Parenting Stress: Associations with Childhood Obesity and Related Risk Behaviours

by

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The purpose of this study was to explore the association between parenting stress and child body mass index (BMI). Behaviours known to increase childhood obesity risk were also examined in relation to parent stress: poor eating habits, increased television viewing, decreased physical activity and poor sleep habits. Cross-sectional, baseline data were collected from 110 parent-child dyads participating in a family-based obesity prevention intervention. The majority of participants identified as Hispanic/Latino and belonged to low-income households. Parents scored an average of 28.4 +/- 10.7 on the PSI-3-SF, classifying 20% as high stress. Using the World Health Organization (WHO) growth charts, 48% of children were categorized as overweight or obese. Parenting stress was not found to be associated with child weight status in this study. Parenting stress was, however, significantly associated with unhealthful behaviours that are associated with increased obesity risk. In comparison to children with unstressed parents, the children of highly stressed parents were less likely to meet the recommendation of 60 minutes spent in active play per day on weekdays. Highly stressed parents also were less likely to limit the amount of television their child viewed. While it is important to target activity and television behaviours among young children, our results suggest that interventions may also need to address parental stress as a possible underlying factor associated with unhealthful behaviours among young children.
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List of Abbreviations

AAP = American Academy of Pediatrics
BMI = Body Mass Index
CDC = U.S. Center for Disease Control
CI = Confidence Interval
DRI = Dietary Reference Intakes
IOTF = International Obesity Task Force
METS = Metabolic Equivalents
NASPE = National Association for Sport and Physical Education
OR = Odds Ratio
PSI = Parenting Stress Index
PSI-3-SF = Parenting Stress Index-Short Form, 3rd edition
PTT = Parents & Tots Together
SES = Socio-Economic Status
SSB = Sugar-Sweetened Beverages
TV = Television
WHO = World Health Organization
1.0 Introduction

In Canada, it is estimated that 21.5% of children aged 2-5 years are overweight or obese, putting childhood obesity prevention at the forefront of public health concern (Shields, 2005). Childhood obesity is associated with many adverse health conditions, including obesity, heart disease and diabetes as well as higher morbidity and mortality in adulthood (Dietz, 1998; Freedman, Khan, Dietz, Srinivasan & Berenson, 2007).

Research has demonstrated that parents are a major influence on children’s obesity risk (Freedman et al., 2007). Parents influence their children’s obesity risk through feeding behaviours, modeling of weight-related behaviours and through the provision of home environments that can either assist or impede healthy lifestyles (Freedman et al., 2007). It is less known how the general home environment, including parental stress, may influence children’s obesity risk through increased levels of child stress.

Emerging evidence shows that an enhanced level of stress can lead to neuro-endocrine responses that can alter metabolism, appetite and activity levels and consequently, obesity risk (Tatarrini et al., 1996; la Fleur, Akana, Manalo & Dallman, 2004; Rosmond, 2005). Stress is associated with the release of the steroid cortisol (Tatarrini et al., 1996; la Fleur et al., 2004). Chronically high levels of cortisol in the body augment the risk of obesity by increasing food intake, specifically with high fat and energy dense food choices (Tatarrini et al., 1996; la Fleur et al., 2004). Parents experiencing high levels of stress may lack the time to shop for or prepare nutritious meals. Parents of young children may also cope with stress by keeping their children occupied watching television. Parents experiencing higher levels of stress may feel they
lack the time or energy to be physically active with their children or to model such active behaviours (Dwyer et al., 2008). An inverse relationship between the duration of sleep at night and obesity risk in children has been observed in cross-sectional studies of children and adolescents (Locard et al., 1992; von Kries, Toschke, Wurmser, Sauerwald & Koletzko, 2002; Sekine et al., 2002; Reilly et al., 2005). In fact, a significant dose-response between late bedtimes or short sleeping hours and childhood obesity has been observed (Sekine et al., 2002). In families where stress levels are high, there may be less structure to the home environment, affecting the consistency of the child’s bedtime and the actual hours they spend sleeping.

The current study will build on this research by examining the association between parental stress and childhood obesity. Existing baseline data from 110 families participating in a community-based parenting intervention, Parents and Tots Together (PTT), were used to examine the association between parenting stress (assessed using a validated self-report measure) and child body mass index (BMI) (assessed objectively by trained research staff). Our hypothesis was that increased parental stress is positively associated with children’s measured BMI.

The second aim of the current research is to assess how unhealthful behaviours known to be associated with increased obesity in children may be affected by parenting stress. Based on the measures available in this secondary data analysis and strong evidence in the literature, the obesity risk factors that were assessed in the current study include child dietary habits, television viewing behaviours, physical activity, and sleep habits. We hypothesized that poorer eating habits, increased television (TV) viewing
times, decreased physical activity and a lack of adequate sleep at night would be positively associated with parent stress levels.

To stop the obesity epidemic, intervention is needed early in life before excess weight gain begins. The results of this research will help inform future family-based obesity prevention efforts. For preschoolers, this research is of particular interest because it will affect the child’s immediate environment and results may provide a foundation for lifelong health and healthy behaviours.
2.0 Review of the Literature

2.1 Childhood Obesity

2.1.1 Measuring Childhood Obesity

Trends in obesity are often based on Body Mass Index (BMI), which is a measure of weight in relation to height (weight in kg divided by height in m\(^2\)). Using cut points based on health risks related to weight, adults are classified as being overweight if their BMI falls between 25 to 29.9 kg/m\(^2\) and obese if their BMI is equal to or greater than 30 kg/m\(^2\). A child’s weight status, however, is measured using age- and sex-specific percentiles for BMI rather than the BMI-specific categories used for adults because children’s body compositions vary as they age and vary between boys and girls (Centres for Disease Control and Prevention (CDC), 2011b). However, it is unclear as to what the cut points should be due to the absence of evidence linking specific BMI values to health risks in children. Instead, cut points have been based on specific populations (Shields & Tremblay, 2010).

Based on specific populations, there are currently three growth references used to assess and classify weight status in children and youth (Shields & Tremblay, 2010). One set of growth references is the U.S. Centers for Disease Control (CDC) growth charts for children 2-19 years of age, which is based on a nationally representative sample of U.S. children obtained from five national survey data sets. These growth references classify a child as overweight if his or her weight is at or above the 85\(^{th}\) percentile but less than the 95\(^{th}\) and obese if it is at or above the 95\(^{th}\) percentile for the same age and sex (CDC, 2011b). Alternative growth references were developed by the International Obesity Task
Force (IOTF) and consist of sex-specific BMI curves with cut points that intersect with the well-established BMI cut points for adults (Shields & Tremblay, 2010; Cole, Bellizzi, Flegal & Dietz, 2000). The IOTF growth references are based on data from an international survey of six nationally representative cross-sectional growth studies in Brazil, Great Britain, Hong Kong, Singapore, the Netherlands, and the U.S. (Cole et al., 2000). The most recent growth references were developed by the World Health Organization (WHO) in 2006 as new international growth standards for children 5 years and younger (Shields & Tremblay, 2010). Standards for children 5-19 years were released in 2007 (Shields & Tremblay, 2010). These BMI-for-age growth charts are based on an international reference population of children raised in desirable environments (Shields & Tremblay, 2010). Desirable conditions for growth were selected on the basis of the ability to provide a socio-economic status favourable for growth. Children used for these growth references were those that had been exposed to conditions allowing for optimal growth and development including a non-smoking mother, basic immunization and access to health care, as well as breastfeeding that transitioned into a good diet (Shields & Tremblay, 2010).

When deciding which reference values to use when evaluating prevalence estimates of overweight and obesity for children and youth, it is important to consider the reference population used to create the specific measure (Shields & Tremblay, 2010). Thus, when considering overweight and obesity in young children, the new WHO growth references may be the most accurate cut points to classify weight. The WHO growth charts are standards and describe how children should grow when provided with optimal conditions, whereas the CDC growth charts are a reference based on how typical children
in the U.S grew during a specific time period; typical growth may not be an ideal growth pattern (CDC, 2010). While the IOTF growth curves were based on international data, they are not based on optimal growth conditions for children as the WHO growth curves are. Recent evidence also suggests that the IOTF growth charts underestimate obesity (Reilly, Kelly & Wilson, 2010). The WHO growth curves therefore represent a desired prescriptive-based “standard” rather than the description-based reference provided by the CDC and IOTF curves (Shields & Tremblay, 2010). Furthermore, the WHO growth standards were created from longitudinal data on child weight and height that were collected in frequent and regular intervals (CDC, 2010). Finally, another characteristic of the WHO growth charts is the remarkable similarity of growth in the children from the 6 diverse sites used for their development (Brazil, Ghana, India, Norway, Oman and the U.S.), indicating the consistency of child growth when provided with optimal living conditions worldwide (Shields & Tremblay, 2010). The WHO growth charts report slightly higher rates of childhood obesity than when compared to those reported by the CDC charts using the same population (Shields & Tremblay, 2010). Because the WHO growth charts are based on a variety of different populations, they most likely provide a more realistic description of the current childhood obesity epidemic.

2.1.2 Prevalence of Obesity in Preschool Children

Rates of childhood obesity in North America have increased dramatically in the last 25 years (Lobstien, Bau & Uauy, 2004). In fact, the prevalence of childhood obesity in the U.S. has almost tripled since 1980 (CDC, 2012). Using data from the National Health and Nutrition Examination Survey 2007-2008, 21.2% of U.S. children aged 2-5 years are overweight or obese (95% CI, 17.3- 25.1) (Ogden, Carroll, Curtin, Lamb &
Flegal, 2010). According to the 2004 Canadian Community Health Survey, similar rates of overweight and obesity have been observed in Canadian children aged 2-5 years at 21.5% (Sheilds, 2005). This estimate is based on measured heights and weights interpreted by the IOTF growth charts (Shields, 2005). Rates such as these have put childhood obesity at the forefront of public health concern (Sheilds, 2005).

Ongoing surveillance is essential to assess the need for, and success of, intervention programs aimed at preventing and treating childhood obesity (Shields & Tremblay, 2010). In Canada, surveillance is infrequent and is often based on measures of self-report (Statistics Canada, 2010). Isolated clinical trials and U.S. data are also frequently used to make inferences regarding the weight of Canadians (Statistics Canada, 2010).

National U.S. data show that racial/ethnic minority children and those living in low-income households bear a disproportionate share of the burden of overweight and its related co-morbidities, making the development of effective intervention strategies for these high-risk populations particularly urgent (Ogden et al., 2010). In fact, 26% (95% CI, 20.5-31.5) of non-Hispanic black, 27.7 % (95% CI 22.6-32.7) of Mexican and 27.7% (95% CI, 22.6-32.7) of Hispanic American preschoolers are overweight or obese, in comparison to the 17.4% (95% CI, 11.2-23.6) of non- Hispanic white preschoolers (Ogden et al., 2010). To develop effective interventions, it is important to understand the key factors influencing obesity risk among these high risk populations.
2.1.3 Health Risks Associated with Child Overweight and Obesity

Preschooler obesity is associated with many health risks including high blood pressure and high cholesterol, both of which are risk factors for cardiovascular disease (CVD) later in life (Freedman et al., 2007). In fact, it is estimated that approximately 70% of obese children present at least one risk factor for CVD risk and 39% present at least two risk factors (Freedman et al., 2007). Excess weight in the preschool age group is also associated with diabetes, and increased morbidity and mortality later in life (Biro & Wein, 2010). Overweight children also often experience breathing problems, sleep apnea and asthma (Sutherland, 2008; Han, Lawlor & Kimm, 2010). Obese children are more likely to be obese adults, with adult obesity also being associated with diabetes, heart disease and some types of cancers (Serdula et al., 1993; National Institutes of Health, 1998; Whitaker, Wright, Pepe, Seidel & Dietz, 2007; Biro & Wein, 2010). Furthermore, if obesity is experienced in childhood, the obesity seen in adulthood is likely to be more severe (Freedman, Khan, Dietz, Srinivasan & Berenson, 2001).

While it has been extensively documented that obese adults face social discrimination in multiple aspects of their lives including health care, educational and employment opportunities and interpersonal relationships, a growing body of literature suggests that this discrimination may begin during childhood (Brownell, Puhl, Schwartz, & Rudd, 2005; Puhl & Brownell, 2001; Puhl & Latner, 2007). Obese children are at a greater risk for social and psychological problems such as poor self-esteem and discrimination due to the weight bias that their peers, educators and even parents may hold (Baur, Yang & Austin, 2004; Davison & Birch, 2004; Dietz, 1998; Swartz & Puhl, 2003; Whitlock, Williams, Gold, Smith & Shipman, 2005). This discrimination is of
particular concern during childhood as the formation of social relationships becomes more important. The experiences of weight bias and its consequences may disrupt social, emotional and academic development and may also aggravate any adverse health outcomes the child already faces (Puhl & Lanter, 2007). Furthermore, a strong association between the experience of being teased about weight and engaging in disordered eating behaviours, including fasting, purging and binge eating as a means of weight loss have been thoroughly documented (Neumark-Sztainer et al., 2002; Thompson, Coover, Richards, Johnson & Cattarin, 1995). Cross-sectional data found that youth who experienced frequent weight teasing were two times more likely to engage in disordered eating behaviours than those who did not report such teasing (OR=2.09, 95% CI (1.38, 3.18)) (Neumark-Sztainer, et al., 2002).

Therefore, due to the prevalence of childhood obesity, its immediate consequences and the increased risk of health problems it can cause and complicate later in adulthood, it is becoming increasingly important to understand the key factors that place children at increased risk of overweight and obesity. This understanding will help to inform effective prevention interventions.

2.1.4 Risk Factors Associated with Preschooler Obesity

The risk of being overweight or obese at any age is multifaceted. In the preschool age group specifically, factors such as poor eating habits, low physical activity compounded with high sedentary activity, and lack of adequate sleep at night may all lead to an increased risk of excess weight gain. Certain parental characteristics and behaviours may also increase obesity risk, such as parental obesity, parent feeding behaviours and parenting style. The general family context, such as overall family
functioning or level of stress in the home, may also influence children’s obesity risk. Existing literature exploring the association between these various risk factors and obesity risk among children will be reviewed in the following section.

2.1.4.1 Preschooler Eating Habits

A healthy diet is an essential part of a healthy lifestyle and it has been well documented in the literature that a poor diet is a strong risk factor for weight gain. Food preferences early in life have an important impact on the development of dietary patterns and food choices later in life (Birch, Johnson & Fisher, 1995; Birch & Fisher, 1998; Skinner, Carruth, Bounds & Ziegler, 2002; Fox, Condon, Briefel, Reidy & Demming, 2010). A longitudinal analysis of food preferences among young children found that new foods were more readily accepted between the ages of 2 and 4 years than they were between the ages of 4 and 8 years (Skinner et al., 2010). In addition, the number of foods liked between the ages of 2 and 3 years did not differ significantly at 8 years (Skinner et al., 2010). These results suggest that eating habits are formed very early in life, and an understanding of key influences on preschool eating behaviours is key to informing effective early-life obesity prevention interventions.

The prevalence of pediatric obesity is grave evidence that poor eating habits begin early in life (Fox et al., 2010). As evidenced in the 2004 Canadian Community Health Survey, 70% of children aged 4-8 did not consume the recommended number of servings of fruits and vegetables, and 37% did not consume the recommended number of servings of milk and alternatives (Garriguet, 2004). In addition, Butte et al. (2010) found that the usual dietary intake for U.S. preschoolers was high in saturated fats and sodium, and low
in fibre, relative to the Dietary Reference Intake (DRI) recommendations. Moreover, in 2008, only 70% of 2 and 3 year olds consumed vegetables at least once a day, with the most common vegetable being French fries or other fried potatoes (Fox et al., 2010). The vast majority of preschoolers (82% to 89%) consumed sugar-sweetened beverages or energy-dense desserts and snack foods at least once a day (Fox et al., 2010). Preschoolers’ nutrient needs are high relative to their energy requirements and, as such, there is little room for energy dense, high fat and high sugar foods (Fox et al., 2010). Consumption of these foods will cause children to exceed energy requirements while consuming inadequate amounts of essential nutrients (Fox et al., 2010). These findings suggest that education surrounding a healthy preschool diet is a key aspect of obesity prevention.

2.1.4.1.1 Sugar-Sweetened Beverage Consumption

The consumption of sugar-sweetened beverages (SSBs) is very common among the preschool age group and is a significant contributor to the poor dietary patterns that have been observed of late. Between 1971 and 2001, the consumption of SSBs increased from 3.0% to 6.9% of daily energy intake among U.S. children aged 2-18 years (Neilson & Popkin, 2004). Fox and colleagues (2010) found that 46% of 2- and 3-year-olds consumed some type of sweetened beverage. Fruit flavoured drinks were most commonly consumed (35%), followed by carbonated soda (8%) and sweetened tea or coffee (7%) (Fox et al., 2010). These statistics are consistent with earlier findings from Guthrie and Morton (2000), which show that soft drinks constitute the leading source of added sugars in the American diet.
These findings are of concern as sweetened beverages are high in calories and low in micronutrients. Excessive consumption of such beverages may be linked with obesity risk (Harnack, Stang & Story, 1999; Ludwig, Person & Gortmaker, 2001; Welsh et al., 2005; Warner, Harley, Bradman, Vargas & Eskenazi, 2006; Dubois, Farmer, Girard & Peterson, 2007; Fox et al., 2010). Moreover, intakes of sweetened beverages are found to be negatively associated with calcium intake, indicating that increased intakes of sweetened beverages may decrease the intake of calcium from the diet by displacing milk intake (Skinner, Zeigler & Ponza, 2004).

Among school-aged children, the consumption of SSBs is associated with high caloric intake and an increased BMI (Harnack et al., 1999; Ludwig et al., 2001). Using observational techniques, Ludwig and colleagues (2001) found that the odds of becoming obese in childhood increased 1.6 times (95% CI 1.14-2.24, p=0.02) for each additional can or glass of sugar-sweetened drink consumed each day. Results from both prospective and cross-sectional studies suggest that the intake of sweetened beverages may also be associated with increased obesity in preschool-aged children (Welsh et al., 2005; Warner et al., 2006; Dubois et al., 2007). Using data from the Longitudinal Study of Child Development in Québec, it was found that preschool children from families with insufficient income are more likely to consume SSBs and are more than three times likely to be overweight than children from families with sufficient income (Dubois et al., 2007). Families were defined as having insufficient income using Statistics Canada’s definition of those who spend 200% more of their income than the average family on necessities such as food, shelter and clothing (Dubois et al., 2007). Factors such as maternal age, maternal education, and family income were found to be negatively associated with the
consumption of SSBs (Dubois et al., 2007). Immigration status was also found to be associated with an increased consumption of SSBs (Dubois et al., 2007). Similar findings with respect to the increased consumption of SSBs among preschoolers from low-income and Mexican-American families were found by Welsh et al. (2005) and Warner et al. (2006).

2.1.4.2 Decreased Physical Activity and Increased Sedentary Activity

Regular participation in physical activity has multiple health benefits for children including improving strength and endurance, building healthy bones and muscles, decreasing stress and anxiety, and improving self-esteem (U.S. Department of Health and Human Services, 1996). Physical activity may also improve blood pressure and cholesterol concentrations in children (U.S. Department of Health and Human Services, 1996). Evidence also suggests that regular physical activity has an effect on BMI, with longitudinal data suggesting that children who are active early in life have a reduced risk for large adiposity gains in elementary school through adolescence (Atkin & Davies, 2000; Moore et al., 2003).

The National Association for Sport and Physical Education (NASPE) recommends that preschool children participate in 120 minutes of physical activity each day, half spent in structured physical activity and half spent in unstructured, free play settings (NASPE, 2002). Although data on physical activity levels among preschoolers are limited, there is consensus that the majority of preschoolers are not meeting these recommendations. Among studies, adherence to these guidelines varies between 32-79%,
either due to differences in measurement tools or inconsistent conclusion of light intensity physical activity (Colley et al., 2013).

While it is estimated that approximately 56% of American preschoolers attend some form of child care, Pate and colleagues (2004) found that a child who attends childcare for 8 hours (typically 9-5pm each day) engages in only approximately one hour (60 minutes) of moderate to vigorous physical activity per day. Furthermore, Pate and colleagues hypothesize that it is unlikely that children participate in any additional vigorous activity outside of the child care setting (Pate, Pfeiffer, Trost, Zeigler & Dowda, 2004). Rodriguez-Oliveros et al. (2011) have explored the perceptions and practices related to obesity-related behaviours among parents of preschool aged children, and the findings that most parents lacked both the time and energy to participate in physical activity with their children on weekdays support Pate et al.’s (2004) hypothesis. Parents also cited many barriers to their children meeting physical activity guidelines including a lack of appropriate space, a need for low-energy activities to counteract their child’s hyperactivity, street safety, and concern over the possibility of the child being injured while participating in physical activity and active sports (Rodriguez-Oliveros et al., 2011).

In an earlier study based on focus groups with parents of preschoolers, Dwyer and colleagues (2008) used the Socio-Economic Model (described elsewhere in Stokols, 1992, 1996) to examine parent perceptions of barriers to their preschoolers’ physical activity. Intrapersonal factors parents identified as potential barriers to their children’s physical activity included preschoolers preferring solitary sedentary activities over group organized activities and the child’s individual health status (Dwyer, Needham, Randall
Simpson & Shaver-Heeney, 2008). Interpersonal factors included parents’ lack of time and parents’ views about the amount and type of physical activity their children should be getting (Dwyer et al., 2008). Family structure was also considered an interpersonal factor where some parents reported that being a single mother with little social support made it difficult to encourage and provide opportunities for their children to be active (Dwyer et al., 2008). Finally, the weather, safety and a lack of available resources were found to be environmental factors affecting the physical activity of preschoolers (Dwyer et al., 2008).

Understanding the many influences surrounding the amount and type of physical activity preschoolers engage in as well as the perceived challenges of parents to such physical activity is important to inform effective interventions. To date, the majority of research focusing on physical activity in young children has relied on subjective measurements of activity levels (Colley et al., 2013). Based on objective measures collected from 2009-2011 as part of the Canadian Health Measures Survey, Colley and colleagues (2013) reported that only 15% of children aged 3-4 years and 5% of 5 year olds are meeting both the physical activity and TV viewing guidelines.

2.1.4.2.1 Television Viewing Habits of Preschoolers

Sedentary behaviour is defined as any waking behaviour with an energy expenditure of less than 1.5 metabolic equivalents (METS) and a sitting or reclining posture, and is considered to be a distinct measure from a lack of moderate to vigorous physical activity (Sedentary Behaviour Research Network, 2012; Tremblay et al., 2010). Television viewing is the most studied form of sedentary behaviour, and has been shown to be associated with increased adiposity as well as lower measures of psychosocial and
cognitive development (Dennison, Erb & Jenkins, 2002; Biddle, Marshall, Gorely, Cameron & Murdey, 2003; Leblanc et al., 2012; Proctor et al., 2003). Dennison and colleagues (2002) found that the number of hours a preschooler spends watching television is associated with increased risk of being overweight. Independent of child age, sex, parental education and race/ethnicity, each additional hour of television viewed is associated with a 6% increase in the risk of being overweight (Dennison, et al., 2002). Additionally, Lumeng and colleagues (2006) found that the exposure to 2 or more hours of television a day was associated with an increased risk of obesity at 36 and 54 months of age. The Committee on Public Education of the American Academy of Pediatrics (2011) has cautioned parents to limit their preschoolers’ exposure to television and other media to 2 hours per day; however, many studies have found children are in front of the screen much longer than recommended. On average, preschool aged children watch 3 hours of television per day (American Academy of Pediatrics, 2011).

Having a television in the child’s bedroom has been found to be a major predictor of television use, as well as a risk factor for the development of obesity among children (Wiecha, Sobol, Peterson & Gortmaker, 2001; Dennison et al., 2002). Approximately one third of American children have televisions in their bedrooms (American Academy of Pediatrics, 2011). Dennison and colleagues (2002) found that significantly more Black and Hispanic children have a television set in their bedroom than white children or children of other races. Children with a television set in their bedroom also spent an average of 4.6 additional hours in front of the screen per week (Dennison et al., 2002). The prevalence of children with a BMI greater than the 85th percentile was higher in children with a TV in their bedroom compared to those without (Dennison et al., 2002).
There are many mechanisms by which television viewing habits may increase adiposity among young children. Simply put, obesity is a result of an energy imbalance whereby caloric consumption exceeds energy expenditure (Jago et al., 2005). Physical activity is the malleable component of energy expenditure and is associated with decreased adiposity in children; therefore, the amount of time a child spends in front of the television takes away from time that could be spent being more active. Television viewing has also been associated with unhealthy dietary behaviours including an increased consumption of soda and fried and snack foods (Jago, Baranowski, Baranowski, Thompson & Greaves, 2005). Similarly, Blass et al. (2006) found that TV viewing during meals increased energy intake in young children. Husby and colleagues (2008) also found that children with poor eating habits were more likely to eat meals and snacks alone and in front of the TV than were children with more healthy eating behaviours.

Finally, the majority of advertisements featured during children’s TV programming are primarily for energy-dense foods that are high in fat, sugar and sodium; these advertisements are related to food habits and food preferences in children (Halford, Gillespie, Brown, Pontin & Dovey, 2004; Halford, Boyland, Hughes, Olivera & Dovey, 2008). Lythoge and colleagues (2013) found that even the ‘healthier’ food options that are marketed to children are higher in fat, sugar and salt than equivalent products marketed to the general population. Children under the age of eight years do not have the developmental capacity to differentiate between persuasive marketing and general information, as critical thinking skills are not developed until later in childhood. Concerns surrounding the marketing of food products to children focus not only on the
nutritional content of such foods, but also on the influence these ads have on a child’s ability to increase household purchasing through ‘pester power’ and their ability to create behaviours for lifelong purchasing (Lythoge, Roberts, Madden & Rennie, 2013).

Due to the concern with the association between television viewing and increased adiposity in childhood, it is important to understand children’s television viewing behaviours and the reasons surrounding such habits.

2.1.4.3 Preschooler Sleep Patterns

In adulthood, short sleep duration has been associated with weight gain, obesity, coronary artery disease and diabetes (Ayas, White & Manson, 2003; Ayas, et al., 2003; Patel, Malhotra, White, Gottlieb & Hu, 2006). A similar inverse relationship between sleep duration and obesity risk in children has been observed in cross-sectional studies of children and adolescents (Locard et al., 1992; von Kries, Toschke, Wurmser, Sauerwald & Koletzko, 2002; Sekine et al., 2002; Reilly et al., 2005). In fact, a significant dose-response between a late bedtime or short sleeping hours and child obesity has been observed (Sekine et al., 2002). When comparing children with 10 hours of nightly sleep to children who receive 9-10 hours, 8-9 hours and fewer than 8 hours nightly, the odds of obesity increased from 1.49 at 9-10 hours of sleep to 1.89 at 8-9 hours, and 2.87 at fewer than 8 hours of sleep nightly (Sekine et al., 2002). Traveras and colleagues (2008) conducted a prospective study and found that infants who slept fewer than 12 hours per day were at increased risk of obesity (OR=2.0) at 3 years of age. It has also been suggested that duration of sleep may be an indirect measure of physical activity whereby children who are more physically active during the day sleep longer at night (Reilly et al., 2005). The National Sleep Foundation (2011) recommends that toddlers (1-3 years of
age) receive 11-14 hours of sleep per night, preschoolers (3-5 years of age) receive 11-13 hours and school aged children (5-10 years of age) receive 10-11 hours. While there is an overlap of ages between these groups, it should also be noted that these guidelines are strictly a ‘rule of thumb’ that is generally agreed upon by health professionals (National Sleep Foundation, 2011). Unlike the guidelines for physical activity, evidence-based research exploring these sleep recommendations has yet to be conducted (National Sleep Foundation, 2011).

2.1.4.4 Parental Characteristics

Throughout childhood when a child’s nutrition and physical activity patterns are established, parents serve as a major influencing factor. In addition to genetics, parents may serve as role models for weight-related behaviours, influence children’s dietary intake through their feeding behaviours, or create environments that serve to promote either healthful or unhealthful behaviours. The following section will examine these parenting characteristics and their association with obesity risk among children.

2.1.4.4.1 Parental Obesity

Parental obesity may increase the risk of childhood obesity through genetic mechanisms or by shared familial characteristics in the home environment such as food preferences or physical activity habits (Birch & Davison, 2001; Francis, Lee & Birch, 2003). Findings from Whitaker and colleagues (1997) suggest parental obesity significantly alters a child’s risk of obesity in adulthood for both obese and non-obese children less than 10 years of age. More specifically, among non-obese 1- and 2-year-olds, those with at least one obese parent were at greater risk of later obesity (28% risk).
than those without an obese parent (10% risk) (Whitaker, Wright, Pepe, Seidel & Dietz, 1997). Among obese 3- to 5-year-olds, those with normal weight parents had a lower risk of later obesity (24%) than those with at least one obese parent (62%) (Whitaker et al., 1997).

While obesity can be hereditary, genetics cannot explain all of the variability associated with child weight gain (Whitaker et al., 1997; Francis et al., 2003). In fact, research in behavioural genetics has found that genetic factors explain only 50% of the population variance in obesity (Bodurtha et al., 1990; Beunen et al., 1998; Faith et al., 1999). Furthermore, research has demonstrated that families in which the parents are overweight have less healthy dietary intakes and have lower levels of physical activity compared to families with parents who are not overweight (Wardle, Gurthrie, Sanderson, Birch & Plomin, 2001; Burke, Beilin & Dunbar, 2001; Davison & Birch, 2002).

Individuals who are overweight or who are at risk for accelerated weight gain may select and create environments that prompt or promote the development of excess weight gain, favouring environments in which overeating and infrequent exercise are common (Wachs, 1983; Davison & Birch, 2002). Growing up in such situations may markedly increase children's risk for overweight, as there is a genetic susceptibility for overweight from parents combined with being raised in an environment that favours the genetic disposition (Wachs, 1983). Furthermore, Wachs (1983) suggests that children with overweight parents are likely to be genetically more susceptible to the effects of the obesogenic environment in our society than children of non-overweight parents.

These findings confirm the need to understand the role of the family unit in the development of childhood obesity risk. Given the strong influence of both parental
genetic and behavioural influences, it is unlikely that childhood obesity is an isolated event within a family; instead, it is likely the result of the overall home and family environment within which the child is raised.

2.1.4.4.2 Parent Feeding Behaviours

Extensive empirical evidence shows that parents influence their children’s obesity risk through parental feeding behaviours (Birch & Fisher, 1998; Faith, Scanlon, Birch, Francis & Sherry, 2004). Children naturally regulate their food intake, but parents’ feeding behaviours may override these internal signals (Birch & Fisher, 1998). For example, focusing a child’s attention on external hunger cues such as portion sizes, cleaning the plate and rewards may undermine their ability to recognize internal satiety cues (Faith et al., 2004). This can also happen when well-intentioned and/or concerned parents assume that children need assistance with determining how much to eat and when parents impose such feeding practices, they leave the child little opportunity for self-regulation and control (Birch & Fisher, 1998). Exercising restrictive behaviours towards child eating behaviours (e.g., restricting intake of certain foods) has also been associated with overeating and poor self-regulation of energy intake in preschool children (Faith et al., 2004). In a study examining parent beliefs about children’s diets, 40% of parents reported believing that restricting or forbidding the consumption of a particular food would decrease their child’s preference for the food (Casey & Rozin, 1989). This parent belief is actually opposite to findings in the literature, where it has been found that restricting children’s access to foods is associated with an enhanced preference for that food and may actually increase intake (Birch, Zimmerman & Hind, 1980). Taveras and colleagues (2006) also found that food restriction at 1 year of age was associated with an
increased odds of obesity at 3 years of age. Similarly, Birch, Fisher and Davidson (2003) found that girls with mothers using restrictive feeding behaviours consumed more food in the absence of hunger than girls whose mothers were less restrictive. These results also suggest that eating in the absence of hunger is a learned behaviour that develops in response to feeding practices during the preschool age as evidence shows that such eating increases significantly between the ages of 5-9 years (Birch, Fisher & Davidson, 2003).

2.1.4.4.3 Role Modeling

Children’s food habits and preferences may also be shaped by observing the food selection patterns and eating behaviours practiced by their parents. Harper and Sanders (1975) found that toddlers put food in their mouths more readily when observing a parent in comparison to modeling a stranger. Children’s dietary habits may be especially influenced by parental eating behaviours, diet patterns and disinhibition when obesity, dieting and weight control are salient problems among members of the family unit (Cutting, Grimm-Thomas & Birch, 1997). Modeling may also play an important role in forming preferences for seemingly unpalatable foods (Birch & Fisher, 1998). Rozin and Schiller (1980) demonstrated this influential role of social influences through the development of children’s preferences for chili-favoured foods; older family members modeling consumption increased the child’s acceptance of the hot foods. Olivera et al. (1992) found a high correlation between mothers and their preschool children’s food intake for most nutrients. Furthermore, for younger children, older siblings have also been found to serve as models for food intake (Salvy, Vartainian, Coelho, Jarrin & Pliner, 2008). In a study where children participated in a sorting game while exposed to a large number of cookies, children eating with their siblings ate more cookies than with a
stranger or alone (Salvy et al., 2008). Other research supports this idea that parents serve as role models for children, but also suggests that parental influence may also be positive (Klesges, Stein, Eck, Isbell & Klesges, 1991). For example, Klesges and colleagues (1991) found that when children were offered a large variety of foods for lunch, they choose fewer non-nutritious foods and had a smaller energy intake when in the presence of their parents than when alone.

Eating for young children is typically a social occasion where other eaters, including parents and siblings, serve as models around which to develop their own food preferences; as such there is a need to confirm and understand the effect of parents as role models in order to educate them on best practices surrounding the development of healthy eating behaviours in preschool children (Birch & Fisher, 1998).

2.1.4.4 Parenting Style

Parenting style is considered to be a set of parental characteristics that are stable over time and make up the environmental and emotional context for child-rearing and socialization (Baumrind, 1989; Darling & Steinberg, 1993). Specific parenting styles also establish a framework for children to interpret particular behaviours of their parents (Darling & Steinberg, 1993). Thus, it is thought that parenting styles have great influence on the daily activities, eating behaviours, emotional functioning, and potentially risk of overweight among young children (Rhee, Lumeng, Appugliese, Lacrioti, & Bradley, 2006).

The four classic parenting styles, as first described by Baumrind (1971), are authoritative, authoritarian, permissive and neglectful. The authoritative style is often
considered to be the ideal way to parent and is characterized by high warmth and high demandingness towards children (Baumrind, 1971). In contrast, authoritarian parenting is associated with high demandingness and low warmth where parents are often insensitive to the child’s developmental needs and are viewed as strict disciplinarians (Baumrind, 1971). Permissive parenting is associated with low demandingness and high warmth while neglectful parenting has been associated with both low demandingness and warmth (Baumrind, 1971).

Using nationally representative data, Rhee et al. (2006) showed that children from families where parents use authoritarian styles of discipline had an odds of being overweight that was over four times (OR= 4.88, 95% CI 2.1-11.1) that of children whose parents are responsive to their needs. Permissive and neglectful parenting styles doubled children’s risk for overweight in comparison to children with authoritative parents (Rhee et al., 2006). Similarly, when controlling for birth weight, maternal obesity and factors associated with socioeconomic status, a study of over 2400 preschool children and their mothers found that parent neglect was associated with significantly higher odds of obesity in children (OR= 1.56, 95% CI 1.14-2.14) (Whitaker et al., 2007).

Specific parenting styles may be linked to certain parent feeding behaviours. According to Ventura and Birch (2008), the application of parenting style to feeding behaviours suggests that parents have an overarching style that characterizes parent-child relationships during feeding situations. Because parent feeding practice and style are related concepts, some behaviours may be more authoritative (e.g., praising and/or negotiating with the child), authoritarian (e.g., punishment and or coercion) or permissive (e.g., letting the child eat whatever they want) (Hennessy, Hughes, Goldberg, Hyatt &
Economos, 2010). Parents who inflict more demands on their children may be more apt to have more defined boundaries or restrictions placed on the food intake of their children. Similarly, it may be possible that parents with high warmth and understanding for children’s developmental needs will foster a greater capacity for self-regulation rather than imposing specific structures on the child such as cleaning one’s plate (Rhee et al., 2006). As discussed above, such structures or rules may result in children learning to eat based on external cues rather than internal hunger and satiety cues. However, in families where permissive parenting styles are used, the increased freedom and few expectations or limitations may not provide children with the incentive and guidance to develop the self-regulation skills that form the basis of healthy eating behaviours (Rhee et al., 2006).

Hennessy et al. (2010) explored this relationship while investigating the association between parenting style, feeding behaviours and parent feeding styles with child (6-11 years of age) weight outcomes. In a sample of low-income, rural parent-child dyads, feeding style, but not parenting style was associated with BMI-z score, suggesting that feeding styles may be the link between parenting style and child weight (Hennessy et al., 2010). Moreover, it was found that an indulgent feeding style was associated with higher child weight outcomes (Hennessy et al., 2010). Similarly, in a sample of preschool aged children (aged 3-5 years), children whose mothers frequently use food for emotional regulation consumed more sweet and palatable foods in the absence of hunger than children whose parents rarely used such feeding practices (Blissett, Haycroft & Farrow, 2010).

Therefore, a balance between demandingness and warmth for self-control may provide the optimal environment in which to limit children’s risk of overweight (Rhee at
al., 2006). Furthermore, understanding the mechanisms by which parenting style and parenting behaviours interact is crucial in determining effective ways of involving parents and families in childhood obesity prevention.

### 2.2 Parenting Stress

Less is known about the impact that the general family environment may have on a child’s weight. Factors in the general family environment that are not specific weight-related behaviours may also have an effect on child weight outcomes. One example of such environmental effects, as discussed above, is parenting style, while other examples may include parent-child interactions and the level of stress in the home.

Stress is a commonly-used term to describe a complex physiological and biological response to environmental, internal or external stimuli. Physiologically, stress can be defined by a hypothalamic-pituitary-adrenocortical (HPA) axis response to alterations in physiological homeostasis (O’Conner, O’Halloran & Shanahan, 2000; McEwen, 2007). Stressful events cause the release of cortisol into the blood stream which provides the body with energy and strength; the classic “fight or flight” response (O’Conner et al., 2000; McEwen, 2007). In some cases, short term stress is seen as a positive coping reaction associated with improving life; however, long term stress, or distress is most often characterised by a lack of coping and can be detrimental to one’s physiological and social functioning (McEwen, 2007).

Examining potential causes of stress in parents, it is hypothesized that multiple factors including marital status, employment status, income and depression all contribute
to high levels of stress (Vandewater & Bickham, 2004). For instance, compared to adults in two-parent homes, single parents are often under more stress (McLanahan, 1983), and single mothers, in particular, have less income, lower levels of education and less occupational prestige (Bianchi, 1995; Downey, Ainsworth-Darnell & Dufur, 1998). Beyond the intrapersonal factors (income, employment, education level, health status) and interpersonal factors (marital status, parent-child relationships and relationships with other family members), low income families may also face psychosocial stressors in their neighbourhoods or communities (Gunderson, Lohman, Garasky, Stewart & Eisenmann, 2008; Webster-Stratton, 1990). Among low income families, these stressors may be exacerbated by the lack of adequate resources to help them cope with their stress (Gunderson et al., 2008).

These parent stressors may translate to the child through several mechanisms including diminished parenting and a lack of time spent with the child, which may lead to higher stress levels among children and a lower well-being (Gunderson et al., 2008).

Stress specific to parenting has most often been examined pertaining to parenting children with chronic diseases and children with behavioural problems (Theule, Weiner, Rogers & Marton, 2011; Haskett et al., 2006). Through this research, parenting stress has been characterised by a complex construct representing a combination of parent, child and family characteristics as they relate to a person’s appraisal of his or her role as a parent (Abidin, 1992). Potential stressors that are specifically associated with parenting and often cause parenting distress include difficulties raising the child, unexpected relationship conflicts arising after becoming a parent, role restrictions including opportunities for personal time and personal health (Abidin, 1983, 1990, 1995; Koch et
Higher levels of parenting stress have been found to disrupt the formation and maintenance of healthy parent-child relationships (McKelvey et al., 2009). Specifically, stress can lead to parents with reduced responsiveness, lack of warmth, and negative views of their roles as parents, which in turn may lead to parents who are unable to care for their children in ways that are sensitive to their developmental needs (Abidin, 1992; Crnic & Low, 2002; Crnic, Gaze & Hoffman, 2005). In fact, parents who report greater levels of parenting stress have been found to hold more authoritarian beliefs in their parenting styles, have more negative interactions with their children and are less involved (Crnic et al., 2005).

Research suggests that parenting stress is a mutable factor; parent-based interventions that address parental stress, including among parents whose children have behavioural disorders or chronic illness, have been shown to reduce stress, increase positive parenting behaviours and improve child outcomes (Haskett, Ahern, Ward & Allaire, 2006). Other studies have demonstrated that the effects of parent training of behaviours can be maintained over time (Strayhorn & Weidman, 1991; Webster-Stratton, 1998; Gross et al., 2003).

2.3 Stress and Obesity

Psychological stressors, particularly unpredictable and uncontrollable stressors such as those presented in one’s surrounding environment are associated with the activation of the hypothalamic-pituitary-adrenocortical (HPA) axis (McEwen, 2007). The activation of the HPA axis then results in the release of the steroid hormone cortisol from the adrenal gland which enhances one’s ability to handle acute stress as discussed
above (O’Conner et al., 2000). However, chronically high levels of stress-induced cortisol have been shown to be deleterious for many physiological processes in the body (McEwen, 2007). Evidence from both human and animal studies has demonstrated that cortisol increases obesity risk through many mechanisms, including increased food intake and insulin and leptin resistance (Tataranni et al., 1996; Bell et al., 2002; La Fleur et al., 2004; Rosmond, 2005; Adam & Epel, 2007).

2.3.1 Stress and Increased Food Intake

The idea of stress-eating is apparent in everyday discourse surrounding conversations of “comfort food” and “comfort eating” (Cartwright et al., 2003). In both animal and human studies, stress has been linked to both hyperphagic (increased eating) and hypophagic (decreased eating) responses and it is still largely unknown which individual or situational factors may lead to these respective responses (Cartwright et al., 2003). However, in a review of the literature on stress related eating, there is confidence that higher levels of life stress are associated with higher levels of unhealthy dietary practices and often lead to overeating (Greeno & Wing, 1994; Cartwright et al., 2003).

Looking to physiological explanations, increased levels of cortisol in the body have been associated with increased food intake, particularly foods that are high in fat (La Fleur et al., 2004). In rats, the presence of corticosterone (stress glucocorticoid in rats) stimulates eating with a preference for high fat foods (La Fleur et al., 2004). Other rat studies have found that glucocorticoids may also be involved in the actual regulation of food intake (Campfield, Smith, Guisez, Devos & Burn, 1995; La Fleur et al., 2004).

In humans, cortisol administration also increases food intake (Tataranni et al., 1996). Epel and colleagues (2001) found that women with increased cortisol levels in
response to stress ate more high fat foods when stressed than women who did not have high cortisol stress responses. Many studies have also observed associations between stress and an increased intake of energy dense foods among both adults and children. For example, Oliver and Wardle (1999) found that stressed subjects, most often women, reported eating more snack foods particularly sweets and chocolates, but reported intakes high in fruits and vegetables and low in such snacks when not stressed. Furthermore, in a similar study, when asked why stress caused a change in their eating habits, over half of the participants said they selected foods to make them feel better (Zellner et al., 2006).

When put in stressful situations, children (aged 9-12 years) have also been observed to eat more than when not stressed (Reommich, Wright & Epstein, 2002). Moreover, the children who were used to following a fairly restrictive diet, as often seen in children with authoritarian parents, ate more when stressed than did children who were not restricted (Reommich et al., 2002). In another study examining stress responses in children (mean age = 11.83 years), it was reported that greater stress was associated with an increased intake of fatty foods, less fruit and vegetable intake, more snacking and a lower likelihood of consuming breakfast daily (Cartwright et al., 2003). These findings suggest that people may choose foods to provide them with positive feelings during aversive situations (Zellner et al., 2006). In fact, Polivy, Herman and McFarlane (1994) found that people who ate cookies when stressed felt happier while eating them.

However, in a study of preschool aged children, children whose parents were not prone to using food for emotional regulation ate very little in induced stress situations, compared to the control situations in which they ate more highly palatable foods (Blissett et al., 2010). This finding is consistent with findings from Nguyen-Rodriguez, Chou,
Unger and Spruijt-Metz (2008) who suggested that emotional eating may be a learned coping response to chronic life stress, making it crucial to understand the mechanisms behind stress related eating in young preschool aged children.

The ingestion of high fat and energy dense foods during stress, as discussed above, has also been linked to a reduction in the neuroendocrine stress response, which further reinforces the reward seeking behaviours observed in the consumption of energy dense foods (Bell et al., 2002). Thus, it may be that the obesity epidemic may be fueled, in part, by the presence of chronic stress, and the synergistic reward value experienced in eating highly palatable foods (Adam & Epel, 2007).

2.3.2 Stress and Insulin and Leptin Resistance

In rats receiving high doses of corticosterone, food intake becomes excessive, even when paralleled by an increased secretion of the satiety hormone leptin (Zakrzewska, Cusin, Sainsbury, Rohner-Jeanrenaud & Jeanrenaud, 1997). Similarly, mice with an overexposure to adipose tissue corticosterone display symptoms of hyperphagia and hyperleptinaemia (Masuzaki et al., 2001). This suggests that glucocorticoids induce overeating, despite the increased leptin production such eating causes, resulting in resistance to the satiety signals of leptin (Masuzaki et al., 2001). This also suggests that increased food intake during stressful situations may be related to and aggravated by hormone responses in the body. For example, increased glucocorticoid concentrations have also been associated with insulin and leptin resistance (Masuzaki et al., 2001). Insulin and leptin hormones are crucial adiposity signals that are released in proportion to white adiposity tissue (Rosmond, 2005). Under unstressed normal conditions, insulin and leptin have antagonistic effects on metabolism which creates a
balanced system in which fuel is provided in sufficient amounts proportional to demands on the organism (Adam & Epel, 2007). In conditions of chronic stress however, the system becomes unbalanced because the stress-related counter regulatory hormones such as cortisol remain unopposed, leading to metabolic disturbances including insulin and leptin excess and resistance (Rosmond, 2005). Therefore, elevated levels of cortisol induced by stress lead to the impairment of satiety cues and cause inadequate metabolic responses to excess weight gain (Rosmond, 2005; Adam & Epel, 2007).

2.4 Parenting Stress and Preschooler Obesity

2.4.1 Animal Models of Parenting Stress and Obesity

Substantial research from both animal and human studies suggests that a child’s early family environment may influence his/her stress response. Findings from Meaney and Szyf (2005) indicate that, in rodents, maternal behaviour during the early life essentially programs the HPA response to stress by promoting the synthesis of glucocorticoids, resulting in the enhancement of the negative feedback process by which the HPA axis is regulated. These stress reactions set in motion by maternal care are explained clearly in Gunnar and Quevedo (2007). During a rat pup’s first week of life, the quality of maternal care, as characterised by licking and grooming, regulates the extent to which glucocorticoid receptors (GRs) become methylated (silencing of genes) in the hippocampus (an area of the brain which contains high levels of these receptors) (Gunnar & Quevedo, 2007). The hippocampal GRs are involved in terminating stress responses in the HPA system and so high levels of GRs ensure an efficient control of
stress, whereas low levels mean slow responses and prolonged exposures to stress reactions in the body (Meaney & Szyf, 2005; Gunnar & Quevedo, 2007). Essentially, poor care during a rat pup’s first weeks of life, which is a critical period of rapid brain development, may increase sensitivity to stress and cause a lower threshold for perceiving stress (Meaney & Szyf, 2005; Gunnar & Quevedo, 2007).

### 2.4.2 Human Models of Parenting Stress and Obesity

This rodent model of maternal behaviour may be the basis of the theory that early childhood experiences may impact developing psychology related to stress (Blair et al., 2008). For example, similar findings have been observed in young children with and without responsive caregivers (Gunnar, 1992; Dettling, Parker, Lane, Sebanc & Gunnar, 2000). In a study of infants and toddlers under the care of a babysitter, no increase in cortisol levels were observed in response to separation from their parents if the babysitter was warm and responsive to the child, but were seen when the babysitter was instructed to be cold and unresponsive towards the child (Gunnar, 1992). Similarly, preschoolers in a day care with minimally responsive caregivers displayed a rise in cortisol levels over the day, but those with highly responsive and stimulating caregivers did not (Dettling et al., 2000).

While it has been convincingly established that severe deprivation and or trauma experienced among children at a young age alters the functioning of the HPA axis (Tarulla & Gunner, 2006), emerging evidence also suggests that alterations occur in response to more subtle adverse parenting behaviours such as insensitivity or hostility. Among a sample of 5-year old children, negative parent-child interactions, characterized by intrusiveness and hostility, were associated with higher cortisol responses when the
children were faced with a stressor (Smeekens, Riksen-Walraven & van Bakel, 2007). Similarly, toddlers whose parents used spanking and/or maternal emotional withdrawal as a behavior management or control tactic had elevated levels of baseline cortisol and higher cortisol reactivity to a stress response (Bugental, Martorell & Barraza, 2003).

Family psychological stress may also be associated with increased weight in children. Measuring stress using 4 domains including serious life events (unemployment, death in the family, accident, divorce), stress specifically related to parenting (time for yourself, difficulty raising the child), a lack of social support and parental worries about child’s safety, Koch et al. (2008) found that children who had been exposed to at least 2 of the 4 domains of stress were more likely to be obese at age 2 (OR= 2.1 95% CI 1.3-3.5, p <0.01) and longitudinally at age 5 (OR=2.6, 95% CI 1.3-5.4, p <0.01). Parks et al. (2012) used similar domains to define parenting stress and found that the number of parent stressors presented was directly related to child obesity (1.12, 95% CI 1.03-1.23, p=0.01). Garasky et al. (2009) found similar results with school age children (5-11 years) where children from homes that lacked cognitive stimulation and emotional support were 4.3% more likely to be obese than children from homes that provided them with such support.

Therefore, one mechanism by which the general family environment may lead to increased obesity risk in children is the negative parent-child interactions characterised by insensitivity and hostility as a result of increased parent stress. Increased stress in the family environment may lead to increased activation of the HPA axis, characterised by increased concentrations of cortisol and resulting metabolic disturbances.
2.4.3 The Association between Parenting Stress and Obesity Behaviours

Another mechanism by which stress may cause increased obesity risk in children may go beyond the nature of the parent-child interaction and affect the actual care the parent provides for his or her child. Thus, it is not difficult to imagine how parenting stress related to such factors may translate into the domains of child health and nutrition or obesity risk (Gable & Lutz, 2000). Figure 1 describes the proposed mechanisms between parenting stress and child weight.

2.4.3.1 Parenting Stress and Child Eating Habits

As discussed above, stressed women report consuming fewer fruits and vegetables and more snack-type foods than unstressed women (Oliver & Wardle, 1999). Stressed parents may have less motivation or time to prepare meals, purchase more prepackaged foods than less stressed parents due to convenience (Gable & Lutz, 2000). When considering the literature pertaining to parental modeling of dietary behaviours, parental eating habits during times of stress are of concern. Increased levels of parent perceived stress has also been found to be associated with increased fast food consumption among children (Parks et al., 2012). Parents self-reported the level of stress they had been under in the past year and it was found that the children of those who reported greater stress levels were more likely to eat fast food 2 or more times a week (OR= 1.07, 95% CI 1.03-1.10, p < 0.01) (Parks et al., 2012). This was especially true for the preschool aged stratum in the study, who, although not significant at p <0.05, had the largest odds ratio for consuming fast food (OR=1.11, 95% CI 0.99-1.20) (Parks et al., 2012). This finding is not surprising, because parents have the most influence and control
over children’s diets during the preschool years. During times of increased parental stress, children’s food consumption may reflect the poor, stress-related eating habits of their parents not only due to food availability but also through modeling behaviours.

However, Gunderson et al. (2008) found that low-income children of mothers experiencing high stress levels only had a higher probability of being overweight if they lived in a food secure household. Low-income children from food insecure households were less likely to be overweight; the children from both food-secure and food insecure homes may have wanted to eat in response to the stress in their homes, but the food insecure children may not have been able (Gunderson et al., 2008). Food security was measured using the U.S. Department of Agriculture (USDA) protocol (Nord, Anderson & Calson, 2005). Because most children in the U.S. belong to food secure homes, policies and programs addressing parental stress in low-income families may have a profound effect on childhood overweight and obesity (Gunderson et al., 2008).

2.4.3.2 Parenting Stress and Child TV Viewing Habits

In terms of the television (TV) viewing habits of preschool children, many studies have found associations between maternal depressive symptoms and heavy TV viewing times in their children (Conners, Tripathi, Clubb & Bradely, 2007; Burdette, Whitaker, Kahn & Harvey-Berino, 2003). According to Conners and colleagues (2007), depressive symptoms in parents may increase the use of TV as an ‘electronic babysitter’ to compensate for their inability to keep children occupied by more active activities. Moreover, the association may be more inadvertent as depression may cause parents themselves to be less active, watch more television and unintentionally increase child TV
time (Conners et al., 2007). Pearlin (1959) first described this association by providing evidence that suggests that TV is often used as an escape mechanism to forget about life stressors for a period of time. Further, evidence from one study on children between the ages of 8-18 years of age suggested that stressful life events were significantly associated with internet use for mood management (Leung, 2007). The notion of TV as an escape has not been well understood in young children and thus it is important to understand child TV habits as both a coping mechanism for increased stress in the family environment and a mechanism for increased risk of obesity.
Figure 1: Proposed mechanisms between parenting stress and child weight

- **Stressors**
  - Income
  - Marital Distress
  - Unemployment
  - Disrupted Parent-Child Relationships

- **Behavioural Causes**
  - Poor Eating Habits*
  - Inadequate Sleep*
  - TV Viewing Habits*
  - ↓ Physical Activity*

- **Physiological Causes**
  - ↑ Cortisol Levels
  - ↑ Ghrelin & ↓ Leptin
  - ↑ Appetite
  - Insulin & Leptin Resistance

*Factors examined in current study*
3.0 Rationale and Research Objectives

3.1 Rationale

Childhood obesity is multifactorial and it is important to look at the child as embedded in his/her environment. Parents influence their children’s obesity risk through feeding behaviours, modeling of weight-related behaviours and through the provision of a home environment that can either assist or impede healthy lifestyles (Freedman et al., 2007). As explored in the literature, the home environment is of particular interest because less is known about how parental behaviours and parent-child interactions may influence childhood obesity risk. Childhood weight status is an outcome, and, thus, in order to prevent and treat the problem, parental behaviours and parent-child interactions involved must be examined. Reduction of parent stress has already been shown to be an important factor in parenting children with developmental disabilities and delays, attention deficit disorder and other behavioural disorders and children with chronic diseases (Haskett et al., 2006)

It is also important to look at how increased parental stress levels may cause preference for or reinforce certain behaviours in children such as poor eating habits, increased TV time, decreased physical activity and poor sleep habits. It is quite possible that the more stressed a parent is feeling, the easier it is to provide the child with poorer food choices or give into tantrums surrounding food choices. It is also possible that the TV may act as an easy babysitter. Parent stress levels may also change the environment of the home by which physical activity is neither modelled nor encouraged either due to a lack of time or energy at the end of a work day. Furthermore, homes experiencing
increased stress levels may lack consistency. The absence of regular routines may be reflected in varying bedtimes and a lack of adequate sleep received by preschool aged family members.

Finally, while stress has been difficult to characterise, coping mechanisms surrounding various behaviours, including eating habits, have previously been better understood in adults than in children. This study will provide a basis for how family stress levels affect young family members and how suspected coping mechanisms surrounding eating and television may lead to increased obesity risk for the preschool age group. Results from this research will also provide an understanding of how parent stress may be associated with increased child weight and thus will to help inform effective obesity prevention interventions with a focus on parental stress reduction.

### 3.2 Research Objectives

This study had two research objectives:

1. **Primary Objective**: To examine the association between parental stress and child body mass index (BMI);
2. **Secondary Objective**: To explore the association between parental stress and known childhood obesity risk behaviours including poor eating habits, increased TV time, decreased physical activity and poor sleep habits.
3.2.1 Hypotheses

We hypothesized that level of parental stress would be positively associated with children’s measured BMI. We also hypothesized that higher levels of parenting stress would be related to an increase in consumption of unhealthy foods and TV viewing as well as decreased physical activity and sleep in preschool children.

The results of this research have strong implications on the future of family-based obesity prevention interventions for preschool aged children and their parents. Results will illustrate how stress affects the home environment for preschoolers and thus provide us with a critical lens in which to evaluate the delivery and content of the messages provided to parents in such programs. Moreover, it is possible that parenting stress is an underlying factor associated with unhealthful behaviours during the preschool age group. Thus, a reduction in parenting stress may help reduce a child’s exposure to the obesity risk factors that will be examined in this study.
4.0 Methodology

4.1 PTT Study Design

To explore the association between parenting stress and child weight, secondary data analysis was conducted using baseline data collected from the Parents and Tots Together (PTT) study, a randomized controlled trial to test the effectiveness of a family-based obesity prevention intervention. Only baseline measurements from the PTT study were used for the purpose of this study to avoid any effect the PTT intervention may have on parent stress levels or child weight. As such, this study will provide a cross-sectional analysis of the association between parent stress levels and child BMI in 110 parent-child dyads.

4.1.1 Recruitment and Eligibility

For the purpose of the PTT intervention study, parents with children between the ages of 2-5 years were recruited through three Community Health Centres and other community agencies in the Boston, MA area that primarily serve low-income families. A number of strategies were used to recruit participants including in-person presentations by research staff at community events, direct mailings, posters and community announcements.

Participants were parents with preschool aged children between the ages of 2-5 years. Exclusion criteria for participation included: 1) inability to respond to interviews in either English or Spanish; 2) plans to move from the Boston area during the study period; 3) parents who were younger than 18 years of age; and, 4) children or parents with severe
health conditions that would inhibit them from participating in study activities. PTT is a primary prevention intervention; the focus of the prevention is to minimize excess weight gain as opposed to secondary interventions that target those already at risk. Therefore, children were eligible regardless of their pre-participation weight status.

For the current research, baseline survey data from PTT were used. Participants with complete data were included in the analyses. Complete data included complete demographic forms, and parent-report measures of parent stress, child eating habits, TV viewing time, participation in physical activity and sleep habits as well as measured child weight and height. Baseline data were received from 112 parent child dyads; 110 of which had complete data. The parent-child dyads that were excluded from the analyses were missing complete information for the parenting stress measure as well as child demographic information such as age, height and weight.

4.1.2 Procedures

Following the completion of an eligibility screen by phone or in-person, eligible and interested parents were invited to an introduction session at the same location and time as the intervention. Consent forms were signed and baseline questionnaires were completed. Child heights and weights were also measured by trained research assistants using a Shorr stadiometer (Shorr Productions, LLC, Olney, Maryland, USA) for standing height and a Seca scale (Seca, the Netherlands).
4.1.3 Ethical Considerations

PTT participants attended an information session prior to enrolment in the study which explained all study procedures. Written informed consent was obtained from all parent participants on behalf of themselves and their preschooler. Ethical approval for the current study was obtained through the University of Guelph Ethics Review Board and the Harvard Pilgrim Health Care Human Participants Committee (see appendix A). For the purposes of this study, the risk to participants is considered low due to the secondary nature of the analysis. The data used for the purpose of this secondary data analysis were provided to us in a de-identified format by Harvard Pilgrim Health Care, where the PTT study is based. The data set contained only ID numbers, no names. Furthermore, access to the file that links study IDs to participant names is not available to us.

4.2 Measures

The baseline measures used to explore the association between parenting stress and child weight were based on parent self-reported stress and measured child weight. The obesity risk behaviours measured included child eating habits, TV viewing time, participation in physical activity and sleep habits. Based on the literature and the relationships they hold with increased stress levels and obesity risk, respectively, the following confounding variables were explored and adjusted for: marital status and education attainment. Due to the large amount of missing data from the self-reported measure of total household income it was not included in analyses. Education level was used as a proxy for socio-economic status.
4.2.1 Parenting Stress

4.2.1.1 Parenting Stress Index

Parenting stress was measured using the self-report Parenting Stress Index-Short Form 3rd edition (PSI-3-SF). The PSI-3-SF is a 36 item derivative of the validated original Parenting Stress Index (PSI) developed by Abidin (1983), using a conceptualized definition of parenting stress as defined by Everly & Lating (2002). The definition defines parenting stress as a complex construct involving behavioural, cognitive and affective components in combination with child and parent characteristics as well as family components as they relate to individual appraisal of the parental role (Everly & Lating, 2002; Whiteside-Mansell et al., 2007). Due to the length of the PSI (120 items), the PSI-SF was created as a shorter version (36 items). Factor analysis of the PSI indicated that a three factor solution using three dimensions labelled, Difficult Child, Parent Distress, Parent-Child Dysfunctional Interaction, was appropriate (Abidin, 1995; Haskett et al., 2006). Abidin’s (1995) validation found a high correlation between the total scores on the original long and short form versions (r= 0.87). The PSI-SF itself has been shown to be a valid and reliable tool to measure parenting stress (Abidin, 1995; Reitman et al., 2002; Haskett et al., 2006, McKelvey et al., 2009). The PSI-SF has been well used in the literature to measure parenting stress across a variety of situations including parenting children with ADHD and chronic diseases (Theule et al., 2011; Haskett et al., 2006). Reitman et al. (2002) conducted a search of the PSI-SF in the PsycINFO database and found over 40 citations since 1995. A similar search conducted for this study produced 279 citations of PSI-SF in the PsycINFO database since 1995.
For the purposes of the PTT study, written consent was obtained from the researchers who developed the PSI-SF to use the Parent Distress subscale alone. The Parent Distress subscale consists of 12 questions, each on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), and yields a score indicating a level of distress (Haskett et al., 2006). This distress could result from personal factors such as depression or conflict with a partner, and life restrictions due to demands of child rearing (Haskett et al., 2006). Examples of these types of stress can be found in the following questions: “I find myself giving up more of my life to meet the needs of my child than I ever expected” or “I am unhappy with the last purchase of clothing I made for myself” and “Having a child has caused more problems than I expected in my relationship with my spouse (or male/female friend)”’. The higher the reported score, the higher the level of distress the parent is experiencing. Abidin (1995) reported that the Parent Distress subscale on the PSI-SF correlated (r=0.92) to the full Parent Domain on the PSI. A Cronbach’s α reliability coefficient of 0.87 was reported for the Parent Distress subscale (Abidin, 1990).

The original development and validation of the PSI-SF was done with primarily middle-class, married Caucasian participants (Abidin, 1995). Since then, the PSI-SF has been found to be a valid and reliable indicator of parenting stress in low income and ethnically diverse families. Reitman et al. (2002) found the PSI-SF to have excellent internal consistency and to be appropriate for use among lower socioeconomic-status African American mothers; specifically, the parent distress subscale had an internal consistency with a Cronbach’s α of 0.89. Construct validity was established and parent distress was significantly related to the Global Severity Index (r= 0.54, p < 0.001), which
measures psychological symptoms and psychological distress (Haskett et al., 2006). Test-
retest reliability was also established with correlations between the first and second
assessments of \( r=0.61, \ p < 0.05 \), for the parent distress subscale (Haskett et al., 2006).
Thus, the use of the PSI-SF Parent Distress subscale is appropriate for use among the low
income ethnically diverse sample present in the current study.

4.2.1.2 Coding of Parenting Stress

Responses to each of the 12 items of the Parental Distress domain of the PSI-3-SF
were recorded individually and tabulated to obtain a total score of parenting stress. Using
the PSI-3-SF manual, raw scores were then converted into percentiles. The normal range
for scores is within the 16\(^{th}\) to 84\(^{th}\) percentiles. Parents whose scores fall between the 85\(^{th}\)
and 89\(^{th}\) percentiles are considered to be experiencing high stress and those whose scores
fall beyond the 90\(^{th}\) percentile are considered to be experiencing clinically significant
stress levels. Based on these percentile conversions, parent stress scores were collapsed
into two categories: normal stress vs. high stress.

4.2.2 Measured Child Weight

Trained research staff measured children’s heights and weights using a Shorr
stadiometer (Shorr Productions, LLC, Olney, Maryland, USA) for standing height and a
Seca scale (Seca, the Netherlands) for weighing. In all cases, BMI is the ratio of weight
(kg) to the square of standing height (m). BMI z-score is the outcome variable for child
weight based on WHO growth charts. BMI z-scores are measures of relative weight
adjusted for child age and sex (Must & Anderson, 2006). The z-score reflects the number
of standard deviations a participant is above or below the group mean for BMI (Daniels,
For this study, BMI z-scores were calculated using the WHO Anthro: software for analysing the growth of the world’s children and adolescents, which calculates BMI z-scores and percentiles based on the age, gender, height and weight of the presholderer (2011).

Supporting the study design, BMI z-scores are useful for assessing adiposity cross-sectionally, and can summarize results across participants for research purposes (Cole, Faith, Pietrobelli & Heo, 2005). This is because they can be appropriately used to compare group means (Must & Anderson, 2006). More specifically, the use of BMI z-scores provides standardization across age and gender groups, which is helpful in this study as both male and female children are participating and may be anywhere between the ages of 2-to-5-years. In addition, the observed z-scores from a population are often normally distributed, thus satisfying the assumption of normality needed for many statistical analyses (Gibson, 2005). Preschoolers were categorized into four groups based on BMI z-scores: underweight (BMI z-score <-2), normal weight (BMI z-score-2 to+1), overweight (BMI z-score > +1 to +2), and obese (BMI z-score > +2). Only two children in this study were categorized as underweight. For the purpose of data analysis, BMI z-scores were collapsed into two categories to characterize child weight: normal weight (BMI z-score ≤ +1, or less than the 85th percentile) vs. overweight/obese (BMI z-score > +1, or more than the 85th percentile).

4.2.3 Child Eating Habits

Child eating habits were measured using two separate variables to gain an understanding of the different pathways by which poor dietary behaviours can increase
obesity risk in preschool aged children. Based on previous research, consumption of fast food and SSB are each known to substantially increase obesity risk in preschool-aged children (Harnack, Stang & Story, 1999; Ludwig, Person & Gortmaker, 2001; Welsh et al., 2005; Warner, Harley, Bradman, Vargas & Eskenazi, 2006; Dubois, Farmer, Girard & Peterson, 2007; Fox et al., 2010). As mentioned previously, preschoolers’ nutrient needs are high relative to their energy requirements, leaving little room for the consumption of items that are energy dense and high in sugar and fat, such as the foods and drinks that fall under the categories of fast food and SSBs.

4.2.3.1 Fast Food Intake

Fast food intake was measured using parent-report of child consumption in the past month: “In the past month, on average how often did your child eat from a fast food restaurant such as a pizza place, McDonald’s, Burger King, Taco Bell, or Dunkin Donuts? Please include breakfast, lunch, and dinner”. This question was answered using a 6-point Likert scale ranging from “Never” to “Once per day or more”. Consistent with previous research, the frequency of consumption was collapsed into two categories: <1 times/week vs. ≥ 1 times/week (Parks et al., 2012).

4.2.3.2 Sugar Sweetened Beverage Consumption

SSB consumption was measured using parent-report of child consumption of items from the Harvard Food Frequency Questionnaire: “In an average week, how often did your child drink each of the following beverages: flavoured milk such as chocolate milk, 100% juice (no sugar added), Fruit Drinks (Hi-C, Kool-Aid, lemonade, sports drinks), Soda (not sugar-free), Sugar-free soda. This questionnaire uses a 5-point Likert
scale ranging from “Never” to “5 or more times per day” and has been validated for use with preschool children (Blum et al., 1999). From these questions, the subscales measuring flavoured milk, fruit drinks and soda were combined to determine the frequency of SSB consumption. The subscales measuring 100% fruit juice and sugar-free soda consumption were not included in these analyses as these beverages do not contain added sugar. Consistent with previous research on SSB consumption, average consumption per day was calculated for each child by assigning the midpoint of the category for each response. This variable was then collapsed into two categories: <1 SSB/day vs. ≥1 SSB/day (Ludwig et al., 2001; Warner et al., 2006).

### 4.2.4 Child Television Viewing Habits

Child television viewing habits were measured by parent-report of a child’s habits on a typical weekday and weekend using the question used in the National Longitudinal Study of Youth: “On an average weekday [weekend day] how much time per day does your child spend watching TV incl. dvds or videos?” (Baker, Keck, Mott & Quinlan, 1993). Answers were provided on a 6-point Likert scale ranging from “None” to “7 or more hours a day”. Based on the American Academy of Pediatrics’ (2011) recommendations that preschool children spend no more than 2 hours per day watching TV and other media, viewing time was collapsed into two categories: <2 hours/day vs. ≥2 hours/day. TV time was analysed separately for weekdays and weekend days to help researchers understand how the home environment may be different between weekdays and the weekend.
The American Academy of Pediatrics (2011) suggests that parents ‘limit’ the amount of television their preschoolers watch. Based on secondary hypotheses, we were interested in how parenting stress might cause the home to be an obesogenic environment; specifically whether increased stress levels may be associated with less monitoring or consistency surrounding the amount of TV children watch. Thus, parents’ use of appropriate boundaries on TV time were measured based on the following question from the “Limit Setting: Activity” subscale of the Parenting Style in Latino Families Questionnaire: “I limit the amount of time my child watches TV or videos” (Arredondo et al., 2006). Answers to this question were based on a 4-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”. Parents’ TV limit setting was collapsed into 2 categories: agree vs. disagree.

4.2.5 Child Physical Activity Behaviours

Child physical activity behaviours were measured based on parental-report of the amount of active play the child participated in on weekdays and weekend days: “On an average weekday [weekend day], how much time per day is your child involved in active play (such as running, jumping, climbing)”. This question was adapted from the Parenting Style in Latino Families Questionnaire (Arredondo et al., 2006). Answers to this question were based on a 6-point Likert scale ranging from 0 minutes to 2 hours or more per day. Based on the NASPE (2011) recommendation that preschooler children spend at least 60 minutes in structured active play per day, responses to the time children spent participating in active play were collapsed into two categories: <1hr/day vs. ≥1hr/day. While it is also recommended that children participate in an additional 60 minutes of unstructured play per day, research has shown that on average, most children
do not even meet the recommendation of 60 minutes of structured active play (Parks et al., 2012; Pate et al., 2004). Furthermore this reference was chosen as it may be easier for parents to think about the structured play their child participated in, rather than trying to quantify “moderate/vigorous” activity bursts throughout the day. Weekday and weekend day activity were again analysed separately to investigate how the activity in a home environment may differ between weekdays and weekend days.

4.2.6 Child Sleep Habits

Child sleep habits were based on parental-report of the amount of time children sleep. Parents were asked to separately record the hours and minutes that their child spent sleeping on an average weekday and weekend day: “On an average weekday [weekend day], how many hours and minutes does your child usually sleep in a 24 hour time period?” Parents may or may not have included the amount of time children spent napping during the day as the question did not specify this information or ask parents to differentiate between daytime napping and nighttime sleeping habits. However, when thinking about obesity prevention, research seems to indicate that napping is not a substitute for nighttime sleep (Bell & Zimmerman, 2010). The hours and minutes a child slept over a 24-hour period were examined separately for weeknight and weekend night sleep to determine whether children’s sleep habits varied throughout the week. Specifically, we were interested in whether parenting stress was associated with a difference in the home environment and routines surrounding sleep between the week and weekend. While the National Sleep Foundation recommends that children aged 2-5 years receive 11-14 hours of sleep per night, their recommendations overlap when they also
recommend that children aged 5-10 years receive 10-11 hours (National Sleep Foundation, 2011). Based on these recommendations and to account for this overlap, child sleep time was dichotomized based on whether or not children were meeting this recommendation: 10-24 hours of sleep/night vs. 0-9.9 hours of sleep/night (National Sleep Foundation, 2011).

4.2.7 Confounding Variables

In a statistical model, a variable is considered a confounder if it is associated with both the independent and dependent variables. Ignoring a confounding variable in a model such as the hypothesized association between parenting stress and child BMI could lead to a misinterpretation of the magnitude of the relationship. Furthermore, controlling for possible confounding variables helps control for variability between participants.

Possible confounding variables considered in this model were parent education, marital status and race/ethnicity. In this study, education was used as a proxy for family socio-economic status (Winkleby, Jatulis, Frank & Fortmann, 1992). Although not all of these measures were associated with parenting stress, child BMI or the various obesity risk outcomes that were explored, they were kept in the models as confounders due to their known associations with stress and increased obesity risk in the literature (Ogden et al., 2006). Measures of education, marital status and race are all based on self-report from the demographic section of the PTT baseline questionnaire described above. Both education and marital status were categorized as binary variables: graduated high school or less vs. some college/technical school or degree and, married/living with a partner vs. single, respectively. Education was defined as education attainment which refers to the highest level of education one has completed, not the level of school the individual is attending.
Race was categorized into four groups: Hispanic/Latino, White, Black and other (including Asian).

4.3 Data Analysis

All statistical analyses were conducted using SPSS version 20 for Windows (PASW, IBM, New York, USA). For this study, a p value of $\leq 0.05$ was considered statistically significant. Data on participant demographics were analyzed by calculating means ($\pm$ SD) and frequencies. There were missing values among some of the variables and as such individuals missing values for a particular variable were excluded from analyses that included that variable. The extents of the relationships among the potential confounding variables (marital status, parental education status and race) were explored. Marital status and education attainment were not found to be associated. Race was found to be significantly associated with both marital status ($\chi^2 (3) = 24.65$, $p=0.000$) and education ($\chi^2 (6) = 44.18$, $p=0.000$). Of those who identified as Hispanic or Latino, 46.7% were married or living with a partner and 46.1% had obtained a high school diploma or less. Race was thought to be strongly associated with both the independent and dependent variables from our main objective, however it was not associated with child weight ($\chi^2 (3) = 8.277$, $p=0.041$), not parenting stress ($\chi^2 (3) = 4.997$, $p=0.172$). It could be argued then that race is not a confounding variable based on these data, despite wide use in the literature. While there are not strong or significant associations with marital status or education either, these variables did not have sparse cells in this sample and were included a priori due to known associations with both stress and weight in the literature; very few participants belonged to the ‘white or ‘other’ race categories. There were no substantive differences between models where marital status and education were
controlled for, and models where race was controlled for. Therefore, due to data
sparseness and significant associations with other confounders, race was not included in
any models. Thus, only education and marital status were included in the final adjusted
models.

Chi-Square tests of association and logistic regression models were then used to
test our hypotheses. Chi-square tests allowed us to investigate the associations among our
categorical variables. Logistic regression is generally well suited for investigating
associations between a binary variable and one or more categorical or continuous
predictor variables; allowing us to investigate the odds of obesity and the obesity risk
factors occurring in the children with highly stressed parents (Peng, Lee & Ingersoll,
2002). The outcome and predictor variables examined in this study were all dichotomized
to ensure a clear understanding of the relationship between the individual outcome and
predictor variables. For example, based on the first study objective, we were interested in
whether parental stress levels affected the odds of a child being overweight or obese.
Based on the second study objective, we were also interested in the effect parental stress
might have on the odds of whether or not children fell within the recommendations for
the amount of TV they should be watching, the amount of physical activity they should
participate in daily and the amount of sleep they should receive nightly. The variables
used to test the hypotheses related to the secondary outcomes, where we predicted that
parental stress would lead to increased odds of children not meeting these health
recommendations were chosen a priori based on a review of the literature and the
measures available in the secondary data set used. Thus, measures assessing child weight
and these obesity risk behaviours were dichotomized so that children were either of
normal weight or were overweight/obese, and either met or did not meet the recommendations. Logistic regression allowed the assessment of the odds of a child’s weight and his/her participation in certain behaviours, based on whether the parent was experiencing normal or high stress levels, while controlling for potential confounders. In this study, odds ratios were considered significant if the p-value for a two-sided test was \( \leq 0.05 \) or the 95\% confidence interval did not contain 1 (Peng et al., 2002).

4.4 Summary of Methods

In summary, quantitative baseline data from 110 parent-child dyads participating in the PTT study were used to explore the association between parental stress and childhood obesity as well as childhood obesity risk behaviours. Parents participating in the PTT randomized controlled-trail completed a baseline questionnaire that included demographic information. Chi-squared tests and logistic regression models were used to assess associations.
5.0 Results

5.1 Study Sample

Demographics for all parent participants are presented in Table 5.1. A total of 112 parents were enrolled to participate in PTT. Of the 112 parent participants, a total of 110 completed the baseline questionnaire. Of the parents who completed the questionnaire, 101 (92.7%) were biological mothers of the child participants. Other parent participants consisted of biological fathers (4.6%) a step mother (0.9%), a foster-mother (0.9%) and a grandparent (0.9%). The majority of parent participants were either married (45.8%) or living with a partner (29%), while others were either single (20.6%) or separated/divorced (4.7%). This was an ethnically diverse sample with the majority of participants identifying as Hispanic or Latino (55.2%), and Black (21.9%). As expected from recruitment strategies, this was a low-income sample with the majority of households earning a total income of less than $60,000/year (63.8%). Beyond demographic purposes, income data were not used any further in the analyses due to the amount of missing data; 17.3% of parents did not know their total household income and 10% chose not to respond. Results showed that this sample obtained a fairly low level of education, where 39.5% of parents had not obtained a high school diploma, 17.3% had graduated high school, 22.1% had attended some college or technical school and just 20.2% had received post graduate training or a degree.

Parents scored an average of $28.4 \pm 10.691$ on the PSI-SF parent distress subscale, with 80% of parents experiencing normal levels of stress and 20% experiencing high levels of stress. Similar parent-distress scores have been observed when examining
other low-income and ethnically diverse populations (Reitman et al., 2002). Reitman et al. (2002) reported an average parent-distress sub-scale score of 24.67 ±9.13 from a sample of low-income mothers participating in a parenting program for children aged 3-5 years.

Table 5.1
Parent Demographic Characteristics

<table>
<thead>
<tr>
<th>Relation to Child</th>
<th>N ( %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td>101 (92.7%)</td>
</tr>
<tr>
<td>Stepmother</td>
<td>1 (0.9%)</td>
</tr>
<tr>
<td>Foster-mother</td>
<td>1 (0.9%)</td>
</tr>
<tr>
<td>Father</td>
<td>5 (4.6%)</td>
</tr>
<tr>
<td>Grandparent</td>
<td>1 (0.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>N ( %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>49 (45.8%)</td>
</tr>
<tr>
<td>Not married, Living with a Partner</td>
<td>31 (29.0%)</td>
</tr>
<tr>
<td>Single</td>
<td>22 (20.6%)</td>
</tr>
<tr>
<td>Divorced</td>
<td>2 (1.9%)</td>
</tr>
<tr>
<td>Separated</td>
<td>3 (2.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>N ( %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic/Latino</td>
<td>58 (55.2%)</td>
</tr>
<tr>
<td>White</td>
<td>14 (13.3%)</td>
</tr>
<tr>
<td>Black</td>
<td>23 (21.9%)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (9.5%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Household Income</th>
<th>N ( %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; $20,000</td>
<td>34 (30.9%)</td>
</tr>
<tr>
<td>$20,000- $59,999</td>
<td>36 (32.8%)</td>
</tr>
<tr>
<td>$60,000- $99,999</td>
<td>6 (5.4%)</td>
</tr>
<tr>
<td>$100,000 or more</td>
<td>4 (3.6%)</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>19 (17.3%)</td>
</tr>
<tr>
<td>Refused</td>
<td>11 (10.0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education Obtained</th>
<th>N ( %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8th Grade or Less</td>
<td>22 (21.2%)</td>
</tr>
<tr>
<td>Some High School</td>
<td>19 (18.3%)</td>
</tr>
<tr>
<td>Graduated High School</td>
<td>18 (17.3%)</td>
</tr>
<tr>
<td>Some College or Technical School</td>
<td>23 (22.1%)</td>
</tr>
<tr>
<td>Post Graduate Training or Degree</td>
<td>21 (20.2%)</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>1 (1.0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parent Stress Level</th>
<th>Mean Stress Level (SD)= 28.38 (10.691)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Stress</td>
<td>88 (80%)</td>
</tr>
<tr>
<td>High Stress</td>
<td>22 (20%)</td>
</tr>
</tbody>
</table>
Child demographics are presented in Table 5.2. There were 56 (50.9%) male and 54 (49.1%) female preschooler participants in this study. The mean age of these children was 3.15 years ± 1 year. Child ages were well distributed across the preschool age group and thus this population of children is thought to be a representative sample of the preschool demographic. Rates of overweight and obesity were higher than rates that have been reported in previous studies and the general U.S. population, with 48.5% of children being classified as either overweight or obese using the WHO growth curves as a reference for BMI z-scores.

<table>
<thead>
<tr>
<th>Table 5.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child Demographic Characteristics</strong></td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Child BMI Categorization</strong></td>
</tr>
<tr>
<td>Normal Weight</td>
</tr>
<tr>
<td>Overweight/Obese</td>
</tr>
</tbody>
</table>

The population frequency of our secondary outcome variables is described in Table 5.3. The majority of these children ate out less than once a week. These children consumed, on average, 8 SSB per week, or more than 1 per day. More than half of the children met the physical activity guidelines of spending at least one hour per day participating in active play, with more children being active on weekend days. Despite the time recorded for active play, there is concern about the amount of time these children spent in front of
the TV, averaging 3.48 hours of TV on weekdays and 3.45 hours on weekend days.

However, 80% of parents reported limiting the amount of TV their children were watching. The majority of the children in this study did not meet the sleep recommendations, with only 34.6% and 31.1% meeting the recommendation of 10-14 hours of sleep per night on weekday and weekend nights, respectively.

Table 5.3
Population frequency of secondary outcome factors

<table>
<thead>
<tr>
<th>Outcome Factor</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast Food Consumption</td>
<td></td>
</tr>
<tr>
<td>&lt; 1 time/week</td>
<td>81 (74.3%)</td>
</tr>
<tr>
<td>&gt; 1 time/week</td>
<td>28 (25.7%)</td>
</tr>
<tr>
<td>SSB Consumption</td>
<td>Mean SSBs/Week (SD)= 8.01 (9.893)</td>
</tr>
<tr>
<td>&lt; 1 beverage/day</td>
<td>69 (62.7%)</td>
</tr>
<tr>
<td>&gt; 1 beverage/day</td>
<td>41 (37.3%)</td>
</tr>
<tr>
<td>TV Viewing</td>
<td>Mean Viewing Hrs. (SD)= 3.48 (1.040)</td>
</tr>
<tr>
<td>Weekday</td>
<td></td>
</tr>
<tr>
<td>&lt; 2 hour/day</td>
<td>51 (48.1%)</td>
</tr>
<tr>
<td>&gt; 2 hour/day</td>
<td>55 (51.9%)</td>
</tr>
<tr>
<td>Weekend Day</td>
<td>Mean Viewing Hrs. (SD)= 3.45 (1.152)</td>
</tr>
<tr>
<td>&lt; 2 hour/day</td>
<td>50 (47.2%)</td>
</tr>
<tr>
<td>&gt; 2 hour/day</td>
<td>56 (52.8%)</td>
</tr>
<tr>
<td>Limiting TV Viewing</td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>88 (80.0%)</td>
</tr>
<tr>
<td>Disagree</td>
<td>22 (20.0%)</td>
</tr>
<tr>
<td>Physical Activity (Active Play)</td>
<td></td>
</tr>
<tr>
<td>Weekday</td>
<td></td>
</tr>
<tr>
<td>&lt;1 hour/day</td>
<td>36 (33.0%)</td>
</tr>
<tr>
<td>≥ 1 hour/day</td>
<td>73 (67.0%)</td>
</tr>
<tr>
<td>Weekend Day</td>
<td></td>
</tr>
<tr>
<td>&lt;1 hour/day</td>
<td>28 (26.9%)</td>
</tr>
<tr>
<td>≥ 1 hour/day</td>
<td>76 (73.1%)</td>
</tr>
<tr>
<td>Night-Time Sleep</td>
<td>Mean Hrs. Sleep/Week Night (SD)= 9.42 (2.674)</td>
</tr>
<tr>
<td>Week Night</td>
<td></td>
</tr>
<tr>
<td>0-9.9 hours</td>
<td>70 (65.4%)</td>
</tr>
<tr>
<td>10-24 hours</td>
<td>37 (34.6%)</td>
</tr>
<tr>
<td>Weekend Night</td>
<td>Mean Hrs. Sleep/Weekend Night (SD)= 9.49 (2.272)</td>
</tr>
<tr>
<td>0-9.9 hours</td>
<td>73 (68.9%)</td>
</tr>
<tr>
<td>10-24 hours</td>
<td>33 (31.1%)</td>
</tr>
</tbody>
</table>
5.2 Research Objectives

We had two objectives for this study. The primary objective of the current study was to examine the association between parental stress levels and child BMI. The secondary objective of the study was to explore the association between parental stress and known childhood obesity risk behaviours including poor eating habits, increased TV time, decreased physical activity and poor sleep habits.

5.2.1 Confounding Variables

Parental marital status and education attainment were controlled for in every model. Results from the chi-square tests between the socio-economic variables (education, marital status) and parenting stress and child weight are illustrated in Table 5.4. There was a significant association between parent education and child BMI ($\chi^2 (1) = 4.239, p= 0.039$). There were no other associations between any of the socio-economic variables and parenting stress or child weight status.
Table 5.4
Chi-square tests for socioeconomic variables and main outcome variables

<table>
<thead>
<tr>
<th>Socio-economic Variables</th>
<th>Parenting Stress Level</th>
<th>Child Weight</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Stress</td>
<td>High Stress</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/Living with a partner</td>
<td>66 (82.5%)</td>
<td>14 (17.5%)</td>
<td>$\chi^2(1)= 1.818$</td>
</tr>
<tr>
<td>Single</td>
<td>19 (70.4%)</td>
<td>8 (29.6%)</td>
<td>$p=0.178$</td>
</tr>
<tr>
<td>Education Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduated High school or less</td>
<td>45 (76.3%)</td>
<td>14 (23.7%)</td>
<td>$\chi^2(1)= 0.462$</td>
</tr>
<tr>
<td>Some College/Technical School or Degree</td>
<td>36 (81.8%)</td>
<td>8 (18.2%)</td>
<td>$p= 0.497$</td>
</tr>
</tbody>
</table>

*significant at $p < 0.05$
The associations between the socio-economic variables and the secondary outcome variables were initially explored using chi-square tests of association and the results can be found in Table 5.5. Marital status was found to be significantly associated with fast food consumption ($\chi^2(1) = 6.227$, p=0.013), where interestingly, being a single parent was associated with children eating fast food less than once a week. It is possible this association may be due to the dual income that is often present in two parent homes; single parent homes may have less disposable income to eat out at restaurants. Education ($\chi^2(2) = 7.486$ p=0.006) was found to be significantly associated with Weekend TV Hours; increased parental education was associated with increased children viewing more than 2 hours of TV on weekend days. Education was also significantly associated with child active play on weekdays ($\chi^2(2) = 10.158$, p=0.001), whereby increased parent education was associated with children participating in more than one hour of active play on weekdays.
Table 5.5
Chi-square tests for socioeconomic variables and secondary outcome variables

<table>
<thead>
<tr>
<th>Socioeconomic Variables</th>
<th>Secondary Outcome Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fast Food Consumption</td>
</tr>
<tr>
<td>Marital Status</td>
<td>$\chi^2(1)=6.227$ p=0.013*</td>
</tr>
<tr>
<td>Education Status</td>
<td>$\chi^2(1)=2.209$ p=0.154</td>
</tr>
</tbody>
</table>

*significant at  $p < 0.05$
5.2.2 Primary Objective

The main objective of this study was to test whether the children of parents experiencing high levels of stress were more likely to be overweight or obese than the children of parents experiencing normal levels of stress. Logistic regression results indicated that the children of highly stressed parents were no more likely to be overweight or obese than the children of normally stressed parents in both unadjusted models (OR= 1.077, 95% CI (0.408-3.180)) and models adjusted for parental marital status and education level (OR=1.005, 95% CI (0.348-2.906)). See Table 5.7 for the results from the logistic regression models.

5.2.3 Secondary Objectives

Secondary outcome measures included obesity risk factors such as dietary habits, TV time, physical activity and nightly sleep. We were interested in whether or not increased parenting stress levels were associated with these behaviours.

The chi-square tests examining the relationship between parenting stress and each secondary outcome variable can be found in Table 5.6. Parenting stress was significantly associated with parent TV limiting ($\chi^2 (1) = 4.602, p=0.032$). Odds ratio estimates from both unadjusted and adjusted logistic regression models in Table 5.7 indicate that for parents experiencing high levels of stress the odds of not setting limits on the amount of TV time are approximately three times that of normal stress parents (adjusted: OR= 3.151, 95% CI (1.076-9.230)). Interestingly, although stressed parents were less likely to place limits on the amount of TV their children watched, their children were no more likely to watch more TV than the children of normally stress parents on weekdays (OR= 0.872, 95% CI (0.329-2.307)) or weekends (OR= 1.932, 95% CI (0.569-5.662)), when controlling for marital status and
education. Regardless of the presence of parent set-limits on the amount of TV children watched, in a day, there were many children watching more than two hours of TV per day (51.9% on weekdays and 53.9% on weekends).

Parenting stress was significantly associated with active play on weekdays ($\chi^2 (1) = 5.770, p = 0.016$), with increased parenting stress being associated with children spending less than 60 minutes participating in active play on weekdays. Both the unadjusted logistic regression models and those adjusted for parental marital status and education level (Table 5.7) indicate that the odds of not meeting the physical activity guidelines on weekdays were approximately three times higher for children of parents experiencing high stress levels compared to the children of parents experiencing normal stress levels (adjusted: OR = 3.033, 95% CI (1.050-8.693)). Parenting stress was not a significantly associated with weekend active play, nor did children with stressed parents have an increased odds of not meeting the physical activity guidelines on the weekend in comparison to children with normally stressed parents (OR = 1.704, 95% CI (0.573-5.175)) when controlling for marital status and education. This may indicate that there are differences in the home environment between a weekday and a weekend day.

Parenting stress was not a significant predictor of child fast food consumption, SSB consumption, or nighttime sleep on either weekdays or weekends. While only 25.7% of children ate at a fast food restaurant such as McDonalds, Pizza Pizza or Dunkin Doughnuts at least once a week, children did consume an average of eight SSBs per week, or about 1 SSB per day, causing concern about increased sugar consumption. Moreover, 65.4% of children did not meet the National Sleep Foundation’s (2011) recommendations of 10-13 hours of sleep for children aged 2-5 years on weekdays, and 68.9% did not meet recommendations on weekends.
Based on our findings that parenting stress was associated with poor TV viewing habits and weekday physical activity behaviours, we were interested to understand what bearing this association might have on child weight. Specifically, whether the children who did not have parent-set limits on the amount of TV they could watch or the children who were not active enough on weekdays to meet physical activity guidelines were actually heavier or had increased odds of being overweight or obese. Results did not reveal any association between child weight and parent-set TV limits. As expected, based on findings from previous studies, a significant association was found between child weight and weekday participation in active play ($\chi^2 (1) = 7.967, p = 0.005$). Children who did not participate in at least 60 minutes of active play per weekday were approximately three times more likely to be overweight or obese than children who did participate in at least one hour of active play per day on weekdays in both unadjusted (OR = 3.182, 95% CI (1.309-7.731)) and adjusted models (OR = 2.563, 95% CI (1.013-6.648)).
Table 5.6
Contingency Table for Parenting Stress Level and Outcome Variables

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Parenting Stress Level</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Normal Stress</td>
<td></td>
<td>High Stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expected</td>
<td>Observed</td>
<td>%</td>
<td>Expected</td>
<td>Observed</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Weight</td>
<td></td>
<td>42.7</td>
<td>43</td>
<td>42.6</td>
<td>9.3</td>
<td>9</td>
<td>8.9</td>
<td>$\chi^2(1)= 0.019$</td>
<td>(p=0.889)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/Obese</td>
<td></td>
<td>40.3</td>
<td>40</td>
<td>39.6</td>
<td>8.7</td>
<td>9</td>
<td>8.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast Food Consumption</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1/week</td>
<td></td>
<td>64.7</td>
<td>62</td>
<td>56.9</td>
<td>16.3</td>
<td>19</td>
<td>17.4</td>
<td>$\chi^2(1)= 2.097$</td>
<td>(p=0.148)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1/week</td>
<td></td>
<td>22.3</td>
<td>25</td>
<td>22.9</td>
<td>5.7</td>
<td>3</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSB Consumption</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1/day</td>
<td></td>
<td>55.2</td>
<td>55</td>
<td>50.0</td>
<td>13.8</td>
<td>14</td>
<td>12.7</td>
<td>$\chi^2(1)= 0.010$</td>
<td>(p=0.921)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1/day</td>
<td></td>
<td>32.8</td>
<td>33</td>
<td>30.0</td>
<td>8.2</td>
<td>8</td>
<td>7.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV Hours</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekday</td>
<td>&lt; 2 hours/day</td>
<td>40.4</td>
<td>40</td>
<td>37.7</td>
<td>10.6</td>
<td>11</td>
<td>10.4</td>
<td>$\chi^2(1)= 0.040$</td>
<td>(p=0.842)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 2 hours/day</td>
<td></td>
<td>43.6</td>
<td>44</td>
<td>41.5</td>
<td>11.4</td>
<td>11</td>
<td>10.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV Hours</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekend</td>
<td>&lt; 2 hours/day</td>
<td>39.6</td>
<td>41</td>
<td>38.7</td>
<td>10.4</td>
<td>9</td>
<td>8.5</td>
<td>$\chi^2(1)= 0.437$</td>
<td>(p=0.509)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 2 hours/day</td>
<td></td>
<td>44.4</td>
<td>43</td>
<td>40.6</td>
<td>11.6</td>
<td>13</td>
<td>12.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limiting TV</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td></td>
<td>70.4</td>
<td>74</td>
<td>67.3</td>
<td>17.6</td>
<td>14</td>
<td>12.7</td>
<td>$\chi^2(1)= 4.602$</td>
<td>(p=0.032^*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td></td>
<td>17.6</td>
<td>14</td>
<td>12.7</td>
<td>4.4</td>
<td>8</td>
<td>7.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Play</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekday</td>
<td>&lt; 1 hour/day</td>
<td>28.7</td>
<td>24</td>
<td>22.0</td>
<td>7.3</td>
<td>12</td>
<td>11.0</td>
<td>$\chi^2(1)= 5.770$</td>
<td>(p=0.016^*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1 hour/day</td>
<td></td>
<td>58.3</td>
<td>63</td>
<td>57.8</td>
<td>14.7</td>
<td>10</td>
<td>9.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Play</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekend</td>
<td>&lt; 1 hour/day</td>
<td>22.9</td>
<td>21</td>
<td>20.2</td>
<td>5.1</td>
<td>7</td>
<td>6.7</td>
<td>$\chi^2(1)= 1.163$</td>
<td>(p=0.281)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1 hour/day</td>
<td></td>
<td>62.1</td>
<td>64</td>
<td>61.5</td>
<td>13.9</td>
<td>12</td>
<td>11.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nighttime Sleep</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekday</td>
<td>0-9.9 hours</td>
<td>56.3</td>
<td>57</td>
<td>66.3</td>
<td>13.7</td>
<td>13</td>
<td>61.9</td>
<td>$\chi^2(1)= 0.143$</td>
<td>(p=0.706)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10-24 hours</td>
<td>29.7</td>
<td>29</td>
<td>33.7</td>
<td>7.3</td>
<td>8</td>
<td>38.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nighttime Sleep</td>
<td>低压/日</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekend</td>
<td>0-9.9 hours</td>
<td>59.2</td>
<td>61</td>
<td>70.9</td>
<td>13.8</td>
<td>12</td>
<td>60</td>
<td>$\chi^2(1)= 0.904$</td>
<td>(p=0.342)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10-24 hours</td>
<td>26.8</td>
<td>25</td>
<td>29.1</td>
<td>6.2</td>
<td>8</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at \(p<0.05\)
Table 5.7
Results of Logistic Regression Analyses of Parenting Stress Level with Child Obesity and Obesity Risk Behaviours

<table>
<thead>
<tr>
<th>Parenting Stress Level</th>
<th>Child Overweight/Obese (BMI &gt; 85th percentile)</th>
<th>Fast Food Consumption (&lt;1/week vs. ≥1/week)</th>
<th>SSB Consumption (&lt;1/day vs. ≥1/day)</th>
<th>TV Weekday (&lt;2hrs/day vs. ≥2hrs/day)</th>
<th>TV Weekend (&lt;2hrs/day vs. ≥2hrs/day)</th>
<th>Limiting TV Time (agree vs. disagree)</th>
<th>Active Play Weekday (&lt;1hr/day vs. ≥1hr/day)</th>
<th>Active Play Weekend (&lt;1hr/day vs. ≥1hr/day)</th>
<th>Night-Time Sleep Weekday (0-9.9hrs vs. 10-24hrs)</th>
<th>Night-Time Sleep Weekend (0-9.9hrs vs. 10-24hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Adjusted†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td>1.139 (0.408, 3.180)</td>
<td>0.398 (0.107, 1.476)</td>
<td>0.971 (0.365, 2.585)</td>
<td>0.950 (0.369, 2.447)</td>
<td>1.762 (0.633, 4.901)</td>
<td>2.989 (1.044, 8.558)*</td>
<td>3.218 (1.218, 8.503)*</td>
<td>1.842 (0.635, 5.346)</td>
<td>1.208 (0.447, 3.268)</td>
<td>1.652 (0.597, 4.569)</td>
</tr>
<tr>
<td>Adjusted†</td>
<td>1.005 (0.348, 2.906)</td>
<td>0.436 (0.114, 1.681)</td>
<td>0.879 (0.322, 2.397)</td>
<td>0.872 (0.329, 2.307)</td>
<td>1.932 (0.659, 5.662)</td>
<td>3.151 (1.076, 9.230)*</td>
<td>3.033 (1.059, 8.693)*</td>
<td>1.704 (0.573, 5.175)</td>
<td>1.282 (0.463, 3.545)</td>
<td>1.760 (0.690, 4.995)</td>
</tr>
</tbody>
</table>

Values presented are ORs (95% CI)
†adjusted for marital status and parent education attainment
*CI does not contain 1
6.0 Discussion

Research has demonstrated that parents influence their children’s obesity risk through feeding behaviours, modeling of weight-related behaviours and through the provision of a home environment that can either assist or impede healthy lifestyles. Less is known about how the general home environment, including parental stress, may influence children’s weight. The objective of this study was to fill this research gap and explore the association between parenting stress, child BMI and weight-related behaviours that may place preschoolers at risk for increased weight gain. To our knowledge, this was the first study examining the association between parenting stress and child weight with an ethnically diverse population in a community-based setting using measured child heights and weights.

The main finding of this study was that parenting stress was not associated with measured child BMI in this population. Parenting stress was, however, associated with unhealthful child behaviours pertaining to TV viewing and physical activity. Specifically, for parents who were found to be experiencing high levels of stress the odds of not setting limits on the amount of TV time are approximately three times that of normal stress parents. Moreover, the odds of the children of parents who were experiencing high levels of stress participating in less than the recommended 60 minutes of active play per day was approximately three times that of the children of parents experiencing normal levels of stress.
6.1 Comparison of Study Participants to General U.S. Population

While the gender distribution of the preschooler participants in this study is similar to that in the general U.S. population (51% males, 49% females), other participant characteristics are not as reflective of the country’s overall demographics.

For example, this was a sample of low-income participants. According to the 2011 U.S. census, the median family income was $50,502 (Noses, 2012). In comparison to the general U.S. population, a greater proportion of families in this study earned less than $50,000 per year (50% in the U.S. population vs. 57% in this study). Moreover, in 2011, approximately 85% of U.S. citizens over the age of 25 years had at least obtained a high school education, compared to the approximately 60% of participants in this study who had obtained a high school education or higher (U.S. Census Bureau, 2012).

In comparison to the general U.S. population in 2011, fewer children in this study lived in a household with married parents than children in the general population (45% in this study vs. 66% in the general population) (Federal Interagency Forum on Child and Family Statistics, 2011). The majority of families identified themselves as belonging to an ethnic minority group (55.2% Hispanic/Latino, 21.9% Black). The population who participated in this study are not reflective of the overall U.S. population, as very few participants identified themselves as being white (13.3%) and a higher proportion than in the general population identified as Hispanic or Latino (55.2% vs. 16.3%) or Black (21.9% vs. 12.6%) (Hums, Jones & Ramirez, 2011).
6.2 Comparison of Prevalence of Parenting Stress and Overweight/Obesity to Other U.S. Samples

Parents scored an average of 28.38 ± 10.691 on the Parent Distress subscale of the Parenting Stress Index Short Form (PSI-3-SF). This average score is slightly higher than has been reported for this subscale in other studies. For example, in a sample of low-income, ethnically diverse parents of preschoolers the average score was 24.67 ± 9.13, and in a sample of fathers (22.3 ± 7.60), and a sample of parents with children diagnosed with autism (27.3 ± 9.60). (Reitman et al., 2002; McKelvey et al., 2009; Davis & Carter, 2008). While 80% scored in the ‘normal stress’ range and 20% scored in the ‘high stress’ range, it is interesting to note that on average, these parents were experiencing more stress than the parents in these previous studies. The Parent Distress subscale of the PSI-3-SF highlights a parent’s personal adjustment to being a parent; having a child is life changing and because the children in this particular study are relatively young, parents may still be adjusting to their new role (Abidin, 2012).

With 48% of children being classified as overweight or obese (BMI over the 85th percentile on the WHO growth charts), the percentage of preschoolers who were overweight and obese was higher in this study than it is in general U.S. population, which is approximately 21%. However, the majority of participants in this study were from low income households and primarily identified as belonging to racial/ethnic minority groups. Individuals belonging to these groups are known to bear a disproportionate share of the burden of overweight and its co-morbidities in both adults and children (Ogden, Carroll, Curtin, McDowell, Tabaco & Flegal, 2006). In this study, there was a higher rate of overweight and obesity among children from low socio-economic households, defined by
the parent having obtained no more than a high school education, than there was for children from a higher socio-economic status (56.4% vs. 34%). Similar findings were found by Ebenegger et al. (2011) who explored parent education status in relation to child weight and found that children from low education homes had a higher body fat than children from high education homes.

The rates of overweight by race are also higher in this study than what is cited in the general U.S. population. Ogden et al (2010) reported that 26% of non-Hispanic Black children and 27.7% of Hispanic children were overweight or obese, while this study found that 40% and 48% of non-Hispanic Black and Hispanic/Latino children respectively, were overweight or obese. The discrepancies in the rates of overweight/obesity may be due to the age of the data being reported. The data presented by Ogden et al. (2010) were collected in the 2007-2008 cycle of the National Health and Nutrition Examination Survey. The data from the current study were collected about 5 years later, in 2012, which may indicate that our results are more reflective of current obesity rates. These differences may be due to differences in the cut-points used to define overweight/obesity. More specifically, Ogden et al. (2010) reported rates of overweight/obesity measured using the CDC growth charts. This study however, defined overweight and obesity using the more recent WHO growth charts. As previously discussed, the WHO growth charts report slightly higher rates of childhood obesity than when compared to those reported by the CDC charts using the same population; because the WHO growth charts are based on a variety of different populations, they most likely provide a more realistic description of the current childhood obesity epidemic (Shields & Tremblay, 2010). Finally, it is possible, based on recruitment methods that parents self-
selected their families to participate in the PTT study. The PTT program is an obesity prevention intervention but does not recruit families based on child weight, nor does the program advertise itself as such. Recruitment posters and flyers simply state that researchers are looking to recruit the parents of preschoolers hoping to learn more about ‘raising a healthy, happy preschooler’. It is possible, however, that the parents of overweight and obese children may be more likely to sign up for a program that is focused on the health of their children.

6.3 Primary Objective

The association between parenting stress and child weight status is a relatively recent and unexplored area of research. Parenting stress has been thoroughly researched in the realm of parenting styles, parent-child attachment theories and parenting children diagnosed with chronic diseases or behavioural disorders such as attention deficit disorder (ADHD). To date however, only four studies have looked specifically at parenting stress and child weight (Garasky et al., 2009; Gunderson et al., 2008; Koch et al., 2008; Parks et al., 2012).

These studies provide varying conclusions towards the association between parenting stress and child overweight/obesity. Parks et al. (2012) found that the number of parent stressors present (financial strain, mental and physical health and family structure) was associated with increase odds of child overweight and obesity (OR= 1.26, 95% CI (1.18, 1.35)). However, measures of child weight were based on parent-report, which is known to be less accurate than measured heights and weights (Dubois & Girard, 2007). Koch et al. (2008) reported similar findings, in that the children of parents who
reported at least 2 of their 4 domains of stress (serious life events, parenting stress, lack of social support and parent worries) had an increased odds of obesity both cross-sectionally at age 2 (OR= 2.55, 95% CI (1.46, 4.46)) and longitudinally at age 5 (OR= 3.32, 95% CI (1.39, 7.90)). When exploring the relationship between individual stressors however, Koch et al. (2008) only found a significant relationship between the serious life events domain and childhood obesity; the parenting stress domain alone was not significantly associated with child weight. It should be noted, that the majority of this sample was Swedish children, only 4.2% of the children were actually classified as overweight or obese and parents with low education were underrepresented in the study (Koch et al., 2008). Moreover, Gunderson and colleagues (2008) only found a relationship between the maternal stressors they measured (mental stress, financial stress, family structure stress and cumulative stress) and child weight when an interaction between parent stress and food security was examined among a nationally representative sample of low-income families. More specifically, they found that in children 3-10-years-of-age, maternal stressors were only associated with a child’s increased odds of obesity when the household was food secure; the positive effect of stress on child weight was reduced when the household was food insecure (Gunderson et al., 2008).

Interestingly, Garasky et al. (2009) found that stress in the home environment has a varying impact on overweight and obesity based on the child’s age. For example, younger children (aged 5-11 years) are 4.3% more likely to be obese when they live in households that lack cognitive stimulation and emotional support, while older children (aged 12-17 years) are at a greater risk of obesity if they live in homes where mental and
physical health problems exist or in homes with greater financial strain (Garasky et al., 2009).

While the literature suggests that there is a relationship between parenting stress and child BMI (Garasky et al., 2009; Gunderson et al., 2008; Koch et al., 2008; Parks et al., 2012), we did not find a significant association between parenting stress and child overweight, contrary to our hypothesis.

Reasons for this could be due to our small sample size and measurement issues. For example, there was small group membership among highly stressed parents, with only 22 out of 110 parents being categorized as experiencing high stress, while existing studies examining this relationship had much larger sample sizes. With the majority of parents experiencing normal stress levels, there may not have been enough variation to see an association between the parenting stress levels (high vs. normal) and child weight.

In our study, only one subscale of the PSI-SF was used to measure parenting stress; the parent distress subscale. However, in the previous studies, measures of financial stability, mental and physical health, family structure and social support were used to quantify household stress (Garasky et al., 2009; Gunderson et al., 2008; Koch et al., 2008; Parks et al., 2012). Due to the fact that individuals have different triggers for stress and experience and cope with stress very differently, stress is difficult to measure, and thus it is not surprising that each of these studies used different measures to quantify individual stress levels (Webster-Stratton, 1990). Among the varied combination of measures used though, only one study included a validated measure of stress specific to parenting (Koch et al., 2008). While the parent distress subscale used in our study
determines the level of stress as a function of personal factors that are directly related to his or her role as a parent, this scale does not take into account stressors that may be missed in the other two subscales of the PSI-SF. The Parent-Child Dysfunctional Interaction and the Difficult Child subscales focus on the parent-child bond and the basic behavioural characteristics of children, respectively (Abidin, 2012). Only measuring one domain of parenting stress may cause other factors which might compensate for or exacerbate the stress to be missed. A total score of parenting stress across these 3 scales may have provided a more robust indication of the overall level of stress, specific to parenting, that these individuals were experiencing (Abidin, 2012). It is important to note that a total stress score provided by the PSI-SF does not take into account stresses associated with other roles in life and life events that may occur, such as the stress measured in previous studies. Thus, even if the entire PSI-SF had been used to measure parenting stress in this study, the results could never have been interpreted as more than the stress one is experiencing within his or her role as a parent. However, stress can ‘pile-up’ as a result of dealing with many stressors at once and it is possible that stressors unrelated to parenting specifically may still be reflected in the quality of parenting provided to the child (Gunderson et al., 2008). For example, parents who are more stressed tend to exhibit a more authoritarian style of parenting, which is characterised by insensitivity towards the child’s growth and development and associated with a 4-fold increase in obesity risk for the children of such parents (Cappa et al., 2011; Rhee et al., 2006).

The lack of association between parenting stress and child weight may also be a result of the type of families participating in the study. The participants from previous
studies were taken from large data sets that were nationally representative of the U.S. race/ethnicity and income demographic. The participants in this study are from low income and ethnic minority families; those characteristics in themselves are known to be associated with increased stress. Only the study conducted by Gunderson et al. (2008) focused on a similar sample of low income, ethnically diverse participants. The families in this study however, may be higher functioning in the fact that the parents may have more coping mechanisms for their daily stressors as they have self-selected themselves to participate in, and attend a 9-week parenting program. The parents in the previous studies were not recruited for such purposes. Parents from these communities who did not choose to participate may experience parenting stress differently and may have fewer coping mechanisms for their stress; as a result, their home environment may be more dysfunctional. Therefore, there may be significant differences between the level of stress the parents in this study are experiencing and the level of stress parents in the general community may be experiencing.

In summary, similar to our study, none of previous studies found a significant association between parenting stress and child weight status when parent stress was measured using a specific parenting stress index or a parent-perceived measure (Koch et al., 2008; Parks et al., 2012). Koch et al. (2008) and Parks et al. (2012) both found that as a parent experienced more stressors (family, financial etc.) their child has an increased risk of obesity. Gunderson et al. (2008) only found an association between parenting stress and child weight when an interaction was created with food security; otherwise no association existed. Finally, Garasky et al. (2009) only found an association between parental nurturance and child weight; children who lack cognitive and emotional
stimulation were more likely to be overweight. In comparison to the current studies, each of these four studies was conducted using data from nationally representative data sets with much larger sample sizes.

6.3.1 Contribution to the Literature

The findings presented in the previous studies illustrate the multifactorial causes and the impact stress has on the home environment (Garasky et al., 2009; Gunderson et al., 2008; Koch et al., 2008; Parks et al., 2012). They also highlight the need for a clearer understanding of how stress is experienced in the home environment. An understanding of how undue stress affects young family members is of particular importance as children are dependent on their care givers and unlike older children, they lack the resources and developmental capacity to recover from diminished parenting caused by stress.

These four previous studies examine measures of both intra-and-interpersonal factors that may place stress on a parent. However, beyond looking at weight as an outcome, they provide limited insight into how young children are affected by their parents’ stress. Parks et al. (2012) did explore risk factors known to increase obesity risk and reported that the young children of parents who self-reported high stress levels ate more fast food than the children of parents who did not report high levels of stress; however, little is known about how stress may affect a parent’s ability to provide his or her child with a home environment that encourages healthy behaviours. Furthermore, many of the measures of stress these studies reported are based on factors that are not easily changed such as financial measures and health status. Stress related to these factors may not be diminished without lessening the cause of the strain, for example, by
providing financial assistance. Stress specific to parenting however, is mutable, and studies have demonstrated an increase in positive parenting behaviours and improved child outcomes in response to a reduction in parenting stress (Haskett, Ahern, Ward & Allaire, 2006). Thus, an understanding of parenting stress specifically may have a greater impact on child health outcomes such as weight, than less mutable stressors such as financial stress.

The current study is an important addition to this growing body of literature. The data used for this study were collected within the last year and thus results may provide a more realistic description of the childhood obesity epidemic and the mechanisms by which the general home environment can increase a child’s risk.

6.4 Secondary Objectives

Childhood obesity is multifactorial; lifestyle, genetics and environment all play a role in increasing a child’s risk of weight gain. Knowing this, we were interested in how factors in the home environment, not directly related to weight status, may either assist or impede the healthy lifestyles of children. Specifically, we were interested in the association between parenting stress and behaviours that have been shown in the literature to increase a child’s risk of overweight; poor dietary habits, increased TV time, decreased physical activity and a lack of sleep at night. We hypothesized that high levels of parenting stress would be associated with each of these unhealthful behaviours in children.
6.4.1 Dietary Behaviours

Dietary habits were quantified using measures of fast food consumption and the frequency of SSB consumption. While these were the only dietary behaviours measured in the PTT study, we hypothesized that stressed parents would be more likely to rely on the convenience of fast food to feed their children due to a lack of time. We also hypothesized that they may not have the time or focus to monitor their child’s dietary intake, in this case, specific to SSB consumption. Contrary to our hypotheses, high parent stress levels were not associated with either of these dietary habits. This is contrary to existing literature, which suggests that higher levels of life stress are associated with higher levels of unhealthy dietary practices and often lead to overeating among adults (Greeno & Wing, 1994; Cartwright et al., 2003). However, stress-related eating may be different among young children as they do not have control over the food they are consuming. Parks and colleagues (2012) found an association between parent stress and child fast food consumption, with the odds of the child consuming fast food two or more times a week increasing by 7% for each unit increase in parent-perceived stress. Parks et al. (2012) also reported that Black and Hispanic children were more likely to consume more fast food. While this study also found that more Hispanic/Latino children consumed more fast food, few parents (n=28) in our study reported that their children ate fast food more than once a week, so further exploration was not possible. The data used by Parks et al. (2012) were collected from a household health survey, where participants were anonymous to the researchers. It is possible that in this study, parents answered questions based on social desirability and thus were less likely than participants in the Parks et al (2012) study to report fast food consumption. In
the current study, increased fast food consumption was associated with marital status, with children from single parent homes consuming less fast food, which could indicate that convenience is not the only precursor to the consumption of such foods; single parent homes may have less expendable income to put towards the purchasing of fast food, regardless of stress levels in the home.

To our knowledge, this is the first study to explore the association between parenting stress and children’s intake of SSB. One important limitation of our research study is that our data on children’s dietary intake was limited; we did not have any data on children’s overall dietary intake. Just because no association was found between parenting stress and children’s intake of fast food or SSB, we cannot conclude that parenting stress has no impact on children’s dietary intake. Future research should explore how parenting stress may impact other aspects of children’s dietary intake.

6.4.2 TV Viewing Habits

The early years of a child’s life represent a critical period for the establishment of active lifestyle habits; however, research indicates that children less than 5 years of age spend the majority of their time participating in sedentary activities (Hinkley, Salmon, Okely, Crawford & Hesketh, 2012; Oliver, Schofield & Kolt, 2007; Tucker, 2008). The findings from the current research confirm that young children are spending much of their time watching TV. On average, parents reported that their children were watching about 3.5 hours of TV per day. No differences were found between weekday and weekend viewing which is contrary to findings by Haines et al. (In press at JAMA Pediatrics) which reported that children watched more TV on weekdays than on
weekends. Parenting stress levels were not associated with the amount of TV children were watching. Previous studies have found that maternal depression is associated with increased viewing times among young children (Conners, Tripathi, Clubb & Bradely, 2007; Burdette, Whitaker, Kahn & Harvey-Berino, 2003). This is the first study to look specifically at parenting stress and child TV viewing. Parents experiencing high levels of stress were however, less likely than parents experiencing normal stress levels, to limit the amount of TV their children watched. Intervention research will benefit from the knowledge that stress levels may cause parents to be less vigilant towards limiting the amount of TV their children watch. For parents to successfully monitor the amount of TV their children watch, it may be important to pay attention to the well-being of the parent and the role that the TV plays in their own lives as well as the culture of the home environment. While the children of parents who did not limit their child’s TV viewing did not spend any more time watching TV, a lack of limits may prove to be a problem as the child grows and develops more independence. Adolescents, who were not limited in their TV viewing as young children, may watch more TV than those who had specific limits placed on viewing time (Carlson et al., 2010).

While it is important to target TV viewing specifically, it is also important to target the underlying factors associated with child screen time. The TV often plays an important role in the household, providing parents with alone time and by keeping children occupied while parents complete chores. Thus, it may be beneficial for intervention messages to focus on providing parents with strategies to limit the amount of TV their child watches rather than simply promoting less screen time. Furthermore, the promotion of alternative activities to keep children quiet and occupied while parents
complete work will be beneficial for children. Alternative activities will need to be age appropriate and child specific. Interventions provide an excellent opportunity for parents to brainstorm and share successes with different quiet activities such as colouring, and playing with toys. Such alternative activities may not decrease the child’s sedentary behaviours, but they will provide the child with more cognitive and psychosocial stimulation than the TV does. Promoting limits on the TV and providing parents with examples of alternative activities to keep their children occupied may have a greater impact on decreasing the amount of TV children watch. This may also be more realistic than cutting the TV out completely for households where the TV may provide stressed parents with needed breaks.

6.4.3 Physical Activity

Participation in active play during the preschooler age group is associated with decreased adiposity, and improved measures of motor skill development, psychosocial health and cardio metabolic health (Colley et al., 2013; Timmons et al., 2012). The majority of children in this study met the NASPE guidelines of participating in 60 minutes of moderate to vigorous activity per day, with approximately 67% meeting the guidelines on weekdays and 73% on weekend days. Due to the variation in the measurements used to calculate preschooler activity, coupled by the use of different accelerometer cut-points, it is difficult to compare compliance to these recommendations across studies (Beets, Bornstein, Dowda & Pate, 2011). For example, previous empirical studies report that 7-96% of preschool aged children are meeting the NASPE physical activity guidelines (Beets et al., 2011; Okely, Trost, Steele, Cliff & Mickle, 2009; Cardon & De Bourdeaudhuij, 2008; Vale, Silva, Santos, Soares-Miranda,& Mota, 2010).
Parenting stress was found to be associated with decreased participation in active play, whereby the children of stressed parents were three times less likely to meet the NASPE physical activity guidelines than the children of parents experiencing normal stress levels. This association existed between parenting stress and weekday active play but not weekend active play suggesting that there are differences in the home environment between the weekday and weekend. There has not been any previous research examining parenting stress in relation to children’s physical activity behaviours. Parents may feel less stressed and have more free time during the weekends in which to encourage and participate in physical activity. Parents who work long hours during the week may also have more energy on weekends in which to model active behaviours.

Children who did not meet the recommendations of spending at least 60 minutes participating in moderate to vigorous active play per day were approximately 2.5 times more likely to be overweight or obese than children who did meet the recommendations. This finding is consistent with previous literature stating that regular participation in physical activity reduces BMI, with longitudinal data suggesting that children who are active early in life have a reduced risk for large adiposity gains in elementary school through adolescence (Atkin & Davies, 2000; Moore et al., 2003). Thus, it is necessary to target child inactivity, while viewing parenting stress as an underlying factor associated with decreased participation.

Intervention research can use this knowledge to target messages surrounding physical activity for weekdays and weekend days separately, depending on the specific struggles parents experience during these times. Moreover, targeting physical activity for children may have a greater impact on both active play and sedentary behaviours.
Increased participation in physical activity has been shown to reduce feeling of stress, anxiety and depression. Thus promoting physical activity to parents as a method of managing their stress levels, will not only have a positive influence on child health outcomes by reducing parenting stress but will also create a home environment in which active lifestyles are modelled. Furthermore, it is likely that the children themselves will be more active, as physical activity is a great way for parents to spend time with their children.

6.4.4 Sleep Habits

Parenting stress was not associated with children’s nightly sleep duration. Regardless of parenting stress level, many children in this study did not meet the National Sleep Foundation’s recommendations for preschoolers to receive 10-13 hours of sleep per night. On average, children were receiving 9.45 hours of sleep per night. While there have been a few studies examining the association between sleep disturbances and parenting stress, there have been no studies examining how stress in the home environment may affect the child’s sleep or even the parent’s ability to get the child to bed with a regular routine. We had hypothesized that the home environments where parents were experiencing increased stress would be more chaotic, leaving children with irregular bedtimes. While the results did not confirm this hypothesis, sleep is an important behaviour to target in both parenting groups and obesity prevention interventions as poor sleep is associated with increased obesity risk and may exacerbate parent stress levels (Locard et al., 1992; von Kries, Toschke, Wurmser, Sauerwald & Koletzko, 2002; Sekine et al., 2002; Reilly et al., 2005). Clinicians have anecdotally reported that parents with children who experience sleep disturbances appear more tired
and stressed (Owens, 2005). Decreased sleep has been associated with excess weight gain in both adults and children. Sekine et al. (2002) reported a dose response for sleep by which children who received between 9-10 hours of sleep were 1.49 times more likely to be overweight or obese. These findings place the majority of the children in this study at increased risk of excess weight. Research has shown that children with regular sleep routines go to sleep sooner and wake up less frequently throughout the night than children without regular routines (Seymour, Brock, During & Poole, 1989). Promoting regular sleep routines in the PTT program has been shown to assist participants engage in regular bedtime routines with their children, which may result in longer night time sleep for children. The participation in regular family routines has been shown to be protective of child weight (Anderson & Whitaker, 2010). Furthermore, through an intervention educating parents on the importance of routines, Haines et al. (In Press at *JAMA Pediatrics*) reported a 0.56 hour increase in nightly child sleep duration; subsequently, at 6 month follow-up child BMI had been reduced by 0.18kg/m\(^2\). The lack of association between child weight and nighttime sleep habits in the current study could have been because very few children in this study actually received adequate nighttime sleep. Thus promoting routines and increased child sleep among parents still has the potential to reduce parent stress levels and have a positive effect on child BMI.

### 6.4.5 Summary of Secondary Outcomes

We had hypothesized that parenting stress would be associated with obesity risk factors in children. Specifically, we had hypothesized that the children of parents experiencing high stress levels would have poorer diets, watch more TV, participate in less physical activity and sleep fewer hours at night in comparison to children with
parents who were experiencing normal levels of stress. Our results found that parenting stress was associated with less parent limits of TV time. Although this lack of limits was not associated with increased TV time, setting limits surrounding TV time is important for reducing time spent in sedentary activities. The majority of children in this study spent more than 3 hours watching TV. We also found that the children of highly stressed parents are less likely to meet the physical activity guidelines of 60 minutes spent in active play per day than their peers with normally stressed parents. Parenting stress was not associated with dietary habits; however, we did not have measures of overall dietary intake, only rough estimates of fast food consumption and SSB intake. Very few children in this study ate fast food more than once a week but that is no indication that the food they eat at home is of any different. Parenting stress was not associated with child sleep habits. However, very few children in this study slept more than 10 hours per night which highlights the importance of promoting regular bedtime routines in intervention programs as a way to get children to sleep and help them sleep longer.

6.5 Limitations

While there are many strengths to the current study, this research is not without its limitations. First, as is common with secondary data analysis, when results are originally collected for an alternative purpose, assessment of the variables of interest was not optimal. For example, parenting stress was measured using only one subscale of the PSI-SF, the parent distress subscale. While this subscale measures a parent’s adjustment to his or her role as a parent, it does not take into account stressors that may be missed in the other two subscales which measure characteristics related to the parent-child bond and child behaviour (Abidin, 2012). Using more than one approach to measure parenting
stress would have provided a more thorough understanding of the pathways by which stress in the home environment may influence obesity risk for young family members. When only measuring one domain of stress, other factors that might compensate for or exacerbate stress may be missed. Thus, parents who may have been classified as experiencing high stress when using the PSI-SF in its entirety could have been misclassified as experiencing normal stress in this study.

Secondly, the variables used to measure children’s dietary habits were relatively poor. While fast food and SSB consumption have been linked to overweight and obesity in preschoolers, these measures do not provide an overall understanding of the quality or quantity of food children are eating. More specifically, the fast food question categorizes children as consuming fast food either less than once a week or more than once a week. This does not provide any information of what children are eating on a daily basis. Preschoolers’ nutrient needs are high relative to their energy requirements and, as such, there is little room for energy dense, high fat and high sugar foods, such as snack foods. Further research should examine how parenting stress may be associated with the intake of these low-nutrient, high caloric foods.

A third limitation of this study was the amount of data missing from some variables, namely total household income. While the majority who did respond indicated that they lived in low-income homes, we were not able to control for income in any of the analyses due to a large amount of missing data on income. Thus, education was used as a proxy for socio-economic status, as education obtainment has been shown to be indicative of specific of income brackets (Cheeseman Day & Newburger, 2002).
Social desirability is the fourth limitation of this study as it could account for some of the results presented, specifically the amount of active play parents reported their children participating in and the amount of fast food children consumed. Social desirability occurs when individuals provide an answer based on what they think is the more desirable attribute, rather than the answer that is actually true of them (Remler & Van Ryzin, 2011). These data were collected at baseline and thus the messages provided to parents in the PTT program would not prime participants to answer questions a certain way. However, the recruitment message of ‘raising a healthy, happy preschooler’ could have primed parents to answer questions in a way that made their children seem healthier. For example, the answers parents provided for the amount of time their children spent in active play suggest a ceiling effect, where parents were more likely to choose the highest option of 2 or more hours/day. Active play may be difficult for parents to recognize and measure properly and may be confused with their child’s natural energy. This highlights the need for more consistent measures and cut-points to determine adherence to these guidelines. Furthermore, the use of objective physical activity measures in this study would have provided a stronger understanding of the activity children were actually receiving. A subjective measure of child physical activity was based on parent-self report of the amount of time children spend participating in active play per day. It is quite possible that parents may interpret the definition of active play differently or over-report the amount of activity their children participate in. Moreover, very few parents reported that their children ate at a fast food restaurant more than once a week, indicating that parents may have viewed such an eating behaviour to be a socially unacceptable answer.
The fifth limitation of this study is the self-selection process by which participants were recruited for the original PTT study. Recruitment posters were displayed in community centres that primarily serve low-income families in the Boston area; potential participants then called the researchers to take part in the study. There may be systematic differences between those who choose to sign up for a parenting program and those that do not choose to sign up. The recruitment posters advertised a parenting program that provides parents with the tools to raise happy and healthy preschoolers. Parents who are interested in participating in such a program may have a heightened interest in, or concern about their child’s health. When thinking about the main outcome of this current study, and what a highly stressed home environment may look like, the coping mechanisms, self-efficacy and social support that participating parents have, may be more stable than for parents who chose not to participate. Simply, the parents who completed baseline measures for the PTT study felt that they would be able to attend a 9 week parenting program with their child; highly stressed parents may not have felt the same.

Finally, in comparison to the general U.S. population, the participants in this study have obtained lower education levels and earn smaller total household incomes. A higher proportion of participants identified as belonging to a racial/ethnic minority group than is reported in the general population. Moreover, fewer children in this study lived in married couple homes than is reported in the U.S. Based on these demographic differences, the results of this study cannot be generalizable to the U.S. population. However, the results are probably reflective of low income, ethnic minority families. While the inability to generalize the findings may be a limitation, the PTT researchers
purposely recruited this type of family as they bear a disproportionate proportion of health related issues and would benefit most from the PTT program. Thus, generalizability was not a focus of this study.

6.6 Strengths

Despite the aforementioned limitations, there are many strengths to the current study. First, the data used for this study were collected from low-income families, with the majority identifying themselves as belonging to an ethnic/racial minority group. Individuals from these populations are known to bear a disproportionate burden of obesity and often face more life stressors due to their financial situations. The advantage of exploring the relationship between parenting stress and child weight in a population such as this is that it provides researchers of an understanding of how to target groups that have the greatest need for assistance.

Second, this study provided further insight into the behaviours mechanisms that might associate parenting stress with child weight gain. For example, it was found that higher levels of parenting stress is associated with children spending less time participating in active play during the weekdays, but not weekend days. This finding indicates that encouraging increased physical activity may not be realistic without looking at the possible barriers or underlying reasons children are not as active. For example, a stressed parent may not have the energy to role-model active living for his/her child or may encourage the child to engage in sedentary activities as a method of moderating the child’s energy levels; without targeting parenting stress levels, it may not be realistic to see behaviour changes towards increased child physical activity. Moreover,
this result also provides researchers with the knowledge that stress levels may be
different during the weekdays and on weekends. This understanding is important for
informing future interventions, as it may be beneficial to tailor intervention messages
separately for weekdays or weekend days.

The third strength of this study involves the anthropometric measurements of the
preschoolers. Extensive research has demonstrated systematic inaccuracies in adult self-
reported heights and weights. Those who are overweight tend to under-report their weight
more than those who are normal weight, and those who are short tend to over-report their
height more than those who are taller (Dubois & Girard, 2007). Children’s weights and
heights are less stable than adult heights and weights, especially during the preschool age
when periods of growth are rapid, which may make it more difficult for parents to
accurately report their measurements (Dubois & Girard, 2007). Dubois & Girard (2007)
found that mothers overestimate their children’s weights more than their heights and
found this weight overestimation to be more common for sons than daughters. This
inaccuracy is of grave concern when a difference as small as 0.5 kg can affect BMI
categorization in young children (Dubois & Girard, 2007). In this study however, child
heights and weights were measured by trained research assistants. While some children
were not comfortable being measured and may not have stood still on the scale properly,
resulting in possible inaccuracies caused by an unequal distribution of weight across the
scale, measured child weights and heights provide the most accurate anthropometric
measurements (Gibson, 2005).

The fourth strength of this study is that child BMI z-scores were calculated using
the WHO growth charts. These growth charts may be more reflective of current obesity
rates as they were created using children from longitudinal data from six diverse international reference countries and describe how children should grow when living in optimal conditions (Shields & Tremblay, 2010). The majority of U.S. studies looking at childhood obesity have used the CDC growth chart to report rates of childhood overweight and obesity. These charts, however, were based only on U.S. reference data from five nationally representative data sets (Shields & Tremblay, 2010). The WHO growth charts report slightly higher rates of childhood obesity than when compared to those reported by the CDC charts using the same population (Shields & Tremblay, 2010). Because the WHO growth charts are based on a variety of different populations, they most likely provide a more realistic description of the current childhood obesity epidemic. This is one of the first studies conducted in the U.S. to use the WHO growth charts to measure child weight status. Thus, the increased rates of childhood obesity reported in this study may be more reflective of the current childhood obesity epidemic in the U.S.

Finally, the fifth strength of this study was that a validated questionnaire was used to measure parenting stress. While previous studies measured general stress, only one study measured stress specific to parenting (Koch et al, 2008). Moreover, one study simply asked parents to report their usual stress on a 10 point Likert scale (Parks et al., 2012). Measurement issues arise with questions such as these due to the variability in the way individuals experience stress. By measuring parenting stress directly, the researchers are provided with an understanding of how parent distress may inhibit a parent’s ability to provide a home environment that encourages a healthy active lifestyle. Furthermore, parenting stress has already been shown to be a mutable factor, and thus specific
measures of parenting stress will allow researchers’ to tailor future parenting interventions to address this. Finally, a reduction in parenting stress is easier to target than other life stressors that may be out of the individual’s control. Stress has been shown to ‘pile-up’ as a result of multiple stressors and providing coping mechanisms for parents dealing with stress specific to parenting may help lessen the burden of other stressors. Moreover, an understanding and reduction of parenting stress may have a greater impact on child health outcomes.

6.7 Next Steps

While the research in this thesis fills gaps in the existing literature that explored the association between parenting stress and child weight, it also serves as a basis upon which future research can expand. Only one study has looked at the association between parenting stress and child weight over time (Koch et al., 2008). Thus, the next step in this current study would be to use the longitudinal data from the PTT intervention study to examine if change in parenting stress is associated with change in child weight or change in parental weight-related behaviours. Future research should be conducted with families in the community not participating in a parenting program focused on healthy behaviours; stress levels may be much different in those who are uninterested or unable to attend a 9-week program. Future research should also utilize biological, objective measures to quantify stress levels, such as saliva swabs or hair samples, rather than self-report measures. Measures of child stress levels should also be taken as they will assist researchers in determining whether or not the child has experienced enough undue stress in the home environment to actually experience HPA-axis activation, increased cortisol levels and the resultant metabolic disturbances described in Section 2.3.
6.7.1 Implications for Practice

The results from this study provide focus for future obesity prevention interventions and parenting programs alike. In addition to focusing on limiting TV time and promoting active play, interventions also need to target the underlying factors associated with these activities, such as parenting stress levels. For example, it may not be realistic to tell parents that their children need to be watching less TV as the TV often plays an important role in the home environment, keeping children occupied when parents are tired or have work to complete. This may be especially true considering the children in this study were watching, on average, 3.5 hours of TV per day, which is already 1.5 hours more than the recommendation of less than 2 hours per day. Furthermore, stressed parents may be less likely to model active lifestyles, preferring their children to participate in sedentary activities to moderate the child’s natural energy. Thus, targeting the underlying barriers to healthy, active lifestyles may have a greater and more immediate impact on child health outcomes than targeting the behaviours themselves. Finally, the results of this study also indicate that there are differences in the home environment between weekdays and the weekend. It may be difficult for families to engage in certain behaviours during the week, such as active play. This knowledge can help researchers target intervention messages to specifically assist parents and provide them with the tools to promote healthy behaviours in their children during the times they struggle to do so.
7.0 Conclusions

In summary, this thesis explored the association between parenting stress and child BMI. This was a cross-sectional study that was completed using secondary data collected from 111 families participating in the family-based obesity prevention intervention, Parents and Tots Together. Parenting stress was not found to be associated with child weight status in this population of low-income ethnic minority participants. Parenting stress was, however, shown to be associated with behaviours that may increase a child’s risk of obesity: a lack of parental limits towards TV time and decreased participation in active play. While it is important to target television and activity behaviours among young children, our results suggest that interventions may also need to address parental stress as a possible underlying factor associated with unhealthful behaviours among young children. This study provides insight into how parenting stress affects the actual care parents are able to provide for their children. More specifically, this study examined risk factors known to increase obesity risk in children, in an effort to highlight the behavioural mechanisms by which parenting stress may lead to increased child weight. The results of this study will not only help inform future obesity prevention interventions, but they will also provide a groundwork upon which future research exploring parenting stress and child weight can build.
8.0 References


Bauer, K. W., Yang, Y. W., & Austin, S. B. (2004). “How can we stay healthy when you’re throwing all of this in front of us?” Findings from focus groups and interviews in middle schools on environmental influences on nutrition and physical activity. *Health Education & Behavior, 31*, 34–46.


Jago, R., Baranowski, T., Baranowski, JC., Thompson, D. & Greaves, KA. (2005). BMI from 3-6 y of age is predicted by TV viewing and physical activity, not diet. *Int. J of Obesity*; 29, 557-564 doi:10.1038/sj.iyo.0802969


Weight-teasing among adolescents: correlations with weight status and disordered eating behaviors. *Int J Obes Relat Metab Disord;* 26:123–131


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Food Selection changes under Stress. Physiology and Behaviour, 87, 789-793.
9.0 Appendices

Appendix A: University of Guelph Research Ethics Approval

RESEARCH ETHICS BOARD

Certification of Ethical Acceptability of Research Involving Human Participants

<table>
<thead>
<tr>
<th>APPROVAL PERIOD:</th>
<th>April 19, 2011 to April 19, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>REB NUMBER:</td>
<td>11AP021</td>
</tr>
<tr>
<td>TYPE OF REVIEW:</td>
<td>Delegated Type 2</td>
</tr>
<tr>
<td>RESPONSIBLE FACULTY:</td>
<td>JESSICA HAINES</td>
</tr>
<tr>
<td>DEPARTMENT:</td>
<td>Family Relations &amp; Applied Nutrition</td>
</tr>
<tr>
<td>SPONSOR:</td>
<td>AMERICAN HEART ASSOCIATION</td>
</tr>
<tr>
<td>TITLE OF PROJECT:</td>
<td>Pilot Study of a Family-Based Intervention to Promote Healthy Eating Behaviors among Preschool Children</td>
</tr>
<tr>
<td>CHANGES:</td>
<td>13 Mar 12: A.2 Students</td>
</tr>
</tbody>
</table>

The members of the University of Guelph Research Ethics Board have examined the protocol which describes the participation of the human subjects in the above-named research project and considers the procedures, as described by the applicant, to conform to the University’s ethical standards and the Tri-Council Policy Statement.

The REB requires that you adhere to the protocol as last reviewed and approved by the REB. The REB must approve any modifications before they can be implemented. If you wish to modify your research project, please complete the Change Request Form. If there is a change in your source of funding, or a previously unfunded project receives funding, you must report this as a change to the protocol.

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Responsible Faculty, the safety of the participants, and the continuation of the protocol.
If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

The Tri-council Policy Statement requires that ongoing research be monitored by, at a minimum, a final report and, if the approval period is longer than one year, annual reports. Continued approval is contingent on timely submission of reports.

Membership of the Research Ethics Board: B. Beresford, Ext.; F. Caldwell, Physician; C. Carstairs, COA; S. Chuang, FRAN (alt); K. Cooley, Alt. Health Care; J. Clark, PoliSci (alt); J. Devlin, OAC; J. Dwyer, FRAN; M. Dwyer, Legal; D. Dyck, CBS; D. Emslie, Physician (alt); B. Ferguson, CME (alt); H. Gilmour, Legal (alt); J. Goertz, CME; B. Gottlieb, Psychology; S. Henson, OAC (alt); G. Holloway, CBS (alt); L. Kuczynski, Chair; J. Minogue, EHS; I. Newby-Clark, Psychology (alt); L. Niel, OVC (alt); A. Papadopoulos, OVC; B. Power, Ext.; L. Robinson, CBS; V. Shalla, SOAN (alt); J. Srbely, CBS (alt); T. Turner, SOAN; K. Wendling, Ethics.

Approved: __________________________
Date: __________________________
per
Chair, Research Ethics Board
### Appendix B: Parenting Stress Index- Short Form, Parent Distress Subscale

For each of the next statements, please tell us if you **strongly agree, agree, neither disagree or agree, disagree, or strongly disagree**.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Disagree or Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I often have the feeling that I cannot handle things very well.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>B</td>
<td>I find myself giving up more of my life to meet my children’s needs than I ever expected.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>C</td>
<td>I feel trapped by my responsibilities as a parent.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>D</td>
<td>Since having this child, I have been unable to do new and different things.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>E</td>
<td>Since having a child, I feel that I am almost never able to do things that I like to do.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>F</td>
<td>I am unhappy with the last purchase of clothing I made for myself.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>G</td>
<td>There are quite a few things that bother me about my life.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>H</td>
<td>Having a child has caused more problems than I expected in my relationship with my spouse (or male/female friend).</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>I</td>
<td>I feel alone and without friends.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>J</td>
<td>When I go to a party, I usually expect not to enjoy myself.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>K</td>
<td>I am not as interested in people as I used to be.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
<tr>
<td>L</td>
<td>I don’t enjoy things as I used to.</td>
<td><img src="image" alt="1" /></td>
<td><img src="image" alt="2" /></td>
<td><img src="image" alt="3" /></td>
<td><img src="image" alt="4" /></td>
<td><img src="image" alt="5" /></td>
</tr>
</tbody>
</table>
Assessment of Child’s Dietary Behaviours

In the past month, on average, how often did your child eat something from a fast food restaurant like a pizza place, McDonald’s, Burger King, Taco Bell, or Dunkin Donuts? Please include breakfast, lunch, and dinner.

- 1 Never/less than once per month
- 2 1 – 3 times per month
- 3 Once per week
- 4 2 – 4 times per week
- 5 5 – 6 times per week
- 6 Once per day or more

In an average week, how often did your child drink each of the following beverages?

<table>
<thead>
<tr>
<th></th>
<th>Never per week</th>
<th>Once per week</th>
<th>2–4 times per week</th>
<th>Once per day</th>
<th>2–4 times per day</th>
<th>5 or more times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Flavored milk such as chocolate milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>100% juice (no sugar added)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td>Fruit Drinks (Hi-C, Kool-Aid, lemonade, sports drinks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td>Soda (not sugar-free)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.</td>
<td>Sugar-free soda</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assessment of Child TV Viewing and Physical Activity Habits

The next questions are about your child’s TV watching and physical activity behaviors. Please answer them as best as you can. Include both the time your child is with you and the time your child spends away from you (for example, at school or after-school child care).

On an average weekday, how much time per day does your child spend watching TV (including DVDs or videos)?

<table>
<thead>
<tr>
<th>Weekdays (Mon – Fri)</th>
<th>Weekend days (Sat, Sun)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1  None</td>
<td>☐ 1  None</td>
</tr>
<tr>
<td>☐ 2  Less than one hour per day</td>
<td>☐ 2  Less than one hour per day</td>
</tr>
<tr>
<td>☐ 3  At least 1, but less than 2 hours per day</td>
<td>☐ 3  At least 1, but less than 2 hours per day</td>
</tr>
<tr>
<td>☐ 4  2 – 3 hours per day</td>
<td>☐ 4  2 – 3 hours per day</td>
</tr>
<tr>
<td>☐ 5  4 – 6 hours per day</td>
<td>☐ 5  4 – 6 hours per day</td>
</tr>
<tr>
<td>☐ 6  7 or more hours per day</td>
<td>☐ 6  7 or more hours per day</td>
</tr>
</tbody>
</table>

Please indicate how much you agree or disagree with the following statement:

<table>
<thead>
<tr>
<th>M</th>
<th>I limit the amount of time my child watches TV or videos</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
</tr>
</tbody>
</table>
On an average weekday, how much time per day is your child involved in active play (such as running, jumping, climbing)?

<table>
<thead>
<tr>
<th>Weekdays (Mon – Fri)</th>
<th>Weekend days (Sat, Sun)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1 0 min</td>
<td>☐ 1 0 min</td>
</tr>
<tr>
<td>☐ 2 1 to 15 minutes a day</td>
<td>☐ 2 1 to 15 minutes a day</td>
</tr>
<tr>
<td>☐ 3 16 to 30 minutes a day</td>
<td>☐ 3 16 to 30 minutes a day</td>
</tr>
<tr>
<td>☐ 4 31 minutes to &lt;1 hour a day</td>
<td>☐ 4 31 minutes to &lt;1 hour a day</td>
</tr>
<tr>
<td>☐ 5 1 hour to &lt; 2 hours a day</td>
<td>☐ 5 1 hour to &lt; 2 hours a day</td>
</tr>
<tr>
<td>☐ 6 2 hours or more a day</td>
<td>☐ 6 2 hours or more a day</td>
</tr>
</tbody>
</table>

Assessment of Child Sleep Habits

On an average weekday, how many hours does your child sleep in a usual 24-hour period?

____ ____ HOURS AND ____ ____ MINUTES PER DAY PER WEEKDAY

On an average weekend day, how many hours does your child sleep in a usual 24-hour period?

____ ____ HOURS AND ____ ____ MINUTES PER DAY PER WEEKEND DAY
**Participant Demographics**

Below are some questions about you and your family.

**How you are related to your child?**

- 1. Mother
- 2. Stepmother
- 3. Foster Mother
- 4. Biological Father’s Partner
- 5. Father
- 6. Stepmother
- 7. Foster Father
- 8. Biological Mother’s Partner
- 9. Grandmother
- 10. Grandfather

Other (*Please specify*): __________________________

**Which of the following best describes your current marital status? Would you say…**

- 1. Married
- 2. Not married, but living with partner
- 3. Single, never married
- 4. Divorced
- 5. Separated
- 6. Widowed
What is the highest grade or degree you completed in school?

- [ ] 1 8th grade or less (0-8)
- [ ] 2 Some High School (9-11)
- [ ] 3 High School Graduate (12)
- [ ] 4 Some College or Technical School (13-15)
- [ ] 5 College Graduate (16)
- [ ] 6 Postgraduate Training or Degree (17+)
- [ ] 98 Don’t Know
- [ ] 99 Refused

What is your total household income?

- [ ] 1 Less than $10,000
- [ ] 2 $10,000 to $19,999
- [ ] 3 $20,000 to $29,999
- [ ] 4 $30,000 to $39,999
- [ ] 5 $40,000 to $49,999
- [ ] 6 $50,000 to $59,999
- [ ] 7 $60,000 to $69,999
- [ ] 8 $70,000 to $79,999
- [ ] 9 $80,000 to $89,999
- [ ] 10 $90,000 to $99,999
- [ ] 11 $100,000 to $149,999
- [ ] 12 $150,000 or more
- [ ] 98 Don’t Know
- [ ] 99 Refused
Do you think of yourself as Latino or Hispanic or Mexican American or of Spanish origin? (Please check one).

☐ 1 Yes ☐ 2 No

How would you describe your ethnicity/race? (Please check all that apply).

☐ 1 White
☐ 2 Black/African American
☐ 3 Asian
☐ 4 Native Hawaiian or other Pacific Islander
☐ 5 American Indian or Alaska Native
☐ 6 Other, please specify: ______________________