An Examination of Immigrant Status and Association with Childhood Obesity

by

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ABSTRACT

Research regarding childhood obesity in Canadian children has failed to address the effects of immigration on weight status. This study examined correlates of obesity and overweight including family functioning, parenting style (consistent parenting, positive interactions, hostile interactions, and punitive parenting), neighborhood conditions, physical activity, and screen time in immigrant children (i.e., children not born in Canada but currently residing in Canada). Correlates of obesity were examined using the National Longitudinal Survey of Children and Youth (NLSCY), a nationally representative data set with several waves of data collection, conducted from 1994 to 2008. The correlates were analyzed using multiple regression models. Neighbourhood factors, family functioning and other parenting factors such as: hostile interaction, positive interactions, punitive parenting and consistent parenting, were not associated with BMI or obesity and overweight status. Contrary to previous findings, time spent in Canada was not associated with physical activity or screen time among immigrant children. None of the variables investigated were significantly associated with obesity and overweight status. This lack of significant findings may have been due to small immigrant sample sizes, inadequate or limited measures of confounding variables; such as macronutrient composition of diet that could not be accounted for in our analysis. However, given that models were run using both logistic and linear regression and results were consistent across the board, there may well have been no relationship between these variables. Findings were non-significant and therefore conclusive findings and recommendations could not be drawn from this study

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Introduction

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Definition and Measurement

The World Health Organization (WHO) defines obesity as "*excessive or abnormal fat accumulation that presents a risk to health"* (WHO, 2012). The WHO (2003) also defines health as "*a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity.*" Recent increases in the prevalence of childhood obesity across the globe have made it one of the most challenging health problems facing young children today and, if not addressed, childhood obesity could be a significant challenge to health worldwide (Must, 1999). Therefore, this condition requires attention from the medical and scientific community. In June 2013, the American Medical Association classified obesity as a disease, allowing for better access to care in the U.S.A speaking to the seriousness of the problem (AMA, 2013). However, the scientific community is still fraught with misconceptions and presumptions about the causes of obesity, which persist despite evidence to the contrary (Casazza et al; 2013).

Adding to the controversy in obesity research, no clear consensus exists on the definition of obesity in children. Childhood obesity has been described using several measures and due to lack of consistency in the anthropometric measures, definitions vary between studies (Must et al; 2013). Anthropometric measures include tools where individual measurements are collected. Obesity and overweight status in children are generally calculated by using the Body Mass Index (BMI), also called the Quetelet Index. It is the weight of a child in kilograms divided by the square of his or her height in metres (Cole, 1995). The value obtained is compared to age and sex specific guidelines.

According the WHO (2012), for adults, a BMI of greater than 29.9 kg/m^2 is defined as obese, whereas a BMI of between 25.0 kg/m^2 and 30 kg/m^2 is defined as overweight. However, in children the effects of age, sex, pubertal status, and race/ ethnicity on growth make classification as underweight, normal weight, overweight, or obese, difficult (Han et al., 2010). For children in the United States, overweight is defined as a BMI above the 85^{th} percentile and lower than 95^{th} percentile for age and sex, whereas obesity is defined as a BMI at or above the 95^{th} percentile for age and sex for the population (WHO, 2012), (Flegal et al., 2001). However, these cutoffs have been cited as arbitrary and not valid for international use (Cole et al., 2000). Based on international, nationally representative data, the International Obesity Task Force proposed international, sex specific BMI cutoff points for overweight and obesity from age 2 to age 18 (Cole et al., 2000).

Although better cutoffs now exist, caution must be exercised when using the BMI as the sole indication of obesity, due to normal age related fluctuations in body fat composition during childhood (Zimmerman, Hess & Hurrell, 2000). Another way of measuring obesity is through skinfold thickness, which provides a more direct measure of the percentage of adipose tissue and percentage of subcutaneous fat. These measurements can then be compared to sex and age specific charts. However, this technique is impractical for large epidemiological studies, as well as on monitoring changes over time (Livingstone, 2001). Another direct measurement of obesity risk is waist circumference, which is comparable to usage of BMI or skinfold thickness. However, data for children is limited and there is no clear consensus about how to define overweight and obesity in children using waist circumference (Krebs, Hines, Jacobsen et al., 2007). Both of these direct measurements, however, require considerable amounts of time and resources to

administer, an especially difficult impediment for large epidemiological studies. Therefore, although the BMI is in an imperfect way of measuring obesity for epidemiologic screening, few other techniques are so widely used and amenable as to allow one to easily make age and sex specific, as well as international comparisons (Mulligan, 2000).

Health and social consequences.

Obesity has been described as one of the leading causes of premature mortality due to the many physical and mental comorbid conditions that are associated with it (Ebbeling et al., 2002). Recent research has shown that being overweight or obese in adolescence is associated with increased adult mortality from several systemic diseases (Han et al, 2010). The metabolic syndrome is defined as the set of obesity- related factors that increase the risk for coronary artery disease, diabetes, and stroke. Almost half of obese children with a BMI greater than the 97th percentile have one or more of the conditions that make up the metabolic syndrome (Calcaterra, 2008). This increases risk of children developing physical conditions, which historically affected older, overweight adults, such as Type 2 diabetes, fatty liver disease, breathing and pulmonary problems such as sleep apnea and asthma, and high cholesterol (Fagot-Campagna, 2000; Goran et al., 2003; Ludwig & Ebbeling, 2001; Ebbeling et al., 2012; Tounian et al., 2001; Kavey et al., 2006; Clarke et al., 2010). In addition, obese children are more at risk for cardiovascular conditions, stroke, and cancer as adults (Etemadi et al., 2012; Must et al., 2012). Other complications of childhood obesity include accelerated timing of thelarche and menarche in girls, as well as pubertal advancement in boys, which can have adverse social outcomes (Han et al 2010). In addition, orthopedic complaints such as fractures,

musculoskeletal discomfort, and impaired morbidity are more common in obese and overweight children **(**Han et al., 2010). The conditions associated with the obesity metabolic syndrome are also linked to changes in brain structure, as well as impairments in learning and attention span (Yau, 2012)

Obese and overweight children are prone to psychological conditions such as anxiety and depression, (Yu, Anderson, Fieldhouse, Protudjer, and Liu, 2007). In addition to poor physical and psychological outcomes, youth who are overweight or obese are more likely to be victims of aggression than normal weight youth, as well as being more likely to be bullies themselves (Griffiths, Wolk, Page and Hardwood, 2006; Katmarzyk & Jannsen et al., 2004). Obese youth are also likely to be less educated (Clarke et al., 2010; Harris, Pereira and Lee, 2009), to be less likely to find partners (Chen & Brown, 2005; Harris et al., 2009;), and also to have lower household incomes or be receiving welfare or unemployment compensation as adults (Clarke et al., 2010; Harris et al., 2009). There is also evidence that roughly half of obese school-age children become obese adults (Serdula, Ivery, Coates, Freedman, Williamson and Byers, 1993). Consequently, intervention at an early age may be more effective than interventions in the adult population (Faith et al., 2012) and may prevent a host of negative outcomes in adulthood (Must et al., 1999; Han et al., 2010).

Childhood Obesity in Developed Countries

Globally, WHO (2012b) reports that at least 43 million children (35 million in developing countries). These numbers represent an increase of 52% in the last two decades. This trend is expected to continue well into the next decade, with an estimated increase of 36% from 2010 to 2020 (De Onis, Blossner, & Borghi, 2010). Obesity is a

problem both in developed and developing countries (Han et al., 2010). Although obesity is increasing at an alarming rate in developing countries (WHO, 2012b), the increasing rates of obesity were first noted in the U.S. and then in Europe before becoming a health issue in the poorer countries of the world (Prentice, 2006). Country rankings of obesity among developed countries suggest that obesity rates in wealthy, English-speaking countries such as the USA, England, Canada, and Australia are much higher than similarly affluent countries such as Japan and Norway (Delpeuch et al., 2009). This could be due to the fact that the former market-liberal welfare countries have an environment of greater economic insecurity and this may drive higher levels of obesity (Offer et al., 2010). Developing countries, however, are not exempt and also show similar trends in increasing obesity (Delpeuch et al., 2009).

Europe.

Rates of obesity vary across Europe and information on childhood obesity, especially in Eastern European countries, is poor (Lien, Henrikson, Neomen, Wind & Klepp, 2010). Prevalence data across Europe, based on International Obesity Task Force (IOTF) criteria, suggest that the highest levels of overweight and obesity among 6-9 year old children are mostly found in Italy (37.2%), Portugal (26.8%), Slovenia (25.2%), Malta (22.7%), and England including Ireland (21.1%). Among adolescents, Cyprus, Greece, and England have some of the highest rates of obesity (Lien et al., 2010). Prevalence data among preschool children estimate that, at minimum, one in ten Romanian preschool children are overweight or obese. (Cattaneo, Monasto, Stamakis et al., 2010). In contrast, a maximum of one in ten Spanish children are overweight or obese (Cattaneo, Monasto, Stamakis et al., 2010).

United States.

Obesity among children aged 2-17 has tripled in the U.S. over the past 30 years, resulting in some of the highest obesity levels in the world (Harvard School of Public Health, 2012). Between 16- 33 % of children and adolescents in the U.S.A are overweight or obese (Ogden, Caroll, Kit & Flegall, 2012).

Canada.

Overall, obesity levels in Canada have also increased in recent years, although they are lower in Canada than in the U.S. (PHAC, 2011). As of 2004, 26.3 % of Canadian children aged 2 to 17 years were overweight, and of these, 8% were obese based on Body Mass Index an increase of 70% compared to 1978 and 1979 (Shields & Tjepkema, 2006).

Epidemiology Of Childhood Obesity

Immigrants versus non-immigrants

In parallel to rising levels of obesity and overweight, the immigrant population in Canada is steadily increasing (Statistics Canada, 2010). In 2006, there were 6.2 million immigrants in Canada forming 19.8 % of the population (Canadian Chamber of Commerce, 2009). Research into the immigrant population regarding obesity is scarce and often controversial. Most European research points to immigration status as a predisposing factor for obesity (Brussard et al., 2001; Fredriks et al., 2003: Kirchengast and Schober, 2006; Livingstone, 2001). However, the majority of research conducted in North America and Canada reveals that immigrants are less likely to be obese than their native counterparts, but that this risk increases with acculturation (Gorden –Larsen, Harris, Ward & Popkin, 2003; Harris et al, 2009; Singh, Kogan & Yu, 2009). To add further complexity, rates of obesity are higher in the U.S than in Canada (Shields, Caroll,

& Ogden, 2011). This difference could result not only from different cultural attitudes towards obesity but also from the ethnic makeup of the population. Although the White population is similar across both countries, the balance of the Canadian population is composed of East/Southeast Asians, who are less predisposed to obesity (Shields et al., 2011). In contrast, the American population consists of a larger proportion of Hispanic persons and African-Americans, for whom the prevalence of obesity is quite high (Shields et al., 2011). Cultural variations and health disparities among racial and ethnic groups with regard to obesity are a complex issue, (Resnicow, Baranowski, Ahluwalia, & Braithwaite, 1999). The existence of these disparities could pose several potential problems for Canadian policy makers and lawmakers, as data on immigrant children and obesity risk among Canadian immigrant children is quite scarce. Another possible reason for the inconclusive finding is that patterns of obesity vary by generational status or duration in the country outcomes (van Hook & Stamper- Balisteri, 2007). By amalgamating groups that have different generational patterns researchers may be unable to identify circumstances in which exposure to North American culture is associated with unhealthy outcomes (van Hook & Stamper- Balisteri, 2007). Therefore, although there is some research available across North America, there is a definite need to investigate obesity in the Canadian population specific to different immigrant generations.

Generational Changes

The current literature on immigrant obesity suggest that rates of obesity, as well as rates of overweight, increase with generation and number of years that have elapsed since immigration (Harris et al., 2009; Quon et al., 2012; Singh et al., 2008). In a longitudinal study of American adolescents (Harris et al., 2009), 72% of second-generation immigrant

youth (those with immigrant parents) were overweight, compared to 50% of first generation youth (those who are immigrants themselves). With regards to obesity, only 10% of first-generation immigrant youth were likely to obese compared to 30% of second-generation immigrant youth. Cross-sectional research echoes these results, with first-generation American immigrant children being at 26% lower odds of obesity than native-born and second-generation immigrant children of the same ethnicity (Singh et al., 2009). Although these studies had definite assets (the large, nationally representative sample and longitudinal method) they were conducted on an American population and may not be generalizable to the Canadian immigrant population with its different ethnic makeup and overall obesity rates (Shields et al., 2011).

Although research on obesity among the Canadian immigrant population is scarce, a recent study (Quon et al., 2012) proposes that, when stratified by race, first-generation immigrant youth are more likely to be overweight or obese, as adolescents than second, third or mixed generation youth (those with two different generations of immigrant parents). This is contrary to prior findings that first-generation immigrant youth are less likely to be obese than second-generation immigrant youth (Gordon-Larsen et al., 2003; Harris et al., 2009; Singh et al., 2008). These patterns appear to be more expected in East Asian, South East Asian and White youth (Quon et al., 2012). Although Quon and colleagues (2012) used the NLSCY, which has the advantage of a large sample size, many waves of data collection, and a nationally representative sample, generational status was used in lieu of acculturation. By clustering all first generation immigrant youth into the same group, this study failed to take into account time spent in Canada, a potential contributor to an increase in BMI (McDonald & Kennedy, 2005). Therefore, a dearth of

research remains concerning acculturation factors in determining obesity risk in immigrant children.

Age and Sex differences.

According to the Canadian Community Health Survey (CCHS) (2004), which took direct measurements of height and weight, 18% of Canadian youth aged 2-17 were classified as overweight and 8% were classified as obese. Although rates of overweight were similar across both sexes (18%), rates of obesity were higher in boys aged 2 to 19 (9%) than in girls (7%) of the sa13me age (Colman & Hayward, 2010).

In terms of physical activity, 74% of adolescent boys aged 12 to 17 in the CCHS could be classified as active or moderately active compared to 59% of girls of the same age (Colman & Hayward, 2010). A Canadian study that examined the number of steps taken in a single day discovered that, on average, boys tend to take more steps than girls (12,100 versus 10,300). Adolescents, especially obese or overweight boys, take fewer steps compared with children aged 6 to 10 years (Colley et al., 2011).

The CCHS revealed that the amount of screen time (i.e. time spent in front of a T.V, in front of a computer and/or playing video games) is lower in school-going girls than boys (Colman & Hayward, 2010), and increases with age (Colley et al., 2011). Overall, age and sex of the child are contributing factors in accounting for the effects of BMI, physical activity and screen time on obesity.

Determinants of Childhood Obesity

Physical inactivity and screen time.

According to the 2004 Canadian Community Health Survey (Statistics Canada, 2009), lower levels of physical activity and greater amounts of time spent on a computer,

in front of a television, or playing video games (screen time) are contributing factors to risk of overweight and obesity. The Canadian Public Health Agency (2011) recommends vigorous physical activity at least three days a week for children aged 5 - 11 years old. Only seven percent of Canadian children meet recommended Canadian guidelines of 60 minutes of physical activity every day. However, approximately forty percent of children get some physical activity three times a week (Active Healthy Kids Canada, 2012; Council on Sports Medicine and Fitness, 2006). The lack of sufficient physical activity across the Canadian population has an estimated economic burden of $1.6 billion in direct health costs to the Canadian government (Katzmarzyk & Janssen, 2004).

Many factors influence levels of physical activity in children, including a school district that promotes physical activity (Ebbeling et al., 2002); safe neighborhoods with open spaces (Singh et al., 2009) and parental socioeconomic status (Ford, 1991). Parental support for physical activity has also been shown to be a mediating factor, probably by the reinforcement of non-sedentary behaviours (Ebbeling et al., 2002; Sallis et al., 2000). Although physical inactivity and sedentary behaviours vary among different ethnic groups, overall U.S. immigrant children, aged 6 to 17 years old, are less likely to participate in physical activity or sports than native children. However, they were also less likely to spend more than three hours a week in front of a TV than non-immigrant children (Singh, Yu, Siahpush & Kogan, 2008).

Children today spend an increasing amount of discretionary entertainment time in front of a computer, playing videogames, or watching TV, corresponding to a decrease in the amount of time engaging in physical activity (Singh et al., 2008b; Faith et al., 2012). In particular, television viewing is also thought to be particularly harmful, as it could

promote consumption of energy dense foods and unhealthy eating through food advertising. (Robinson, 1998; Eppstein et al., 1998; Kotz, 1998; Singh et al., 2008b.) The Quebec Longitudinal Study of Child Development determined that, on average, 2.5 year old children were watching about 8 hours of TV a week, which increased to about 28 hours a week by the time these children were about 4. The more time kids spent in front of the TV, the larger were their waistlines. Each additional hour of TV weekly between the ages of 2.5 and 4.5 was linked with a small increase in waist size of almost half a millimeter by the time these children were in grade school (Fitzpatrick, Pagani & Barnett, 2012).

Barriers for immigrant parents promoting physical activity in their children may include a lack of awareness of the health and psychological benefits of sports participation and being active (Singh et al., 2008b). Although organized activities are not solely necessary for achieving sufficient physical activity levels, participation in organized activities does increase reported levels of physical activity (Active Healthy Kids Canada, 2012). Issues of cost, accessibility, and parental time commitment may reduce participation in organized activities (Canadian Pediatric Society, 2012). In addition, sporting activities that are quite popular in other countries may have sparse opportunities for participation in Canada, which may deter some immigrant children from participating in physical activities.

Environmental factors.

The causes of obesity are as complex as the ill effects; however, an individual approach will not be sufficient to halt the rising tide of obesity (Weir, 2012). More psychologists suggest that to halt the obesity crisis, a top-down approach must be taken

and we need to focus on the toxic environment rather than make the child solely responsible for eating less and exercising more (a blaming the victim approach) (Weir, 2012). Many factors in the child's environment including socioeconomic status, parenting style, family functioning, and built environment could play a role in the development of obesity. However, many of these factors have not been examined in an immigrant Canadian population (Faith et al., 2012; Singh et al., 2009; Singh et al, 2008). Therefore, more research into these areas is needed in order to better understand the problem and eventually contribute to solving it.

Socioeconomic Status.

Socioeconomic status or SES is a term used to refer to relative position of a family or individual in a socioeconomic structure, based on their access to resources (Harvard School of Public Health, 2012). There is often great disparity between the socioeconomic status of recent immigrants and their native-born counterparts (Picot, Hou and Coulombe 2007). International migration is highly selective with regards to health, wealth, and education (McDonald & Kennedy, 2004). Recent Canadian immigrants tend to be of the economic class (skilled workers and business people) with greater fluency in the Canadian official languages and better qualifications. However, Canadian immigrants may experience very different economic outcomes than members of the general population (Wang & Lo, 2005). In addition, Canadian immigrants are more likely have lower employment and self-employment income than the general population (Wang & Lo, 2005). It may take as many as 20 years for immigrants to achieve an economic status comparable to the general population (Wang & Lo, 2005). Poverty levels among immigrants also vary by generation, with higher levels of poverty among first generation

(36%) immigrant families than second or third generation immigrant families (Beiser et al., 1998).

Socioeconomic status operates through multiple mechanisms on the development of obesity. Indeed, obesity has been classified as a 'poor man's disease' (Delpeuch et al., 2009). Some researchers have suggested that income inequality and economic insecurity may be key factors in rising obesity levels (Offer et al., 2010). Markers of low SES (low levels of education and income) tend to be associated with low levels of recreational physical activity and inadequate nutrition, as well as less health consciousness (Gearhart, Druber, & Vanata, 2008). Research also suggests that socioeconomic status exerts an influence through neighborhood factors (Oliver & Hayes, 2005; Singh et al., 2009). Factors associated with SES that play a role in reducing the risk for being overweight or obese include adequate neighbourhood safety and presence of open areas for the children to play, as well as proximate supermarkets that provide easy access to fresh and healthy food. These positive factors tend to be associated more with moderate to high SES neighbourhoods than with low SES neighbourhoods (Oliver & Hayes, 2005; Singh et al., 2009). Although the problem of childhood obesity in Canada is not restricted to one socio-economic group, the influence of socio-economic status on obesity is clear, as the prevalence of poor health and sedentary behaviours become less prevalent as we go up the SES scale (PHAC, 2011).

Parenting style and family functioning.

As part of the ecological framework of child development, the inherent genetic predisposition of children interacts with the environmental system (Bronfrenbrenner, 1975). In terms of environmental influences, primary responsibility for prevention and

treatment of obesity in children is attributed to parent and adult caregivers, as they shape dietary habits and physical activities (Faith et al., 2012). Good parental monitoring of diet and physical activity has been associated with better health outcomes for children. In addition, parents who provide structure and boundaries regarding eating, tangible (e.g. stickers) or intangible reinforcers (praise) for healthy behaviour, are more likely to have children who eat in a healthy manner (Arredondo et al., 2006). The effect of parenting on obesity risk also differs cross-culturally (Chen & Kennedy, 2004; Renzaho & Mellor, 2010). Cultures in developing countries where fewer resources are present tend to favor harsher parenting styles that socialize children to be more competitive and aggressive (LaFreniere, 2010). Parenting is characterized by more authoritarian styles using corporal punishment, absolute standards including complete obedience, and respect for authority (Renzaho & Mellor, 2010). Authoritative parenting on the other hand is characterized by discipline, limit setting, and warmth towards the child (Renzaho & Mellor, 2010). Children of more authoritarian parents are at least five times more likely to be overweight that children of authoritative parenting styles. This difference reflects a general trend of lack of parental warmth and sensitivity contributing to greater obesity risk (Rhee, 2008).

In addition to these previously mentioned parenting factors, different cultural values regarding obesity may contribute to parenting practices, which may influence obesity in children. In some African cultures, obese girls are highly esteemed, as weight is seen as a symbol of health and wealth (Holden, 2010). Although many people in the Western world would consider such practices inhumane, young girls are force fed to “fatten” them up before marriage, a practice known as *gavage* (Holden, 2010). Therefore, immigrant parents who hold this value regarding body size are more likely to impose unhealthy

eating habits on children.

Family functioning also plays an important role in the development of obesity (Chen & Kennedy, 2004). A well-functioning family incorporates a) support, love, and caring for other family members b) security within the family, c) a sense of belonging and d) communication, resulting in each member of the family feeling respected and valued (American Academy of Pediatrics, 2012). Good parenting practices within the family, good communication of clear expectations to children, and good behavior control contributed to a healthy child's BMI (Forthun, 2012; Guilfoyle et al., 2007). In contrast, obese youth are more likely to come from families that report higher levels of interpersonal conflict and lack of cohesion (Guilfoyle et al., 2007). In addition, familial stress due to the mental or somatic illness, or parental stress due to low socio-economic status has also been thought to contribute to more food intake (Kitzmann et al., 2011). Parental stress contributes to the development of obesity in children, (Parks et al., 2012) even when adjusted for a) the race/ethnicity, sex, health quality, age of the child as well as b) the education, sex, BMI and poor sleep quality of the parent. Parks et al., (2012) also found that perceived parental stress contributed to fast food consumption. However, it was not related to decreased fruit and vegetable consumption. Immigrants may live under economic pressure (Liu & Kerr, 2003) and immigrant parents report feeling that their parenting ability is under stress due to pressure to acculturate to parenting practices of the host country (Tyyskä 2005). Parenting styles that are authoritarian, with the high levels of control, could be expected to cause greater conflict in the home. Therefore, family functioning and parenting style may be inexorably linked. The role of the family has important implications for treatment of child obesity, as family interventions are

based on the assumptions that parenting style, family functioning, and the home environment are key factors in treatment of obesity (Davison et al., 2012).

Neighborhood characteristics.

Other environmental conditions influencing obesity include neighborhood conditions and built environments. Recent immigrants tend to move into highly crowded inner-city areas, where safety and open areas for vigorous activity are scarce, due to some economic disparity (Picot, Hou & Coulombe, 2007). Singh, Saipush, & Kogan (2009) found that child obesity tended to be as much as 60% higher in neighborhoods with unfavorable conditions, poor housing, and poor access to parks or recreation centers. The safety of their children may be such a concern for many parents, especially in low SES neighborhoods (Molnar et al., 2004), that physical activity may be kept to a minimum. Even after controlling for age, sex, family income, and level of parental education, a child's odds of being overweight increased when living in a low versus high SES neighborhood (Oliver and Hayes, 2005; Singh et al., 2009). Singh and colleagues (2009) measured neighborhood conditions using two factors: neighborhood socioeconomic conditions and the built environment index. Neighborhood socioeconomic conditions were measured by parental endorsement of questions regarding the safety of the neighborhood: presence of garbage or litter, poor or dilapidated housing, and vandalism. The built environment index included access to sidewalks, parks and playgrounds, and recreation centers, as well as to community centers. However, systematic reviews have suggested that the contribution of the built environment to obesity is one of the 'myths' of obesity and needs to be examined further (Casazza, 2013; Ferdinand et al., 2012).

Research Questions

The limitations in the existing literature and the lack of ecological research into the immigrant population lead to the following research questions.

1) Among first-generation immigrant children who are between 5-11 years of age, is length of time spent in Canada associated with a higher prevalence of overweight and obesity?

2) Among first- generation immigrant children who are between the ages of 5-11 is length of time spent in Canada associated with physical activity levels?

a) Is length of time spent in Canada associated with physical activity levels among 5-9 year old immigrant children?

b) Is length of time spent in Canada associated with physical activity levels among 10 to 11 year old immigrant children?

3) Among first- generation immigrant children who are between the ages of 5-11 is length of time spent in Canada associated with amount of screen time?

a) Is length of time spent in Canada associated with the amount of time spent watching TV among 5-9 year old immigrant children?

b) Is length of time spent in Canada associated with amount of time spent playing video games or computer games among 5-9 year old immigrant children?

c) Is length of time spent in Canada associated with amount of time spent watching TV among 10-11 year old immigrant children?

d) Is length of time spent in Canada associated with amount of time spent in front of a computer among 10-11 year old immigrant children?

4) Is poorer immigrant family functioning associated with higher prevalence of overweight and obesity?

5) Is hostile/ineffective parenting by immigrant parents associated with higher prevalence overweight and obesity in first-generation immigrant children?

6) Is less consistent parenting by immigrant parents associated with higher prevalence of overweight and obesity risk in first-generation immigrant children?

7) Is punitive parenting by immigrant parents associated with higher prevalence of overweight and obesity in first generation immigrant children?

8) Are less positive interaction between immigrant parents and their children associated with higher prevalence of overweight and obesity, in first generation immigrant children?

9) Is neighborhood safety associated with higher prevalence of overweight and obesity risk in first-generation immigrant children?

Method

Date Source

The National Longitudinal Survey of Children and Youth (NLCSY)

Objectives and general structure.

The NLCSY was conducted in partnership with Human Resources Development Canada (HRDC) and Statistics Canada with the intention of understanding biological, social, and economic determinants of development and risk factors in Canadian youth. It was also intended to monitor the development and well being of Canadian children as they grew into adulthood, as well as to provide policy and program officials' with information to develop effective strategies and interventions targeted towards Canadian youth (Statistics Canada, 2010). Data for the NLSCY was collected in biennial cycles from 1994-2008, with periodic top-ups to the sample to compensate for attrition.

Sample selection and stratification.

The 1994 NLSCY (n = 22,381, response rate = 89%) sampled the non-institutionalized Canadian population from all ten Canadian provinces. Children living in First Nations communities, on Crown land, or where parents were full-time members of the Canadian Armed Forces were excluded. Collectively, the sample represented 98% of the Canadian population. Information was gathered from a variety of sources including parents, adult caregivers, principals, teachers, adolescents, and children. The NLSCY sample consisted of three components: The Main Component, The Integrated Component, and the Territories Component. The sample for the Main component of the NLSCY was selected from the Labour Force Survey (LFS), an ongoing Statistics Canada Survey at the time (Statistics Canada, 2010). Approximately 12,900 households were

chosen from the LFS database and eligible children were selected at random from these households (a maximum of 4 children per household). The Integrated Component consisted of individuals who participated both in the NLSCY and the National Population Health Survey, another Statistics Canada longitudinal study (Statistics Canada, 2010). Approximately 2,700 households were considered part of the Integrated component and children were again elected at random (a maximum of 4 children per household). The Territories Component consisted of households from the Yukon and the Northwest Territories. It consisted of approximately 2,300 children. However, data from the Territories component was later suppressed due to privacy concerns related to small sample sizes.

The NLSCY employed a stratified, multi-stage design with probability sampling at all stages of the design, whereby random samples are taken in a series of simple stages. First, provinces were divided into economic regions (ER). These regions were further classified into urban, rural, and remote areas; further subdivided into low income and high-income strata (Statistics Canada, 2010). Oversampling of smaller provinces such as Prince Edward Island, and Newfoundland and Labrador, was done to ensure sufficient sample sizes. In addition, certain age groups, such as 0 to 11 month old children, were oversampled. In order to ensure sufficient sample sizes, periodic top-ups to the sample were needed to ensure that age groups no longer adequately represented by the longitudinal sample were still represented. Three age cohorts make up the NLSCY. The first cohort consists of children aged 0-11 in Cycle 1, who will in remain the survey until they reach the age of 25. The second cohort consists of children aged 0-1 at the time of their selection in Cycle 3 (1998), and the third cohort consists of children aged 0-1 in

Cycle 4 (2000). Cycle 1 of the survey, was chosen for the present research, to allow greatest access to immigrant children population due to the large sample sizes. In addition, the following cycles did not provide cross-sectional weights for the immigrant population, eliminating them from consideration.

Procedure.

NLSCY data collection consisted of both computer-assisted interviews and paper and pencil questionnaires. The computer-assisted interviews were conducted both over the telephone and face to face, with all data being entered into a computer. Questions in both the telephone-assisted and face-to-face interviews were the same. The interviews were divided into separate components. Parents or guardians filled out the whole survey for children under the age of ten, whereas children over the age of ten filled out some questionnaires themselves. Follow-up questionnaires were mailed to teachers and principals of the schools these children attended. The survey also contained some cognitive tests such as the Peabody Picture Vocabulary Test, mathematics test (for children aged 7 and 14-15), a problem solving exercise for youth aged 16-17, and a literacy assessment for youth aged 18-19 years old.

Household component.

The household component was designed to obtain basic demographic information on all members in the household. For this component, the PMK (Person Most Knowledgeable) was identified. Once initial contact was made, the household was questioned about the person most knowledgeable (PMK) about the target child(ren). In 89.9 % of cases, the PMK was the mother, but it could also be a father, a step-parent, or an adoptive parent who lived in the same dwelling. All subsequent questions were asked

of the PMK. In the household roster, demographic information as well as information on relationships between household members was obtained (Statistics Canada, 2010). A relationship grid was created to determine the relationships between family members, as well as their age and sex.

Child component.

The child component was created for the children in the sample (i.e. younger than 18 years of age). The PMK answered questions regarding the target child's and the family's education, child health and medical information, child development and activities, as well as custody arrangements if applicable. As indicated above, all questions for the child component were answered by the PMK. However, the target child was the respondent for assessments of receptive vocabulary (4 - 6 year olds), self-administered questionnaires (similar questions to the PMK regarding education, health activity levels etc) for 10-11 year olds and 12-14 year olds, and a reading and arithmetic aptitude test for children administered at home. The child also completed some Reading Comprehension and Mathematics Computation Exercises (second grade and over) in the school. In addition, the interviewer administered the Peabody Picture Vocabulary Test. It was in the child component that the PMK was asked to report the height and weight of the target child as well as levels of physical activity, screen time, family functioning, neighborhood characteristics and parenting style.

Youth component.

This component was an additional component which questioned youth aged 16 and over regarding their education, goals and aspirations, health and physical activity, volunteering, relationships with family and others, and income, as well as questions about

delinquent behaviours.

Adult component.

The adult component was created for the PMK and their spouse or partner. Only the PMK and their partners were permitted to answer these questions, asked once per household. Questions from this component included relationships and custody arrangements, as well as family income, mother's work after childbirth, and parenting habits.

School component.

A school component was created for target children of school age. Teachers answered questions about academic performance and school behavior, as well as school environment and teaching methods. Principals of these schools also answered questions concerning the school such as resources available to students, hiring policies, as well as family involvement in the school.

Ethics and confidentiality.

Written informed consent for the NLSCY was obtained from all adult participants prior to participating in the survey. Parents provided consent for children. In order for staff to contact the school, parents signed a form allowing teachers to release answer questions about the child. Statistics Canada is obligated under law to protect any data that relates to any identifiable person, business, or organization. Due to the complex design of the NLSCY, in which information was collected from children, teachers, school administrators, and the parents, steps were taken to prevent the data of each individual participant not only from being identified by the general public, but by any other participant For example, measures were taken to prevent a teacher from identifying a

parent's or child's answers, a parent from identifying a child's answers or those of a school etc. Data obtained from the Territories was suppressed entirely, as the sample size was very small, making individual identification easier. To help ensure confidentiality, the full longitudinal data file was not made available to the public. Moreover, certain sensitive variables such as health information were suppressed in the public use file. Only researchers who have received security clearance are allowed to access the data, which cannot be removed unless a disclosure analysis has been performed and judged to maintain confidentiality (Statistics Canada, 2010).

Gaining Access to the NLSCY

Access to the Statistics Canada data is mediated through Research Data Centers (RDC) affiliated with universities throughout Canada. In order to gain access to NLSCY data file, proposal was completed outlining the objectives of the project. Access to the file was granted once Statistics Canada was satisfied regarding the feasibility as well as importance of the research in question.

Variables Utilized or Created.

Immigration status.

First-generation immigrant children were the focus of this study. First-generation immigrant children are children who were not born in Canada. In Cycle 1 of the NLSCY child questionnaire, the PMK was asked whether the child had ever been a landed immigrant, as well as how many years the child had been in Canada and his or her country of birth. Regardless of current citizenship, if the child had ever been a landed immigrant they were considered as having first-generation immigrant status, consistent with previous studies (Kirchengast and Schober, 2005; Singh et al., 2009). There were

358 first-generation immigrant children in the initial sample. However, in order to ensure confidentiality and national representativeness of the sample, the data was weighted resulting in a sample of close to 173,534 immigrant children.

Body mass index.

PMKs were questioned about the child's height in feet and inches, or in meters and centimeters, as well as the child's weight in kilograms. These questions were only asked if the child was above the age of 2 years old. The weight in kilograms was divided by the square of the height in inches (WHO, 2012). This BMI variable was compared to sex and age specific charts from the IOTF in order to classify children as normal, overweight or obese (Cole, 2000). BMI was used both a continuous and a categorical variable.

Physical activity.

In the NLSCY, several questions were asked regarding physical activity. Unfortunately, these questions were asked differently of the 5-9 year olds as well as the 10-11 year olds. Parents answered questions on physical activity for the younger age group, whereas for the older age group, physical activity measures were self-reported. This limits the comparability of our sample; therefore we did not combine these samples but analyzed the two age groups separately (See Appendix A). Parents were asked if the child took part in organized sports with a coach or instructor as well as in unorganized sports without a coach or instructor. Children aged 10-11 were asked the same questions but using different time values to gauge amount of play.

For the 5-9 year olds, both questions on physical activity were assigned a score from 1 to 5 ranging from most days a week to almost never. If none of these values were

chosen then the data was considered missing and treated as such in the analysis. To conduct the analyses for the 5-9 year olds the organized sports and unorganized sports variables were combined to create a total physical activity variable. This resulted in scores ranging from a minimum of 2 to a maximum of 10 with higher scores indicating higher levels of physical activity. When combined if one of the pair of scores were missing, the data was treated as missing and excluded from the analyses.

For the 10-11 year olds, both questions on physical activity were assigned a score from 1 to 4 ranging from never to 4 or more times a week. If none of these values were chosen then the data was considered missing and treated as such in the analysis. To conduct the analyses for the 10-11 year olds, the organized sports and unorganized sports variables were reverse coded and then combined to create a total physical activity variable. This resulted in scores ranging from a minimum of 2 to a maximum of 8 with higher scores indicative of higher levels of physical activity. When combined if one of the pair of scores were missing, the data point was treated as missing and excluded from the analyses.

Screen time.

Screen time was defined in this study as the amount of time spent in front of a T.V or computer, or playing video games. In order to determine amount of screen-time, questions asked in the self- report measures (10 to 11 year olds) as well as on the parent questionnaires (5 to 9 year olds) were used. In addition, on the survey, the amount of time spent in front of a TV or watching videos was measured separately from the amount of time spent in front of a computer or playing video games; therefore these variables (computer time versus TV time) were analyzed separately (See Appendix B).

For the 5-9 year olds the amount of time spent in front of a computer in the last 12 months was assigned a score from 1-5 ranging from most days to almost never. These values were reverse coded so higher scores corresponded with more amount of time spent in front of a computer. If none of these values was selected, then the data point was considered a missing value.

For the 10-11 year olds the amount of time spent in front of a computer in the last 12 months was assigned a score from 1-4 ranging from never to 4 or more times a week. If none of these values was selected, then the data point was considered a missing value.

For the 5-9 year olds the amount of time spent weekly front of a TV or watching videos, in the last 12 months was assigned a score from 0-7 ranging from 0 days to 7 days. If the child watched TV at least once a week, they were asked how many hours per day on average the child watched T.V ranging from 0.1 hours a day to 5 hours a day. A composite variable created by multiplying responses to questions 1 and 2 in order to gauge how many hours in total the child spent watching TV in total a week. If a child was missing values on any of these questions, then they were excluded from the analysis.

For the 10-11 year olds the amount of time spent weekly in front of a TV or watching videos the last 12 months was assigned a score from 1-4 ranging from never to 4 or more times a week. The child also answered questions relating to the amount of time on average spent daily in front of the TV ranging from 0 -1 to 7 or more hours a day. A composite variable was created by multiplying responses to questions 1 and 2 in order to gauge how much time a week on average the child spent in front of the TV. If a child was missing values on any of these questions, then they were excluded from the analysis.

Family functioning.

The questions involving family functioning on the NLCSY were created to measure various aspects of family functioning including communication, problem solving, behavior control, alcohol consumption, as well as acceptance and family support (See Appendix C) (Arim, 2001). The PMK completed a series of twelve questions, which were scored on a 4-point Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree). The total score on this scale fell within 0 to 36 with higher scores indicating higher levels of family dysfunction. Parental responses, however, were clustered within 0 to 14. Cronbach's alpha for the family functioning scale is 0.88 (Arim, 2001). Family functioning was treated as a continuous variable in order to determine the association between obesity and family functioning. (See Appendix B for family functioning scale).

Neighbourhood.

Although the questions in NLCSY did not permit measurement of neighborhood conditions using all the factors examined in the study by Singh et al (2008b), neighbourhood safety was examined. Neighborhood safety in the NLSCY was measured using two questions namely, " It is safe for children to play outside during the day" and " "There are safe parks, playgrounds and play spaces" (variables that have direct bearing on children's physical activity) with answers being on a 7-point Likert scale ranging from strongly agree (1) to strongly disagree (4) and an option of answering " Don't Know"(7). Answers to these two questions were combined for the NLSCY neighbourhood safety variable with answers ranging from 0 to 6. No imputation was conducted for this variable so there were several missing values, which were excluded from the analysis. The values were reverse coded for ease of interpretation, so a higher score indicated lower neighbourhood safety. Cronbach Alpha value for this factor is 0.68 (Statistics Canada,

1994).

Parenting style.

The NLSCY parenting scale was broken down into four factors: Positive Interaction, Hostile Ineffective Parenting, Consistency, and Punitive (Aversive) Parenting. The four-factor scale was used because it allowed the analysis of these separate contributing factors, thus providing the most information. Parents answered a series of 19 questions, which were scored on a 5-point Likert scale ranging from 0 (never) to 4 (all the time). Answers to these questions were selectively combined to create the four factors described above. Imputation was done for all four factors to reduce missing values.

***Positive interaction*:** Refers to the degree to which parents praised the child and whether parents spent quality time with the child, engaging in activities that the child enjoyed. The total score on this 5- item factor varied between 1 and 20, a high score indicative of more positive interaction between the child and the parent. The majority of parent responses fell within 0 to 10, the data being skewed to the left. The Cronbach's Alpha for the Positive Interaction Scale is good (.81) (Statistics Canada, 1994). This item was reverse coded so that higher scores were indicative of less positive interaction between parents and children, for ease of interpretation.

Consistency: Refers to the degree to which parents follow through with requests or threats of discipline. The total score on this 5- item factor varied between 0 and 20, a high score indicative of more consistent between the child and the parent. This item was reverse coded so that higher scores were indicative of less consistent between parents and children, for ease of interpretation. However, the majority of parent responses fell

between 0 to 10. The Cronbach's Alpha for the 5-item Consistency factor is fair (.54) (Statistics Canada, 1994).

Hostile/Ineffective Parenting: This 2-item factor targets the parents' disciplinary practices and how they reacted to their children, as well as the degree to which they whether they engage in blaming or chastising behavior if their children did not meet their standards. This scale was reversed so that a higher score indicated more hostile/ineffective parenting. The total score on this factor varied from 0 to 25, a higher score indicating more hostile parenting. The majority of parent responses were recorded between 5- 12. The Cronbach's alpha for this scale is poor however and falls at 0.40 (Statistics Canada, 1994).

Punitive/Aversive Parenting: This factor was derived using 4 items that targeted the parents' disciplinary style and the degree to which they preferred punitive methods or preferred to calmly discuss the problem. The total score on this factor varied from 0 to 19, a higher score indicating more punitive parenting. However, parental responses varied from 5 through 18. The Cronbach's Alpha for this factor was fair (0.57) (Statistics Canada, 1994).

Socioeconomic Status (SES).

Each household in the NLSCY was assessed for socioeconomic status. SES was assessed by combining five variables, namely: the level of education of the PMK, the level of education of the spouse or partner, occupational prestige of the PMK, occupational prestige of the spouse, and household income. This resulted in scaled scores of -2 to +2, with the higher the score, the higher the SES (Statistics Canada, 2010).

Education and Years of School- The level of education of the PMK and the

spouse was derived by calculating the number of years spent in school with a scale ranging from no schooling on one end to an MD/PhD on the other end. This was done individually for both partners and then combined (Statistics Canada, 2010).

Household Income – The sources and amount of the household income were collected, as well as the personal income of the PMK. To derive a value used in the computation of SES income was coded in $1,000s of dollars. A few outliers with incomes greater than $150,000 were recoded to $150,000. A wage edit was then carried out to compare household income to reported income. Cases where there were large discrepancies were not reported. In the review, incorrect household incomes were set to not-stated (Statistics Canada, 2010).

Occupational Prestige - The NLSCY variable used 16 homogenous categories, in where a value was assigned from highest level of occupation to lowest. For both the PMK and partner, these classifications were based on the previous 12 months (See Appendix B). These were combined in the final calculation of SES.

As socioeconomic status could operate through multiple mechanisms on the development of obesity (Gearhart et al., 2008; Oliver and Hayes; 2005; Singh et al., 2009), the effect of SES on the development of obesity was not directly assessed. Instead, SES was used as a control variable as has been done in other studies examining immigration and obesity (Harris et al., 2009; Singh et al., 2008, 2009).

Data Analysis

Weights and bootstrapping.

The sample selection and design of the NLSCY is complex, resulting in dependencies within the sample selection of units, which has a significant bearing on the variance of the sample. Outlier detection was performed once all the weights had been calculated. Each child's final survey weight was adjusted for non-response and stratified by province, age, and sex to match population demographics at the time of sample selection. The data provided by the NLSCY is already weighted. Therefore, all analyses were conducted on the cross-sectional, weighted data.

Missing values.

Missing values for adult income, youth income, household income, and motor and social development items were imputed using hot deck donor imputation. Hot deck donor imputation is the process of replacing missing values from the current dataset based on other similar values to the replacement (Statistics Canada, 2010). Imputation was only performed in the above circumstances. Other missing values were designated in the survey as "Don't know", "Refusal" or "Not Stated" on the final data file. If a participant had missing data on the questions pertaining to immigrant status, such that it was impossible to identify the participant as a first generation immigrant, that participant was excluded from the analysis. If on other variables the participant's answers were designated as "Don't know", "Not Applicable", or "Refused to Answer", they were excluded from the study. In addition, a previous study of obesity using the immigrant sample of the NLSCY revealed that there were no significant differences between the

imputed and non-imputed sample, rendering this unnecessary for our analyses (Quon et al., 2012).

Statistical analysis.

In order to evaluate the research questions, both descriptive and regression analyses were performed.

Descriptive analyses.

First, descriptive prevalence rates of normal, overweight, and obese weight status among first generation immigrant children were obtained. Children who were normal/underweight versus overweight/obese were compared across several variables using Chi-square analyses. The Chi-Square analyses determined whether there were differences across the normal versus overweight/obese group across the categorical varaibles. To protect confidentiality, the RDC disallowed dividing overweight and obese children into two categories, as the sample sizes were so small. The descriptive correlates: age, sex and SES were adjusted for in the regression models, although none of these descriptive factors were significantly associated with prevalence of overweight and obesity.

Regression Analyses.

Analyses were conducted using BMI both as a continuous variable and as a categorical variable (normal/underweight versus overweight/obese). Years since immigration, family functioning, neighborhood safety, consistent parenting, hostile/ineffective parenting, positive interaction, and punitive parenting were all examined as factors associated with BMI using linear regression, adjusting for the age of the child, the sex of the child, and the socioeconomic status of the family. We also ran

these same models using BMI as a categorical variable comparing underweight/normal children to overweight and obese children, using the same variables adjusted for age, sex and SES of the family.

1) Among first-generation immigrant children who are between 5-11 years of age, is length of time spent in Canada associated with a higher prevalence of overweight and obesity?

In order to answer this question, linear regression models were used to test whether time spent in Canada was associated with BMI. Logistic regression models were then used to test the odds that time spent in Canada was associated with obesity/overweight as dichotomous dependent variable. Children who were normal weight or underweight were used as the reference group in this regression analysis. Both models were adjusted for age, sex, and family socioeconomic status.

2) Among first- generation immigrant children who are between the ages of 5-11 is length of time spent in Canada associated with a physical activity levels?

a) Is length of time spent in Canada associated with physical activity levels among 5-9 year old immigrant children?

b) Is length of time spent in Canada associated with physical activity levels among 10 to 11 year old immigrant children?

In order to answer these questions, linear regression models were used to test whether time spent in Canada was associated with physical activity levels. Models were adjusted for age, sex, and family socioeconomic status. Logistic regression models were also used to determine if there was a relationship between time spent in Canada and high versus low levels of physical activity.

3) Among first- generation immigrant children who are between the ages of 5-11 is length of time spent in Canada associated with amount of screen time?

a) Is length of time spent in Canada associated with the amount of time spent watching TV among 5-9 year old immigrant children?

b) Is length of time spent in Canada associated with amount of time spent playing video games or computer games among 5-9 year old immigrant children?

c) Is length of time spent in Canada associated with amount of time spent watching TV among 10-11 year old immigrant children?

d) Is length of time spent in Canada associated with amount of time spent in front of a computer among 10-11 year old immigrant children?

In order to answer these questions, linear regression models were used to test whether time spent in Canada were associated with amount of screen time. Models were adjusted for age, sex, and family socioeconomic status. Logistic regression models were also used to test if time spent in Canada was associated with an high versus low levels of screen time.

4) Is poorer immigrant family functioning associated with higher prevalence of overweight and obesity?

In order to answer this question linear regression models were used to test whether family functioning was associated with BMI. Logistic regression models were used to test the odds that family functioning was associated with BMI status. Children who are normal weight or underweight were used as the reference group in this regression analysis. Models were adjusted for sociodemographic characteristics such as age, sex,

and family socioeconomic status.

5) Is hostile/ineffective parenting by immigrant parents associated with higher prevalence of overweight and obesity in first-generation immigrant children?

In order to answer this question linear regression models were used to test whether hostile/ ineffective parenting styles were associated with BMI. Logistic regression models were used to determine whether hostile and ineffective parenting was associated with BMI status. Children who are normal weight or underweight were used as the reference group in this regression analysis. Models were adjusted for sociodemographic characteristics such as age, sex, and family socioeconomic status.

4) Is a less consistent parenting style by immigrant parents associated with higher prevalence of overweight and obesity in first-generation immigrant children?

In order to answer this question linear regression models were used to test whether inconsistent parenting styles were associated with BMI. Logistic regression models were used to test associations between consistent parenting and BMI status. Children who are normal weight or underweight were used as the reference group in this regression analysis. Models were adjusted for sociodemographic characteristics such as age, sex, and family socioeconomic status.

5) Is punitive parenting by immigrant parents associated with higher prevalence of overweight and obesity in first generation immigrant children?

In order to answer this question linear regression models were used to test whether punitive parenting styles were associated with BMI. Logistic regression models were used to test the odds that punitive parenting was associated with BMI status. Children who are normal weight or underweight were used as the reference group in this

regression analysis. Models were adjusted for sociodemographic characteristics such as age, sex, and family socioeconomic status.

6) Are less positive interactions between immigrant parents and their children associated with prevalence of overweight and obesity, in first generation immigrant children?

In order to answer this question linear regression models were used to test whether less positive interaction with children was associated with BMI. Logistic regression models were used to test the odds that less positive interaction was associated with BMI status. Children who are normal weight or underweight were used as the reference group in this regression analysis. Models were adjusted for sociodemographic characteristics such as age, sex, and family socioeconomic status.

7) Is neighborhood safety associated with prevalence of overweight and obesity in first-generation immigrant children?

In order to answer this question we used linear regression models to test whether neighborhood safety was associated with BMI. Logistic regression models were used to test the odds that neighbourhood safety was associated with BMI status. Children who are normal weight or underweight were used as the reference group in this regression analysis. Models were adjusted for sociodemographic characteristics such as age, sex, and family socioeconomic status.

Results

Descriptive Statistics

Table 1a presents descriptive statistics of the sample and depicts normal versus overweight/ obese compared to demographic, parenting and neighborhood factors.

Table 1a. Descriptive Characteristics of the sample comparing normal weight versus overweight and obese

	Normal (%)	**Overweight/Obese (%)**	**Chi-Square (df)**	***p***
Demographic				
Age				
5-9	29270 (57)	22080 (43)	**6.79(1)***	**0.009**
10-11	51760 (79.0)	13713 (20.9)		
Sex				
Male	30555 (72.7)	11485 (27.3)	1.02	0.29
Female	21119 (71.0)	8664 (29.0)		
SES				
Low	23856 (62.7)	14145 (37.2)	.689(1)	0.403
Moderate to High	29205 (72.8)	10841 (27.1)		
Parental and Familial				
Inconsistency				
Low	54642(68.17)	25511(31.83)	0.037(1)	0.84
High	24270 (70.24)	10282(29.76)		
Negative Interaction				
Low	15678(56.9)	11877(43.1)	2.32(1)	0.12
High	65353 (73.21)	23916(26.79)		
Hostile Interaction				
Low	19551(67.59)	9376(32.41)	.025(1)	0.87
High	59836(69.37)	26417(30.63)		
Family Functioning				
Low	50119(71.10)	20362(28.99)	.339(1)	0.56
High	28650(65.37)	15178(34.63)		

Note. 1) Descriptive statistics could not be provided for punitive interaction due low cell counts. 2) Percentages refer to row percentages.

There were 358 immigrants in this sample giving us a weighted sample of 173,534. Of this sample, the sample of interest was children between the ages of 5-11 giving us a weighted sample of 116,823. Of the weighted sample, 58% of the sample was male and 41.7% of the sample was female. In terms of BMI, 43.5% of the sample were normal weight males, and 29.4 % of the sample, normal weight females. Overweight and obese males and formed 15.1 % of the sample, and overweight and obese females formed 12% of the sample. However, there was no significant difference between male and female rates of obesity and overweight (($\chi 2\ (df) = 1.02\ (1); p > .05$

Table 1a presents descriptive statistics of demographic and environmental factors. There was a difference between age groups and prevalence of overweight and obesity ($\chi 2\ (df) = 6.79\ (1); p < 05$. Overall however, there was no difference between normal versus overweight and obese individuals when compared across several different variables such as socioeconomic status, neighborhood safety, family functioning and parenting factors.

Table 1b presents descriptive characteristics of the sample comparing years since immigration to levels of physical activity and screen time.

Table 1b. Descriptive Characteristics of the sample comparing years spent in Canada to levels of physical activity and screen time.

	Low (< 5) (%)	**High (>5) (%)**	**Chi-Square (df)**	***p***
Physical Activity				
5-9				
Low to Moderate	16632(41.9)	23063 (58.1)	0.4091	0.522
High	50212(47.9)	54448 (52.0)		
10-11				
Low to Moderate	8737(34.1)	16877(65.89)	0.2639(1)	0.607
High	4579(27.1)	12296 (72.8)		
Computer/Video games				
5-9	44550 (51.0)	42699 (48.9)	1.36	0.242
10-11	22293 (39.0)	34812(60.9)		
TV/videos				
5-9				
Low to Moderate	37029 (49.6)	37586 (50.3)	0.727	0.393
High	9264 (39.0)	14493(61.0)		
10-11				
Low to Moderate	11403 (33.17)	22970 (66.8)	0.509	0.475
High	1913 (23.0)	1842 (76.9)		

Note. 1) Percentages refer to row percentages.

As can be seen in Table 1b. There were no statistically significant differences on levels of physical activity and screen time across those who had been in Canada for less than 5 years versus those who had been in Canada for a longer period of time. However, a larger proportion of children who had resided in Canada for longer than 5 years

engaged in high levels of physical activity across the older age group. With regards to screen time, higher levels of computer use and TV watching were seen in the group that had been in Canada for longer than 5 years. However, these results were not statistically significant.

Inferential Statistics

In the inferential portion of the analysis several regression models were conducted in order to determine the association between the above-mentioned variables.

Table 2a shows the association between years since immigration and organized and unorganized physical activity in the 5-9 year olds.

Table 2a. Years since immigration and association with physical activity 5-9 years.

	Beta Coefficient[1]	**SE Beta**	**t**	***p***
Physical Activity				
5-9	-0.18	0.15	-1.21	0.22
Demographic Factors				
Sex (Female)	1.77	0.62	2.84	0.21
Age	-0.26	0.21	-1.25	0.21
SES	-0.11	0.35	-0.32	0.75

Note. 1) R^2 for the model= 0.18. 2) Models adjusted for demographic factors.

In this model physical activity was not associated with years since immigration. The covariates in the model SES and sex were not associated with physical activity levels as well. However the coefficient of determination, R^2 for the model was quite low indicating poor fit between the regression line and the data points, therefore suggesting that the variance is better accounted for by other factors.

Table 2b shows the association between years since immigration and levels of physical activity (low versus high) in the 5-9 year olds.

Table 2b. Years since immigration associated with high versus low levels of physical activity 5-9 years.

	Adjusted Odds Ratio[1]	**95% CL**	***p***
Physical Activity			
5-9	0.96	0.81-1.14	0.67
Demographic Factors			
Sex (Female)	1.07	0.51-2.24	0.86
Age	1.44	1.19-1.74	0.0*
SES	0.82	0.46-1.47	0.50

Note. 1) Pseudo R^2 for the model= 0.113 2) Models adjusted for demographic factors.

In this model, levels of physical activity were not associated with years since immigration. The covariates in the model SES and sex were not associated with physical activity levels as well. However the coefficient of determination, R^2 for the model was quite low accounting of 11% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 2c shows association between years since immigration and organized and unorganized physical activity in 10- 11 year olds. Table 2d shows the logistic relationship between years since immigration and levels of physical activity (low versus high)

Table 2c. Years since immigration and association with physical activity 10-11years.

	Beta Coefficient[1]	**SE Beta**	**t**	***p***
Physical Activity				
10-11	0.09	0.12	0.78	0.43
Demographic Factors				
Sex (Female)	-0.88	0.56	-0.14	0.88
Age	0.55	0.55	1.01	0.31
SES	0.22	0.32	0.69	0.49

Note. 1) R^2 for the model= 0.07 2) Models adjusted for demographic factors.

In this model, levels of physical activity were not associated with years since immigration. In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 7% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 2d shows the association between years since immigration and levels of physical activity (low versus high) in the 10-11 year olds.

Table 2d. Years since immigration associated with high versus low levels of physical activity10-11years

	Adjusted Odds Ratio[1]	**95% CL**	***p***
Physical Activity			
10-11	1.14	0.73-1.76	0.56
Demographic Factors			
Sex (Female)	1.09	0.22-5.27	0.91
Age	1.18	0.28-4.96	0.82
SES	1.63	0.71-3.74	0.25

Note. 1) Pseudo R^2 for the model= 0.05 2) Models adjusted for demographic factors.

In this model, levels of physical activity were not associated with years since immigration. The coefficient of determination, R^2 for the model was quite low accounting for only 5% of the variance. This suggests that a large proportion of the relationship is better accounted for by other factors.

Table 3a shows the association between years since immigration and time spent in front of a computer or playing video games in the 5-9 year olds. Table 3b shows the logistic relationship between the variables.

Table 3a. Years since immigration and association with computer or videogame time 5-9years.

	Beta Coefficient[1]	**SE Beta**	**t**	***p***
Computer/Videogame				
5-9	0.05	0.11	0.44	0.658
Demographic Factors				
Sex (Female)	0.38	0.37	1.03	0.30
Age	0.28	0.14	1.97	0.04*
SES	0.14	0.27	0.51	0.610

Note. 1) R^2 for the model= 0.128 2) Models adjusted for demographic factors.

In this model, time spent playing video games or on a computer was not associated with years since immigration. In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 12% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 3b shows the association between years since immigration and levels of time (high versus low) spent in front of a computer or playing video games.

Table 3b. Years since immigration and association with levels of computer or videogame time (low versus high) 5-9years.

	Adjusted Odds Ratio[1]	**95% CL**	***p***
Computer/Videogame			
5-9	1.23	0.90-1.67	0.187
Demographic Factors			
Sex (Female)	1.02	0.47-2.18	0.96
Age	1.43	1.18-1.74	0.03*
SES	0.83	0.47-1.47	0.51

Note. 1) Pseudo R^2 for the model= 0.126 2) Models adjusted for demographic factors.

In this model, low versus high amounts of time spent playing video games or on a computer was not associated with years since immigration. The covariates in the model SES and sex were also not associated with physical activity. In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 12.6% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 3c shows the association between years since immigration and time spent in front of a computer or playing video games in the 10-11year olds. Table 3d shows the logistic relationship between the two variables.

Table 3c. Years since immigration and association with computer or videogame time 10-11years.

	Beta Coefficient[1]	**SE Beta**	**t**	***p***
Computer/Videogame				
10-11	-0.04	0.08	-0.54	0.588
Demographic Factors[2]				
Sex (Female)	-0.13	0.31	-0.43	0.66
Age	-0.00	0.34	-0.01	0.99
SES	0.07	0.21	0.33	0.74

Note. 1) R^2 for the model= 0.128 2) Models adjusted for demographic factors.

In this model, time spent playing video games or on a computer was not associated with years since immigration. The covariates in the model SES and sex were also not associated with computer or video game time. In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 12% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 3d shows the association between years since immigration and levels of time (high versus low) spent in front of a computer or playing video games, in the 10-11 year olds.

Table 3d. Years since immigration and association with levels of computer or videogame time (low versus high) 10-11years.

	Adjusted Odds Ratio[1]	**95% CL**	***p***
Computer/Videogames			
10-11	0.94	0.39-2.27	0.88
Demographic Factors			
Sex (Female)	1.12	0.22-5.62	0.88
Age	1.27	0.31-5.12	0.73
SES	1.66	0.72-3.85	0.23

Note. 1) Pseudo R^2 for the model= 0.048 2) Models adjusted for demographic factors

As seen in Table 3d the length of time spent in Canada also was not associated in amount of time spent in front of a computer or playing video games (high vs low). In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 4% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 4a shows the association between years since immigration and time spent in front of a computer or playing video games in the 5-9 year olds.

Table 4a. Years since immigration and association with TV time 5-9 years

	Beta Coefficient[1]	**SE Beta**	**t**	***p***
TV				
5-9	-0.46	0.39	-1.17	0.24
Demographic Factors				
Sex (Female)	-2.17	1.68	-1.29	0.19
Age	0.09	0.73	0.13	0.89
SES	-1.13	0.99	-1.14	0.25

Note. 1) R^2 for the model= 0.18. 2) Models adjusted for demographic factors

As seen in Table 3d the length of time spent in Canada also was not associated with time spent watching TV. In addition, the coefficient of determination, R^2 for the

model was higher than the other models but still low (18%) of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 4b. Years since immigration and association with levels of TV time (high versus low) 5-9 years

	Adjusted Odds Ratio[1]	**95% CL**	***p***
TV time			
5-9	1.01	0.95-1.07	0.83
Demographic Factors			
Sex (Female)	1.20	0.54-2.69	0.65
Age	1.46	1.20-1.79	0.0*
SES	0.78	0.42-1.45	0.43

Note. 1) Pseudo R^2 for the model= 0.09 2) Models adjusted for demographic factors

Table 4c shows the association between years since immigration and time spent in watching TV in the 10-11year olds, and Table 4d shows the logistic relationship between years since immigration and TV time.

Table 4c. Years since immigration and association with TV time 10-11years.

	Beta Coefficient[1]	**SE Beta**	**t**	***p***
TV time				
10-11	0.52	0.71	0.73	0.46
Demographic Factors				
Sex (Female)	1.22	3.01	0.40	0.68
Age	2.53	2.30	1.10	0.27
SES	0.95	1.72	0.55	0.57

Note. 1) R^2 for the model= 0.09 2) Models adjusted for demographic factors

In this model, time spent watching TV was not associated with years since immigration. The covariates in the model SES and sex were also not associated with computer or video game time. In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 9% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 4d shows the association between years since immigration and levels of time (high versus low) spent watching TV, in the 10-11 year olds.

Table 4d. Years since immigration and association with amount of TV time (high versus low) 10-11years.

	Adjusted Odds Ratio[1]	**95% CL**	***p***
TV time			
10-11	1.02	0.92-1.14	0.68
Demographic Factors			
Sex (Female)	1.39	0.27-7.22	0.69
Age	1.22	0.26-5.77	0.79
SES	1.58	0.64-3.94	0.32

Note. 1) Pseudo R^2 for the model= 0.05 2) Models adjusted for demographic factors

As seen in Table 4d the length of time spent in Canada also was not associated with amount of time spent watching TV (high vs low). In addition, the coefficient of determination, R^2 for the model was quite low, accounting for 5% of the variance therefore suggesting that the relationship is better accounted for by other factors.

Table 5a shows the results of the linear regression with continuous BMI as the outcome measure, whereas Table 5b shows the results of the logistic regression (0=1 Normal; 1= overweight or obese).

Table 5a. Factors associated with BMI

	Mean (SE)	**Beta Coefficient[1]**	**SE Beta**	**t**	***p***
Years since Immigration	5.46(0.25)	-0.01	0.18	-0/04	0.970
Parental and Familial					
Inconsistency	5.94(0.34)	0.03	0.13	0.25	0.80
Negative Interaction	9.21 (0.34)	-0.05	0.20	-0.25	0.80
Punitive Interaction	8.54(0.15)	-0.39	0.25	-1.53	0.12
Hostile Interaction	9.21(0.34)	0.03	0.14	0.24	0.80
Family Functioning	9.65(0.70)	-0.09	0.13	-0.75	0.45
Neighborhood Safety	NA	0.58	0.46	1.26	0.20
Demographic Factors					
Age	8.25	-0.15	0.32	-0.47	0.63
Sex (Female)	NA	-1.07	-1.23	-0.87	0.368
SES	-0.02	-0.97	0.75	-1.30	0.195

Note. [1]Models adjusted for age, sex and SES.
[2] R^2 for the model = 0.092

As can be seen in Table 5a, parenting that was harsh and punitive was not associated with BMI (M (SE) =9.30(0.26)). Parenting that was described as hostile was not associated with BMI ((M (SE) =8.97 (0.44)). Family dysfunction also was not associated with BMI (M (SE) =9.65 (0.70)). Negative interactions between parents and children ((M (SE) =9.21(0.34)) also was not associated with BMI over time nor was inconsistent parenting ((M (SE) =5.94(0.34)). Neighbourhood safety was not correlated

with BMI. The coefficient of multiple determination for the model (R^2= 0.09) suggests that this model did not explain a large proportion of the variance in BMI.

Table 5b shows the relationship between weight status (0=1 Normal; 1= overweight or obese) and parenting and familial factors.

Table 2d. Association between Years since immigration, parenting factors, familial factors and demographic factors and BMI status (normal versus overweight/obese)

	Adjusted Odds ratio[1]	**95% CL**	***p***
Years since Immigration	0.95	0.75-1.20	0.65
Parental and Familial			
Inconsistency	1.01	0.86-1.18	0.92
Negative Interaction	0.92	0.75-1.12	0.39
Punitive Interaction	0.99	0.73-1.35	0.96
Hostile Interaction	0.97	0.80-1.16	0.71
Family Functioning	1.02	0.91-1.15	0.72
Neighborhood Safety	1.12	0.75-1.66	0.58
Demographic Factors			
Age	0.86	0.66-1.12	0.26
Sex (Female)	0.59	0.21-1.65	0.31
SES	0.77	0.42-1.43	0.41

Note. [1]Models adjusted for age, sex and SES.
[2] Pseudo R^2 for the model = 0.063309

As can be seen in Table 5b parenting that was harsh and punitive was not associated with overweight or obesity status. Parenting that was described as hostile was also not associated with a BMI status. Family dysfunction also was not associated with development of obese or overweight BMI status. Negative interactions between parents and children were not associated with overweight or obesity, nor were there any

associations with BMI status. Neighborhood safety also did not have an effect on BMI status. The coefficient of multiple determination for the model (R^2= 0.06) suggests that this model did not explain a large proportion of the variance in BMI status.

Overall BMI was not accounted for by parenting factors, family factors or environmental factors such as neighborhood factors. Years spent in Canada were not associated with BMI, physical activity levels or screen time.

Discussion

Examining obesity from an environmental and individual perspective; family dysfunction, parenting factors, and neighborhood safety were not associated with BMI. Other results revealed that years since immigration was not associated with physical activity levels, amount of time spent in front of a computer, or BMI. This adds to the controversy in the literature. However, age was significantly associated with levels of physical activity and screen time in the 5-9 year olds. This is to be expected as 5-9 covers quite a varied age range, and levels of physical activity and screen will change with age (Bock, 2008; Colley, 2011). In addition, age was a covariate in the model and not a variable of interest. With regards to BMI, some authors have found a significantly lower BMI among new immigrants compared to immigrants who have resided in Canada for several years; however these findings are among the adult population (McDonald & Kennedy, 2005). If years since immigration is used as an indicator of acculturation; then the present results suggest that, among children, acculturation is not associated with a more obesogenic lifestyle; however there are several other factors that could have contributed to these non-significant results.

Factors contributing to non-significant results.

The immigrant sample formed only a small proportion of the entire sample of the NLSCY (approximately 1.5%); therefore, we were restricted by very small sample sizes. The weighted sample of immigrant children also appears unusual in that 43% of the "weighted sample" in the immigrant population between the ages of 5-9 belonged to the overweight/obese group. It is unusual for nearly 50% of the sample to be overweight or obese; therefore, this suggests that this particular sample may not be representative of the

population in terms of obesity/overweight status. However, a bootstrapping method was used for the data analysis therefore providing a sampling distribution based on the population in the study. The measures in this study may not adequately reflect the ideas being studied and therefore may mask the relationship between BMI and these variables. In addition, BMI is a complex factor that can be accounted for by several different phenomena, not all of which were accounted for in this study. For example, we were unable to measure macronutrient composition of diet and the absence of this factor may have weakened the analysis. In addition, a large proportion of this study was dependent on parental report, and therefore on sensitive topics such as family functioning, and parental factors, reports may be positively skewed. However, given that these variables were examined using both linear and logistic regressions in order to obtain a more complete and accurate picture of the relationship, there may very well be no relationship between the variables examined. A discussion of individual factors examined in the study follows.

Time Spent in Canada

As previously mentioned, time spent in Canada among first-generation immigrant children was not associated with BMI, or overweight and obesity. This is in contrast to previous literature that suggests increasing acculturation contributes to increasing rates of obesity among immigrant children. These divergent results may be due to the fact that time spent in Canada is not necessarily an indicator of acculturation, although it has been used as such in previous studies (McDonald & Kennedy, 2005). Other studies have examined acculturation by other means including language spoken at home (Gordon-Larsen al., 2005**)** and generational status (Quon et al., 2012**).** In addition, our sample was

restricted to first-generation immigrant children whom studies have shown are less predisposed to developing overweight or obesity status (Quon et al., 2012; Singh et al., 2009). However, this study focused on first generation immigrant children, as there are few studies that focus on this sample specifically. In addition, findings in the area of child obesity are often controversial, with some studies finding that immigrant children are more predisposed towards obesity and other studies finding differently (Kirchengast & Schober, 2005; Quon et al., 2012; Singh et al., 2009). In addition, the 1994 cycle of the NLSCY was used. Rates of both obesity and immigration have increased since that time. Therefore the present results are not necessarily indicative of the situation today (Statistics Canada, 2002). A more up-to-date analysis of more recent cycles and/or a longitudinal study will need to be conducted in order to ascertain the situation today.

Time spent in Canada was not associated with levels of screen time. Intuitively, given the increasing reliance on technology today, increasing acculturation could be expected to be associated with increasing time spent in front of the TV or using a computer. In addition, immigrant families often report watching TV as a way to become acculturated to the customs and traditions of the new country (Somani, 2008). Moreover, they also keep in touch with their cultural roots by watching television from their own countries through satellite dishes (Somani, 2008). However, increasing acculturation and increasing technology may change TV watching habits over time (Somani, 2008). Other factors have also been associated with TV watching, including parental education (Kristiansen et al., 2013), generational status, and ethnicity. Immigrant children are purported to watch less TV than native-born children of similar ethnicity (Singh et al.,

2008b). However, a longitudinal analysis was not conducted, therefore changes over time and increasing acculturation could not be observed.

Computer or video game use was not associated with increasing time spent in Canada. Computer use has been shown to change with acculturation levels (Singh et al., 2008b). However, in 1994, computer use was limited to 32% of the population, as opposed to 53% in 2000 (Roberts et al., 2005). In addition, only 7% of households had access to the Internet in 1994, increasing to 50% in 2000 (Roberts et al., 2005.) Not surprisingly, higher income households were more likely to report having a computer than lower income households. Due to the fact that early immigrants often have lower socioeconomic status than immigrants who have resided in Canada longer or their native born counterparts, some first generation immigrant children may not have access to a computer (Wang & Lo. 2005). This is not reflected in the way the question was asked and does not separate those who did not have access to a computer from those who did but chose not to spend time in front of the computer as they may represent two different populations.

Time spent in Canada was not associated with physical activity. However, it has been shown that immigrant children are less likely to participate in physical activity than native-born children of similar ethnicities **(**Singh et al., 2008b**).** Studies among adults demonstrate that physical activity levels increase with increasing length of time in Canada and, therefore, increasing acculturation, even when acculturation is measured by other means such as language acquisition (Abraido-Lanza et al., 2005; Cantero et al., 1999; and Crespo et al., 2001). In interpreting the present results, it should be remembered that the parents of first generation immigrant children are likely also

engaged in the acculturation process. Therefore, acculturation affects not only children but the family as a whole. Consequently, physical activity levels of parents may also influence physical activity levels of children. However, the current results did not show that time spent in Canada affected the physical activity levels of children. This may also be due in part to the nature of the question asked. Immigrant children may be more active than non-immigrant children. However, one part of the question specifically asked about unorganized sports activities, such as those without a coach or instructor. Many common activities that are physical, such as a game of tag, may not be captured in this question. In addition, immigrant children may not be participating in activities with a coach or instructor due to financial constraints. Therefore the current non-significant results could speak to the limitations of performing a cross-sectional as opposed to longitudinal analyses. In addition, age in years and months was adjusted for in the models that examined time spent in Canada. Age and years in Canada are correlated variables and therefore collinearity could be a potential factor in the non-significant results. Finally, time spent in Canada may not be a valid measure of acculturation and if so, it could not be expected to be associated with physical activity levels.

Family Dysfunction

In the present study, family dysfunction was not associated with BMI. Poor family functioning has been linked with obesity and overweight status in childhood (Rhee, 2000). However, the mechanism by which family dysfunction plays a role in the development of obesity has not been fully understood (Wen et al., 2012). Some studies report that family dysfunction is associated with development of maternal behaviours that may pose an obesity risk (Wen et al., 2012). In this study, immigrant family functioning

was not associated with overweight or obesity. However, immigrant children have not been examined previously in terms of family dysfunction. As previously stated (Wen et al., 2012), the literature does not clarify whether poorer family functioning is a contributor to childhood obesity or whether an obese child puts more stress on the family system. Nonetheless, poor family functioning has been associated with a range of chronic health conditions, as well as other mental and physical health problems (NSW Department of Health, 1999; Zubrick et al., 2000; Zubrick et al., 1995).

Another reason findings may be inconsistent with previous research is the questionnaire used to determine family dysfunction. Family functioning is a very complex phenomenon that can be assessed in several ways. The NLSCY questionnaire obtained information on various aspects of family functioning including problem solving, behavior control, and communication, as well as roles within the family. However, the scales used in other studies measure other aspects of family functioning including adaptation, partnership, growth, and affection (Smilkstein et al., 1982). Due to the differences in the measurement tools, the present results may not be comparable to those of previous studies.

Neighborhood factors.

Neighborhood factors were not associated with childhood overweight or obesity status or BMI. Again, this is in contrast to previous literature in the United States that found that child obesity tended to be as much 60% higher in neighborhoods with unfavorable conditions, poor housing, and /or poor access to parks or recreation centers (Singh et al., 2009). Some studies have shown that neighborhood factors may contribute to childhood obesity even when controlling for a host of factors such as age, sex, family

income, and level of education. However, we did not assess built environment factors other than neighborhood safety. Although neighborhood safety may be a deciding factor in the level of physical activity and play spaces to which a child has access (Singh et al., 2009), neighborhood safety is almost certainly not the only factor that is associated with levels of physical activity that could contribute to obesity development. Nonetheless, less safe neighborhoods are often an indicator of lower SES, which in turn is strongly associated with levels of childhood obesity (Oliver & Hayes, 2005). Some studies focus on concentrated urban poverty, defined as "any area where greater than forty percent of the residents have an income below the poverty line" (Hajnal, 1995). Concentrated urban poverty has been associated with a number of conditions, such as educational insufficiencies and reliance on social assistance (Hajnal, 1995). Canada has a proportionally higher number of these areas than the U.S.A, and most residents in these areas tend to be white, non-immigrants (Hajnal, 1995). Therefore, immigrants to Canada may not be as highly represented in low SES neighborhoods as immigrants to the USA. Thus, results from U.S. studies may not be generalizable to Canada. Further, neighborhood factors may not be as important in the development of obesity in immigrant children, given that a large proportion of residents in neighborhoods of urban poverty may in fact, may not be immigrants.

Parenting Factors

Several studies have focused on the importance of parenting factors to the risk of overweight and obesity in children (Field et al., 2012; Rhee et al., 2008). However, parenting factors such as positive interaction, hostile/ineffective parenting, consistent

parenting, and punitive parenting were not associated with childhood obesity or overweight, nor did was parenting associated with BMI.

However, in this study specific parenting styles, such as authoritarian parenting or authoritative parenting were not examined as a whole. Instead, specific characteristics of parent child interactions were examined. Positive interaction between a parent and child was not associated with BMI or overweight and obesity. The positive interaction scale used in the present research measured the nature of interactions between the parent and children (e.g. how the parent reinforces the child's behavior or how often the parent plays with the child). This scale did not correlate with children's risk for overweight or obesity. This may be due to the nature of the positive parenting scale, as it focuses more on the associations between parents and children and less on the way the parent responds to child behaviours (Ryan & Adams, 1998). Therefore, it is not a conventional parenting scale. In addition, positive interaction between parents and children may not be indicative of a specific parenting style. The NLSCY scale also did not target parenting of eating related behaviours, which may be a defining factor in the way parents contribute to obesity risk, other than genetic influences (Rhee et al., 2008)

Punitive parenting and hostile/ineffective parenting were not associated with BMI status (normal versus overweight/obese), or BMI. Specific ways in which parents respond to children could play developmental role of self-regulation of eating habits in children (Frankel, 2012). Punitive and hostile parenting styles reflect a more authoritarian parenting style, which have been more associated with childhood obesity than other parenting styles (Baumrind, 1991). Although we did not find positive results, this may be due to several factors. Some studies have indicated that paternal parenting styles are

associated more highly with prevalence of obesity than maternal style (Wake et al., 2007). In the present study the PMKs who answered parenting questions were much more often mothers than fathers, therefore a future examination of father's parenting practices across these factors could provide important insight into the development of obesity.

The level of consistency in parenting practices was assessed by measuring the degree to which parents reporting following through with threats to discipline children, or made sure children were disciplined when they needed to be. Consistent parenting has been more associated with authoritative parenting (Stang & Loth, 2011). Authoritative parenting is also associated with lowered obesity risk, as well as an increased consumption of healthful foods compared to other parenting styles (Stang & Loth, 2011). However research that solely targets consistency in parenting practices is scarce, so the conclusions we can draw from these results are limited.

Strengths

The weighted and nationally representative nature of the NLSCY data set allowed examination of obesity risk from an individual and ecological perspective using factors such as, parenting factors, neighborhood safety, and family functioning, which have not previously been examined in a Canadian immigrant population. This data set also had the advantage of relatively low cost to conduct the study, and high time efficiency as the data was already collected.

Limitations

The lack of control over the NLSCY survey design was a definite limitation of the present study, as is the case with any secondary data. Macro- nutrient composition of diet, a key factor in predicting obesity or overweight development (Ebbeling et al., 2002)

was not assessed by the NLSCY. Direct measurements of weight and height would have been preferable; however, parent-reported height and weight data has been shown to be valid and reliable, particularly for studying correlates of obesity in school-age children (Goodman et al, 2000; Oliver & Hayes; 2005; Singh et al, 2008). Also, immigrant children formed a small proportion of the NLSCY sample and were not the main focus of the survey, resulting in small sample sizes. The survey questions may not have adequately addressed the unique factors and stressors associated with migration and development of obesity. In addition, ethnicity could not be considered, as these questions were not asked of the first-generation immigrant sample until later cycles of the survey. As this was an exploratory study, a cross-sectional analysis was performed. However, a longitudinal study would have provided more information about the effect of the predictor variables on obesity. The current research was limited to the earliest cycle of the survey, as cross-sectional weights were not provided for the immigrant population in subsequent samples. The fact that this early cycle occurred in 1994 means that some findings may not necessarily reflect immigrant children today (about 20 years later).

Future directions

This study is the first to examine environmental factors, parenting factors, time since immigration and the association with childhood obesity in immigrant children. Future directions for research would be to examine these issues from a longitudinal perspective in order to obtain more information on the mechanisms by which selected predictors contribute to childhood obesity. In addition, an examination of the specific parenting styles that contribute to childhood obesity in immigrant children would be very valuable. As previously stated, it was not possible to examine ethnicity in conjunction

with immigrant status as it associates with childhood obesity. However, ethnicity is an important factor that could provide more information obesity in immigrant children due to differential risk across ethnicities. Therefore, future research taking ethnicity into consideration would provide more detailed information on how obesity could vary by immigrant status and other ecological factors. This study was also confined to the immigrant sample and given that there were no significant results in this study, possibly due to low sample sizes, and the nature of the study, more refined and empirically reformed studies of immigrants is warranted. In addition, it would also be beneficial to compare these results to a non-immigrant population in order to determine if the same effects are present in the non-immigrant population.

Significance

Findings were non-significant and therefore conclusive findings and recommendations could not be drawn from this study. This reiterates the fact that often there is no direct link between one factor and obesity. Instead obesity is a complicated phenomenon that is affected by several different factors. In the light of the cost of obesity for Canadian government rising to as much as $4.6 billion in health care costs in 2008 (Jansen, 2012), more research is needed into the obesity risk associated with immigration, especially among children. Further research into this topic may help provide more information that would allow policy makers and other government agencies to generate culturally relevant, promising avenues for preventive programming with obesity.

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APPENDIX A
Physical Activity and Screen Time

1) Physical Activity Ages 5 -9

a) In the last 12 months, outside of school hours, how often has child: Taken part in sports or activities without a coach or instructor.

1) Most days
2) A few times a week
3) About once a week
4) About once a month
5) Almost never
6) Aot applicable
7) Dont know
8) Refusal
9) Not stated

b) In the last 12 months, outside of school hours, how often has child:: taken part in unorganized sports or physical activities?

1) Most days
2) A few times a week
3) About once a week
4) About once a month
5) Almost never
6) Not applicable
7) Don't know
8) Refusal
9) Not stated

2) Physical Activity 10-11

a) Outside of school, I take part in sports with a coach or instructor:

1) Never
2) Less than once a week
3) 1 to 3 times a week 1
4) 4 or more times a week
6) Not Applicable
7) Don't Know
8) Refusal
9) Not Stated

b) Outside of school, I play sports or do physical activities WITHOUT a coach or instructor.

1) Never
2) Less than once a week
3) 1 to 3 times a week 1
4) 4 or more times a week
6) Not Applicable
7) Don't Know
8) Refusal
9) Not Stated

3) Screen time ages 5 -9

a) In the last 12 months, outside of school hours, how often has child played computer or video games?

1) Most days
2) A few times a week
3) About once a week
4) About once a month
5) Almost never
6) Not applicable
7) Don't know
8) Refusal
9) Not stated

b) About how many days a week on average does child watch T.V. or videos at home?

1) 0 days
2) 1 day
3) 2 days
4) 3 days
5) 4 days
6) 5 days
7) 6 days
8) 7 days
9) Not applicable
10) Don't know
11) Refusal
12) Not stated

c) On those days, how many hours on average does he/she spend watching T.V. or videos?

_____ (number in hours and minutes)

3) Screen Time ages 10-11

a) I play computer or video games
1 Never
2 Less than once a week
3 1 to 3 times a week
4 4 or more times a week
6 Not Applicable
7 Don't Know
8 Refusal
9 Not Stated

b) I watch T.V.
1 Never
2 Less than once a week
3 1 to 3 times a week
4 4 or more times a week
6 Not Applicable
7 Don't Know
8 Refusal
9 Not Stated

c) On average, about how many hours a day do you watch TV?
01 0 - 1 hour a day
02 1 - 2 hours a day
03 3 - 4 hours a day
04 5 - 6 hours a day
05 7 or more hours a day
96 Not Applicable
97 Don't Know
98 Refusal
99 Not Stated

Appendix B
Parenting Scale

Positive Interaction Scale

1) How often do you praise (name) by saying something like 'Good for you!' or 'What a nice thing you did!' or 'That's good going! '?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

2) How often do you and he/she talk or play with each other, focusing attention on each other for five minutes or more, just for fun?

01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

3) How often do you and he/she laugh together?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

4) How often do you do something special with him/her that he/she enjoys?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

5) How often do you play sports, hobbies or games with him/her?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

Hostile Interaction

1) How often do you get annoyed with s/he for saying or doing something he/she is not supposed to?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

2) Of all the times that you talk to s/he about his/her behaviour, what proportion is praise?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day

96 not applicable
97 Don't know
98 Refusal
99 Not stated

3) Of all the times that you talk to him/her about his/her behaviour, what proportion is disapproval?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

4) How often do you get angry when you punish (name)?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

5) How often do you think that the kind of punishment you give him/her depends on your mood?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

6) How often do you feel you are having problems managing him/her in general?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day

96 not applicable
97 Don't know
98 Refusal
99 Not stated

7) How often do you have to discipline him/her repeatedly for the same thing?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

Consistent Parenting

1) When you give him/her a command or order to do something, what proportion of the time d o you make sure that he/she does it?
   01 Never
   02 About once a week or less
   03 A few times a week
   04 One or two times a day
   05 Many times each day
   96 not applicable
   97 Don't know
   98 Refusal
   99 Not stated

2) If you tell him/her he/she will get punished if he/she doesn't stop doing something and he/she keeps doing it, how often will you punish him/her?

   01 Never
   02 About once a week or less
   03 A few times a week
   04 One or two times a day
   05 Many times each day
   96 not applicable
   97 Don't know
   98 Refusal
   99 Not stated

3) How often does he/she get away with things that you feel should have been punished?
   01 Never

02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

4) How often when you discipline him/her, does s/he ignore the punishment?

01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

5) How often do you have to discipline him/her repeatedly for the same thing?
01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

Punitive Parenting

1) When s/he breaks the rules or does things that he/she is not supposed to, how often do you: Raise your voice, scold or yell at him/her

01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

2) When s/he breaks the rules or does things that he/she is not supposed to, how often do you: Calmly discuss the problem?

01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

3) When s/he breaks the rules or does things that he/she is not supposed to, how often do you Use physical punishment?

01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day
96 not applicable
97 Don't know
98 Refusal
99 Not stated

4) When s/he breaks the rules or does things that he/she is not supposed to, how often do you describe alternative ways of behaving that are acceptable?

01 Never
02 About once a week or less
03 A few times a week
04 One or two times a day
05 Many times each day

96 not applicable
97 Don't know
98 Refusal
99 Not stated

Appendix C
Family Functioning scale.

1) Planning family activities is difficult because we misunderstand each other.
2) In times of crisis we can turn to each other for support.
3) We cannot talk to each other about sadness we feel.
4) Individuals (in the family) are accepted for what they are
5) We avoid discussing our fears or concerns.
6) We express feelings to each other.
7) There are lots of bad feelings in our family.
8) We feel accepted for what we are.
9) Making decisions is a problem for our family.
10) We are able to make decisions about how to solve problems.
11) We are able to make decisions about how to solve problems.
12) We don't get along well together.
13) We confide in each other.
14) Drinking is a source of tension or disagreement in our family.
15) All things considered, how satisfied or dissatisfied are you with your marriage or relationship with your partner? ~Which number comes the closest to how you feel,where 1 is completely dissatisfied and 11 is completely satisfied?

(Questions 1 – 14 answered on a 5 point Likert scale ranging from Strongly agree to strongly disagree)