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An Examination of Demographic Associations Predicting Success in the Children's Healthcare of Atlanta's Strong4Life Program

Amy Hawes

AN EXAMINATION OF DEMOGRAPHIC ASSOCIATIONS PREDICTING SUCCESS IN THE CHILDREN'S HEALTHCARE OF ATLANTA STRONG4LIFE PROGRAM.

By
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B.S., Georgia Southern University

A Thesis Submitted to the Graduate Faculty
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Approval Page

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By

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Curriculum Vitae

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QUALIFICATIONS SUMMARY

Master of Public Health experienced in planning, implementing, and evaluating interventions to benefit communities. Experienced in Health Promotion interventions, especially those focused on youth health initiatives; resourceful and efficient in completing projects; able to multi-task effectively. Confident and poised in interactions with individuals at all levels.

EXPERIENCE HIGHLIGHTS

Program Planning

- Developed new ideas and content to implement an effective intervention
- Aided in preparation of activities to engage children in health education initiatives
- Coordinated events and meetings for programs

Data Analysis

- Analyzed research data using statistical techniques and programs such as SPSS, interpreted results, and prepared reports
- Transformed qualitative data into quantitative data for statistical analysis

Presenting & Educating

- Prepared lesson plans and lectures to teach to undergraduate students
- Spoke publicly to educate people on different health topics
- Presented projects conducted on interventions and evaluations; communicated results

EDUCATION AND TRAINING

Master of Public Health, Health Promotion and Behavior, Georgia State University, May 2015
Bachelor of Science, Nutrition and Food Science, Georgia Southern University, May 2013
Semester Study Abroad, University of New South Wales, June-November 2011

EMPLOYMENT HISTORY

Student Research Assistant, Georgia State University, Atlanta GA (January 2015-Present)
Graduate Teaching Assistant, Georgia State University, Atlanta GA (August-December 2014)
External Child Wellness Intern, Children's Healthcare of Atlanta, Atlanta GA (May-July 2014)
Nutrition Intern, MedStar Union Memorial Hospital, Baltimore MD (May-June 2012)

OTHER EXPERIENCE

Advisor of Chapter Development, Alpha Omicron Pi (2013-Present)

- Assist undergraduate students who are members in career possibilities and academics

Executive Alumni Relations Officer, Alpha Omicron Pi (2012)

- Planned and orchestrated events for 110 alumni
- Managed multiple philanthropic events including 5K runs and blood drives

Meals on Wheels (2010-Present)

- Deliver food to the elderly and poverty-stricken population of metro Atlanta

Public Health Student Association (2013-Present)
Student Dietetic Association (2011-2013)

ABSTRACT

An Examination of Demographic Associations Predicting Success in Children's Healthcare of Atlanta Strong4Life Program.

Amy A. Hawes

BACKGROUND: The purpose of this study was to explore demographic associations and their predictive value of effective weight maintenance among participants in the Children's Healthcare of Atlanta [CHOA] Strong4Life program for children and youth ages 2 to 20.

METHODS: Analyses are based on the Strong4Life clinic data collected by Strong4Life from 2010 through 2014. Participants of the program fell into the 85th percentile and above for Body Mass Index (BMI). Descriptive tests, comparison of means, and logistic regression analyses were run to determine if patterns in the data examining demographic characteristics of the sample and their relationship to successful weight management were statistically significant.

RESULTS: Logistic regression findings indicate that ethnicity (OR=2.737, CI: 1.273-5.892) p =0.01 is a predictor of successful weight management (n=324). Stong4Life defined program success as a decrease in BMI z-score of 0.04. While gender, race, baseline weight, asthma and pre-diabetes status were examined; statistical tests did not detect significant variations among the participants. Overall, the Strong4Life program is successful as seen by the p value< 0.001.

CONCLUSIONS: Findings from this study are important for childhood obesity programs because tailoring strategies that align with unique segments of the population maximize their potential reach. Obesity research is required to advance intervention development that is sensitive to patterns and distinctions that exist among subpopulations. These findings are important for prevention of childhood obesity efforts and promotion of multidisciplinary approaches to combat obesity world-wide.

KEY WORDS: Childhood Obesity, Obesity, Success, Predictors, Strong4Life

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CHAPTER I

INTRODUCTION

1a. Childhood Obesity: A National Public Health Problem

Childhood obesity is a public health problem that affects millions of children and adolescents worldwide. The Centers for Disease Control and Prevention has stated, as of 2012, one-third of American children and adolescents are overweight or obese. Obesity can have a significant impact on a person's physical and mental health (Adolescent and School Health, Centers for Disease Control and Prevention (2014); it can lead to many diseases such as cardiovascular disease, hypertension, diabetes, metabolic syndrome, asthma, depression, and other co-morbidities. Childhood obesity has also been associated with the same negative physical and mental health consequences (Sherry, B., Blanck, H. M., Galuska, D. A., Pan, L., Dietz, W. H., & Balluz, L. (2010). Preschoolers who are overweight or obese are five times more likely than their normal weight peers to become overweight of obese adults (Sherry, B et al., 2010). As an obese child grows into adolescence, they become more likely to have more absences from school due to illness, an increased risk of asthma (Pan, L., Sherry, B., Park, S., & Blanck, H. M., 2013).

Overweight and obesity are measured on an international scale that categorizes individuals based on Body Mass Index (BMI). BMI is measured using the formula of weight in kilograms divided by height in meters squared (kg/m^2). There are four major BMI categories for adults (See Figure 1). An adult is considered underweight if their BMI is below 18.5, normal weight is 18.5-24.9, overweight is 25-29.9, and obese is a BMI of 30 or greater. For children ages 2 to 20 years, BMI-for-age growth charts,

categorized by sex, are used to determine their BMI percentile in order to account for a child's changing height, and therefore provide more accurate results (About BMI for children and teens, Centers for Disease Control and Prevention (2014). These percentiles can be seen in Figure 2.

Figure 1. *Adult BMI Categories*

Category	BMI Range – kg/m²
Underweight	<18.5
Severe Thinness	<16
Moderate Thinness	16-16.9
Mild Thinness	17-18.49
Normal	18.5-24.9
Overweight	≥25
Pre-Obese	25-29.9
Obese	≥30
Obese Class I	30-34.9
Obese Class II	35-39.9
Obese Class III	>40

Table adapted from the CDC

Figure 2. *BMI Percentiles for Children and Teens ages 2-20*

Category	Percentile Range
Underweight	<5%
Healthy Weight	5%-85%
At risk of overweight	85%-95%
Overweight/Obese	>95%

Table adapted from the CDC

A person becomes overweight, and subsequently obese, by having a higher intake than output of energy (i.e. consuming more calories than they are burning). While this biological mechanism is a driving factor of obesity, multiple social factors have been identified as possible influences on obesity as well. These include family dynamic of the child's home, the income of their parent or parents, the physical environment in which they live, how obesity is viewed among their family and peers, and other health conditions that have been previously diagnosed. Children are especially susceptible to these factors as, up to a certain age, they have little or no choice on the food that is

provided to them and are highly influenced by the actions of their parents or caregivers. Other potential factors may be non-modifiable such as genetics and ethnicity (Wang, Y. F., & Beydoun, M. A., 2007).

Children's Healthcare of Atlanta (CHOA) is one of the leading pediatric healthcare facilities in the United States. In 2010, CHOA pioneered a clinic known as Strong4Life. This program was set in place to combat the obesity epidemic and has a community-facing component as well as a clinical program. Strong4Life uses a multidisciplinary approach to give children the best chance of preventing or overcoming obesity. The four focal points of the program, known as The 4 Healthy Habits, are eating more fruits and vegetables, drinking more water, being active for 60 minutes a day, and limiting screen time to 60 minutes a day. The Strong4Life program believes by following these 4 Healthy Habits, a child can achieve a healthy weight and, most importantly, a healthy lifestyle. The Strong4Life movement has been brought into many schools in the metro-Atlanta area to inform children of these healthy habits. There is also a camp put on for one week every summer where children who are overweight or obese can come and learn these beneficial lifestyle habits and forget about any limitations their weight has on them at home.

A child's primary care physician recommends them to the Strong4Life clinical program if they have a BMI in the 85th percentile or above. While this is the percentile needed, most children at the clinic are in the 97th percentile or above (Walsh, S. M., Palmer, W., Welsh, J. A., & Vos, M. B., 2014). At each appointment, the child and their primary caregiver see four specialists; a physician, a psychologist, a registered dietitian, and an exercise physiologist. With each specialist, the child makes goals that are

achievable by their next appointment. By working with this team of experts, CHOA and Strong4Life have seen a significant drop in obesity among their patients within 6 months of starting the program.

1b. Purpose of Study

A systematic review of literature provided evidence that there are numerous factors that contribute to childhood obesity. Childhood obesity is known to be a precursor to many life-threatening diseases and conditions.

The purpose of this study is to examine any possible participant demographic factors that could be predictors for success within the Strong4Life program. This study will enrich the literature by analyzing how multiple variables, such as gender, age, BMI category, as well as prior diagnoses of asthma, ADHD, and depression effect success in a pediatric weight loss clinical program. The data for this study was obtained from Strong4Life, a Children's Healthcare of Atlanta movement.

1c. Research Question

Based upon previous research, the student investigator developed testable hypotheses speculating relationships of risk related to program success.

Question 1: Is a child's race a predictor of Strong4Life program success?

Hypothesis: A child's race is a predictor of success in the Strong4Life program.

Question 2: Is a child more successful in the Strong4Life program if they have a lower starting BMI than a child with a higher starting BMI?

Hypothesis: A child is more likely to be successful in the Strong4Life program if they have a lower baseline weight.

Question 3: Is ADD/ADHD status associated with Strong4Life success?

Hypothesis: A diagnosis of ADD/ADHD is associated with successful Strong4Life participation.

Question 4: Is one gender more likely to be successful in the Strong4Life program?

Hypothesis: Gender is related with Strong4Life success.

Question 5: Is being of Hispanic or Latino ethnicity predictive of Strong4Life success when compared with non-Hispanic/Latino ethnicity?

Hypothesis: Hispanic or Latino ethnicity is predictive of Strong4Life success.

Question 6: Does the Strong4Life program demonstrate success by change in BMI?

Hypothesis: Strong4Life completion BMI measures will be lower than at baseline.

CHAPTER II

REVIEW OF THE LITERATURE

To gain a deep understanding of the research question, a literature search was performed to understand: the prevalence of obesity among children; the effects of obesity; and previous approaches. Furthermore, a comprehensive review of the effect of a previously diagnosed condition such as depression or ADD, parental influence, and perception are also reviewed.

2a. Theoretical Framework

The childhood obesity epidemic is complex, which makes it difficult to identify one causation of overweight and obesity. The condition in which a person is born into, lives, and works is known as their social determinants. Research has found that these determinants are mainly responsible for health inequalities. When it comes to obesity, social determinants play a major role. A person's gender, socio-economic status, community, race and ethnicity can be disadvantages for health (Pinto Guedes D, Rocha G, Martins Silva A, Mourão Carvalhal I, and Coelho E., 2011).

Minorities and subpopulations have been found to have a more unequal level of hardship due to social determinants. Access to food stores or physical activity areas is something that is normally limited in these communities. This limitation can create a snowball effect; less access to healthy foods leads to a higher likelihood to eat unhealthy foods and become overweight (Rossen, L. M., 2014).

Numerous studies have recommended multiple level interventions for childhood obesity prevention. Factors of these interventions need to be focused on the determinants

a population is facing, such as family, community environment, and socio-economic status. By being aware of these determinants, reaching the targeted population becomes more effective.

2b. Perceptions of Obesity

The perception children and adolescents have regarding their weight can be detrimental to potential healthy lifestyle changes. One study set out to investigate the way youth understand obesity and where there may be gaps in knowledge of nutrition, dietary habit, and their susceptibility to obesity (Larson, N. I., Wall, M. M., Story, M. T., & Neumark-Sztainer, D. R. (2013). Focus groups were used to gain an understanding of overweight and normal weight youth in the 7^{th} and 8^{th} grade as well as in the 4^{th} and 5^{th} grade. The study included 41 children separated into 10 focus groups. The researchers selected these two age groups as it has been noted that late childhood and early adolescence are major time periods for children to become more independent and make their own dietary and lifestyle choices.

The researchers found that most youth in the state of Georgia failed to connect their behavior with obesity, but could recognize obesity as a problem. Females were more open to the idea of consuming healthy foods and showed a desire to positively change their diets. Females were also able to make the connection between food choices and body weight. Males, however, associated healthy foods as tasting bad. Interestingly, many of the overweight youth were unable to recognize themselves as overweight or obese. Girls who were overweight were more likely to recognize their excess weight than boys, but this seemed to be contributed to teasing at school that brought it to their attention. Overweight youth also did not think increasing their exercise was a reasonable

treatment for achieving a normal weight. The overweight youth did not focus on the long-term effects of obesity, but instead focused on current life events. Normal weight youth were able to express that obesity is not something that has a quick fix and knew the connection between obesity and quality of life. One exception to the different perspectives on weight loss and management was if an overweight youth had watched a family member or close friend lose weight. They were then able to identify the long process and lifestyle changes it takes to lose and keep off weight (Sylvetsky, A. C. et al., 2013).

A sample of 1224 children ages 8 to 18 completed an online survey to understand their perceptions of obesity and its factors. The participants self-reported their weight and were asked a series of questions regarding the percentage of American children they believed to be overweight or obese, whether young people understand the consequences of becoming obese, why kids are becoming overweight, and why it's important to not be overweight. Answers were in the form of multiple choice, opinion-scale, and open-ended. It was found that 27% of the participants categorized themselves as being overweight, much less than the national rate. This is consistent with other research findings that some overweight children will categorize themselves as normal or underweight. A large majority (91.1%) of the participants indicated that it was very important for a person their age to not be overweight, for health and social related reasons. It was also noted that the large majority felt that if someone their age was overweight, they would most likely be overweight as an adult. The children also indicated people who were overweight would most likely be made fun of in school. Most of the sample felt that people their age are overweight due to food reasons, while few felt

it was due to physical inactivity. Participants who categorized themselves as overweight were more likely to have spoken with an adult about their weight. It was found that children have a good understanding of issues associated with becoming overweight, and suggested interventions tailor to these perceptions and understandings (Economos, C. D. et al., 2014).

2c. Childhood Obesity and Ethnicity

There is speculation regarding the connection between a person's ethnic background and their risk for becoming obese. When examining self-reported data of adults in the United States, Non-Hispanic Blacks have the highest prevalence of obesity, followed by Hispanics, and last, Non-Hispanic Whites (Adolescent and School Health, Centers for Disease Control and Prevention (2014). While this connection in adults has been widely researched, availability of data on children is limited.

One study examined the differences in BMI, weight, and height among three ethnic groups; Non-Hispanic Whites, Non-Hispanic Blacks, and Hispanics. It was found that over the last three decades, the prevalence of obesity for children ages 6 to 11 increased from 4% to 13% among white children and 4% to 20% among black children (Freedman, D.S., Khan, L.K., Serdula, M.K., Ogden, C.L., & Dietz, W.H., 2006).

It has been found that the highest rates of obesity occur in historically disadvantaged groups, primarily African Americans and Hispanics (Dunn, R. A., Sharkey, J. R., & Horel, S., 2012). In this same study conducted by Dunn et al., researchers found that whites living in the same area as non-whites have a higher household income, are more likely to be married, and have more years of education. The difference in the average BMI of whites and non-whites is statistically significant with

whites having a BMI almost three points lower than non-whites. The obesity rate of whites in this population was 64% lower than the rate of non-whites (Dunn, R. A. et al., 2012).

In a sample of approximately 8,550 4 year old children in the United States, 18.4% met the criteria for being obese. The prevalence of obesity differed among the five racial groups examined. Researchers found that American Indians/Alaska Natives had the highest rates of obesity among the sample at 31.2%. This percentage is twice as high as those for non-Hispanic whites and Asians. Asians had the smallest percentage of obesity at 12.8%. The study shows that there are significant differences in obesity among racial/ethnic groups that are apparent in 4 year old children (Anderson, S. E. & Whitaker, R. C., 2009).

2d. Childhood Obesity and Age

One study set out to examine the effects of obesity on children in their early life stages between the ages of 2 to 5 years old. Preschool-aged children who are overweight or obese are five times more likely to become overweight or obese adults than their normal weight peers.

In a study conducted to examine the impact of age on obesity, it was found that if a child is overweight or obese in kindergarten, they have a greater chance of being obese by the 8th grade. The researchers followed a sample of kindergarteners through the 8th grade to document the incidence of obesity. 14.9% of kindergarteners in the sample were overweight. By the 8th grade, 31.8% of this group was obese. The overweight kindergarteners were at four times the risk of becoming obese by the 8th grade as their normal-weight peers. Children who fell into the 50th percentile for BMI in kindergarten

had a 6% chance of becoming obese by age 14. Those who fell into the 85th percentile had a 25% chance of becoming obese by age 14. Those who fell in the 95th percentile had a 47% chance of being obese by the 8th grade, and for those children who fell into the 99th percentile, 72% would be obese by age 14. The results of this study are consistent with national data and provoke the thought that a high BMI at a young age increases the chances of a child continuing to have a high BMI as they age (Cunningham, S. A., Kramer, M. R., & Narayan, K. V., 2014).

2e. Obesity and Socio-economic Status

Many studies have shown a higher rate of obesity among those who have a low socio-economic status. A recent study set out to understand this connection, as well as if gender plays a role as. Both men and women in the low socioeconomic group were more likely to be obese than the men and women in the high socioeconomic group. Within both groups, women were more likely to be obese than their male counterpart. Upon talking to the participants, it appeared that participants in a higher occupational status were more concerned with body image and health then those with lower occupational status (Porwal, V., Verma, A., Inamdar, S., & Bajpai, P., 2013).

In lower socioeconomic areas, fast-food restaurants are more prevalent. In a study conducted by Dunn, it was found that in low SES, rural areas people had approximately 1.8 fast-food restaurants within one mile of their home. It was found however, that availability of fast food does not have an influence on obesity. (Dunn, R., A. et al., 2012)

A study conducted by Young Jo took a slightly different approach to examining the correlation between income and obesity. In this study, Jo looked at why low-income

families children gain weight more rapidly than those of high-income families. It was found that obesity rates did not significantly differ, regardless of income, in young children. The relationship between family income and obesity increases as the child ages. In families where total income was below the tenth percentile, obesity and income were positively correlated; meaning in very poor families, if income increased so did childhood obesity rates. A suggested reason for this could be that families who are living in areas with high food prices may not be able to afford very much, while families living in low food cost areas are able to purchase a greater quantity. In families where total income was above the tenth percentile but still considered low, below the 25th percentile, obesity rates and income were negatively correlated. As income decreases, childhood obesity increases. In high-income families, it was found that obesity and income were again negatively correlated as income increased, childhood obesity rates declined. Jo also found that the relationship between income and obesity is significantly stronger among children with higher BMI; children who were consistently in a low-income family continued to become more overweight. While many children begin life around the same weight, children of low-income families are more likely to be obese by age 14 than those from high-income families (Jo, Y., 2014).

2f. Family Impact

The impact a family has on a child's weight has produced mixed results. There seem to be certain factors that do have an impact on a child's weight, such as weight status of the parent, the father's job and the parents' education level (Doustmohammadian, A., Abdollahi, M., Bondarianzadeh, D., Houshiarrad, A., &

Abtahi, M., 2012). Other studies have focused on the dynamics of the household and the effects it can have on a child's physical health.

One study explored the possible correlation between the severity of obesity in obese children and adolescents at two separate ages, 7 and 15 years old, and parental Body Mass Index in obese children and adolescents. The researchers also looked at the age at onset of obesity in relation to the other factors. The study included 231 obese children and 462 of their parents. Out of the sample, researchers found that 76% of the children who were in the age 7 group were classified as obese. In the age 15 group, 81% of the children were obese. It was found that 58% of the sample was obese by age 4, and 77% was obese by age 6. Both age groups examined had a positive correlation with maternal BMI; at age 15, there was also a positive correlation with paternal BMI. It was found that children who had two obese parents were significantly more likely to be severely obese (Svensson, V. et al., 2011).

Parents who are able to recognize that their child is overweight or obese may be more likely to provide support to help their child achieve a healthy weight. One study examined the parent's ability to recognize their child's overweight status. In previous studies, parents of younger children were less likely to recognize their child as overweight, while parents of older children were more likely to. The parents were asked to rate their child's weight level and their answers were then compared to the child's actual weight. When the children were weighed, 17% were classified as overweight or obese according to international criteria, but only 8% were said to be overweight and 0.3% obese according to their parents. Eighteen percent of the parents of obese children and over 50% of the parents of overweight children considered their child to be normal

weight. A very small portion of parents thought their normal weight child was overweight. Parents classified their daughters as overweight more accurately than their sons (Vanhala, M. L., Keinanen-Kiukaanniemi, S. M., Kaikkonen, K. M., Laitinen, J. H., & Korpelainen, R. I., 2011).

Another relationship that has been observed is household status and childhood obesity. Huffman evaluated the association between these two factors, using the NHANES data. Huffman found that there were a greater percentage of overweight children from single-parent households than from dual-parent households. The children from single-parent homes had a higher intake of total fat than children in a dual-parent home. Single-parent homes also purchased fewer vegetables than dual-parent homes. These factors suggest a likelihood of higher dietary fat consumption by children in single-parent households, which may contribute to the higher BMI and LDL cholesterol levels in these children (Huffman, F. G., Kanikireddy, S., & Patel, M., 2010).

Potential Predictors of an increased risk of Childhood Obesity

2g. Asthma

Youth who are overweight or obese and have asthma are at a higher risk for negative health implications and psychological distress than their overweight or obese peers who do not have asthma (Fedele, D. A., Janicke, D. M., Crystal, S. L., & Abu-Hasan, M., 2014). Weight loss in asthmatics who are obese has been found to improve airway function, and therefore, improve asthma control and quality of life (Pakhale, S., Baron, J., Dent, R., Vandemheen, K., & Aaron, S. D., 2015). A study looked at adiposity distribution among children who had asthma and those who did not. Children with asthma had a significantly higher BMI and skin-fold thickness found from

anthropometric tests. The asthma group was also found to have significantly less lean muscle mass. Girls of the asthma group had the highest amount of excess body fat in the sample. For girls who have severe asthma or those who have been suffering for an extended period of time, fat tended to be primarily distributed in the trunk area of the body. These findings go against some recent research, but are very similar to findings from research done in the 1980's (Umawska, W., 2015).

2h. ADD/ADHD Diagnosis

It has been suggested by multiple studies that ADD or ADHD may correlate with an increased risk of obesity for youth. One proposed reason may be that the impulsivity and poor behavioral regulation that many ADHD youth have can lead to poor eating habits that contribute to obesity.

A study conducted in Korea examined 12,350 children ages 5-13 to see if there was an association between an ADHD diagnosis and obesity. Parents of the children completed a questionnaire comprised of topics such as lifestyle habits, psychosocial indicators that included ADHD symptoms. Anthropometric measurements were also collected (i.e height, weight, and BMI of the children). The researchers found that ADHD had an influence on body weight for both extremes, overweight and underweight. It found that ADHD had a positive direct effect on consumption of unhealthy foods and a positive direct effect on bulimic dietary behaviors. The study concluded that ADHD was a risk factor for obesity due to dietary behaviors (Kim, E. J. et al., 2014).

2i. Depression Diagnosis

While there is currently no direct link between depression and obesity among adolescents, many suspect a connection. Depression and obesity share many factors, both biological and psychological. Different theories possibly linking the two may include inflammation, which is known to play a role in both obesity and depression and hypothalamic-pituitary-adrenal axis dysfunction, in which dysregulation has been found to impact obesity and depression. From a psychological aspect, eating disorders, such as over-eating and binging, can impact a child's likelihood of being obese. Some psychiatric drugs are also known to lead to weight-gain as a side-effect (Roberts, R. E., & Duong, H. T., 2013). The question many researchers are anxious to answer is: does obesity cause depression or does depression cause obesity?

A study examined 39,542 French adolescents who were age 17 to determine the association of depression and obesity. This was the largest sample for a study in this area of research, and used a validated tool to measure depression, something other similar studies have not. In addition, as many previously conducted studies have found a significant association in depression and obesity depending on parent's working and marital status, this study controlled for those two variables.

It was found that depression and BMI were significantly associated in both the total sample, and each gender group separately. The association was not linear and was different for boys and girls. For boys it was found that obesity and underweight were associated with an increased level of depression. For girls, it was found that overweight girls were more likely to be depressed than obese girls. In addition, underweight girls were just as likely to be depressed as obese girls. The researchers concluded that obesity itself does not cause depression, but can it be correlated? (Revah-Levy, A. et al., 2011)

A systematic review conducted by (Korczak, D. J., Lipman, E., Morrison, K., & Szatmari, P., 2013) set out to explore the relationship between early-onset depression and other disruptive behaviors on adult body weight. The review analyzed 16 available studies and found that the majority of research studies indicate that adolescents with depressive symptoms or diagnoses of depression have an increased BMI at their follow-up.

Multiple studies have found that depression at baseline predicted obesity in adolescents (Roberts, R. E., & Duong, H. T., 2013). In an article review, it was concluded that adolescents with depression are about 2.5 times more likely to gain weight or be obese at follow-up than their non-depressed peers (Gundersen, C., Mahatmya, D., Garasky, S., & Lohman, B., 2011). The majority of studies conducted thus far have only focused on adolescents to adults, not the relationship of depression and obesity on an adolescent during adolescence. Robert & Duong found that weight status is not a predictor of depression, but depression is a predictor of future weight issues. Those adolescents who were diagnosed with mood disorders or major depression had an increased risk of obesity by two-fold, but not an increased risk of over-weight. Basic symptoms of depression at baseline predicted future overweight in the adolescent, but not obesity. The results varied by gender in that males who had major depression were at six-times the risk of becoming obese.

CHAPTER III

METHODOLOGY

3a. Data Source and Study Population

This study is based on the secondary analysis of data obtained from the Health4Life clinic, at Children's Healthcare of Atlanta in Atlanta, GA. The Strong4Life clinic has seen patients since 2010. Patients who fall into the 85th percentile or above for their BMI are referred to the clinic by their primary care physician. A patient sees four specialists at each appointment: physician, a registered dietitian, an exercise physiologist, and a psychologist. This multidisciplinary approach addresses multiple important factors that affect a patients weight; the goal of the team approach is to aid in lifestyle change, rather than just weight loss, in youth who are obese.

Participants are assessed at their first appointment at which all baseline measurements are taken. Each youth then spends approximately 30 minutes with each specialist to identify main issues and set goals to be accomplished by their next visit. In subsequent visits, patients spend 15 minutes with each provider.

3b. Data Collection Procedures

This study performs secondary data analysis on de-identified data provided by Children's Healthcare of Atlanta. This study underwent Institutional Review Board approval by Children's Healthcare of Atlanta and Georgia State Univeristy; both organizations deemed this study exempt.

The sample analyzed contained patient data on 324 patients with multiple visits to the Strong4Life clinic. For the purpose of this study, only data from the first and fourth

data will be examined to assess change over time. The fourth appointment is when progress is expected to be seen, and therefore is an appropriate point for comparison.

3c. Study Measures

The study measures that were considered in the study were obtained from the demographic file. These included age, sex, height, weight, race, BMI category, ADD diagnosis, depression diagnosis, asthma, and any co-morbidities present.

Age

Age of participants at the Strong4Life clinic range from 2 years to 20 years of age.

Sex

Participants were categorized as either male or female based on physical examination.

Race

Race was categorized into multiple groups by participant response. These groups include American Indian or Alaska Native, Asian, Black or African American, and White. There were options for patients who opted to not share this information or did not fit one of the specified categories. These options were Declined or Unknown.

Ethnicity

Participants were asked to identify themselves as Hispanic or Latino or Non- Hispanic or Latino. Again, patients were given the option to decline or choose unknown.

BMI Category

Patients were placed into one of four BMI categories based on their BMI at their first appointment. The international BMI scale was used for categorization. A child was considered underweight if they had a BMI or 18.5 or less, normal weight if their BMI

was between 18.5-24.9, overweight if their BMIwas between 25-29.9, and obese if their BMI was 30 or greater.

Depression Diagnosis

Patients were categorized as having depression if they were diagnosed prior to entering the Strong4Life program.

ADD/ADHD Diagnosis

Patients were categorized as having ADD/ADHD if they were diagnosed prior to entering the Strong4Life program.

Asthma

Patients were categorized as having asthma if they were diagnosed prior to or at any time during the Strong4Life program.

Dependent Variable

BMI z-score

Participants were deemed successful at the 4th appointment if their BMI z-score, which accounts for a child's increasing height, was at least 0.04 points less than their BMI measured at their first appointment.

3d. Statistical Analysis

The Statistical Package for Social Sciences (SPSS v.21) was used for data analysis. To have an understanding of the study population, frequency tables were produced to determine the representation of variables such as sex, BMI category, and previous diagnoses. Independent T-tests were performed to compare mean BMI score among those with and without asthma and those who were and were not pre-diabetic. This was done for asthma and pre-diabetes. To assess the impact of all variables on the

likelihood that a child would be successful in the Strong4Life program, a direct logistic regression was performed.

CHAPTER IV

RESULTS

4a. Sample Demographics

This chapter presents the results of the statistical tests to determine the research question answers. While records were available for 353 overall participants, the data set utilized in this study included 324 patients who attended the requisite 4 clinic appointments. Cases were excluded due to lack of information or data entry error. The demographic profile of the complete study sample is presented in Table 1.

Table 1. *Demographic Profile of Strong4Life Sample at Baseline*

Variables	N	Percentage
Sex		
Male	119	33.7%
Female	234	66.3%
Race		
Black or African American	139	42.8%
White	146	44.9%
Other	7	2.4%
Missing	33	10.2%
Ethnicity		
Hispanic or Latino	90	25.5%
Non-Hispanic or Latino	248	70.3%
Declined	1	0.3%
Unknown	3	0.8%
Baseline BMI Percentile		
Obese	305	93.8%
Overweight	9	2.8%
Missing	9	2.8%

4b. Associations

The study's research questions were addressed systematically. Question 1 considered: *is race a predictor of success among Strong4Life?* Results of a logistic regression test indicate there is no statistically significant difference in success based on race. Therefore, the hypothesis is not supported as race does not predict success (Table 2).

Table 2. *Logistic Regression*

Variables	OR	95% CI	p value
Sex	1.106	0.621-1.971	0.732
Race			
Black	5.041	0.496-51.283	0.172
White	4.755	0.486-46.52	0.18
Ethnicity	2.737	1.272-5.892	0.01
Baseline Weight	0.993	0.986-1	0.042
Pre-diabetic	0.906	0.376-2.183	0.825
Asthma	1.146	0.334-3.938	0.829

Question 2*: Is a child more successful in the Strong4Life program if they have a lower baseline weight than a child with a higher baseline weight?* Results of a logistic regression test indicated there is no significant difference in success based on a participant's initial weight.. See Table 2.

Question 3: *Is ADD/ADHD status associated with Strong4Life success?* Unfortunately, due to a very small amount of participants being diagnosed as ADD or ADHD, a statistical analysis to determine predictability was not able to be run. Therefore, the hypothesis is neither accepted nor rejected. It is suggested that further research be conducted on a sample with more ADD or ADHD diagnoses.

Question 4: *Is one gender more likely to be successful in the Strong4Life program?* An independent samples t-test was conducted to compare the difference of BMI z-scores for males and females who had completed 4 appointments at Strong4Life. There was no significant difference in BMI z-score decrease for males (M=0.076, SD=0.173) and females (M=0.064, SD=0.199; t (322) = 0.523, p=0.601, two-tailed). The magnitude of the differences in the means (mean difference = 0.012, 95% CI: -0.033 to 0.056) was very small (eta squared =0.0008). Therefore, the hypothesis of gender impacting success is not supported.

Table 3. *Difference in BMI z-scores Among Sample Males and Females*

	Mean	SD	Mean Difference	P value
Male	0.076	0.173	0.012	0.601
Female	0.064	0.199		

Question 5: *Is being of Hispanic or Latino ethnicity predictive of Strong4Life success when compared with non-Hispanic/Latino ethnicity?* Multiple tests were run to determine the predictability ethnicity has on success. Results of a logistic regression indicate an odds ratio of 2.737. This shows that participants who are Hispanic or Latino are 2.737 times more likely to be successful in the Strong4Life program than their non-Hispanic or Latino peers. We can be 95% confident that the actual value of the odds ratio in this population lies somewhere between 1.27 and 5.89. These findings support the hypothesis of ethnicity being a predictor of success in the Strong4Life program. See Table 2.

Question 6**:** *Does the Strong4Life program demonstrate success by change in BMI?* A paired-samples t-test was conducted to evaluate the impact of the Strong4Life program on participants' BMI z-score. There was a statistically significant decrease in

BMI from baseline (M=2.47, SD=0.50) to the fourth appointment (M=2.40, SD=0.45), t (323) =6.407, p<.001(two-tailed). The mean decrease in BMI of participants was 0.068 with a 95% confidence interval ranging from 0.047 to 0.089. The eta squared statistic (0.11) indicated a small effect size. This analysis supports the hypothesis that there was a significant decrease in BMI z-scores from baseline to the fourth appointment. This is shown in Table 4. The prevalence of success among participants can be found in Table 5. The BMI categories participants fell into at the 4th appointment can be found in Table 6.

Table 4. *Average Decrease in BMI at 4th Appointment*

	Mean (SD)	Significance (2-tailed)
BMI z-score time 1	2.47 (0.50)	
BMI z-score time 4	2.40 (0.45)	
z-score 1 – z-score 4	0.068 (0.19)	0.000

Table 5. *Prevalence of Success at the 4th Appointment*

	Number	Percent
Successful	156	48%
Not Successful	168	51%
Missing	1	0.3%

Table 6. *BMI Category at 4th Appointment*

	N	Percentage
Obese	303	93.2%
Overweight	14	4.3%
Normal Weight	2	0.6%
Missing	6	0.02%

While most demographic characteristics did not predict program success, there are significant findings for ethnicity.

CHAPTER V

DISCUSSION AND CONCLUSIONS

5a. Discussion

The purpose of this study was to identify possible demographic predictors of success for those who enroll in the Strong4Life program. This study found that a participant's ethnicity is a predictor of successful weight maintenance in the Strong4Life program. There may be other factors at play which influenced the statistical results.

a. Race and SES

While previous research has found that obesity is more prevalent in minorities, obesity research has not previously identified a genetic/ race-based predictor of successful weight maintenance. There did not seem to be a relationship between race and success in the Strong4Life program, however this may be due to other factors. For this study, socio-economic status (SES) of participants was not available. It is believed, as presented in other research, that SES has a strong influence on a child's body composition. For future research, SES among participants in a weight management program should be explored.

b. Gender

The findings of this study did not show any difference in success based on a participant's gender. This may be due to a variation of starting weight, even though the BMI categories are similar. It has also been discovered that males tend to lose weight more easily than females, but, especially at this age due to puberty-related changes, females may have more weight to lose, meaning they would decrease their BMI faster.

c. Ethnicity

The findings did indicate a statistically significant difference in success among Hispanic and Latino participants when compared to non-Hispanic or Latino participants. Research has found that Hispanic and Latino populations tend to have a higher prevalence of obesity, but also have a unique culture. There is evidence that supports the concept of a large amount of social support among the Latino population, which is very influential for positive health and well being. A strong support system has been proven to increase a person's likelihood of success in a weight management program, and therefore this social dynamic may have a positive impact on those in a weight management program.

d. Asthma and Pre-diabetes

The findings did not indicate a statistically significant difference in success based on a previous diagnosis of asthma or pre-diabetes. Research has found that children who suffer from these ailments are at an increased risk for becoming obese. There is evidence that achieving a lower BMI can improve asthma symptoms as well as reverse a pre-diabetic diagnosis.

e. Overall Success

This study found that the Strong4Life program is successful in decreasing BMI. Children who completed the four appointments did see a statistically significant difference in BMI z-scores overall. This suggests implementing more obesity interventions similar to Strong4Life.

This study is different from others examining factors of childhood obesity as it aims to identify possible demographic predictors that may lead a child to be successful in multidisciplinary obesity intervention program.

5b. Limitations

There are several limitations to the study that should be noted. First, this study only looks at children and adolescents in the State of Georgia and therefore may not be generalizable to the national population. Second, variables such as ADD diagnosis or depression are difficult to be properly represented in this sample due to the participants' age. Depression is often not diagnosed until the early twenties, so it would be surprising to have a large amount of the sample diagnosed. ADD/ADHD is also not always diagnosed at a young age, and therefore its true impact is unknown. Third, variables such as parent income, parental marital status, or primary caregiver were not included in this study. These variables may have an impact on a child's likelihood of success and would provide some insight into combating obesity at home. Fourth, different medications children might take, such as corticosteroids, may be contributors to weight gain and medication intake was not examined.

5c. Recommendations and Implications

Future research that focuses on potential predictors of success in an obesity intervention program is warranted. There may be other predictors not discovered in this study that could have a powerful influence on success, such as other diagnoses (i.e. metabolic syndrome, sleep apnea, etc).

Some challenges faced in this study include the limited variables. Had other variables such as socio-economic status, parent education level, and primary caregiver been included, there may have been different results and additional predictors identified. It is important for future research to include these variables, as previous studies have suggested each has a strong influence on childhood obesity. Another challenge was having some variables in which the sample of participants was too small to conduct analyses on. It would be interesting for future research to examine the predictability of diagnoses such as depression and ADD/ADHD on success in a similar program. It does appear that these two variables have an impact on obesity and may also be detrimental in maintaining a healthy weight.

There are so many other variables that could impact a child's weight status and their chance of being successful in achieving a healthy weight. Questions such as does a child attend a private or public school, do they eat lunch at school and are they on free or reduced lunch are important to be examined as there may be demographic differences based on these answers that contribute to success. Other variables to look at include the BMI of the child's parents, if they have insurance, private or Medicaid, how many meals they are consuming at home, and how many of those meals were prepared by a primary caregiver. The impact a primary caregiver has on a child's health and lifestyle is huge, especially in the child's early years.

If the study were to be taken a step further, having focus groups comprised of patients and separate parent groups could yield some new insights into other possible predictors. Things such as body perception or a parent's perception of their child's

weight may be found to impact a participant's success. Exploring possibilities such as these may help to refine similar programs to best impact the participants.

5d. Conclusion

This study is important because it identifies potential demographic associations that may predict a child's success in an obesity prevention program and indicates that a specialized program targeting obesity treatment is successful in helping children achieve a healthy weight. Obesity is not caused by one factor, but rather a combination of many. These predictors can be used by similar programs to modify intervention strategies based on a child's demographic background.

Future research of possible predictors could enhance obesity-combating programs by tailoring interventions to better help each child achieve a healthy weight and maintain a healthy lifestyle. Exploring innovative strategies that are culturally relevant and age appropriate may increase success. As the Strong4Life program, and other multidisciplinary child obesity programs grow, more research will be needed to determine predictors. Further exploration into demographic differences among those children who are overweight and obese would likely improve programs such as Strong4Life across the nation.

REFERENCES

About BMI for children and teens, Centers for Disease Control and Prevention (2014). *Healthy Weight – it's not a diet, it's a lifestyle.* Retrieved from http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Anderson, S. E. & Whitaker, R. C. (2009). Prevalence of obesity among U.S. preschool children in different racial and ethnic groups. Archives of Pediatrics and Adolescent Medicine, 163(4), 344-348.

Adolescent and School Health, Centers for Disease Control and Prevention (2014). *Childhood Obesity Facts.* Retrieved from http://www.cdc.gov/healthyyouth/obesity/facts.htm

Buser, M. C., Murray, H. E., & Scinicariello, F. (2014). Age and sex differences in childhood and adulthood obesity association with phthalates: analyses of NHANES 2007-2010. International Journal Of Hygiene And Environmental Health, 217(6), 687-694. doi:10.1016/j.ijheh.2014.02.005

Buttitta, M., Iliescu, C., Rousseau, A., & Guerrien, A. (2014). Quality of life in overweight and obese children and adolescents: a literature review. Quality Of Life Research, 23(4), 1117-1139.

Champion, S. L., Rumbold, A. R., Steele, E. J., Giles, L. C., Davies, M. J., & Moore, V. M. (2012). Parental work schedules and child overweight and obesity. *International Journal Of Obesity*, *36*(4), 573. doi:10.1038/ijo.2011.252

Chang, V. W. & Lauderdale, D. S. (2005). Income disparities in body mass index and obesity in the United States, 1971-2002. Archives of Internal Medicine, 165, 2122-2128.

Chia, Y. F. (2013). Dollars and pounds: the impact of family income on childhood weight. Applied Economics, 45(14), 1931-1941. doi:10.1080/00036846.2011.641929

Cockrell Skinner, A., Perrin, E. M., & Steiner, M. J. (2010). Healthy for now? A cross-sectional study of the comorbidities in obese preschool children in the United States. Clinical Pediatrics, 49(7), 648-655. doi:10.1177/0009922810362098

Cunningham, S. A., Kramer, M. R., & Narayan, K. V. (2014). Incidence of childhood obesity in the United States. New England Journal Of Medicine, 370(5), 403-411. doi:10.1056/NEJMoa1309753

Dodd, A. H., Briefel, R., Cabili, C., Wilson, A., & Crepinsek, M. K. (2013). Disparities in consumption of sugar-sweetened and other beverages by race/ethnicity and obesity status among United States schoolchildren. *Journal Of Nutrition Education And Behavior*, *45*(3), 240-249.

Doustmohammadian, A., Abdollahi, M., Bondarianzadeh, D., Houshiarrad, A., & Abtahi, M. (2012). Parental determinants of overweight and obesity in Iranian adolescents: a national study. Iranian Journal Of Pediatrics, 22(1), 35-42.

Dunn, R. A., Sharkey, J. R., & Horel, S. (2012). The effect of fast-food availability on fast-food consumption and obesity among rural residents: an analysis by race/ethnicity. *Economics And Human Biology*, *10*(1), 1-13.

Economos, C. D., Bakun, P. J., Herzog, J. B., Dolan, P. R., Lynskey, V. M., Markow, D., & ... Nelson, M. E. (2014). Children's perceptions of weight, obesity, nutrition, physical activity and related health and socio-behavioural factors. Public Health Nutrition, 17(1), 170-178. doi:10.1017/S136898001200479X

Eagle, T. F., Sheetz, A., Gurm, R., Woodward, A. C., Kline-Rogers, E., Leibowitz, R., & ... Eagle, K. A. (2012). Understanding childhood obesity in America: linkages between household income, community resources, and children's behaviors. American Heart Journal, 163(5), 836-843. doi:10.1016/j.ahj.2012.02.025

Farajian, P., Panagiotakos, D. B., Risvas, G., Karasouli, K., Bountziouka, V., Voutzourakis, N., & Zampelas, A. (2013). Socio-economic and demographic determinants of childhood obesity prevalence in Greece: the GRECO (Greek Childhood Obesity) study. Public Health Nutrition, 16(2), 240-247. doi:10.1017/S1368980012002625

Fedele, D. A., Janicke, D. M., Crystal, S. L., and Abu-Hasan, M. (2014). An examination of comorbid asthma and obesity: assessing differences in physical activity, sleep duration, health-related quality of life and parental distress. Journal of Asthma. 51(3): 275–281. DOI: 10.3109/02770903.2013.873807

Freedman, D.S., Khan, L.K., Serdula, M.K., Ogden, C.L., & Dietz, W.H. (2006). Racial and ethnic differences in secular trends for childhood BMI, weight, and height. *Obesity Research, 14*(2), 301-308. Doi:10.1038/oby.2006.39

Gigante, D. P., Victora, C. G., Matijasevich, A., Horta, B. L., & Barros, F. C. (2013). Association of family income with BMI from childhood to adult life: a birth

cohort study. Public Health Nutrition, 16(2), 233-239. doi:10.1017/S1368980012003229

Golay, A., Fossati, M., Delétraz, M., Luzy, F. d., Howles, M. N., & Ybarra, J. (2003). Multidisciplinary approach to obesity treatment. Diabetes, Obesity And Metabolism, 5(5), 274-279

Gorin, A. A., Wiley, J., Ohannessian, C. M., Hernandez, D., Grant, A., & Cloutier, M. M. (2014). Steps to Growing Up Healthy: a pediatric primary care based obesity prevention program for young children. BMC Public Health, 14(72), (23 January 2014).

Gundersen, C., Mahatmya, D., Garasky, S., & Lohman, B. (2011). Linking psychosocial stressors and childhood obesity. Obesity Reviews: An Official Journal Of The International Association For The Study Of Obesity, 12(5), e54-e63. doi:10.1111/j.1467-789X.2010.00813.x

Hasson, R. E., Adam, T. C., Pearson, J., Davis, J. N., Spruijt-Metz, D., & Goran, M. I. (2013). Sociocultural and socioeconomic influences on type 2 diabetes risk in overweight/obese African-American and Latino-American children and adolescents. Journal Of Obesity, 2013Article ID 512914.

Hebestreit, A., Börnhorst, C., Barba, G., Siani, A., Huybrechts, I., Tognon, G., & ... Krogh, V. (2014). Associations between energy intake, daily food intake and energy density of foods and BMI z-score in 2-9-year-old European children. European Journal Of Nutrition, 53(2), 673-681.

Huffman, F. G., Kanikireddy, S., & Patel, M. (2010). Parenthood - a contributing factor to childhood obesity. International Journal Of Environmental Research And Public Health, 7(7), 2800-2810. doi:10.3390/ijerph7072800

Jo, Y. (2014). What money can buy: family income and childhood obesity. Economics And Human Biology, 151-12.

Kavita, H. S., & Ashok, N. C. (2013). Prevalence of obesity among primary school children and its association with parental obesity and socio-economic status. Medica Innovatica, 2(1), 27-32.

Kim, E. J., Kwon, H. J., Ha, M., Lim, M. H., Oh, S. Y., Kim, J. H., & ... Paik, K. C. (2014). Relationship among attention-deficit hyperactivity disorder, dietary behaviours and obesity. Child: Care, Health And Development, 40(5), 698-705. doi:10.1111/cch.12129

Kipke, M. D., Iverson, E., Moore, D., Booker, C., Ruelas, V., Peters, A. L., & Kaufman, F. (2007). Food and park environments: neighborhood-level risks for childhood obesity in East Los Angeles. *Journal Of Adolescent Health*, *40*(4), 325-333. doi:10.1016/j.jadohealth.2006.10.021

Korczak, D. J., Lipman, E., Morrison, K., & Szatmari, P. (2013). Are children and adolescents with psychiatric illness at risk for increased future body weight? A systematic review. Developmental Medicine & Child Neurology, 55(11), 980-987. doi:10.1111/dmcn.12168

Larson, N. I., Wall, M. M., Story, M. T., & Neumark-Sztainer, D. R. (2013). Home/family, peer, school, and neighborhood correlates of obesity in adolescents. Obesity, 21(9), 1858-1869.

MacCann, C., & Roberts, R. D. (2013). Just as smart but not as successful: obese students obtain lower school grades but equivalent test scores to nonobese students. *International Journal Of Obesity*, *37*(1), 40-46. doi:10.1038/ijo.2012.47

May, A. L., Pan, L. P., Sherry, B., Blanck, H. M., Galuska, D., Dalenius, K., & ... Grummer-Strawn, L. M. (2013). Vital signs: obesity among low-income, preschool-aged children - United States, 2008-2011. Morbidity And Mortality Weekly Report, 62(31), 629-634.

Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. Journal of the American Medical Association 2014;311(8):806-814

Pakhale, S., Baron, J., Dent, R., Vandemheen, K., and Aaron, S. D. (2015). Effects of weight loss on airway responsiveness in obese asthmatics: Does weight loss lead to reversibility of asthma? Chest. doi:10.1378/chest.14-3105

Pan, L., Sherry, B., Park, S., & Blanck, H. M. (2013). The association of obesity and school absenteeism attributed to illness or injury among adolescents in the United States, 2009. Journal Of Adolescent Health, 52(1), 64-69. doi:10.1016/j.jadohealth.2012.04.003

Pinto Guedes D, Rocha G, Martins Silva A, Mourão Carvalhal I, Coelho E. Effects of social and environmental determinants on overweight and obesity among Brazilian schoolchildren from a developing region. Pan American Journal Of Public Health [serial online]. October 2011;30(4):295-302. Available from: Academic Search Complete, Ipswich, MA. Accessed March 26, 2015.

Porwal, V., Verma, A., Inamdar, S., & Bajpai, P. (2013). A STUDY ON OBESITY IN RELATION TO SOCIO - ECONOMIC STATUS IN MEN AND WOMEN. National Journal Of Community Medicine, 4(1), 149-152.

Revah-Levy, A., Speranza, M., Barry, C., Hassler, C., Gasquet, I., Moro, M. R., & Falissard, B. (2011). Association between Body Mass Index and depression: the "fat and jolly" hypothesis for adolescents girls. BMC Public Health, 11(649), (16 August 2011).

Roberts, R. E., & Duong, H. T. (2013). Obese youths are not more likely to become depressed, but depressed youths are more likely to become obese. Psychological Medicine, 43(10), 2143-2151. doi:10.1017/S0033291712002991

Rojo, L., Ruiz, E., Domínguez, J. A., Calaf, M., & Livianos, L. (2006). Comorbidity between obesity and attention deficit/hyperactivity disorder: population study with 13-15-year-olds. International Journal Of Eating Disorders, 39(6), 519-522. doi:10.1002/eat.20284

Rossen, L. M. (2014). Neighbourhood economic deprivation explains racial/ethnic disparities in overweight and obesity among children and adolescents in the USA. *Journal Of Epidemiology & Community Health*, *68*(2), 123-129. doi:10.1136/jech-2012-202245

Sherry, B., Blanck, H. M., Galuska, D. A., Pan, L., Dietz, W. H., & Balluz, L. (2010). Vital signs: state-specific obesity prevalence among adults - United States, 2009. *Morbidity And Mortality Weekly Report*, *59*(30), 951-955.

Shugart, H. A. (2013). Weight of tradition: culture as a rationale for obesity in contemporary U.S. news coverage. *Obesity Reviews*, *14*(9), 736-744. doi:10.1111/obr.12043

Svensson, V., Jacobsson, J. A., Fredriksson, R., Danielsson, P., Sobko, T., Schiöth, H. B., & Marcus, C. (2011). Associations between severity of obesity in childhood and adolescence, obesity onset and parental BMI: a longitudinal cohort study. International Journal Of Obesity (2005), 35(1), 46-52. doi:10.1038/ijo.2010.189

Sylvetsky, A. C., Hennink, M., Comeau, D., Welsh, J. A., Hardy, T., Matzigkeit, L., & ... Vos, M. B. (2013). Youth understanding of healthy eating and obesity: a focus group study. Journal Of Obesity, 2013Article ID 670295.

Umawska, W. (2015). Adipose tissue content and distribution in children and adolescents with bronchial asthma. *Respiratory Medicine*, *109*(2), 200-207. doi:10.1016/j.rmed.2014.11.006

Vanhala, M. L., Keinanen-Kiukaanniemi, S. M., Kaikkonen, K. M., Laitinen, J. H., & Korpelainen, R. I. (2011). Factors associated with parental recognition of a child's overweight status - a cross sectional study. BMC Public Health, 11(665), (24 August 2011).

Vansant, G., Hulens, M., van der Borght, W., Demyttenaere, K., Lysens, R., & Muls, E. (1999). A multidisciplinary approach to the treatment of obesity. International Journal Of Obesity And Related Metabolic Disorders: Journal Of The International Association For The Study Of Obesity, 23 Suppl 165-68.

Walsh, S. M., Palmer, W., Welsh, J. A., & Vos, M. B. (2014). Challenges and successes of a multidisciplinary pediatric obesity treatment program. NCP - Nutrition In Clinical Practice, 29(6), 780-785.

Wang, Y. F., & Beydoun, M. A. (2007). The obesity epidemic in the United States - gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis. Epidemiologic Reviews, 29(1), 6-28. doi:10.1093/epirev/mxm007

Yannakoulia, M., Papanikolaou, K., Hatzopoulou, I., Efstathiou, E., Papoutsakis, C., & Dedoussis, G. V. (2008). Association between family divorce and children's BMI and meal patterns: The GENDAI Study. Obesity, 16(6), 1382-1387. doi:10.1038/oby.2008.70

Zapico, A. G., Benito, P. J., González-Gross, M., Peinado, A. B., Morencos, E., Romero, B., and ... Calderón, F. (2012). Nutrition and physical activity programs for obesity treatment (PRONAF study). Methodological approach of the project. *BMC Public Health*, 12(1100), (21 December 2012)