



# The Correlation Between Family Socioeconomic Status and the Prevalence of Childhood Obesity

Soumia Benmeddour, Jennifer Go, Johanna Ponnuthurai

University of Ottawa, Ottawa, ON, Canada

## Abstract

**Background:** The prevalence of childhood obesity has been on the rise in North America. Recent studies have shown that there may be a correlation between SES and childhood obesity. **Purpose/objectives:** To conduct a structured literature review and determine whether there is a correlation between SES and obesity prevalence in children under eighteen years old living in North America. **Methods:** Seven databases were searched through Ovid for studies that examined the relationship between childhood obesity and SES. The keywords used in the search strategy were childhood, obesity, and socioeconomic. This search generated twenty publications. The inclusion criteria consisted of studies conducted in North America and a population of children below the age of eighteen. From each of the articles, information about age criteria, data collection methods, and definitions for SES and obesity were extracted. **Results:** Six of the twenty research articles were found to meet inclusion criteria. Results show that children with low SES had a higher prevalence for obesity. Elementary school children were more affected by low SES than older children in the same situation. **Conclusions:** Further investigation regarding the factors affecting SES should be undertaken to determine what can be done to reduce the prevalence of childhood obesity. Through this research, new policies can be put in place to reduce the burden of low SES on children and their families, thereby reducing the prevalence of childhood obesity.

## Introduction

Over the past few decades, North America has been experiencing an obesity epidemic. In Canada alone measured rates of obesity has increased. In the late 1970s, about 15% of the population was obese. This number has increased to 25% in 2005.<sup>3</sup> It is speculated that if obesity rates continue to increase at this speed, 70% of adults will become overweight or obese in 2040.<sup>4</sup> While this is a concerning issue among the adult population, this obesity epidemic has also been evident in the younger populations. In particular, the prevalence of childhood obesity was 12% in 2010.<sup>15</sup>

The prevalence of obesity in Canada differs based on sex and age groups. In particular, the rates of obesity appear to be greater among younger children. According to Statistics Canada (2012)<sup>16</sup>, the rate of obesity is 13.1% among children aged 5 to 11, and 10.2% among children aged 12 to 17. Another trend indicated that obesity rates were greater among boys than girls. The rate of obesity ranged from 19.5% among boys aged 5 to 11, and 10.7% among boys aged 12 to 17. In contrast, the obesity rate ranged from 6.3% among girls aged 5 to 11, and 9.6% among girls aged 12 to 17.<sup>16</sup>

Often, Body mass index (BMI) is used as a measurement for obesity; this is measured in kilograms divided by the squared height of the individual in metres.<sup>1</sup> Since children are still developing, it is difficult to have one definition or measurement for obesity. For instance, girls who are five years of age are considered obese if they have a body mass index of 19 or above, whereas girls who are 16 years of age are considered obese if they have a BMI of 29 or above.<sup>20</sup> In contrast, boys who are five years of age are considered obese if they have a BMI greater than 18, whereas boys who are 16 years of age are considered obese if they have a BMI greater than 28.<sup>19</sup> In children, BMI can be affected by developing bones structure and density, organ development, and growth.<sup>5</sup>

Research has been revolving around two central aspects related to childhood obesity: causes and interventions. There are several risk factors associated with obesity including lifestyle, genetics, and health status. However, there may be underlying factors such as socioeconomic status (SES) that play a large role in the obesity epidemic. Current research continues to show a link between SES and adverse health problems. It is one of the most significant determinants of health.<sup>11</sup> Although there are several ways of calculating SES, one of the common ways is to calculate annual income of a family and then divide it by the number of family members. The family is considered as being in the low-income population if the annual income is not enough to provide adequate necessities such as shelter, food, and water.<sup>2</sup> Overall, current literature suggests that household SES may be associated to the prevalence of childhood obesity.

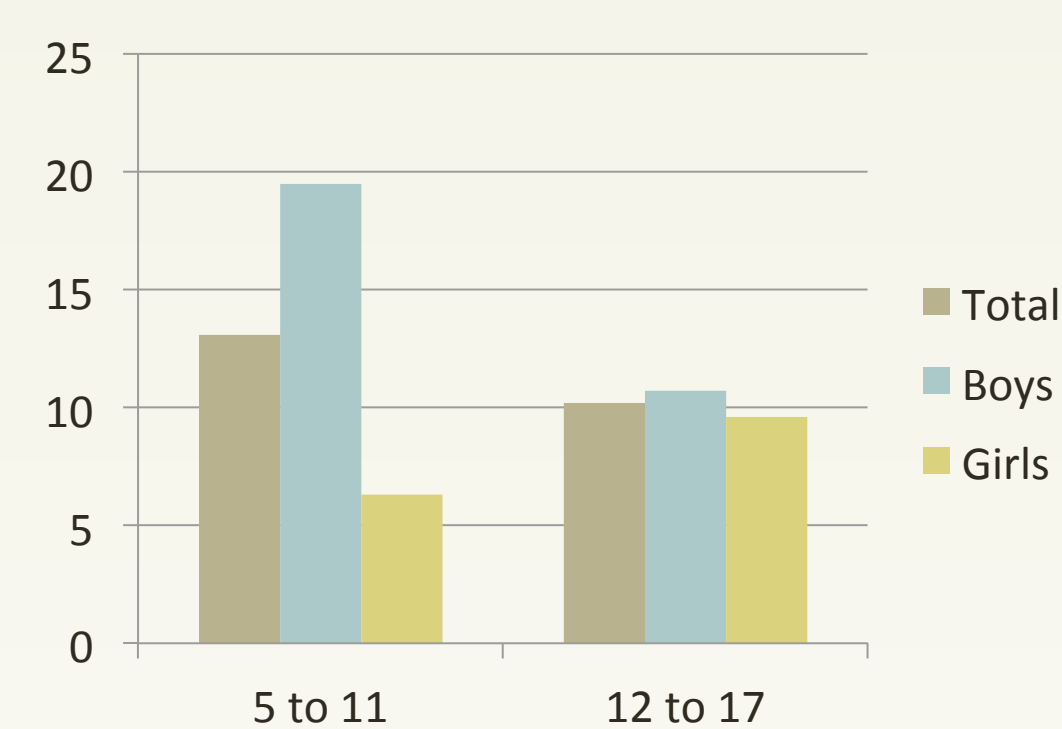


Figure 1: Prevalence of Obesity among different age and sex groups in Canada<sup>16</sup>



## Research Question/ Objective

The objective of this structured literature review is to investigate the research question: In children under the age of 18 living in North America, how does low socioeconomic status compared with high socioeconomic status influence the prevalence of obesity?

## Methods

A structured literature review was constructed in March 2014. Using seven databases (Cochrane DSR, ACP Journal Club, DARE, CCTR, CMR, HTA, and NHSEED), a search was done through Ovid for studies that examined the relationship between childhood obesity and socioeconomic status. The keywords that were used in the search were, childhood, obesity, and socioeconomic. For the purposes of this review, childhood was defined as individuals under 18 years of age. Three raters analyzed the articles and determined whether or not they met the inclusion criteria. Using these keywords, the search generated twenty articles. The inclusion criteria consisted of studies that were conducted in North America and had a population that consisted of children under 18 years of age. Information about age criteria, data collection methods, results and definitions for socioeconomic status and obesity were extracted from each of the studies.

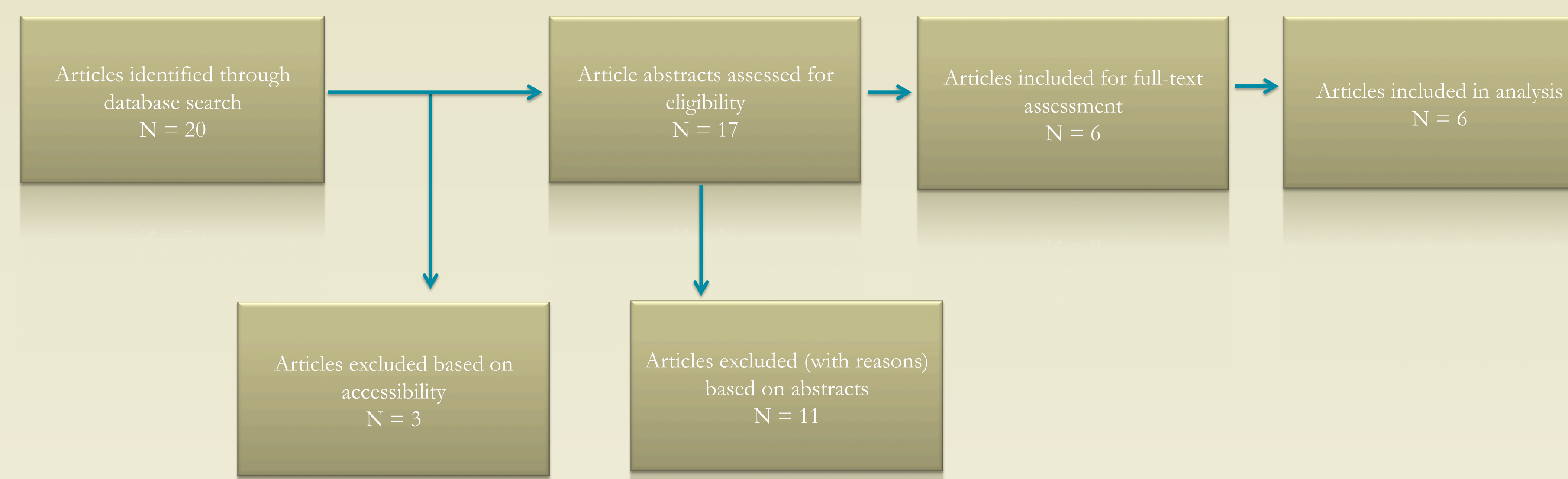


Figure 2: Visual representation of the methods process

## Results

Article	Study Details	Indicators	Main Findings
Singh et al., 2010	Age Group 10-17 years old Sample Size 44, 101 Study Design Cross sectional Methods Telephone surveys	SES: - Neighbourhood socioeconomic conditions Obesity: - BMI at or above sex- and age-specific 85th and 95th percentile BMI cutoffs from the 2000 CDC growth charts	- 20% of children in low SES neighbourhoods were obese compared to 14.7% of children in high SES neighbourhoods - Low SES neighbourhoods had a 61% higher odds of being obese
Kuklina a., 2014	Age Group up to 11.5 years old Sample Size 17, 046 Study Design Longitudinal (11.5 yrs) Methods - Observation - Follow-up	SES: - Undefined Obesity: - At or above the 95th percentile of the CDC sex-specific growth chart	- No evidence that longer duration of breastfeeding is protective against adult hypertension, diabetes mellitus, or overweight/adiposity was found in studies limited to low-/middle-income populations (compared to other studies)
Marshall et al., 2007	Age Group > 11 years old Sample Size 427 Study Design Cross sectional Data Collection Methods - Questionnaires - 3 day food and beverage diaries	SES: - Family income - Parental education Obesity: - BMI defined using age- and gender-specific Centers for Disease Control and Prevention	- Caries and obesity are associated with low SES in children - Overweight children have a lower paternal education level (some college) compared to normal weight children (associate degree) - There was no significant difference in maternal education level, and family income between overweight children and normal weight children
Singh et al., 2008	Age Group 10-17 years old Sample Size 46, 707 Study Design Cross sectional Methods - 2003 National Survey of children's Health - Telephone survey from Jan 2003 to July 2004	SES: - Household poverty status as a ratio of family income to poverty threshold - Social capital Obesity: - BMI at or above the gender- and age-specific 95th percentile BMI cut-off points from the 2000 Centers for Disease Control and Prevention growth charts	- SES, behavioural factors, and race/ethnicity are independently associated with childhood and adolescent obesity Prevalence of obesity based on age: - Age 10-11: 21.89% - Age 12-14: 14.43% - Age 15-17: 10.72% Household Poverty Status TOTAL (M/F):- Income to poverty ratio of less than 100% has an obesity prevalence of 22.18% whereas income to poverty ratio of greater or equal to 400% has an obesity prevalence of 9.33%. MALES:- Income to poverty ratio of less than 100% have an obesity prevalence of 26.11% whereas income to poverty ratio greater or equal to 400% has an obesity prevalence of 11.74%. FEMALES: Income to poverty ratio of less than 100% have an obesity prevalence of 18.26% whereas income to poverty ratio greater or equal to 400% has an obesity prevalence of 6.77% Social Capital: TOTAL (M/F):- Social capital index of 4 (highest) has an obesity prevalence index of 11.37% whereas social capital index of 11+ has an obesity prevalence of 22.45%. MALES:- Social capital index of 4 (highest) has an obesity prevalence index of 14% whereas social capital index of 11+ has an obesity prevalence of 23.43%. FEMALES:- Social capital index of 4 (highest) has an obesity prevalence index of 8.59% whereas social capital index of 11+ has an obesity prevalence of 21.22%.
Vieweg et al., 2007	Age Group School-aged kids - 2-19 years Sample Size 29, 824 Study Design Cross sectional Methods Height and weight measurements from Nutstat module of Epi Info	SES: 2 methods 1. Elementary and middle school: National School Program (low class given free meals and lower-middle class given discounted meals). 2. High school: per capita income data 2000 Obesity: - Over the 95th percentile in the CDC sex-specific growth chart	- 28.4% to 38.3% of students in high risk group: 28.4% in kindergarten - Increase in rate of high risk individuals from lower grades to higher grades, peaking at middle school: 28.4% in kindergarten, 35.4% in grade three, and 38.3% in grade seven. - Rate decreases in high school: 32.5% in grade ten. - Strong correlation between low income and childhood obesity: kindergarten (r=0.593), grade 3 (r = 0.565), grade 7 (r = 0.842), and grade 10 (r=0.811). p < 0.0001
Wang, 2001	Age Group 6-18 years old Sample Size 6, 110 Study Design Cross sectional Methods NHANES III 1988-1994	SES: - Per capita family income tertiles used to indicate low, middle and high SES Obesity: - Following WHO's recommendations, used a series of sex-age-specific BMI cut offs to define obesity and overweight	- Overall, children of low SES groups have a higher prevalence of obesity - In children 6-9 years old, those with a high SES, had a higher prevalence (13.2%) of obesity than those of a low SES (12.1%) - In teens 10-18 years old, those with a high SES had a lower prevalence (5.5%) of obesity than those with a low SES (14.0%) Obesity: - Overall, children 6-9 years old had a higher prevalence of obesity (12.0%) than teens aged 10-18 years (10.7%) - In children 6-9 years old, girls had a higher prevalence of obesity

## Discussion

This review investigates the association between low SES and the prevalence of childhood obesity in North America. Based on the research findings, the general consensus indicates that children with a low SES have a higher prevalence of obesity than their high SES counterparts.

The effect of SES on the prevalence of obesity differs depending on the SES indicator used. The study conducted by Marshall et al<sup>6</sup> investigated family income and paternal education as indicators of SES. The study found that overweight children have a lower paternal education level compared to normal weight children. However, other indicators such as family income and maternal education did not demonstrate any significant differences between overweight and normal weight children. The study conducted by Singh et al<sup>13</sup> measured SES using income to poverty ratio and social capital as indicators. Both SES indicators used demonstrated higher obesity prevalence among children with low SES.

There were several trends found in the results of this literature review. The study by Wang<sup>18</sup> found that the prevalence of obesity differed between children with high SES and children with low SES. In children 6 to 9 years of age, the prevalence of obesity in those with a high SES was 13.2%, whereas the prevalence among those with a low SES was 12.1%. In teens 10 to 18 years of age, those with a high SES had an obesity prevalence of 5.5%, whereas those with a low SES had a prevalence of 12.0%. This indicates that obesity is more prevalent among young children with a high SES and older children with a low SES.

Further investigation carried out by Vieweg et al<sup>17</sup> revealed that obesity trends differ among younger and older children. The variation in obesity rates were as follows: 28.4% among children in kindergarten, 35.4% among children in grade 3, 38.3% among children in grade 7, and 32.5% among children in grade 10. Regardless of high or low SES, the results indicate that the prevalence of obesity increases up until grade 7 but began to drop in grade 10. This finding indicates the importance of focusing on younger age groups in the future when carrying out interventions that target childhood obesity.

The limitations of this structured literature review are related to errors present in the design or methodological aspects of the included studies. There is potential for non-response bias as several studies relied on the use of surveys and questionnaires to collect data. Misclassification bias is possible as there was a lack of agreement among the studies in how SES and obesity was defined. Although most studies defined BMI according to the Centre for Disease Control and Prevention, there was one article that defined BMI according to the World Health Organization criteria.<sup>18</sup> Criteria such as parental education, poverty status, neighbourhood conditions and family income were used to define SES. This lack of homogeneity in definitions between studies may compromise the accuracy of the literature review results. Finally, publication bias is possible as grey literature was not included in the literature review. As it is unknown whether negative results were withheld from publication, the study results may be inaccurately skewed away from the null hypothesis.

Research in this area is imperative because childhood obesity is a growing problem in North America. The goal of this research is to determine what is contributing to the rise in the prevalence of obesity in children. Through investigation of these factors, policies and programs can be developed in an effort to reduce the prevalence of childhood obesity in North America.

## Conclusion

Overall, low socioeconomic status increases the prevalence of obesity in children under 18 years old living in North America. However, more research needs to be done in this area. This study can act as an impetus for future research regarding the prevalence trends of childhood obesity among different age groups. Further investigation regarding the various factors affecting SES should be undertaken to determine what can be done to reduce the prevalence of childhood obesity. Through this research, new policies can be put in place to reduce the burden of low-income status on children and their families, thereby reducing the prevalence and incidence of childhood obesity.

## References

1. Body Mass Index (BMI) Nomogram. (2012, February 23). *Health Canada*. Retrieved March 24, 2014, from [http://www.hc-sc.gc.ca/fn-an/nutrition/weights-poids/guide-ld-adult/bmi\\_chart\\_java-graph\\_ime\\_java-eng.php](http://www.hc-sc.gc.ca/fn-an/nutrition/weights-poids/guide-ld-adult/bmi_chart_java-graph_ime_java-eng.php)
2. Davis, R. J. (n.d.). *Socioeconomic status*. Retrieved from <http://www.ryanjdavis.net/control/uploads/SES.pdf>
3. Kuklina, E. V. (2014). Breastfeeding and Cardiometabolic Profile in Childhood: How Infant Feeding, Pterin Birth, Socioeconomic Status, and Obesity May Fit Into the Puzzle. *Circulation*, 129(3), 281-284.
4. Le Petit, C., Berthelot, J. (2005). *Obesity: A growing issue*. (No. 1 no. 03). Ottawa: Health Analysis and Measurement Group, Statistics Canada.
5. Mack, K.B., Phillips C., Jain, N., Koruluk, L.D. (2013). Relationship between body mass index percentile and skeletal maturation and dental development in orthodontic patients. *American Journal of Orthodontics and Dentofacial Orthopedics*, 143(2), 228-234.
6. Marshall, T. A., Eichenberger-Gilmore, J. M., Broffitt, B. A., Warren, J. J., & Levy, S. M. (2007). Dental caries and childhood obesity: roles of diet and socioeconomic status. *Community Dentistry and Oral Epidemiology*, 35(6), 449-458.
7. Navalpotro, L., Regidor, E., Ortega, P., Martinez, D., Villanueva, R., & Astasio, P. (2012). Area-based socioeconomic environment, obesity risk behaviours, area facilities and childhood overweight and obesity: socioeconomic environment and childhood overweight. *Preventive Medicine*, 55(2), 102-107.
8. Public Health Agency of Canada (2009). *Obesity in Canada - Snapshot*. Retrieved from <http://www.phac-aspc.gc.ca/publicat/2009/oc/pdf/oc-eng.pdf>
9. Public Health Agency of Canada (2012). *Obesity in Canada - Snapshot*. Retrieved from <http://www.phac-aspc.gc.ca/publicat/2012/oc/index-eng.php#fear>
10. Public Health Agency of Canada. (2013). *What Makes Canadians Healthy or Unhealthy?* Retrieved March 24, 2014, from <http://www.phac-aspc.gc.ca/ph-sp/determinants/determinants-eng.php#income>
11. Roberts, K. C., Shields, M., Groh, M. d., Aziz, A., & Gilbert, J. (n.d.). Overweight and obesity in children and adolescents: Results from the 2009 to 2011 Canadian Health Measures Survey. *Statistics Canada*. Retrieved March 24, 2014, from <http://www.statcan.gc.ca/pub/82-003-x/2012003/article/11706-eng.pdf>
12. The Obesity Epidemic in Canada (PRB 05-11E). (n.d.). *Library of Parliament*. Retrieved March 24, 2014, from <http://www.parl.gc.ca/Content/LOP/ResearchPublications/prb0511-e.htm>
13. Singh, G. K., Kogan, M. D., Van Dyck, P. C., & Siahpush, M. (2008). Racial/ethnic, socioeconomic, and behavioural determinants of childhood and adolescent obesity in the United States: analyzing independent and joint associations. *Annals of Epidemiology*, 18(9), 682-695.
14. Singh, G. K., Siahpush, M., & Kogan, M. D. (2010). Neighbourhood socioeconomic conditions, built environments, and childhood obesity. *Health Affairs*, 29(3), 503-512.
15. Statistics Canada. (n.d.). *Childhood Obesity Foundation*. Retrieved March 24, 2014, from <http://www.childhoodobesityfoundation.ca/>
16. Statistics Canada (2012). *Prevalence distribution of children and adolescents by body mass index (BMI) category (based on World Health Organization cut-offs), age group and sex: household population aged 5 to 17, 2009 to 2011*. Retrieved from <http://www25.statcan.gc.ca/pub/82-003-x/2012003/article/11706/tbl/tbl1-eng.htm>
17. Vieweg, V. R., Johnston, C. H., Lanier, J. O., Fernandez, A., & Pandurangi, A. K. (2007). Correlation between High Risk Obesity Group and Low Socioeconomic Status in School Children. *Southern Medical Journal*, 100(1), 8-13.
18. Wang, Y. (2001). Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socioeconomic status. *International Journal of Epidemiology*, 30(5), 1129-1136.
19. World Health Organization (2007). *BMI-for-age boys*. Retrieved from [http://www.who.int/growthref/cht\\_bmi\\_fa\\_boys\\_x\\_5\\_19years.pdf?ua=1](http://www.who.int/growthref/cht_bmi_fa_boys_x_5_19years.pdf?ua=1)
20. World Health Organization. (2007). *Bmi-for-age girls*. Retrieved from website: [http://www.who.int/growthref/cht\\_bmi\\_fa\\_girls\\_x\\_5\\_19years.pdf?ua=1.0](http://www.who.int/growthref/cht_bmi_fa_girls_x_5_19years.pdf?ua=1.0)