banks in order to provide food for their families. While these food banks helped ensure adequate quantity of food, the quality was often poor and not culturally appropriate, hence it did not contribute to the healthfulness of families' diets. Even in times of need, caregivers were not comfortable visiting food banks because of the stigma associated with food charity. This deterred caregivers even in times of need, because they felt that they were being discriminated by the volunteers and also ashamed for needing to use the food bank. For Aboriginal and non-Aboriginal people alike, many people report shame associated with using food banks (Hamelin et al., 2002). This stigma is perhaps worse for Aboriginal peoples, who already tend to fall in the lower income groups and are more vulnerable to food insecurity. Hence insensitivity and discrimination towards Aboriginal peoples in particular prevents many people from seeking help from community food initiatives like food banks (Stephens et al., 2006).

6.6 Limitations of the APS

There are several other limitations associated with the APS in addition to issues with some of the survey questions previously outlined. First, it is important to note that food insecurity, diet, and BMI are not static concepts. All of these variables will change over time; hence a cross-sectional perspective at one point in time is not fully representative of children's experiences with food insecurity, their diets, or weight status. The cross-sectional nature of the surveys also meant that only associations between the variables of interest could be established.

Due to the nature of post-censal sampling, individuals not included in the 2006 Census are also left out of the APS. While the 2006 Census had a high response rate (97.3%), participation in the APS

was voluntary (Statistics Canada, 2009b; Wannell, 2008). The individuals least likely to respond to the Census are characterized as young, mobile, and members of the lower income groups – categories in which Aboriginal peoples are overrepresented (Statistics Canada, 2011; Wannell, 2008). According to Statistics Canada, the response rate of Aboriginal peoples living off reserve in the Census is unknown, but is expected to be lower than the percentage reported above (Statistics Canada, 2011; Wannell, 2008).

There are also limitations regarding the 2006 APS PUMF because of missing variables that could have been used in the data analysis. In particular, the PUMF does not include geographic identifiers such as province, and instead classifies an individual's residence into CMA, other rural, other urban, or arctic. While data about province may have served as a helpful control, the PUMF contains full information on all of the other variables of interest.

Other limitations associated with the quantitative analysis itself include the fact that the data were secondary and retrospective in nature. Using secondary data means that the responses are only as detailed as the survey itself, and clarifications or elaborations in follow-ups with the sample are not possible. Also, PMKs may not have accurately remembered the details of their children's food intake, for example. However research indicates that parents are more reliable reporters of children's food intake, given some limitations such as not being as knowledgeable about food being consumed outside of the home after a certain age (Livingstone et al., 2004).

6.7 Limitations of the Focus Group Method

There are several potential limitations associated with the focus group method. Since the interviews were in a group setting, some participants may have felt less comfortable sharing their thoughts or personal information as compared to a one-on-one interview (Berg, 2008). However given the community-based sampling design, some members may already know one another, thus increasing comfort and potentially encouraging participants to share their stories.

Another limitation associated with the focus group procedure itself was that there were sometimes inaudible sections in the transcripts or recordings, so some ideas may have been left out.

However these inaudible sections were few and are not expected to change the coding or themes. Also the participants from the focus groups could only be identified by gender and location (Midland-Penetanguishene or London) since additional identifiers, such as pseudonyms, were not used. Again this does not affect the study results, however knowledge of which participant spoke throughout the focus groups would allow us to identify if there were dominant speakers or if certain comments were coming from recruited participants versus service providers. Another limitation was the sample size, as there were 23 Métis caregivers interviewed and only 9 First Nations caregivers. The discrepancy in sample size was due to challenges with recruitment, and difficulty predicting final attendance. Measures were taken to ensure that participation was as convenient as possible, however the focus groups in London were particularly small. According to Krueger and Casey (2000), focus groups can range from four to twelve people. While the feedback and discussion would be affected by group size, the positive and engaging environment created by the facilitator during these discussions ensured that all caregivers felt comfortable enough to actively participate.

Child obesity and food insecurity are both sensitive topics that had to be carefully approached during the focus group discussions. The discussions did not probe too deeply into families' coping strategies and personal experiences of food insecurity to avoid making participants feel uncomfortable. However the facilitator and interview guide were still able to obtain important and relevant information on the topic. While one-on-one interviews could have been better for accessing more personal information, focus groups were a still better fit given that the objective was not to gain an understanding of the individual experience, instead the point was to get a broader understanding of what families and children experienced within those communities. Focus groups allowed caregivers to comment beyond their personal experience, and share what they had observed in the community.

Another limitation is that caregivers were a secondary source of information for children within the communities studied. Caregivers' feedback could have been biased or inaccurate depending on the level of familiarity they had with children's behaviours, for example. However it is important to keep in mind that most children, depending on their age, would not have specific knowledge about food security

status (i.e., if there was enough money, if compromises were being made, what coping strategies were employed) or factors affecting their diets and physical activity, hence caregivers were the most appropriate source of this information.

A related limitation to experiences of food insecurity was that the service providers who participated were unlikely to have experienced food insecurity. Although as mentioned above, personal experience was not where the emphasis was placed in these discussions, so service providers were able to speak about what they had encountered or in the community and provide valuable feedback nonetheless.

Since the focus groups took place with only two Aboriginal communities in Ontario, results are not generalizable. Although it is important to note that the results are not intended to be generalizable to all Métis and First Nations Canadians, or Aboriginal Canadians; rather they provide some insight into important issues that require further attention in future research or policy.

6.8 Study Strengths and Implications

While there are certainly limitations associated with this study, there are also many strengths. First, this study makes use of post-censal survey data, which allows for wide reach and a large sample size. The nationwide sample increases the likelihood that a broad range of information was captured; hence findings associated with the APS would be generally representative of First Nations and Métis Canadians living outside of First Nations reserves. Also, unlike other surveys, the APS was designed in partnership with Aboriginal organizations, which helped ensure that unique cultural considerations, such as including traditional Aboriginal foods as part of the nutrition section, were in the survey.

The focus groups allowed for an in depth exploration of the research questions, as well as broader determinants of child obesity for First Nations and Métis children. The use of quantitative and qualitative methods in this study meant that areas where there were insufficient descriptions or context within the quantitative analysis could be explored within the focus group discussions. The focus groups provided rich descriptions of caregivers' and families' lived experiences with food insecurity, child obesity, as well as the barriers and facilitators to healthy living.

This study makes important contributions to the literature, as it attempts to explain the complex relationship between food insecurity, diet, and obesity. Few studies have explored the effects of food insecurity on obesity among Aboriginal children specifically, and the relationships between these variables have been unclear. There have also been few studies which explored this topic using qualitative research methods. The discussions around barriers and facilitators to healthy eating, as well as how these barriers relate to obesity, allowed for the identification of unique challenges that Aboriginal families face.

The results have the potential to influence programming and policies within Canada to improve the child obesity prevention strategy, as well as resources to improve food security. There is some debate in the food insecurity literature that community programming, such as food banks and school meal programs, act as Band-Aid solutions for food insecurity (Dietitians of Canada, 2005). School meal programs are typically offered to children only during the school year, and food banks may mask bigger issues of low income that need to be more effectively and directly addressed by federal policies. This study also suggests from both the quantitative and qualitative findings, that broader shifts such as addressing inequalities and distribution of income are necessary. However, it is important to note that these programs are still needed since there is unlikely to be one quick fix or solution.

Some of the barriers to healthy eating that caregivers discussed, beyond issues with access and affordability, included lack of knowledge or skills to prepare healthy foods. Hence these discussions suggest that Aboriginal families require programs which are family-oriented and take a more hands-on approach. Also in order to improve program effectiveness among different age cohorts, social skills and self-esteem are facets that need to be emphasized within a program's design and delivery.

6.9 Future Research Directions

There is a paucity of research addressing food insecurity among off-reserve Aboriginal populations, and among Métis peoples specifically. As evidenced by this and other studies, the factors affecting both populations are unique; hence the health outcomes also differ among these groups. Food

insecurity and the factors that affect food security status remain to be explored in greater detail in order to really understand how it affects obesity and other health outcomes.

The literature draws links between food insecurity and its impacts on diet to cause obesity, but it was clear from this study that income had an independent effect on diet and obesity status. The mechanisms by which income has this effect beyond diet also remain to be explored and better understood in these populations. Longitudinal studies using validated food security measures and FFQs among off-reserve Aboriginal populations would help elucidate the complex relationships between income, food insecurity, diet quality, and weight status.

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Appendix A – Newspaper Recruitment Ad

We are currently looking for

PARENTS AND CAREGIVERS

of **MÉTIS CHILDREN IN MIDLAND-PENETANGUISHENE**

to participate in a focus group discussion on health, food and exercise at the

North Simcoe Sports and Recreation Centre, Tuesday July 12, 2011, from 6:30 to 8:30 pm

This research is sponsored by the Canadian Institutes of Health Research (CIHR), and is being conducted by the Researchers from the University of Western Ontario, the University of Waterloo, and partners from the Métis Nation of Ontario.

On-site childcare and taxi vouchers will be provided. Participants will also be provided with a $20 grocery gift card (limit 2 per household).

To participate in the Métis Childhood Health Focus Group, or if you have questions, please contact **Tera Lynn Copegog, Métis Nation of Ontario, Community Wellness Coordinator**

at **(705) 526-6335**, ext **221**, or **teralynnc@metisnation.org.**

Appendix B – Flyer Recruitment Ad

Schulich MEDICINE & DENTISTRY

WATERLOO APPLIED HEALTH SCIENCES

Indigenous Child Health Study
Focus Group Participants Needed

We are looking for **parents and caregivers of First Nations and Métis children** living in London to participate in a focus group discussion on health, food and exercise. The moderated discussion will cover topics such as the availability of programs, the cost of food, and play spaces in London.

The purpose of the research is to pinpoint the barriers and supports available in the community for promoting childhood health.

This research is sponsored by the Canadian Institutes of Health Research (CIHR), and is being conducted by researchers from Western University and the University of Waterloo.

When: DATE
Time: 6:30 to 8:30
Where: London YMCA Centre Branch,
Corner of King and Waterloo

Transportation: Taxi vouchers will be provided.
Childcare: On-site childcare will be provided

A meal will be provided.
Participants will receive a $20 grocery gift card (limit 2 per household).

To participate in the Indigenous Childhood Health Focus Group, or if you have questions, please contact: **Melissa Smith** **Melissa.Smith@schulich.uwo.ca**
519-661-2111 ext. 80433

(Please note: RSVP is required for participation in the Focus Group)

If you have any questions about your rights as a research participant or the conduct of the study you may contact the University of Western Ontario's Office of Research Ethics at (519) 661-3036 or by email at ethics@uwo.ca

Melissa.Smith@schulich.uwo.ca (519) 661-2111 ext. 80433
Melissa.Smith@schulich.uwo.ca (519) 661-2111 ext. 80433
Melissa.Smith@schulich.uwo.ca (519) 661-2111 ext. 80433
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Melissa.Smith@schulich.uwo.ca (519) 661-2111 ext. 80433
Melissa.Smith@schulich.uwo.ca (519) 661-2111 ext. 80433

Appendix C – Midland-Penetanguishene Focus Group Interview Script

Focus Group Agenda

[Consent forms, information letters, and gift cards distributed as participants arrive]

1. **Introductions and welcome (**Shelley Gonneville, Manager of Child and Family Initiatives, Métis Nation of Ontario)

2. **Opening** (Joe McQuarrie, Elder, Métis Nation of Ontario)

3. **Trust-building** (Little Brown Bear, Health Director, Beausoleil First Nation)

4. **Group discussion: Métis child health** (Facilitator: Little Brown Bear)

5. **Thanks, and Goodbye**

Promoting Healthy Weights among Métis Children

Semi-Structured Guide for Focus Group Moderator

Theme 1: The Health of Children in the Community

First, I'd like to talk about the general health of children in the community. Here I'm not asking you about your own children's health, necessarily, but about the health of children in general.

1. How would you define a healthy child? What are some of the things that you think of when you think of a healthy child?

2. Is there a traditional Métis view of a healthy child?
    a. What makes a child healthy?
    b. What were traditional parenting practices like, compared with today?

3. In general, would you say that children in (Midland-Penetanguishene) are healthy?
    a. Would you say that they are as healthy as other kids, say as healthy as kids in Toronto?
    b. What is it about Midland-Pen that you think makes it different here?
    c. Follow-ups as needed

4. Even if children are generally healthy, we all have some concerns about our children's health. What do you think are the biggest health concerns related to children in this community?
    a. Follow-up as needed
    b. Is children gaining too much weight a major concern in the community?
    c. What proportion of the children in the community would you say are overweight?

5. Do you think that children in Midland-Pen are heavier than they used to be?
    a. Do people talk about this as a problem?
    b. If they do, is it an important problem, or are there more important health issues in the community? What are those?

Theme 2: Diet and Nutrition

We are interested in making changes that help children to stay healthy. Of course, we know that diet and exercise are both important for children's' health, regardless of their weight. First, I'd like to talk about food and nutrition among children in the community.

1. Do you think that children in this community generally have good diets?
    a. Do you think people could be eating better?
    b. How so? How could children's diets be improved?
    c. Follow up as required

2. In some communities, part of the problem is that it is hard to get healthy food. Do you feel that most children and families in this community have access to enough healthy food?
    a. Is it easy for parents to find fresh food, like fruit and vegetables, in stores in the community?
    b. If not, why not?
    c. Is it easy for most people to get to grocery stores? Are they conveniently located?
    d. Is this any different for people living in Midland or those living in Penetanguishene?
    e. Follow-up as needed.

3. Are prices for food in this community too high? Do you think some people have trouble affording fresh food?
    a. Are they higher than in other places?
    b. Are there programmes that can help people who are having financial trouble? Like a foodbank?
    c. Are there school breakfast or lunch programmes? Do you know what they serve?

4. Food is obviously an important part of culture. Do many Métis people in the community still eat traditional foods?
    a. Like what?
    b. Are these foods easy to get? Do people harvest or hunt?
    c. Are they an important part of children's' diets here?

5. What else do you think is the biggest barrier to children and families eating better?
    a. For example, some people think that fast food is too easily available.
    b. Follow up as required.

Theme 3: Physical Activity

Regular exercise is important for healthy. Many people are concerned that children might not be getting as much exercise as they should.

1. Do you think that children in Midland/Penetanguishene get enough regular exercise?
    a. Why or why not?
    b. Follow up as necessary

2. Do many children participate in sports in the community?
    a. Which ones are most popular?
    b. Winter? Summer? Are there leagues for all ages?
    c. Are they accessible to everyone? Geographically? Financially? Why or why not?

3. Do you think children do enough exercise in schools?
    a. Are there regular gym classes?
    b. Is there a difference between schools?

4. Are there after school programmes?
    a. How are they run?
    b. Do Métis children participate?
    c. Are there any programmes just for Métis or Aboriginal kids?

5. Are there safe places for children to play in this community?
    a. Are there accessible parks, for example?
    b. Can children play there unsupervised?
    c. Both in Midland and Penetanguishene?

6. Do you think that most children in this community walk to school, or take a bus?
    a. Are there places to walk or hike?
    b. Do people use them? Why or why not?

7. What do you think is the most important barrier to children getting enough regular exercise?
    a. Follow up as required

Theme 4: Neighbourhoods

We know that the neighbourhoods that people live in can affect their health. For example, some neighbourhoods don't have sidewalks so it's hard to walk places. Other neighbourhoods aren't close to grocery stores, so people might make poorer food choices.

1. Thinking of the neighbourhoods in Midland-Penetanguishene, are there particular neighbourhoods in which you think it might be harder for families to eat healthy food and to get regular exercise?
    a. What is it about these neighbourhoods that makes it more difficult?
    b. Are there neighbourhoods in which it is not safe for children to play outside or walk to school?

2. Are there neighbourhoods that are less walkable? Which have fewer facilities?
    a. Are they in Midland or Penetanguishene? Is there a difference between the two communities?

Theme 5: Families

Now I'd like to think about families and how family life can affect the healthy activities of children.

1. As parents, what do you think are the biggest challenges to getting children to be more active or to eat a better diet?
    a. What do you think we could do to

2. Is there anything that you think parents could do to improve their children's health?
    a. What would need to be in place to support that?

3. Do you think children in this community spend too much time indoors?
    a. Why is this?

4. What kinds of activities do families do with children after work or on the weekends in this community?
    a. Do you do those things regularly?
    b. Why or why not?

5. In some families, it is hard to find the time to exercise or cook a healthy meal. Do you think this is this a problem for people in this community?

Theme 6: Programmes and solutions

Finally, I'd like to talk with you about what you think could be done to improve the health of children in the community.

1. Are there programmes related to child or family health in the community?
    a. For example , are there family walks, or Healthy Babies, Healthy Children programmes?
    b. Who offers them?
    c. Do people generally participate?

2. Are the facilities and programmes available in the community sufficient?
    a. Do they serve children of all ages?
    b. Are they accessible?
    c. Do Métis people feel comfortable there?

3. If you could do one thing that would improve the health of children in Midland or Penetanguishene, what do you think it would be?
    a. For example, you could offer free after-school sports programs, build a playground...
    b. Follow up as required

4. Now, if we wanted to improve the health of *Métis children*, *in particular*, what would we do?
    a. Would it be anything different?

Closing and thanks

Appendix D – London Focus Group Interview Script

Focus Group Agenda

[Consent forms, information letters, and gift cards distributed as participants arrive]

1. **Introductions and welcome**
2. **Opening**

3. **Trust-building** (Little Brown Bear)

4. **Group discussion: Métis child health** (Facilitator: Little Brown Bear)

5. **Thanks, and Goodbye**

Promoting Healthy Weights among First Nations and Métis Children

Semi-Structured Guide for Focus Group Moderator

Theme 1: The Health of Children in the Community

First, I'd like to talk about the general health of children in the community. Here I'm not asking you about your own children's health, necessarily, but about the health of children in general.

1. How would you define a healthy child? What are some of the things that come to mind when you think of a healthy child?

2. Is there a traditional view of a healthy child?
    a. What makes a child healthy?
    b. What were traditional parenting practices like, compared with today?

3. In general, how would you describe the health of children in London? Would you say that they are as healthy as other kids, say as healthy as kids in Toronto?
    a. What is it about London that you think makes it different here?
    b. Follow-ups as needed

4. Even if children are generally healthy, we all have some concerns about our children's health. What do you think are the biggest health concerns related to children in this community?
    a. Follow-up as needed
    b. Is being overweight a major concern for children from the community a major concern in the community?
    c. What proportion of the children in the community would you say are overweight?

5. Do you think that children in London are heavier than they used to be?
    a. Do people talk about this as a problem?
    b. If they do, is it an important problem, or are there more important health issues in the community? What are those?

Theme 2: Diet and Nutrition

We are interested in making changes that help children to stay healthy. Of course, we know that diet and exercise are both important for children's' health, regardless of their weight. First, I'd like to talk about food and nutrition among children in the community.

1. We know that a good diet includes a variety of foods, particularly fruits and vegetables. Do you think that children in this community generally have good diets?
    a. Do you think people could be eating better?

b. How so? How could children's diets be improved?
c. Do you think they are consuming enough fruit and vegetables?

2. In some communities, part of the problem is that it is hard to get healthy food. Do you feel that most children and families in this community have *access* to enough healthy food?
    a. Is it easy for parents to find healthy food, like fruit and vegetables, in stores in the community?
    b. If not, why not?
    c. Is it easy for most people to get to grocery stores? Are they conveniently located?
    d. Are there any neighbourhoods for which access to food is a problem?
    e. *Follow-up as needed*.

3. Are prices for food in this community too high?
    Are they higher than in other places?

4. Do you think some people have trouble affording fresh food?
    a. Does this impact the food choices made when grocery shopping?
    b. Is it expensive to buy fruits and vegetables in London?
    c. How about snack foods like chips, cookies, etc.?

5. How do families cope when there is not enough food or money for food?
    a. Do they get help from family or friends?
    b. Are there programmes that can help people who are having financial trouble? Like a foodbank?
    c. Are there school breakfast or lunch programmes? Do you know what they serve?

6. Food is obviously an important part of culture. Do many people in the community still eat traditional foods?
    a. Like what?
    b. Are these foods easy to get? Do people harvest or hunt?
    c. Are they an important part of children's' diets here?

7. What else do you think is the biggest barrier to children and families eating better?
    a. For example, some people think that fast food is too easily available.
    b. *Follow up as required*.

Theme 3: Physical Activity

Regular exercise is important for health. Many people are concerned that children might not be getting as much exercise as they should.

1. Do you think that children in London get enough regular exercise?
    a. Why or why not?
    b. *Follow up as necessary*.

2. Do many children participate in sports in the community?
    a. Which ones are most popular?
    b. Winter? Summer? Are there leagues for all ages?
    c. Are they accessible to everyone? Geographically? Financially? Why or why not?

3. Do you think children do enough exercise in schools?
    a. Are there regular gym classes?
    b. Is there a difference between schools?

4. Are there after school programmes?
    a. How are they run?
    b. Do First Nations and Métis children participate?
    c. Are there any programmes just for First Nations or Métis kids?

5. Are there safe places for children to play in this community?
    a. Are there accessible parks, for example?
    b. Can children play there unsupervised?

6. Do you think that most children in this community walk to school, or take a bus?
    a. Are there places to walk or hike?
    b. Do people use them? Why or why not?

7. What do you think is the most important barrier to children getting enough regular exercise?
    a. Follow up as required

Theme 4: Neighbourhoods

We know that the neighbourhoods that people live in can affect their health. For example, some neighbourhoods don't have sidewalks so it's hard to walk places. Other neighbourhoods aren't close to grocery stores, so people might make poorer food choices.

1. Thinking of the neighbourhoods in London, are there particular neighbourhoods in which you think it might be harder for families to eat healthy food and to get regular exercise?
    a. What is it about these neighbourhoods that makes it more difficult?
    b. Are there neighbourhoods in which it is not safe for children to play outside or walk to school?

2. Are there neighbourhoods that are less walkable? Which have fewer facilities?

Theme 5: Families

Now I'd like to think about families and how family life can affect the healthy activities of children.

1. As parents, what do you think are the biggest challenges to getting children to be more active or to eat a better diet?
    a. What do you think we could do to support that?
2. Is there anything that you think parents could do to improve their children's health?
    a. What would need to be in place to support that?

3. Do you think children in this community spend too much time indoors?
    a. Why is this?

4. What kinds of activities do families do with children after work or on the weekends in this community?
    a. Do you do those things regularly?
    b. Why or why not?

5. In some families, it is hard to find the time to exercise or cook a healthy meal. Do you think this is this a problem for people in this community?

Theme 6: Programmes and solutions

Finally, I'd like to talk with you about what you think could be done to improve the health of children in the community.

1. Are there programmes related to child or family health in the community?
    a. For example, are there family walks, or Healthy Babies, Healthy Children programmes?
    b. Who offers them?
    c. Do people generally participate?

2. Are the facilities and programmes available in the community sufficient?
    a. Do they serve children of all ages?
    b. Are they accessible?
    c. Do Métis people feel comfortable there?

3. If you could do one thing that would improve the health of children in London, what do you think it would be?
    a. For example, you could offer free after-school sports programs, build a playground...
    b. Follow up as required

4. Now, if we wanted to improve the health of *Métis children*, *in particular*, what would we do?
    a. Would it be anything different?

Closing and thanks

Appendix E – Midland-Penetanguishene Participant Information Form

Métis Child Health Study

Dear Parent or caregiver,

We invite you to participate in the Métis Child Health Study. This letter provides you with information about the study. If you agree to participate in the focus group and audio recording, please sign the consent form and return to the researchers. Please keep a copy of this information letter for your personal records.

Researchers: Dr. Piotr Wilk (University of Western Ontario), Dr. Martin Cooke (University of Waterloo), and Metis Nation of Ontario (MNO), represented by Ms. Shelley Gonneville.

Description: This research is funded by the Canadian Institutes for Health Research. The focus group will take place at the *North Simcoe Sports and Recreation Centre*. As parents or caregivers of Métis children, you are asked to participate in a 90 minute, audio recorded focus group on childhood obesity. We are interested in your views on possible facilitators and barriers to: childhood nutritional and physical activity health programs and resources. We will also ask you to fill out a short questionnaire. With your insight we hope to outline proposed community-specific interventions which will encourage health in the Métis community.

Confidentiality and Risk: All of the information you provide will be kept confidential. This research poses little risk to participants. There is the potential that you may be uncomfortable with some of the topics and experience slight emotional distress when discussing childhood obesity. If this is the case, we ask that you inform the researchers and they can provide you with appropriate assistance and follow-up.

Participation and Withdrawal: Participation in this research is voluntary. You may remove yourself from the focus group at any point in time and still receive compensation for your participation. Unfortunately, as the focus group involves input from various participants, we cannot assure that all of your responses prior to your withdrawal will be removed from the study data.

Security and Data: We will be obtaining transcriptions of your focus group from a professional transcription firm. These transcripts and your audio files will be kept in locked filing cabinets and on

password protected computers at the University of Western Ontario, University of Waterloo offices. Transcripts from the focus group will be analyzed in order to generate reports and papers based on group members' responses. We will not be identifying individual participants in our reports and will ensure that all transcripts and recorded information stored does not include identifying information.

Study Information: Preliminary findings from this research project will be made available by the MNO in winter, 2012. Research reports will also be available on our project website, www.healthyweightsforum.ca. If you would like a copy mailed to you, please contact Martin Cooke at cooke@uwaterloo.ca.

Remuneration: Each participant will be provided with a $20 gift card to a local grocery store for their participation. The amount received is taxable. It is your responsibility to report the amount received for income tax purposes. A maximum of two gift cards will be provided per household. Childcare and refreshments will be provided on-site and taxi vouchers are available upon request. If you choose to withdraw from the focus group at any time, you will still receive compensation.

Appendix F – London Participant Information Form

First Nations and Métis Child Health Study

Dear parent or caregiver,

We thank you for taking the time to participate in the First Nations and Métis Child Health Study. This letter provides you with information about the study. If you agree to participate in the group discussion and audio recording, please sign the consent form and return to the researchers. Please keep a copy of this information letter for your personal records.

Researchers: Dr. Piotr Wilk (University of Western Ontario), Dr. Martin Cooke (University of Waterloo), the Metis Nation of Ontario (MNO), represented by Ms. Shelley Gonneville and the Southwest Ontario Aboriginal Health Access Centre (SOHAC), represented by Ms. Lin Yuan, Community Dietitian, Nutrition & Healthy Lifestyles Program.

Description: This research is funded by the Canadian Institutes for Health Research. The group discussion will take place at the *[insert location* . As parents or caregivers of First Nations and/or Métis children, you are asked to participate in a 90 minute, audio recorded group discussion on childhood obesity. We are interested in your views on childhood nutritional and physical activity health programs and resources. With your insight we hope to develop community-specific interventions which will improve health in the First Nations community.

Confidentiality and Risk: All of the information you provide will be kept confidential. This research poses little risk to participants. There is the possibility that you may be uncomfortable with some of the topics and experience slight emotional distress when discussing childhood obesity. If this is the case, we ask that you inform the researchers and they can provide you with appropriate assistance and follow-up.

Participation and Withdrawal: Participation in this research is voluntary. You may remove yourself from the group discussion at any point in time and still receive a gift card for your participation. Unfortunately, as the focus group involves input from various participants, we cannot assure that all of your responses prior to your withdrawal will be removed from the study data.

Security and Data: We will be obtaining transcriptions of your group discussion from a professional transcription firm. These transcripts and your audio files will be kept in locked filing cabinets and on password protected computers at the University of Western Ontario and University of Waterloo offices. Transcripts from the group discussion will be analyzed in order to generate reports and papers based on group members' responses. We will not be identifying individual participants in our reports and will ensure that all transcripts and recorded information stored does not include identifying information.

Study Information: Research reports will be available on our project website, www.healthyweightsforum.ca. If you would like a copy mailed to you, please contact Martin Cooke at cooke@uwaterloo.ca

Appendix G – Midland-Penetanguishene Focus Group Consent Form

Métis Child Health Study Consent Form

I have read the Letter of Information, (have had the nature of the study explained to me) and I agree to participate. All questions have been answered to my satisfaction.

I am also aware that excerpts from the focus group may be included in the publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Office of Research Ethics at 519-888-4567 ext. 36005 or ssykes@uwaterloo.ca.

Participant name: _____

Signature:_____ Date:_____

Researcher name: _____

Signature:_____ Date:_____

I acknowledge having received a $20 gift card for participating in a discussion group on December 8, 2011 in appreciation of my involvement as a research participant in the above study on Métis child health.

Name:_____ Date:_____

Appendix H – London Focus Group Consent Form

First Nations and Métis Child Health Study Consent Form

Remuneration: Each participant will be provided with a $20 gift card to a local grocery store for their participation. The amount received is taxable. It is your responsibility to report the amount received for income tax purposes. A maximum of two gift cards will be provided per household. Childcare and refreshments will be provided on-site and taxi vouchers are available upon request. If you choose to leave the group discussion at any time, you will still receive compensation.
I have read the Letter of Information, (have had the nature of the study explained to me) and I agree to participate. All questions have been answered to my satisfaction. I acknowledge that I have received a $20 gift certificate in appreciation of my involvement as a research participant in the above study.

I am also aware that parts of the group discussion may be included in the publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

If you have any questions about your rights as a research participant or the conduct of the study you may contact the University of Western Ontario's Office of Research Ethics at
(519) 661-3036 or by email at ethics@uwo.ca

Participant name: _____

Participant Signature: Date:

_____ _____

Researcher Signature: Date:

_____ _____

Appendix I – Midland-Penetanguishene Background Questionnaire

Métis Child Health Study

Participant questionnaire

Thank you very much for participating in our focus group discussion about child health in Midland-Penetanguishene. Your views on the health of children in your community are very important to us.

We would like to gather a little bit of information about the participants in the group discussion. Please answer the questions below, and use the space to add any comments you would like. You answers will remain anonymous and confidential.

1. How long have you lived in the Midland-Penetanguishene area? _____

2. Do you have children living at home with you? Yes_____ No_____
   If yes, what are their ages? _____

Is there anything about Métis child health that you think is important for us to know, and was not covered in the group discussion? Please use the space below to add any comments you would like.

Appendix J – London Background Questionnaire

First Nations and Métis Child Health Study
Participant questionnaire

Thank you very much for participating in our focus group discussion about child health in London. Your views on the health of children in your community are very important to us.

We would like to gather a little bit of information about the participants in the group discussion. Please answer the questions below, and use the space to add any comments you would like. You answers will remain anonymous and confidential.

1. Are you: Male___ Female____
2. What is your age: _____
3. How do you usually identify your heritage? _____
   (For example, First Nations, Métis, Anishnabe/Anishnabe-kwe, Haudensaunee, or another way?)
4. How long have you lived in the London area? _____
5. Do you have children living at home with you? Yes_____ No_____
   If yes, what are their ages? _____

Is there anything about First Nations and Métis child health that you think is important for us to know, and was not covered in the group discussion? Please use the space below to add any comments you would like.

Appendix K – Coding Manual

Coding Manual

Number	Label/Category
1	**Healthy child attributes**
1.1	Physically active and/or energetic
1.2	Good appetite
1.3	Happy
1.4	Eats healthy foods
1.5	Few illnesses
1.6	Rosy complexion
1.7	Balanced life
1.8	Mental well-being
1.9	Self-confident
1.10	Good communication skills
1.11	Proportional weight for height (perceived)
2	**Healthy Aboriginal (Métis or First Nations) child attributes**
2.1	No difference between non-Aboriginal and Aboriginal child
2.2	Possesses knowledge and/or appreciation of their culture
2.3	Independence
2.4	Not shy
3	**Family practices**
3.1	Traditional practices
3.1.1	Family meals
3.1.2	Harvesting food and/or gardening
3.1.3	Hunting
3.1.4	Children participate in meal preparation
3.1.5	Instilling cultural pride
3.2	Current practices
3.2.1	Not eating meals together as a family

3.2.2 Fast-paced lifestyle

3.2.3 Lack of communication

3.2.4 Shift in family values

3.2.5 Ashamed of cultural background

4 Health concerns for children in the community

4.1 Obesity/overweight as a concern

4.2 Diabetes

4.3 Negative media impact

4.3.1 Negative body image as a result of media influence

4.4 Mental health disorders

4.5 Poverty

4.6 Lack of culturally sensitive healthcare

4.7 Allergies

4.8 Overuse of medication

4.9 Dental issues

4.10 Poor nutrition and/or diet quality

4.11 Undernutrition

4.12 Asthma or other respiratory problems

4.13 Not physically active

4.14 Underweight

5 Community characteristics (as compared to Toronto)

5.1 Midland-Penetanguishene (compared to Toronto)

5.1.1 Better air quality

5.1.2 Less fast-paced lifestyle

5.1.3 More social support and/or greater sense of community

5.1.4 Better outdoor play/recreation space

5.1.5 School environment more conducive to learning

5.1.6 Safer for children

5.2 London (compared to Toronto)

5.2.1 Fewer places to visit/things to do

5.2.2 London closer to reserves

5.2.3 Fewer opportunities for walking

6 Perceptions of obesity/overweight

- 6.1 Estimated percentage of children overweight in respective community
  - 6.1.1 0-9%
  - 6.1.2 10-19%
  - 6.1.3 20-29%
  - 6.1.4 30-39%
  - 6.1.5 40-49%
  - 6.1.6 50-59%
  - 6.1.7 60-69%
  - 6.1.8 70-79%
  - 6.1.9 80-89%
  - 6.1.10 90-100%
  - 6.1.11 50/50
- 6.2 Child obesity/overweight perception differs from social norm
- 6.3 Obesity as a touchy subject
  - 6.3.1 Yes
  - 6.3.2 No
- 6.4 Midland-Penetanguishene before and after comparison of obesity as a problem
  - 6.4.1 Heavier than previous generation(s)
  - 6.4.2 Same weight issues/weight as previous generation(s)
- 6.5 London before and after comparison of obesity as a problem
  - 6.5.1 Heavier than previous generation(s)
  - 6.5.2 Same weight issues/weight as previous generation(s)

7 Children's diet quality

- 7.1 Good diet
- 7.2 Mediocre diet
- 7.3 Poor diet
- 7.4 Methods for improving children's diet
  - 7.4.1 Increase water intake
  - 7.4.2 Increase fruit and vegetable consumption
- 7.5 Current diet attributes
  - 7.5.1 High fast food consumption

7.5.2 Snacking on processed foods

7.5.3 Consuming traditional foods

7.5.4 Not consuming traditional foods

8 Barriers to healthy eating

8.1 Accessibility

8.1.1 To healthy food and nutrition programs

8.1.2 Limited and/or inconvenient public transit to grocery stores

8.1.3 Grocery stores inconveniently located

8.1.4 Seasonality of foods

8.2 Lack of cooking knowledge

8.2.1 Caregivers

8.2.2 Children

8.3 Lack of meal preparation time

8.3.1 Children's fast-paced lifestyles

8.3.2 Caregivers' fast-paced lifestyles

8.4 Nutrition education

8.4.1 Lack of caregiver education

8.4.2 Lack of education for children in schools

8.4.3 Abundance of nutrition information as confusing

8.5 Food allergies

8.5.1 in schools

8.5.2 of children in general

8.6 Children's shift away from traditional food consumption

8.6.1 Traditional foods unavailable

8.6.2 Traditional foods expensive

8.7 Children's behaviour related to food

8.7.1 Unhealthy options as most popular

8.7.2 Social desirability and/or peer pressure

8.7.3 Preference for fast food and/or processed food

8.7.4 Overeating

8.7.5 Snacking

8.7.6 Addictiveness of processed foods

8.8 Lack of positive role modeling from caregivers

8.9 Caregivers purchasing unhealthy food options for the home

8.10 Unaffordability of healthy food options

8.10.1 Low cost food options as least healthy

8.10.2 Healthy foods, i.e. fruits and vegetables, too costly

8.10.3 Short shelf-life of produce (hence not economical)

8.11 Unaffordability of food in general

8.12 Corporate sponsorship from unhealthy brands in schools

8.13 Media and/or advertising

8.14 Fad dieting

8.15 Not eating together as a family

8.16 Home situation

8.16.1 Caregiver/family drug issues

8.16.2 Lone parent household

8.17 Obesogenic food environment

8.18 Lack of personal motivation

8.19 Fresh food not available in grocery stores

8.20 Environmental contamination and/or polllution

9 Facilitators to healthy eating

9.1 Family support

9.1.1 Introduce healthy food options at home

9.1.2 Talking to and/or educating children

9.2 Healthy options available in school environment (i.e. vending machines, cafeterias)

9.3 Caregiver role modeling

9.4 Involving children in meal preparation

9.5 Concept of moderation

9.6 Traditional food consumption

9.6.1 Still consuming traditional foods in the home

9.6.2 Community feasts

9.7 Conveniently located grocery stores

9.8 Nutrition knowledge and/or education

9.8.1 Early learning/introduction to nutrition in schools

9.9 Availability of healthy food programs in the community

9.10 Money and/or employment

9.11 Convenient transportation

9.11.1 Having a car

9.11.2 Free bus pass/public transit

10 Physical activity level among children

10.1 Adequate

10.1.1 Exercise type: sports

10.1.2 Exercise type: play

10.2 Inadequate

11 Barriers to children's physical activity

11.1 Safety concerns within the neighbourhood and/or built environment

11.2 Accessibility of physical activity programs

11.2.1 Limited and/or inconvenient public transit to physical activity programming

11.2.2 Physical activity programming inconveniently located

11.3 Physical activity program attributes

11.3.1 Inflexible program rules (i.e. registration date issues)

11.3.2 Not designed for different cohorts (i.e., limited gender and age group options)

11.4 Self esteem issues

11.5 Increased sedentary behaviours

11.5.1 Video gaming

11.5.2 Computer time

11.5.3 Watching TV

11.5.4 Phone use

11.6 Organized sports/physical activity programs not affordable

11.6.1 Stigma attached to having low income

11.7 Schools not equipped to support physical activity programming

11.7.1 School programming/teams too limited or exclusive

11.8 Insufficient programming within the community

11.9 Lack of personal motivation

11.10 Neighborhood design not conducive to physical activity (i.e. play structures, sidewalks)

11.11 Lack of caregiver role modeling of physically active behaviours

12 Facilitators of physical activity

- 12.1 School programming
- 12.2 Free and/or affordable community programming
- 12.3 Family support
  - 12.3.1 for physical activity
  - 12.3.2 role modeling of physically active behaviours
- 12.4 Education about physical activity benefits
- 12.5 Built environment not conducive to physical activity

13 Community programming

- 13.1 Lack of programs for children within the community
- 13.2 Lack of programs for caregivers and/or families within the community
- 13.3 Barriers to effective health programming
  - 13.3.1 Lack of promotion or awareness about programs
  - 13.3.2 Unaffordable
  - 13.3.3 Lack of program options
  - 13.3.4 Lack of volunteers to run programs
  - 13.3.5 Difficulty qualifying for free programs
  - 13.3.6 Not culturally appropriate/specific
  - 13.3.7 Programming not suited to individual needs
- 13.4 Barriers to nutrition program usage
  - 13.4.1 Poor food quality
  - 13.4.2 Stigma of receiving food charity
  - 13.4.3 Discrimination and/or judgment from volunteers
  - 13.4.4 Don't know how to cook
- 13.5 Food programs in the community
  - 13.5.1 Food Box
  - 13.5.2 Food bank
  - 13.5.3 Soup kitchen
  - 13.5.4 School breakfast and/or lunch programs
  - 13.5.5 Church meal program
  - 13.5.6 Community kitchens
  - 13.5.7 Pre-natal nutrition programs
  - 13.5.8 Community garden