Abstract

Predicting and Addressing Factors of Childhood Obesity

Childhood obesity has been a rising concern in the United States for many years. The health risks associated with obesity especially beginning in childhood can be immense, with costs to the wellbeing and mental health of the individual, as well as overwhelming costs to the healthcare system. Addressing childhood obesity has been of great importance and need especially with the understanding that reducing the impact involves a multifaceted approach. Current research has looked at many points that impact children's obesity, this study sought to look at multiple variables within the same data set to determine what the factors that predict outcomes of childhood obesity are, so that methods to combat this crisis can be developed using this information. Data for this study came from the Child Mind Institute's Healthy Brain Network. Data points evaluated included demographics relating to the child and family situation, sleep duration, food availability, Adverse Childhood Experiences (ACEs) and the diagnoses of the children in the data set. After the predictive factors of childhood obesity are discussed, the implication for social work practice, policy and education are examined.

Predicting and Addressing Factors of Childhood Obesity

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DISSERTATION

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Dedication

I would like to dedicate this work to the important people in my life without whom it would not have been possible for me to achieve my dream. My mother, Adele Sebbag, who passed this year, who constantly asked me for updates on when I would be finishing my doctorate and whose fierce pride in her children taught me that I can do anything I set my mind to. My sister Elana, whose unsparing and sometimes brutal but loving questioning and shoving me toward the finish line got me here, and my sister Mimi who listened to my endless complaints about both of them. Thank you, I could never have done this without you. Thank you for teaching me nothing is out of my reach.

To my children, Tara, Zachy and Max, I did this, you can do anything you set your mind to and there are no limits to your dreams.

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Chapter I: Dissertation Overview

Obesity is a significant challenge affecting many millions of people. Already considered a public health crisis in America, the incidence of obesity is currently worsening rather than improving (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018). Obesity leads to serious health problems, both physical and mental (Brady, 2017). Preventing childhood obesity is a key goal in social work because childhood obesity frequently leads to adult obesity, which in turn leads to serious health problems (Grossman et al., 2018). Hence, this study examined obesity in children and the factors that predict it. This was a quantitative non-experimental cross-sectional study as defined by Johnson (2001) and was used to build a profile of risk factors for childhood obesity, as well as potentially protective factors. Data was collected from the parents of children ages 5-19 drawn from existing, historical data collected for the Healthy Brain Network (Bumpass & Sweet, 2020). The data was analyzed by the use of chi squares and multiple logistic regression (Robinson, Tomek, & Schumacker, 2013). The NASW Codes of Ethics relevant to this study were the commitment to competence, in so far as understanding the predictors and causes of childhood obesity in an attempt to impact change and improvement and promoting social welfare in the ability to change the patterns of childhood obesity and its negative life impacts.

Chapter II: The Study Problem

The problem of interest was obesity in children and the factors that predict it. Obesity is a relatively modern problem. For most of human history, procuring sufficient nutrition, rather than the adverse affects of obtaining two much nourishment has been the most pertinent food-related concern (Medina-Albaladejo & Calatayud, 2020). Today, nutritional insufficiency remains the condition in many poorer nations (World Health Organization, 2018). However, in more developed economies such as the United States, Japan, or Western Europe, resource scarcity has been replaced by excess (Santos, Lira, & Silva, 2017). In these nations, overeating and obesity are an increasing problem, especially with the rise and spread of high-calorie, low-expense fast food (Juul, Martinez-Steele, Parekh, Monteiro, & Chang, 2018). This has given rise to an epidemic of obesity - one that often begins in childhood (Sutaria, Devakumar, Yasuda, Das, & Saxena, 2019). Childhood obesity may be related to both social and genetic factors, making it more of a problem as obesity becomes more widespread and also a self-perpetuating problem.

Despite some claims to the contrary, recent research indicates that the epidemic of obesity continues to worsen, in both adults and children (Skinner et al., 2018). Obesity is a difficult condition to fully diagnose in children as most existing techniques of measuring and defining the disease are defined primarily for adults (Aggarwal & Jain, 2018). Nonetheless, obesity in children is no less a grave problem and has serious consequences, which are correlated with both mental health disorders such as depression (Sutaria et al., 2019) and physical health issues such as hypertension (Brady, 2017). Furthermore, childhood obesity is correlated with adult obesity (Grossman et al., 2018), which is in turn linked to increased risks of serious health conditions such as diabetes (Dai & Jiang, 2019) and cancer (Deng, Lyon, Bergin, Caligiuri, &

Hsueh, 2016). Accordingly, identifying the predictors of obesity in children and how they may be addressed to help stem the epidemic is a valuable research priority.

The factors predicting obesity are complicated. For example, though some have attributed obesity to urbanization (Aggarwal & Jain, 2018), children in rural areas are no less likely to become obese and at risk for severe obesity (Ogden et al., 2018). The role of factors such as socioeconomic status is also complicated; although affluence exerts some protective effect against obesity, this effect differs along racial lines (Assari, 2018). Given the complexities that surround obesity and its predictors, more research is needed into the role of factors such as sleep (Hanlon, Dumin, & Pannain, 2019), the complexities of race as a moderating factor (Assari, 2018), and, more generally, into multifaceted approaches to obesity prevention (Lee & Yoon, 2018).

Chapter III: Literature Review

Introduction

This quantitative non-experimental correlational research aimed to evaluate childhood obesity and the factors that predict it. Research indicates that the epidemic of obesity continues to worsen, in both adults and children (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018). Medical researchers argue that it is difficult to fully diagnose obesity among children because the majority of methods used in measuring and defining the condition is based on studies on adults (Aggarwal & Jain, 2018). However, pediatric obesity has a similar impact as that of adults because it leads to serious health issues which include mental health disorders such as depression (Sutaria, Devakumar, Yasuda, Das, & Saxena, 2019). Furthermore, according to Brady (2017), depression in children also leads to physical health issues, which include hypertension. According to Grossman et al. (2018), children's obesity is correlated to adult obesity. It is also connected to increased health risks that are common among adults, which include diabetes and cancer (Dai & Jiang, 2019). Therefore, according to Deng, Lyon, Bergin, Caligiuri, and Hsueh, (2016), identification of the predictors of pediatric obesity and mitigation is critical in eliminating the disease. However, according to Aggarwal and Jain, (2018), predictors of obesity in children are complex as some of them are attributed to an urban lifestyle. The reason is that rural children are less predisposed to obesity problems compared to their urban counterparts. This means that children in rural areas have less risk for severe obesity. According to Ogden et al. (2018), factors such as social-economic status forms a positive predictor. However, the effect of social-economic status and obesity in children have a varied impact among different ethnic and racial groups. As Assari (2018) puts it, predictors of obesity are highly complex and individualization of cases is essential for comprehensive mitigation

measures. Hanlon, Dumin, and Pannain, (2019), find that the complexities surrounding obesity among children including race and sleep are among the moderating factors, which indicate the need for a multifaceted approach to curbing pediatric obesity. The precise problem of this study was to determine various predictors of childhood obesity influence the treatment outcomes of this disorder.

The databases and search engines that were used to compose the literature review encompass Google Scholar, Global Health, ProQuest, EBSCO, SAGE, Nexus Lexus, and Medline. These are reliable sources and yielded a wide variety of pertinent articles to the current study (Gusenbauer, 2019). The keywords, terms, and phrases that were implemented while searching for the articles included "childhood obesity," "childhood obesity treatments," "the relationship between demographic factors and outcomes of childhood obesity," "the relationship between parental demographic factors and childhood obesity," "the relationship between children's adverse childhood experiences and outcomes of childhood obesity," "the relationship between children's bedtimes and outcomes of childhood obesity," and "how moderation impact of race or ethnicity affect outcomes of childhood obesity," and "BMI." Eighty-five percent of the incorporated articles were current, meaning they were published between 2017 and to date, while the remaining 15 percent were published prior to 2017. The use of more current articles enabled the investigator to evaluate closely how the predictors of childhood obesity have evolved in recent times. The Boolean Combinations of search words and phrases which were implemented include AND, OR, and NOT. These operators are important because they enabled the investigator to produce different keyword strings for the search of the pertinent articles (Grover & Basu, 2017). An example of how these Boolean operators were executed is "demographic factors as predictors of childhood obesity" AND "sociological factors as predictors of childhood

obesity," "demographic factors as predictors of childhood obesity" OR "sociological factors as predictors of childhood obesity."

The literature review aimed to give a basis of knowledge on the subject of the current study. It was essential to undertake this literature review to determine fields of previous scholarship to avert any duplication as well as to give credit to other investigators. The literature review further was aimed at determining the gaps, conflicts, open questions, or inconstancies in the previous studies. For the current research, the gap that was determined was based on how various predictors of childhood obesity impact the treatment outcomes of this illness. The literature review was structured into sections and subsections centered on the key concepts, ideas, and research questions of the present study.

Childhood Obesity and its Measurements

Childhood obesity is a critical health issue which impacts kids and teenagers. Childhood obesity is especially serious since it subjects kids and adolescents to medical issues that were once regarded as strictly adult related issues, such as high cholesterol, high blood pressure, and diabetes (Petersen et al., 2019). Petersen et al. (2019) argue that obese children and teenagers are considered to have a weight that is above the average for age and height. The body mass index (BMI) is a useful metric that offers a measure of weight relative to height and is a frequent tool used in determining obesity and overweight. Adults are considered to be obese when they attain a BMI score of above 30, but in kids and teenagers under 18 years, there is still confusion concerning the determination of their obesity scores (Lee et al., 2019). Nonetheless, the common method is a weight to height ratio of 120% or greater than the 95th percentile for age and sex (Lee et al., 2019). The Centers for Disease Control (CDC) determined that a Body Mass Index of 25- 29 is Overweight, 30-35 is Obese, and 35 or greater in adults is deemed to be Morbid or

Extreme Obesity. An alternate form of measurement is the Waist to Height Ratio (WHtR) (Latifah & Dewi, 2020). In this measure, one's waist measurement in inches divided by their height in inches. The value found is used as a determinant of health risks associated with obesity. For those under age 40, a value of 0.50 or greater is deemed critical, for those 40-50 it is 0.50-0.60 and for those over 60, a WHtR of .60 or greater is deemed critical. Another related metric of weight is the Fat Mass Index (FMI), which is computed by dividing a person's weight in kilograms by his or her height in meters (Latifah and Dewi, 2020). FMI considers the fat segment of the overall body weight.

Sanyaolu et al. (2019) found that childhood obesity in the U.S. has reached a pandemic stage. In the last 30 years, the occurrence of childhood obesity in the country has tripled in teenagers and doubled among children. A survey on the National Health and Nutrition Examination depicted that between 2015 and 2016, 18 percent of U.S. kids and adolescents were obese. As of 2019, approximately 17 percent of children and teenagers in the United States were reported to be obese (Sanyaolu et al., 2019). Sanyaolu et al. (2019) also realized that obesity can influence all aspects of the health of kids and teenagers, including their general bodily well-being as well as their cardiovascular and psychological health. The high prevalence of childhood obesity in the United States has further been found to be closely linked to various comorbidity concerns like depression, inadequate self-esteem, sleep apnea, diabetes, hyperlipidemia, and hypertension (Anderson, Butcher, & Schanzenbach, 2019). The rise in body fat further subjects kids and teenagers to increased risk of many types of cancers such as pancreatic, kidney, esophageal, colon, and breast cancers (Nehus & Mitsnefes, 2019). Further, obese children and adolescents who are followed-up to adulthood are more vulnerable to digestive and cardiovascular illnesses.

Location and Mapping for Fresh Food Scarcity

Although food insecurity and especially fresh food have often been deemed counter-intuitive, their co-existence and correlation have been associated with urban environments. As indicated in a study by Kaiser et al (2017), the persistence of fresh food insecurities in the absence of hunger situations contributes at least 22% towards child obesity. Whereas such findings are critical to fostering in-depth insight into the child obesity phenomenon, researchers have also posited that it is fundamental to map out specific locations in which the phenomenon has been rampant. In a study conducted by Olfert et al (2019), the researchers attempted to deploy geo-mapping technologies to evaluate the correlation between child obesity and fresh food scarcity. According to the study, places like Detroit, Michigan exhibited comparatively increasing cases relative to other states like San Francisco, CA, Los Angeles, CA, and and Denver, Colorado. Commenting on the location-based disparities, Olfert et al (2019) argued that Michigan exhibited heightened child obesity levels compared to the other states because public health initiatives have failed to focus on increasing the availability of fresh foods. Such an assertion strongly suggests that some locations have turned into risky zip codes when it comes to child obesity.

In a similar study, D'Alonzo et al. (2020) deployed Geographic Information System (GIS), which is an emerging technology that can be used in the field of public health to organize, conceptualize, gather, and manage location-based data. Plotting the acquired data on child obesity in relation to fresh food availability across US states, researchers were able to map out “hot spot” zip codes. Particularly, the study incorporated the use of Mapline software, which led to the identification of relationships between fresh food shortages in specific US states and the prevalence of child obesity. Unlike the previous study that indicated a positive relationship

between the availability of fresh foods and child obesity, this study generated results that presented a contradicting point of view. D'Alonzo et al (2020) discovered that the zip codes 48228 and 48227 (both in Detroit) depicted high and increasing rates of child obesity despite the existence of sufficient grocery stores. In an effort to explain the outcome of the study, Kaiser et al (2017) pointed out that geographical locations and the availability of fresh foods have little to do with child obesity compared to the food options selected by parents.

Childhood Obesity and Trauma

Trauma is undoubtedly a critical factor for children who begin to battle weight problems during their early lives. Explaining the correlation between the two, Witt et al (2017) opined that obese children are more likely to develop negative body images that eventually culminate in eating disorders. However, the association is not merely related to unhealthy dieting. According to Belli et al (2019), trauma is more of a cause than it is an outcome of obesity. This suggests that childhood experiences can cause children to begin experiencing weight issues. Affirming this point of view, research conducted by Dye (2018) posited that children that have experienced abuse are four times more likely to develop obesity compared to those that have not suffered any form of abuse. Further, Witt et al (2017) observed that over 2 million cases of childhood obesity have been associated with traumatizing experiences that involved sexual, verbal, and physical abuse. Despite the fact that early childhood trauma is not uncommon, few researchers have attempted to explain how traumatizing experiences cause obesity among children. Making a reasonable attempt to explain, Dye (2018) argued that the inability of children to deal with the deep emotional scars associated with trauma causes them to become obsessed with food while attempting to assuage the pain. As such, the correlation between childhood obesity and trauma is

embodied in the consistent pursuit of psychological and emotional comfort, which they often find in food.

Preventions and Treatments of Childhood Obesity

Regardless of the cause of obesity among children, lifestyle changes are the primary means to achieve weight loss. Gold et al. (2020) observes that, typically, obese people have challenges in adopting low-calorie and low-fat nutrition, and those who lose weight through such lifestyle changes have trouble maintaining the weight loss long-term. The Optimal Wellness for Life (OWL) initiative adopts a technique recognized as low-glycemic nutrition, which integrates diets that promote slow digestion and includes slowly digested carbohydrates (Larson, 2020). Another tool in preventing or treating obesity and maintaining optimal weight, is engaging the child in regular physical exercises (Hughes et al., 2019). Parents and guardians ought to keep their children physically active and engage them in activities that are suitable for their developmental capability and level. The World Health Organization (WHO), as well as the National Institute of Health (NIH), recommends adopting a healthy lifestyle with a reduction in caloric intake in combination with physical activity to prevent overweight and obesity (Nittari et al., 2019). The algorithm for weight loss remains essentially the same for all interventions. Since weight gain occurs from the consumption of more calories than expended, the reverse is true for weight loss. A person must consume fewer calories than needed for an extended period of time to lose weight (Wootan et al., 2019). Some dietary plans specify the amount, the type or the time calories should be consumed, but all utilize the same core principles.

Current treatments for obesity include pharmacological, behavioral/environmental, a combination of those, and surgical options. The most commonly recommended strategy is dietary modification combined with physical activity (Carrasco-Pozo et al., 2019).

Unfortunately, most people who attempt weight loss through this intervention will lose about 10% of their total body weight, and pharmacological options yield about the same success rate. Jebeile et al. (2019) found out that dieting as a self-reported activity to maintain an ideal weight is linked with an increased risk of the development of eating illness and disordered eating. While the health benefits of weight loss begin at 10% of total weight, the benefits are quite different when looking at 10% of 220 pounds or 300 pounds (Forman et al., 2019). Even when behavioral interventions to decrease calorie intake and increase physical activity are combined with psychotherapy or support with Cognitive Behavioral Therapy, poor adherence usually leads to weight gain. However, adding psychotherapy and/or behavioral therapy results in better outcomes than nutritional counseling alone.

Food and Drug Administration (FDA) approved methods for pharmacological weight loss which include the medications sibutramine, orlistat, and phentermine, can sometimes lead to cardiac disorders (Daneschvar et al., 2016). Most of these medications are consumed orally. Some of these FDA-approved drugs carry an increased risk of stroke (Khera et al., 2018). Though the specific functional mechanism for each of these medications vary, all carry some risksand generally do not work for long-term or for enough weight loss to outweigh the risk- . There are also off-label uses of other medications like topiramate and Glucophage which have resulted in weight loss in some patients, as well as Byeda, a diabetic medication (Jagim et al., 2020). These too, are not suitable for long-term, sustained weight loss. The rates of those who maintain weight loss through either behavioral or pharmacological means are abysmal. Nearly 95% of extremely obese people who lose weight with pharmacological or behavioral methods regain all of the lost weight within 2-5 years (Agnihotri et al., 2018). A medication is considered effective if there is a statistically substantial reduction in body mass of greater than or equal to 5

percent above the placebo effect or a minimum of 35 percent of patients reduce their body mass (Chatham-Stephens et al., 2017).

In an experimental study, Moore et al. (2019) found out that a pharmacological intervention for obesity can only be justified when integrated with nutrition and lifestyle transformations. The effectiveness of all agents relies on the patient's compliance with behavioral and dietary evolutions. Moore et al. (2019) further assert that pharmacological interventions should be undertaken under close and constant supervision from a medical expert and when the intervention is discontinued, the patient might gain the weight back. The risks related to the adoption of medication should be further evaluated considering the persistence of obesity. Pharmacological intervention is indicated when the BMI is more than 30 kg/m^2 or when morbidities are linked to being overweight when behavioral transformations, physical activities, and nutrition have provided ineffective (Moore et al., 2019). Moore et al. (2019) however note that pharmacological interventions are not recommended for children because there is insufficient analysis of their side effects. In a different research, Vitiello and Ordóñez (2016) found out that pharmacological anti-depressants have minimal therapeutic impact. The study further notes that fluoxetine results in rapid and greater weight loss as compared to psychotherapy among teenagers. Based on the increased reaction to non-precise medications and the security issues related to their use, antidepressants should be administered carefully in young people and should be restricted to patients with moderate to critical depression for whom psychosocial mediations are either not viable or are inefficient (Vitiello & Ordóñez, 2016).

Albaugh (2018) reports that for the past few years, bariatric surgery has proved to be beneficial in addressing obesity and reducing the concomitant morbidity and mortality risks associated with being obese. Bariatric surgery is a set of approaches encompassing weight-loss

and gastric bypass surgeries (Albaugh, 2018). The surgery entails making transformations to the patient's digestive system to aid them in losing a considerable amount of weight. Bariatric surgery is conducted when food and physical practices have not functioned on the patient's body or when the person has critical medical weight issues. Some processes of bariatric surgery restrict how much food and drink the person can consume in the future. Although bariatric surgery has proved significant in addressing overweight and obesity conditions, it poses critical dangers and side effects to the patient, just like the other two categories of obesity intervention (Albaugh, 2018). Another key aspect of bariatric surgery intervention that should be considered is that the patient has to make long-term alterations to their nutrition and get frequent physical practices to aid them to effectuate the surgery (Albaugh, 2018). Akhter et al.,(2019) note that bariatric surgery is conducted to aid a person to lose extra weight as well as minimize their threats of possible chronic weight-linked medical issues, including type 2 diabetes, sleep apnea, non-alcoholic fatty liver illness, high blood pressure, heart disorder, and stroke. According to Akhter et al. (2019), two key qualifications make a patient eligible for bariatric surgery. The first qualifying factor is that the patient’s BMI be 40 or more while the second is that the person’s BMI be 35 to 39.9 AND he or she has severe weight-linked medical issues such as type 2 diabetes, sleep apnea, non-alcoholic fatty liver illness, high blood pressure, heart disorder, and stroke. Armstrong, Bolling, Michalsky, and Reichard (2019) argue that bariatric surgery is not suitable for every person who is critically overweight or obese. A person should meet particular health guidelines to be eligible for bariatric surgery for weight loss and they should further have prolonged screening procedures to ensure that they qualify.

Predictors of Childhood Obesity

Behavioral and Environmental Predictors. In studying the effectiveness of behavioral and environmental interventions of childhood obesity, it is important to evaluate various predictors of this disorder. In a cross-sectional and longitudinal study, Ochoa and Berge (2017) found out that the five environmental factors that are linked to childhood obesity include sleep duration, food security/socioeconomic status, sedentary behavior/physical activity, screen time, and parental impacts. In another study, Felso et al. (2017) determined that sleep duration is a key predictor of weight gain in kids and adolescents, but the causal illustrative mechanisms are still undefined. Felso et al. (2017) only examined the association between a short sleep period and the progression of unhealthy dietary trends, sedentarism, and insulin resistance. Nonetheless, the function of other mediators like leptin levels, transformation in ghrelin, screen time, and physical activity, remained indeterminate. Using a weighted multivariate logistic regression technique, Wang et al. (2018) found a u-shaped association between sleep period and obesity threat among girls, with the minimal risk among girls who slept for only 8 hours, but an identical threat was not present among boys. From this study, Wang et al. (2018) concluded that a sufficient sleep period is a significant component of the prevention of obesity among teenagers. Li et al. (2017) further argued that community medical determinations, which stimulate kids to have an adequate sleep period are essential in eradicating obesity.

Hayes et al. (2019) determined that family-centered behavioral weight loss treatment (FBT) for obesity among children aids households to establish plans to stimulate ideal options in their homes and other settings. The regression models depicted that minimizing electronics and red foods in the respondents' homes during FBT has positive impacts on kid weight and weight-linked outcomes. Nonetheless, no neighborhood diets or recreation environment components in

this study were substantially associated with results, even though having a wider density of civic recreation spaces was linked with increases in bodily activities of the children (Hayes et al., 2019). The modification of the home setting, specifically the reduction of electronics and red foods were then found to be significant for the efficiency of FBT. Staiano et al. (2017) further determined that family-oriented behavioral interventions are efficient techniques to enhance the management of children's weight via healthy nutrition and physical activities. Nonetheless, such initiatives usually have low attendance and high attrition (Staiano et al., 2017). Even among children, obstacles such as exercise options, the supposed expense of healthy nutrition, frustration from previous ineffective weight-loss trials, and lack of time hinder the successful implementation of viable and sustainable approaches for the intervention of childhood obesity.

Campbell (2015) noted that the ideal predictor of childhood obesity is the balance of energy between dietary consumption and activity, where the latter is impacted by sedentary behavior and physical activity. These behavioral aspects are thus usual targets for therapeutic and preventive mediations of childhood obesity. Nonetheless, diet and physical activities are downstream components, which are impacted by numerous upstream factors. The balance of energy needed to keep a suitable fat mass fluctuates among persons because of the dissimilarities in lipostatic set point and metabolism, which in turn impact activity preferences and appetite. Nonetheless, Campbell (2015) noted that lipostatic set point and metabolism, which to some level are impacted by biological predisposition, could be changed through gene-environment associations.

The social, physical, and family contexts impact childhood obesity risks in two ways. These are indirect influences like anxiety and via direct impact on kids’ diet and physical activity (Beets et al., 2019). Higher self-esteem, parental nurturing, and parental education minimize the

obesity threat among girls (Beets et al., 2019). Karachaliou et al. (2020) further note that the use of electronic media, shared household meals, and family food context are three key environmental predictors that broadly impact childhood obesity via behavioral ways. Mothers mainly create the family food setting and are typically the role models for eating patterns with evidence of a direct relationship between eating behaviors of methods and those of kids (Tylavsky et al., 2020; Morales-Camacho et al., 2019). Food preferences and control of appetite are formulated early in life, and there is a strong association between parental obesity and their kids' weight statuses (Lei et al., 2019).

Qiao et al. (2020) reported that community setting is progressively obesogenic, with more use of televised and electronic types of entertainment, automobiles, and convenience diets, resulting in more sedentary lifestyles and increased consumption of calorie-dense diets, Nutrition selections have been depicted to be impacted by closeness to farmers markets, groceries, supermarkets, and fast-food dealers. Physical activities in the community environment setting are affected by neighborhood walkability, transit obtainability, and social recreation facilities (Kelly et al., 2019; Wexler et al., 2020). Further, reduced levels of childhood obesity are prevalent in regions where the natural setting has a high recreational value. Wu et al. (2019) found out that community settings are primary environmental aspects that impact risk behaviors and childhood obesity, but there is a significant gap in comprehending how kids interface with the obesogenic setting.

In an experimental study involving participants in educational and residential contexts, Bennett et al. (2017) found out that children and adolescents with developmental and psychological inabilities in the U.S. are more vulnerable to obesity as compared to youth and kids without incapacities. Nonetheless, the researchers determined that there is broad evidence

that supports the effectiveness of family-oriented interventions of childhood obesity, encompassing behavior modification, physical activity, and nutrition. All family-centered mediations were provided in-person, but additional progressing use of telenursing was proposed for implementation to stimulate access to interventions among more young people are households (Bennett et al., 2017). This study suggests that prevailing medical conditions inhibit the effectiveness of intervention approaches for childhood obesity.

Prevailing research depicts that psychosocial anxiety is related to childhood obesity. Metrics of anxiety fluctuate from one assessment to another, but the outcomes are relatively steady. A remedy from stress to childhood obesity can comprise inflammatory techniques, encompassing the stimulation of the hypothalamic-pituitary-adrenal axis resulting in a rise in the levels of cortisol and then metabolic disturbance and increased appetite (Bahia et al., 2019; Campbell et al., 2019). Nutrition is then found to be an intervention of the association between anxiety and childhood obesity and lifestyle components can co-exist with ecological stressors. Schultz et al. (2018) determined that the link between environmental stressors with obesity among children encompasses parental anxiety, the efficiency of the communication between family members, maltreatment, and adverse life occasions. A direct relationship is evident between depression and obesity among adults and children. The association between depression and obesity can be caused by environmental etiologies, typical genetic or usual pathways through dysregulation of the hypothalamic-pituitary-adrenal configuration (Hagman et al., 2017; Kumar and Kelly, 2017). Further, mothers' emotional and psychological health is depicted to be directly linked to obesity among children. Kids belonging to mothers with depressive signs are more likely to be overweight or obese in the childhood and teenage stages of life (Grandone et al.,

2018). Commonly reported interventions obesity linked to psychological and emotional conditions in both parents and children is pharmacological Treatments.

Depression among children is considered a critical psychiatric illness, which is typically shown as a reduced mood combined with various other signs such as suicidal behavior, truancy, academic burnout, aggressive behavior, fidgeting, restlessness, irritability, and attention deficit (Du, 2013). Childhood depression can adversely impact a child's social associations, educational attainment, and other features of their routine lives. Du (2013) reported that interpersonal therapy (IPT) and cognitive-behavioral therapy (CBT) were efficient in the intervention of teenage depression, but mediation with anti-depressants, especially selective serotonin reuptake inhibitors (SSRIs), was the typical approach of addressing depression among kids and adolescents. The only FDA-sanctioned anti-obesity drug in the United States for addressing childhood and teenage depression is fluoxetine. Du (2013) suggests that fluoxetine is 41 percent to 61 percent efficient, has a remission degree of between 23 percent and 41 percent, and is regarded as the most effectual drug for persons with depression. Nonetheless, in the last ten years, the administration of pharmacological intervention to address depression among kids and adolescents has been a controversial issue due to increased cases of suicide threats among children and teens under these treatments (Du, 2013). Due to these cases, the FDA now necessitates the adoption of black box cautions on SSRI packages, warning the public about the rise in suicidal incidents of these drugs when consumed by kids and teenagers to treat depression.

Family Socioeconomic Status

Family socioeconomic status represents the broad socioeconomic conditions in which a child lives and is mainly measured categorically (Alexander et al., 2017). There is developing literature signifying that the relationship between socioeconomic status and the emergence of

childhood obesity is progressing rapidly. Using a multiple regression model, Rogers et al. (2015) found that low-income was directly and strongly correlated with the status of being overweight or obese among a population of students. The study also reported that the impact of race or ethnicity was not mathematically significant (Rogers et al., 2015). Low socioeconomic status is possibly one of the most significant risk factors for developing overweight and obesity as well as numerous other medical issues, encompassing cancer, diabetes and psychological health illnesses (Hemmingsson, 2018). In most developed nations including the United States, the prevalence of obesity in children has stabilized among higher socio-economic groups of people while in low socio-economic groups, the rate of childhood obesity has steadily increased. These findings suggest that the low socio-economic status presents a considerable risk for childhood obesity (Hemmingsson, 2018). As the income gap continues to widen, there is a high expectation that the negative impacts of low socioeconomic status will continue to contribute even more, especially in communities where the obesity rate is already high. Low socio-economic status is associated with certain emotional conditions which have significance in their impact on obesity, including feelings of guilt, shame, frustration, hopelessness, apathy, adverse emotions, negative belief systems, anxiety, insecurity, feeling disempowered, low self-worth and self-esteem and mental illnesses (Hemmingsson, 2018). Low socioeconomic status also makes a fit lifestyle less obtainable, which, in return, can stimulate unhealthy food choices and lack of involvement in physical exercise. Low socioeconomic status is further harmful since it leads to a lack of advanced education and critical reasoning, which in turn stimulates vulnerability to junk diet promotion.

Williams, Ge, Petroski, Kruse, McElroy and Koopman (2018) report that even though multiple parental and child factors are linked with obesity in kids, few models assess the

influences of socioeconomic status on childhood obesity. A low family socioeconomic status is linked with increased rates of obesity in children. Irrespective of the recent reduction in childhood obesity prevalence among United States low-income, preschool-aged kids, obesity levels are still high in low-income youth as compared to those in higher-income families (Williams et al., 2018). Various adaptable risk criteria for obesity in kids are linked to socio-economic status, including the amount of time spent watching television, the amount of sugared drinks consumed, the frequency of smoking and relative security in the neighborhood. Williams et al. (2018) further noted that demographic risk factors that are related to increased childhood weight, like birth weight and race, similarly vary with socio-economic status. Applying a logistic regression model, Williams et al. (2018) found that failure to eat dinner as a family, parental smoking, birth weight, race and socioeconomic status is linked with preschool-aged kids being overweight or obese. Psaltopoulou et al. (2017) found out that the risk aspects of obesity in children are substantially impacted by the socio-economic status of diverse families and communities. The outcomes of this experimental study revealed a strong correlation between low socioeconomic status and the prevalence of childhood obesity.

Lieb, Snow and DeBoer (2009) found out that pediatric obesity in the United States has reached critical levels. Although pediatric obesity impacts persons from all ethnic, racial and socio-economic settings, the prevalence was found to be higher among kids from households of lower socio-economic groups. The sources of this disparity in obesity prevalence by socioeconomic background were found to be multi-fold and also were accounted for by dissimilarities in the obtainability of healthier diets in homes and learning institutions, and availability of secure surroundings for physical exercises (Lieb et al., 2009).

Race/ethnicity

Isong, Rao, Bind, Avendano, Kawachi and Richmond (2018) determined that the rate of obesity in children is substantially higher among ethnic or racial minority kids in the U.S. Nonetheless, it is not evident whether obesity risk aspects in childhood and preschool explain these inequalities. The investigators examined the influences of socioeconomic factors and obesity in children from ethnic or racial disparities in kids. The outcomes revealed that the rate of risk factors fluctuated substantially by ethnicity or race (Isong et al., 2018). Black American children had the highest occurrence of risk factors whereas Asian children had the least prevalence. The socio-economic gaps among the kids from diverse ethnicities were found to be key contributors to the differences in the prevalence of childhood obesity among kids from diverse races. Early infancy risk factors such as television watching and the consumption of vegetables and fruits showed minimal contribution to the differences between weight statuses among children from different ethnicities (Isong et al., 2018). Disparities in rapid weight gain in children were found to contribute significantly to ethnic or racial differences in obesity in early babyhood (Isong et al., 2018). The suggestion was interventions executed early in life to address the identified risk factors that could aid in curbing the broadening ethnic/racial differences in early infancy obesity.

Cossrow and Falkner (2004) found that there is a disproportionate increase in the occurrence of obesity and overweight conditions among Hispanic Americans and African Americans when compared to other races in the United States. Obesity is a key contributor to insulin-resistant syndrome (IRS), a condition with numerous metabolic irregularities that is a predictor of type II diabetes and poses a risk of cardiovascular illnesses. Cossrow and Falkner (2004) realized that the rate of IRS is greater among Hispanic Americans and African Americans

as compared to Caucasians. As a result, obesity-linked illnesses, encompassing hypertension and diabetes are found at higher levels within minority ethnicities such as Hispanic Americans and African Americans as compared to Caucasians. The study further reported that ethnic or racial disparities in lifestyles and economic disadvantage also contribute to some of the race differences of obesity-associated illnesses and the outcomes of these illnesses. In a different study, Asieba (2016) determined that out of the 33.05 percent of kids who were obese, the higher prevalence was observed among Hispanic and non-Hispanic African American children. Further, Asieba (2016) found out that sex had no impact on obesity rates, but higher education levels in families were strongly correlated to a healthy weight.

Ayine, Parra, Jeganathan, and Thangiah (2018) reported that nearly 12.7 million kids and teenagers were obese in the United States. Of this total, 23.8 percent of black American children were obese as compared to 13.1 percent of white children aged between 6 to 11 years. The researchers realized that the most prevalent causes of obesity in children are genetic factors and/or behavioral factors or some mix of these two causes. Ayine et al. (2018) assessed the disparities in the behavioral factors such as television viewing, dinner time and sleeping time in various racial groups. The findings revealed that 35 percent of white children went to sleep later than 8:30 pm during the school year, compared to 68 percent of African American kids. Fifty percent of African American kids had late dinner during school days compared to 4 percent of white children. The results further showed that 79 percent of African American kids watched television every day while only 21 percent of white children watched TV for more than an hour (Ayine et al., 2018). These findings revealed that longer exposure to television; late dinner schedule and inadequate sleep are the behavioral aspects that lead to a greater proportion of obesity in children among African American children as compared to white kids.

Adverse Childhood Experiences

Davies, Barnes, Gross, Ryder and Shlafer (2019) argue that the etiology of childhood obesity is complicated, encompassing psychological factors like anxiety, depression and quality of life, underlying biology and genetics and socio-economic position. The evaluation of Adverse Childhood Experiences (ACEs) during infancy is especially problematic due to the compulsory reporting necessities, which require reporting of children's subjection for various ACEs, both sexual and bodily abuses to authorities. There is a progressing probability of reporting prejudice when parents or guardians are requested to report on their children' ACEs. Using a quantitative survey approach, Davis et al. (2019) examined 105 public school learners in 8th, 9th and 11th grades on the issue of ACEs. The findings revealed that ACEs were directly related to weight conditions. Teenagers with more ACEs were more obese and severely obese as linked to those with no ACEs (Davis et al., 2019).

Studies show that, some of the complexities in the study on obesity is that when using control groups, following a weight loss program, is less effective in the reduction of mortality and often leaders to several participants' death in the course of the study. Other problems associated with studying obesity according to Davis et al., (2019) include participants who do not follow up or cease medical care once they reach an optimal weight or who are dissatisfied with the outcome of their procedure. Therefore, when administered appropriately, the behavioral and environmental interventions can be suitable since they mainly rely on the children's behavior and their five levels of environment as described by the ecological systems theory. According to Ayine et al., (2018), the effectiveness of the behavioral and environmental mediations of childhood obesity depends on the people, community and surroundings of a child.

Nevertheless, the pharmacological interventions are not fully effective mediations of childhood obesity due to the side effects caused by different drugs (Ayine, Parra, Jeganathan & Thangiah 2018). Some studies suggests that bariatric surgeries are also not effective for children and teenagers due to the strict eligibility needs required for someone to undergo these interventions (Isong *et al*., 2018). For someone to be eligible for bariatric surgery, his or her BMI should be 40 or more while the second criteria is that the person's BMI should be 35 to 39.9 when he or she has severe weight-linked medical issues such as type 2 diabetes, sleep apnea, non-alcoholic fatty liver illness, high blood pressure, heart disorder and stroke. These are not normal conditions among children and teenagers. The worst part of bariatric surgeries such as gastric surgery is the patients have to change their diets for the rest of their lives.

Summary

Chapter 4 outlined the review of literature based on the purpose of the study, which is to evaluate childhood obesity, and the factors that predict it. The study aimed to determine the factors that enhance or inhibit the outcomes of the interventions of childhood obesity. The interventions that were evaluated in this literature review comprised pharmacological, integration of behavioral and environmental, and surgical options. There is evidence that behavioral and environmental interventions of childhood obesity are relatively efficient since they can be controlled by both behaviors and the environment. The studies reveal that pharmacological mediations are not fully effective mediations of childhood obesity because of the side effects caused by different drugs. Other key predictors of obesity revealed in the literature review comprise socioeconomic status, race/ethnicity and adverse childhood experiences.

The following chapter evaluates the theoretical foundations of the current study. The study is based on two key theories, which are the theory of planned behavior (TPB) and

ecological systems model. The TPB lens portrays that an individual's worldview, combined with their thoughts about their capability to change and insights of change impact their decision to make a change in their life. The ecological systems theory on the other hand describes complicated environmental layers to stress that a kid's distinct biology is a key context that fuels his or her growth. Just like the literature review, the theoretical framework is based on the study's research questions and key concepts.

Chapter 4: Theoretical Framework

Introduction

This section provides the theoretical framework that support the current quantitative non-experimental correlation study, that was aimed at examining childhood obesity and predictive factors. This research's specific objective was to determine the various predictors of childhood obesity that influence the treatment outcomes. Studies shows that obesity continues to be an epidemic that is destructive to the younger population in both developed and developing countries. According to Skinner, Ravanbakht, Skelton, Perrin, and Armstrong, (2018), obesity is a health challenge that prompts various diagnostic approaches among children and adults. These variant approaches are based on different theoretical paradigms with some substantial reprieve to obese patients but does not provide a holistic cure. Studies have also shown that childhood obesity is no different from the adult obesity. The resultant health problems in adults such as diabetes, high blood pressure, and cancer also affect the children. Therefore, the aim of this study is to identity the predictors of childhood obesity and device strategies that could offer best approach to reducing or eradicating it from the population. The importance of this section of the study is to provide theoretical approach that link well with the study objective.

Consequently, identifying the predictors of obesity in children and how they may be addressed to help stem the epidemic is a serious research priority. However, the factors predicting obesity are complicated. For instance, though some have attributed obesity to urbanization (Aggarwal and Jain, 2018), children in rural areas are no less likely to be obese and at higher risk for severe obesity (Ogden et al., 2018). The role of factors such as socioeconomic status is also complicated; although affluence exerts some protective effect against obesity, this effect differs along racial lines (Assari, 2018). Given the complexities that surround obesity and

its predictors, more research is needed into the role of factors such as sleep (Hanlon, Dumin and Pannain, 2019), the complexities of race as a moderating factor (Assari, 2018), and, more generally, into multifaceted approaches to obesity prevention.

The previous chapter focused on the summary and critique of the theoretical and empirical literature, which had bearing on the research questions. This chapter expounds on the theoretical framework that formed the basis for this research. It provided a complete explication of the theories that were adopted to link this assessment to variable selection and conception associations of those variables. Similar to chapter 3, the databases and search engines that were adopted to compose the theoretical framework encompass Google Scholar, Global Health, ProQuest, EBSCO, SAGE, Nexus Lexus and Medline. These are reliable sources and yielded a wide variety of pertinent articles to the current study (Gusenbauer, 2019). Most articles that were selected are current that is, those that were published between 2017 and to date. Nonetheless, some older sources were incorporated mainly to establish the historical context of the theories used in evaluating the subject of the study.

Description of Theories Used

The theoretical foundations for this study were a combination of the theory of planned behavior and ecological systems theory. The theory of planned behavior (TPB) is a theory of planning, intention, and follow-through. From the TPB perspective, a person's worldview, combined with their thoughts about their ability to change and perceptions of change impact their decision to make a change in their life (Bagheri et al., 2019). The TPB theoretical perspective pertains to the behavioral components of obesity insofar as the extent to which behavioral factors such as sleeping or eating patterns affect obesity. The influence of planned behavior in the context of children is particularly complicated in that there are two layers of planned behavior to

consider: the planned behavior of children and the planned behavior of their parents (Bagheri et al., 2019). Key aspects of this study pertain to the extent to which parents' planned behaviors, such as setting bedtimes for their children, affect their children's risk of obesity.

Ecological systems theory on the other hand is a theory of environmental influence. Originally a theory of developmental psychology, ecological systems theory describes the web of interconnected systems that comprise a person's social ecology. These include microsystems, or all the systems in which an individual is involved directly, mesosystems or the interaction of these contexts such as the effect of school life on home life, exosystems or the effects of external contexts like parents' jobs on children's home lives, and macrosystems, or the combined effect of all systems. The ecological systems perspective offers a theoretical perspective that better encapsulates the extent to which different layers of a person's context, such as racial identity, may shape the person's social norms and behaviors. It is through this lens that the effect of key factors such as race/ethnicity on the drivers of obesity will be understood within the context of the present study.

The Theory of Planned Behavior (TPB)

The TPB theory was developed by Icek Aijzen has been applied to some health-related decisions and outcomes. The TPB lens indicates that the person's worldview, combined with their thoughts about their ability to change and perceptions of change affects their decision to make a change in their life (Qi and Ploeger, 2019). The theory was primarily intended to expound all actions over which individuals can exert self-control. The main component of the TPB is behavioral intent, implying that behavioral objectives are impacted by the outlook concerning the chance that the behavior will give the anticipated result as well as by the subjective assessment of the benefits and threats of that outcome (Qi and Ploeger, 2019). The

TPB theory has previously been implemented to forecast and expound a broad range of medical intentions and behaviors, encompassing substance consumption, breastfeeding, health provisions use, drinking and smoking.

Taghipour et al. (2019) argue that there are six components of the TPB theory, which collectively signify an individual's actual management of his or her actions. These components comprise attitudes, behavioral intention, subjective norms, social norms, supposed power and perceived behavioral control. The attitudes construct of the TPB is the level at which an individual has a desirable or undesirable assessment of the behavior of interest, and it typically comprises a deliberation of the results of showing the behavior (Taghipour et al., 2019). Behavioral intent includes the motivational aspects, which impact a particular behavior where the stronger the intent to undertake the behavior, the more chances the behavior will be undertaken. Subjective norms form the third construct and entail the consideration of whether most individuals favor or condemn the behavior (Taghipour et al., 2019). Social norms entail the traditional behavior codes in a set of individuals or the wider cultural setting. The fifth construct is perceived power, which refers to the supposed presence of factors, which might impede or facilitate the undertaking of an action. The last construct is the supposed behavioral control, which is typically the individual's outlook of the difficulty or ease of undertaking the behavior of interest (Faisal et al., 2020). Supposed behavioral control also varies across actions and scenarios that lead to an individual having changing outlooks of behavioral management based on the situation.

The TPB theory is often used to explain eating habits and patterns in populations to understand modifications. Andrews, Silk and Eneli (2010) reviewed the impact parents have on childhood obesity by looking at the parents' own perceived perceptions combined with subjective

norms and behaviors. In the study, 201 people responded to TPB assessments as it related to healthy eating habits for their children. Parents were evaluated and the study found that TPB predictions were accurate for parents and those who viewed providing healthy options and limiting access to unhealthy foods indicated better parent tracking of unhealthy behaviors (Andrews et al., 2010). Further, in this study, parent Television viewing behavior was associated with the supposed reaction effectiveness of restricting kids' television viewing period. Other studies linking nutritional intake to TPB are also found to be accurate. A study by Kassem, Modeste and Johnston (2003) on 707 female adolescents and their soft drink consumption reported that after completing a TPB based questionnaire, 96.3% reported they drink soda, with 50.1% drinking more than 2 glasses of soda per day. The investigators reported more non-diet soda than diet or low calorie. The girls' attitude, subjective norm and perceived behavioral controls were statistically significant positive associations with intent and successfully predicted intent to drink regular soda, with a 64% variance. The strongest link was attitude, and then perceived behavioral control and then subjective norm. Kassem et al. (2003) also found that including parents and friends in shifting the perceived control and attitude influenced a reduction in soft drink consumption.

Cheng, Yam, Cheung and Lee (2019) employed the TPB model to study physical and eating behaviors among a sample of 104 university learners, both males and females. The aim of this study was to justify whether or not there is adequate evidence that the use of TPB can explain physical activities and weight-reduction behaviors . The participants completed various questionnaires evaluating behavioral intents, supposed behavioral control, attitudes and subjective norms. The outcomes revealed that weight-linked self-stigma was directly and substantially related to both physical activity and healthy eating behaviors (Cheng et al., 2019).

Supposed behavioral control was just indirectly linked with physical activity via intent. Behavioral intent, on the other hand, was substantially related to physical activity behaviors but not significantly linked with healthy eating. The problem with Cheng et al. (2019) study was the use of a convenience sampling approach, which led to poor generalizations.

Rahmati-Najarkolaei et al. (2017) used the TPB model to evaluate the socio-cognitive factors, which might be linked to the selection of lifestyle among a population of pre-diabetic patients. Prospective research together with a follow-up after one month was formulated to gather information from 350 pre-diabetic patients. The information that was gathered included four constructs of the TPB model, encompassing behavioral intention, supposed behavioral control, subjective norms and attitude as well as data on food intake, physical exercise behavior and demographic variables. These independent variables were correlated with the measures of dietary selection and physical activity. The findings showed substantial associations between the four TPB constructs and the dietary selection and physical activity behaviors, both during the study and after the follow-up (Rahmati-Najarkolaei et al., 2017). The inference from this assessment was that the TPB model could be a valuable tool in the prediction of dietary choice and physical activity behaviors among pre-diabetic patients.

In a dissimilar study, Lambert, Chang and Mann (2020) adopted the TPB model to study the tendency of college learners to select healthy snacks. The investigators undertook an online survey of learners in a large public university in the South-eastern part of the United States. The variables that were evaluated comprised metrics of supposed behavioral control, subjective norm and attitudes as well as the behavioral intents to select healthy snacks. The dependent and independent variables were correlated by the use of multiple linear regressions. The findings indicated that university students supposed behavioral control and attitude concerning healthy

snack consumption were the primary predictors of behavioral intents (Lambert et al., 2020). The implication of this study was that the TPB is an efficient framework in determining variables predictive of diet selections and nutrition behaviors.

In a different research, Johnston and White (2003) evaluated the association between TPB and binge drinking studied 289 undergraduate students in a longitudinal design. The researchers looked at the intent to binge drink or not, and self-reports of those participants. They found that TPB can be used to explain instances of binge drinking and interventions that influence the subjective norms and perceived behavioral controls reduced this amount (Johnston & White, 2003). In another study linking alcohol and illegal drug use to TPB, 176 students completed questionnaires and the data indicated that of the 69% contacted one week later TPB was an effective predictor of alcohol or cannabis use (Armitage, Connor, Loach & Willets, 2010). Cooke, Dahdah, Norman and French (2016) conducted a systematic evaluation and meta-analysis of 40 eligible pieces of research on the association between TPB and the consumption of alcohol. The outcomes showed that female participants portrayed stronger outlook-intent associations as compared to males and that adults depicted stronger outlook-intent and self-efficacy-intent connections than teenagers (Cooke et al., 2016). Nonetheless, there was a gap in Cooke et al. (2016) research on adopting more clear descriptions of alcohol use in TPB items to justify forecasting and evaluating self-efficacy that determine threat behaviors.

Studies linking TPB to a health-related behavior have further been done for smoking cessation. In one study, 84 smokers completed questionnaires that evaluated the main items of the theory and perceived susceptibility. Regression testing confirmed that the intent to quit smoking was predicted accurately by perceived behavioral controls. At a six-month retest, quit attempts were predicted by intent and number of failed attempts and found the most likely to

remain smoke-free had to support to shift perceptions of susceptibility and control (Norman, Conner, & Bell, 2002). TPB is a theoretical basis that has previously been adopted to explain and forecast both eating and consumption behaviors. The same authors also did a study on TPB and healthy eating and studied 144 respondents in a health clinic, once and again six months later, then again six years later. Participants were asked TPB questions related to measuring healthy eating intentions and behavioral controls. The intent was predicted using perceived behavioral control and past behavior. They found that as intent stability increased, intent became less indicative and perceived past behavior became more indicative predictors of behavior (Norman, Conner, & Bell, 2002). The strongest predictor of physical exercising behavior was determined to be intent, while the significant predictors of eating behavior were found to be supposed behavioral control, intentions and attitudes.

In another study, Tapera et al. (2020) employed TPB to undertake a cross-sectional evaluation to determine students' perceived behavioral control, subjective norms, attitudes and behavioral intentions on smoking. Structured self-administered questionnaires were executed to gather information from 2,554 teenagers in elementary and high schools. Smoking behavior was forecasted by intention, supposed behavioral control, subjective norms and attitudes. The findings revealed a firm association between having a close friend, caregiver, parent or guardian who smokes and being a smoker. Learners who showed positive outlooks on smoking behavior were likely to be present smokers (Tapera et al., 2020). The study revealed that perceived behavioral control, subjective norms and attitudes led substantially to the behavior of smoking among the evaluated students.

Various researchers have based their theoretical foundations in TPB while evaluating the behaviors of consumers. They justify their link of TPB to consumer behaviors in different sectors

on the point that human life is endangered by environmental concerns such as global warming, farmland erosion ozone depletion, water pollution and air pollution, which in turn influence the behavior of consumers. Bashir, Khwaja, Turi and Toheed (2019) implemented TPB to evaluate the predictors of consumer behavior in the hospitality sector. The study involved a conceptual framework outlining four research constructs, encompassing green consumer behavior, environmental consciousness, intent towards green restaurants and individual norms (Bashir et al., 2019). The outcomes revealed that to establish green branding plans for the restaurants, the administrators should first deliberate on how the ecological consciousness of clients positively impacts their behavior towards green restaurants and individual norms. The findings further revealed that behavioral intent towards ecologically accountable lodging mediates the substantial positive association among a client's norms and green consumer behavior (Bashir et al., 2019). In a different study, Rehman et al. (2019) examined the link between TPB and technology acceptance model components and client purchase intent. The outcomes showed that supposed behavioral control, subjective norms, attitude, perceived ease of use and supposed usefulness have a statistically significant and direct impact on client intent to purchase (Rehman et al., 2019). Rehman et al. (2019) also employed trust and commitment to effectively moderate the association between online shopping behavior and client intent to purchase. The study revealed that irrespective of the constructs of TPB, trust and commitment are two factors that can increase the consumer intent to buy.

The TPB has been used widely in past studies to explain the predictors of blood donation behavior in diverse populations. Chiu, Yie, and Ling (2020) applied TPB to evaluate the intent of medical care employees to donate blood. TPB theory was adopted to help the investigators comprehend the factors, which inspire medical care employees' intent to blood donation (Chiu et

al., 2020). The outcomes showed that the TPB theory could forecast the behavior of blood donation. The predictive value for this study ranged from 51 percent to 81 percent. Out of this, the TPB model explained 69.1 percent of the intent variance to blood donation among healthcare workers, which was steady with the previous researchers on blood donation. It was found that evidence concerning blood donation is adequate among the prevailing literature (Chiu et al., 2020). Nonetheless, the intent of the past studies towards blood donation was found to be temperately acceptable. Medical care employees' intents were determined to be linked with perceived behavioral control, previous behavior and age concerning the donation of blood. In a different study, Kassie, Azale and Nigusie (2020) employed the TPB theory to explain the predictors of blood donation behavior among a population of adults. The research entailed a community-oriented cross-sectional evaluation of 515 adults. The findings revealed that the significant predictors of blood donation behavior among the respondents were past blood donation experiences, direct subjective norm, and direct supposed behavioral control (Kassie et al., 2020). The conclusion was that the TPB theory could be effectively implemented in finding the intention of blood donation among adults.

Neto et al. (2020) argued that Ajzen's TPB theory and its extension are frequently implemented to explain walking behavior. The study was conducted in three cities in Brazil to show which of the two models was better in explaining walking behaviors. The evaluated sample comprised 3,296 natives of Porto Alegre, Florianopolis and Distrito Federal, and they provided the required data by use of a 10-item metric (Neto et al., 2020). The findings showed that the TPB was better in explaining walking behavior as compared to the extended TPB model. These outcomes revealed that adding components to the original theory does not lead to improved

results at all the time (Neto et al., 2020). The implication of this assessment was that the TPB model is ideal to explain the behavior of walking among people.

Si, Shi, Tang, Wen, Miao, and Duan (2019) argue that the TPB theory is useful in studying environmental studies. Si et al. (2019) evaluated 531 prevailing journal articles to comprehend the implementation of the TPB model in environmental studies from an information domain visualization lens. The findings revealed that sustainable transportation; saving and conservation, environment and climate, green consumption and waste management are the primary subjects that adopt the model of TPB (Si et al., 2019). The outcomes lead to various approaches to aid pertinent investigators to learn about the execution of the TPB model in environmental science as well as to offer holistic references and insights for assessment on environment-linked behavior.

According to Moore et al., (2019), using the TBT Model argued that pharmacological intervention is inadequate without integrating it with nutritional and lifestyle transformation. In addition, the efficiency of intervention would also be determined by the patient's compliance with both the behavioral and dietary interventions. The researchers argued that pharmacological intervention requires constant regulation through professional medical experts because discontinuation of this intervention could reverse the gains and witness the patient gaining weight again. Therefore, Moore et al., (2019), notes that pharmacological interventions should be considered after behavioral transformation such as physical activities and the nutrition intervention have proved ineffective. If a patient BMI exceeds 30kg/m2, the patient could be prescribed to medication. Therefore, TBT reveals that individual behavior is pivotal in eradicating obesity for both adults and children..

The Ecological Systems Theory

The Ecological systems theory was formulated by Urie Bronfenbrenner. While developing this model, Bronfenbrenner delineated the environment into five diverse levels, encompassing the chrono-system, the macro-system, the exo-system, the mesosystems and the micro-system (Arifin and Teh, 2020). The chrono-system includes the dimension of time as it connects to the development of a child. Components within the chrono-system can either be internal like physiological transformations, which happen with the growth of a child or external such as the timing of a parent or guardian's demise. As kids develop, they can respond dissimilarly to environmental evolutions and might be more capable of determining more how the transformation will influence them. The macro-system level is regarded as the outmost layer in the environment of a child and it includes cultural laws, customs and values (Arifin and Teh, 2020). The impacts of broader values described by the macro-system have a cascading effect throughout the association of the other four levels of the environment. The exo-system level describes the wider communal scheme in which a kid does not act directly. The components in the exo-system affect the child's growth by associations with some structure in their micro-system. The examples of exo-system environments comprise community-centered family resources and workplace dairies. The meso-system level offers the link between the structures of a child's micro-system. The closest layer to a child is the micro-system and it comprises the structures which are directly exposed to them (Arifin and Teh, 2020). At the micro-system level, associations influence two routes, which are toward the child and away from the child. For instance, a child's parents might impact his or her behavior and beliefs.

Noursi, Saluja and Richey (2020) also contend that Bronfenbrenner's model of ecological systems is concerned with the development of a child within the setting of the relationships

scheme which formulates his or her surroundings. The theory describes complicated environmental layers to stress that a kid's distinct biology is a key context that fuels his or her growth. The association between the components in a kid's developing biology, the social landscape and the immediate family or community setting steers and fuels his or her ecology (Noursi et al., 2020). Noursi et al. (2020) further argue that to evaluate a kid's growth, it is important to look at his or her setting and the interaction of the wider context. In practice, Bronfenbrenner's theory describes the unpredictability and instability of household life, which influences children growth and subsequent obesity. When the associations in the close micro-system are eliminated, the kid will lack the tools to explore other segments of his or her ecology (Noursi et al., 2020). The deficits portray themselves particularly in teenage life and their examples are inability to self-direction, lack of self-discipline and anti-social conduct. Various applications of the theory ecological systems will be described in this section.

The Ecological systems model has been applied in various studies to explain the relationship between children's well-being and development, and the different systems of the environment. Reifsnider et al. (2020) used an ecological model to evaluate the risk aspects, which contribute to childhood obesity in a population of Mexican Americans. The study adopted a cross-sectional descriptive method, and it was composed of 55 respondents. The outcomes revealed that kids' BMI and age are directly related to childhood obesity, as determined by BMI percentile by sex/age. The study portrayed substantial variations in the agent and host factors of fruit beverage, a period of outdoor play and extended bottle-feeding between typical weight and obese kids (Reifsnider et al., 2020). The inference was that the involvement and engagement of other members of the family in childcare, nutritional programs and outdoor activities can eradicate the adverse impacts of agents and host factors on the body size of a kid. Based on the

theory of environmental systems, interactions with family members are one of the micro-systems essential for a kid throughout his or her development.

In a cross-sectional and longitudinal study based on the theory of environmental systems, Ochoa and Berge (2017) determined that the five environmental factors that are linked to childhood obesity include sleep duration, food security/socioeconomic status, sedentary behavior/physical activity, screen time and parental impacts. From the model of environmental systems, these factors belong to the micro-systems since they are immediate to the Child. Ochoa and Berge (2017) argued that these micro-systems factors could lead to disparities in obesity among children. By use of a weighted multivariate logistic regression approach based on the ecological systems model, Wang et al. (2018) found a u-shaped association between sleep period and obesity threat among girls, with the minimal risk among girls who slept for only 8 hours, but an identical threat was not present among boys. From this assessment, Wang et al. (2018) concluded that a sufficient sleep period is a significant component of the prevention of obesity among teenagers. Li et al. (2017) further argued that community medical determinations, which motivate children to have adequate sleep period, are essential in eradicating obesity. Felso et al. (2017) further found out that sleep duration is a key predictor of weight gain in kids and adolescents, but, the causal illustrative mechanisms are still undefined. Felso et al. (2017) only examined the association between short sleep period and the progression of unhealthy dietary trends, sedentarism and insulin resistance. However, the function of other mediators like leptin levels, transformation in ghrelin, screen time and physical activity, remained indeterminate. Both Li et al. (2017) and Wang et al. (2018) note that the Bronfenbrenner's model of ecological systems is portrayed to depict how a particular inclusive behavior transformation can

substantially enhance the efficiency of sleep training initiatives and finally support the healthy growth of kids.

In an experimental study involving participants in educational and residential settings and based on the ecological systems model, Bennett et al. (2017) determined that kids and teens with developmental and psychological incapacities in the U.S. are more vulnerable to obesity as compared to youth and kids without incapacities. Nevertheless, the researchers determined that there is broad evidence that supports the effectiveness of family-oriented interventions of childhood obesity, encompassing behavior modification, physical activity and nutrition. All family-centered intermediations were provided in-person, but additional progressing use of telenursing was proposed for implementation to stimulate access of interventions among more young people are households (Bennett et al., 2017). This research proposes that prevailing medical conditions inhibit the effectiveness of intervention approaches for childhood obesity. The study further justifies that the ecological systems model is significant in explaining the role of micro-systems such as interactions with family members in addressing obesity among kids.

The ecological systems model is further used by researchers to comprehend the impact of social, physical and family contexts childhood on childhood obesity. These two impacts of these environments on childhood obesity include indirect influences like anxiety, and via direct impact on kids' diet and physical activity (Beets et al., 2019). Higher self-esteem, parental nurturing and parental education minimize the obesity threat among girls (Beets et al., 2019). Karachaliou et al. (2020) also argue that the adoption of electronic media, shared household meals and family food context are three key environmental predictors that broadly impact childhood obesity via behavioral ways. Mothers mainly create the family food setting and are usually the role models for eating patterns with evidence of a direct relationship between eating behaviors of methods

and those of kids (Tylavsky et al., 2020; Morales-Camacho et al., 2019). Food preferences and control of appetite are formulated early in life, and there is a strong association between parental obesity and their kids' weight statuses (Lei et al., 2019). Wu et al. (2019) found out that community settings are primary environmental aspects that impact risk behaviors and childhood obesity, but there is a significant gap in comprehending how kids interface with the obesogenic environment. These studies disclose the importance of the model of ecological systems in evaluating the role of different levels of the environment in addressing childhood obesity.

Hayes et al. (2019) adopted an ecological systems model to study the family and neighborhood built setting aspects in home-centered intervention for obesity in children. The investigators found out that family-based behavioral weight loss treatment (FBT) for obesity among children aids households to establish plans to stimulate ideal options in their homes and other settings. The regression models depicted that reducing electronics and red foods in the respondents' homes during FBT has positive impacts on kid weight and weight-linked outcomes. Nonetheless, no neighborhood diets or recreation environment components in this study were substantially associated with results, even though having a broader density of civic recreation spaces was linked with increases in bodily activities of the children (Hayes et al., 2019). The adjustment of the home setting, precisely the reduction of electronics and red foods were then found to be significant for the effectiveness of FBT. In a different study, Staiano et al. (2017) found out that family-oriented behavioral interventions are efficient techniques to enhance the management of children's weight via healthy nutrition and physical activities. However, such programs usually have low attendance and high attrition (Staiano et al., 2017). Even among children, obstacles such as exercise options, the supposed expense of healthy nutrition, frustration from previous ineffective weight-loss trials and lack of time hinder the successful

implementation of viable and sustainable approaches for the intervention of childhood obesity. The model of ecological systems in these two studies was useful in explaining that adjusting the family setting, particularly minimizing electronics and RED diets can be especially significant for the success of FBT. Further, Staiano et al. (2017) study portrayed the importance of the ecological systems model in explaining the role of micro-systems like healthy family nutrition in addressing childhood obesity.

Campbell (2015) used the ecological systems model to evaluate the social, environmental and biological impacts on obesity in children. The study reported that the key determinants of obesity in children comprise behavioral, social and behavioral threats that in turn imbed in the setting of the community context. The impacts of obesity are experienced among all obese children hence there is need to transform both behavior and nutrition in order to curb the pandemic. The idea that the determinants of obesity in children function at numerous stages and diverse levels of childhood is of policy importance to individuals who are strategizing early medical promotion and primary intervention initiatives (Campbell, 2015). The study proved that the ecological systems theory is significant in evaluating the impacts of diverse levels of the environment on the development of children.

Evaluation of the Theories

Both the TPB and the ecological model have been based on the research questions of the current study. The two theories have been used to explain the study's variables, encompassing demographic factors such as family type, socio-economic status, family age and sex, parental demographic factors, stressors, bedtime and ethnicity. The review of the theoretical framework also stressed on the studies that have been based on quantitative models, particularly multiple regression approaches, to align to the present research and paint a picture of how the analysis of

the targeted variables will be conducted. The inclusion of the TPB theory contributes to the comprehension of the study model since it illustrates how the study variables predict the outcome of childhood obesity prevention approaches. Precisely, the TPB model explains how demographic factors such as family type, socio-economic status, family age and sex, parental demographic factors, stressors, bedtime and ethnicity, predict the outcomes of childhood obesity interventions. The TPB model was used to help the investigator understand the factors, which motivate children and teenagers' intentions to engage in intervention approaches of childhood obesity, encompassing pharmacological, integration of behavioral and environmental interventions, and surgical options. The ecological systems model on the other hand was employed to provide a theoretical outlook, which better encapsulates the level at which diverse layers of an individual's environment such as social norms and behaviors and social identity impact their intent to engage in obesity prevention approaches.

Summary

Chapter 4 described the theoretical foundations for this study. The theories that were selected to form the theoretical basis are the TPB and the ecological systems model. The TPB lens designates that the individual's worldview, combined with their own opinions about their ability to change and perceptions of change impact their decision to make a change in their life. The ecological systems model on the other hand is concerned with the development of a kid within the setting of the relationships scheme, which formulates his or her surroundings and is composed of five levels, including the chrono-system, the macro-system, the exo-system, the mesosystems and the micro-system. Both the TPB and the theory of ecological systems are based on the research questions of the current study. The two models have been used to explain the study's variables, encompassing demographic factors such as family type, socio-economic status,

family age and sex, parental demographic factors, stressors, bedtime and ethnicity. The following chapter describes the research questions and pertinent hypotheses.

Chapter V: The Research Questions

The following quantitative research questions guided the study.

RQ1. What relationship, if any, exists between demographics factors of sex, age, family socioeconomic status, the family type, and race/ ethnicity and the outcome of childhood obesity?

$H1_A$: There is a statistically significant relationship between one or more of the demographic factors of sex, age, family socioeconomic status, the family type, race/ ethnicity and the outcome of childhood obesity.

RQ2. What relationship, if any, exists between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity?

$H2_A$: There is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity.

RQ3. What relationship, if any, exists between children's Adverse Childhood Experiences and the outcome of childhood obesity?

$H3_A$: There is a statistically significant relationship between children's Adverse Childhood Experiences and the outcome of childhood obesity.

RQ4. What relationship, if any, exists between children's bedtimes and the outcome of childhood obesity?

$H4_A$: There is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity.

RQ5. What relationship, if any, exists between food availability and the outcome of childhood obesity?

Research Question	**Test/ Analysis to be used**
RQ1. What relationship, if any, exists between demographics factors and Childhood Obesity? Sex Age Family Socioeconomic Status Family type Race/Ethnicity	Chi-Sq, logistic regression
$H1_A$: There is a statistically significant relationship between one or more of the demographic factors of sex, age, family socioeconomic status, and the family type and the outcome of childhood obesity.	
RQ2. What relationship, if any, exists between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity?	Chi-sq, logistic regression
$H2_A$: There is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity.	
RQ3. What relationship, if any, exists between children's Adverse Childhood Experiences and the outcome of childhood obesity?	Chi-sq, logistic regression
$H3_A$: There is a statistically significant relationship between children's Adverse Childhood Experiences and the outcome of childhood obesity.	
RQ4. What relationship, if any, exists between children's bedtimes and the outcome of childhood obesity?	Chi-sq, logistic regression
$H4_A$: There is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity.	
Overarching RQ: What factors predict childhood obesity?	Multivariate Multiple Logistic Regression

Chapter VI: Research Methodology

Research Perspective

The research methodology for the study is quantitative. Quantitative research is empirical and relational (Balnaves & Caputi, 2001). The quantitative approach to research is closed-ended and numerical in nature (Balnaves & Caputi, 2001). In alignment with its closed-ended nature, quantitative research is best suited to conducting studies that address numerical quantities or quantified relationships between study variables (Balnaves & Caputi, 2001). The definitive strength of quantitative inquiry is the ability to generate results that are accurate up to an arbitrary degree of specificity with an adequately large sample size (Balnaves & Caputi, 2001). However, in order to effectively collect accurate data from large sample sizes, quantitative researchers must employ closed-ended data collection tools and use only validated measures of the key variables (Balnaves & Caputi, 2001). Hence, data collection is more limited and cannot be exploratory (Balnaves & Caputi, 2001). All these characteristics make quantitative research ideal for this study. The study is based on a strong theoretical foundation comprised of ecological systems theory together with the theory of planned behavior, meaning it has the necessary existing theoretical definitions and quantifications in place. In addition, there are existing, historical data from the Healthy Brain Network‘s data repository which allow for the easy quantification of many key variables. In addition, the research questions are all relational in nature, pertaining to understanding the relationships between those key variables.

By contrast, a qualitative research design would be a poor fit. Qualitative research is exploratory and open-ended (Merriam & Tisdell, 2015). Rather that examining key relationships between variables, qualitative researchers instead seek to explore and describe a broader

phenomenon (Merriam & Tisdell, 2015). Qualitative research is ideal for exploring new theoretical ground not yet covered well by existing theory (Merriam & Tisdell, 2015). While qualitative inquiry has its strengths, especially in terms of exploring new ideas, those strengths would be a very poor fit for the closed-ended, relational, and theory-driven issues that are under study in this research. Hence, a qualitative perspective was not adopted.

Research Design

The specific research design for the study was non-experimental, correlational, and historical. Quantitative research can be experimental or non-experimental (Johnson, 2001). When possible, experimental research is the ideal form of quantitative inquiry as it is the strongest, being able to achieve causal results (Johnson, 2001). However, experimental research requires a high level of control and manipulation of the variables (Johnson, 2001). Controlling variables such as those, which may potentially lead to obesity in children, is not merely unfeasible but has the potential to be highly unethical. Hence, an experimental or quasi-experimental approach cannot be used, making a non-experimental design the only appropriate choice. Non-experimental studies produce weaker results in the sense that they can only prove correlation, not causation (Johnson, 2001). However, non-experimental research can also be conducted much more feasibly, using much more practical sets of data that are derived from the real world (Johnson, 2001).

There are several types of non-experimental design, including correlational, descriptive, and causal comparative (Johnson, 2001). Descriptive research is used, as the name suggests, describing a population in quantified terms. Descriptive research is the weakest type of non-experimental research and would provide little meaningful insight. Causal comparative research

is used to compare outcomes in two or more circumstances that have diverged naturally (Johnson, 2001). Such an approach is not suitable for this study are there are no groups being compared. The final type of non-experimental research is correlational research, which is used to examine the predictive relationships or associations between two or more variables (Johnson, 2001). In this study, a correlational design is appropriate because the purpose of the proposed study is to identify the correlational or predictive relationships between key variables. Within the correlational approach, a historical approach is further appropriate to this study. Historical designs are used when large, existing sets of data exist and can be used as source of data for the study (Johnson, 2001). The Healthy Brain Network's dataset represents such a set of existing data containing key variables of interest.

Context for the Study

Because the study was conducted using historical or archival data, there was no direct data collection from participants. Instead, obesity and its predictors were examined using the existing dataset created by the Healthy Brain Network. The original context of the Healthy Brain Network's dataset is a set of 10,000 New York area participants ages 5-21 (Alexander et al., 2017). These participants were recruited to provide a highly in-depth dataset for which over 6,000 different measurements were taken for each subject. Hence, the research context for the proposed study will be identical to that laid out by Alexander et al. (2017) in their reporting on the Healthy Brain Network's open dataset. As these data were openly available, no additional access was required.

Data and Subjects

The population studied were all US children ages 5-21. The age range of 5-21 is selected in alignment with the definition of children used in the Healthy Brain Network for the purposes

of convenience. Although this age range slightly exceeds the definition of children used in many places, the developmental process is considered to extend past age 18 by most experts. Furthermore, the dataset available from the Healthy Brain Network is such that restricting the study to the subset of participants ages 5-18 or even 5-13 would likely not impair the ability to generate meaningful results. Hence, sub-analyses of these other populations may be conducted in order to determine if changing the population in these ways fundamentally changes the predictors of obesity.

The sample involved all the participants who participated in data collection by the Healthy Brain Network. The dataset included over complete data on over 900 participants, and partial data on 4737 participants. A G*power analysis for multivariate logistic regression is not easily calculated; instead, given the large sample size, *post hoc* power analysis were used to determine the actual power using a significance level of 0.01 and a medium effect size. The set of data available through the Healthy Brain Network well exceeds this minimum necessary sample size, with over 6,000 variables available for each participant. Hence, meeting the sample sizes necessary for statistical significance will not be a problem. A significance level of 0.01 was be employed given the large sample size available.

Measures

The key variables of interest for the study were defined and measured as follows:

Childhood obesity. Per the literature, obesity is more complicated to diagnose in children than it is to diagnose more generally (Aggarwal & Jain, 2018). Accordingly, the variable of childhood obesity will be measured using body mass index (BMI) and the resultant classifications of “obese” or “not obese.”

BMI. The dependent variable of BMI will be measured as a continuous variable, calculated by body weight divided by the square of height (Aggarwal & Jain, 2018). Body mass index is one of the three measures of childhood obesity.

Sex. Sex will be an independent or predictor variable. Sex will be measured as a categorical variable with values male, female, or other (Alexander et al., 2017).

Age. Age will be an independent or predictor variable. Age will be measured as a continuous variable in years (Alexander et al., 2017).

Family socioeconomic status. Family socioeconomic status will be a predictor or independent variable. Family socioeconomic status represents the broad socioeconomic conditions in which a child lives and will be measured categorically (Alexander et al., 2017).

Family type. Family type will be a demographic predictor or independent variable. This variable will be categorical and measure if a child is in a traditional family, in a single parent household, cared for by an extended family, in foster care, etc. (Alexander et al., 2017).

Race/ethnicity. Race/ethnicity will be a key predictor and moderator variable. Race/ethnicity will be recorded as a categorical variable following the categories used on the United States Census.

Consensus diagnosis of trauma or stressor related disorders. Consensus diagnosis of trauma or stressor-related disorder will be a set of binary variables with values of Anxiety spectrum, Depression spectrum, ADHD type, developmental/learning disorders, SPMI, and/or PTSD (Alexander et al., 2017). These variables will serve as independent or predictor variables.

Adverse Childhood Experiences. Adverse Childhood Experiences will represent a predictor or independent variable. The Adverse Childhood Experiences variable will be measured as a continuous variable using an index value for various adverse childhood

experiences measured by the Adverse Childhood Experiences Scale (ACES) instrument (Alexander et al., 2017). Individual elements of the ACES may also be tested as predictors to examine if specific adverse experiences are relevant.

Hours of Sleep. Children's degree of sleep or bedtime will be treated as a predictor or independent variable (Hanlon, Dumin, & Pannain, 2019). Hours of sleep will be collected as a continuous variable.

Procedures

Data collection. Data collection for the study was carried out as follows. Firstly, university IRB approval to conduct the study was sought. Since the research involves secondary data from a historical dataset, approval was straightforward but, nonetheless, no data was conducted prior to IRB approval. In addition, formal permission to utilize the Healthy Brain Network's dataset was sought, despite the dataset being open for use by researchers. Once all approvals have been obtained, the data analyses began.

The act of data collection will entailed obtaining an extract from the Healthy Brain Network of all data for all participants scrubbed to remove all identifying information. At this point, the data was transformed into a format that is appropriate for use in SPSS statistical analysis software, which was used in analyzing the data. From there, any datapoints, which do not include all of the relevant variables for this study, were cleaned from the data. Because the data used in the study are part of an open dataset, the acquisition of the necessary data was straightforward and involved no difficulties.

Data Analysis. Once data were collected, cleaned, and imported into SPSS Statistical Analysis Software, the data analysis began. The study will involved two levels of analysis: descriptive analysis and inferential analysis. The descriptive analysis was the first step. In this

stage, the samples were broken down by demographics to better understand the participants. In addition, descriptive statistical properties such as mean, median, and range were calculated for each of the variables included in the data for the study. The results of the descriptive analyses are presented in the form of tables and charts.

Once the data was analyzed descriptively, an inferential analysis was carried out to answer the research questions. To recall, research questions 1-4 pertain to predictive relationships. In all variables, the outcome is a dichotomous variable (obese or not obese). Therefore, all analyses utilized logistic regression, which is appropriate to continuous predictors and a binary outcome (Laerd, 2021). A logistic regression model assumes independent data, low collinearity of variables, and that the outcome be binary or categorical (Laerd, 2021). All these assumptions are satisfied with the current study. Research question 1 (RQ1) is most involved since it involves a number of predictors. Therefore, a hierarchical logistic model will be built up using the variables of Sex, Age, Family Socioeconomic Status, Family type, and Race/Ethnicity. These will begin with individual regressions, then move up the hierarchy to a full multiple logistic regression model.

For RQ2-RQ4, there were two forms of analysis. Individually, these research questions can be addressed by a generalized Chi-Square, the most general form of Pearson's correlation coefficient will be applied to two categorical variables. The t- tests were used to analyze the individual correlations for the independent variable in each research question. Then, a combined analysis drew on multiple logistic regression to regress all predictors against obesity in a combined model. Analyzing all of these variables together in a single multiple logistic regression analysis serves two purposes: to create a more comprehensive model and to avoid the heightened

risk of type I error from conducting multiple parallel analyses (Robinson, Tomek, & Schumacker, 2013).

Both the individual chi-squared tests and multiple logistic regression model were used to test the hypotheses associated with RQ1-RQ4 together (Robinson et al., 2013). The overall model's multiple R-squared value must first be tested in order to ensure the model has any significant predictive power. If the overall model is significant, then the individual hypotheses may be tested using the coefficients of regression (Robinson et al., 2013).). For each dimension of each predictor, there was a coefficient of regression with obesity. If at least one dimension of a predictor significantly predicts childhood obesity, the null hypothesis for the corresponding research question may be rejected and that factor deemed a statistically significant predictor. If the predictor is significant in the chi-squared but not in the logistic model, this suggests that it is intercorrelated with another predictor.

Protection for Human Subjects

Ethical research practices were adhered to at all stages of the research process. This began with acquiring IRB approval to conduct the study and also permission from the Healthy Brain Network to conduct the study. The study drew on existing, archival datasets rather than newly collected data. In this regard, there is no ethical peril from the data collection process. All data in the Healthy Brain Network's dataset are already in anonymous, quantified form and hence pose no risk of exposing the participants. The present study is concerned with a vulnerable population, namely that of children. However, data will not be collected directly from this population and the researcher will have no direct contact with the vulnerable population. Furthermore, much of the data collected for the Healthy Brain Network's original study was also collected from the parents of children, not children directly. The study is also ethical in that the

results of the study serve to create potential benefits to the same population from which the data were collected. In addition, although the study data pose no risk to participants, they will nonetheless be stored securely and kept in a password-protected folder on the researcher's personal computer once they have been downloaded.

Chapter VII: Results

The purpose of this study was to evaluate childhood obesity, and the factors that predict it. The study goal was to determine the specific factors that are related to the outcome of childhood obesity. Specifically, the following research questions and corresponding hypotheses were addressed:

RQ1. What relationship, if any, exists between demographics factors of sex, age, family socioeconomic status, the family type, and race/ ethnicity and the outcome of childhood obesity?

H1A: There is a statistically significant relationship between one or more of the demographic factors of sex, age, family socioeconomic status, the family type, race/ ethnicity and the outcome of childhood obesity.

RQ2. What relationship, if any, exists between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity?

H2A: There is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity.

RQ3. What relationship, if any, exists between children's Adverse Childhood Experiences and the outcome of childhood obesity?

H3A: There is a statistically significant relationship between children's Adverse Childhood Experiences and the outcome of childhood obesity.

RQ4. What relationship, if any, exists between children's bedtimes and the outcome of childhood obesity?

H4A: There is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity.

RQ5. What relationship, if any, exists between food availability and the outcome of childhood obesity?

H5A: There is a statistically significant relationship between food availability and the outcome of childhood obesity

The following is a discussion of the study's population and sample as well as a demographic description of the sample. Demographic descriptions included frequencies and percentages for categorical (nominal) variables and descriptive statistics of minimum, maximum, mean, and standard deviation for variables measured at the interval level of measurement. Also presented are the testing of parametric assumptions for the statistical analysis and results of hypothesis testing. This chapter concludes with a discussion of the results of this study.

Data Collection

Secondary data was used in this analysis from the Healthy Brain Network's website. The data was exported as an Excel file and then imported into SPSS. Any data points that did not include all of the relevant variables for this study were removed from the dataset. The data set originally contained 4737 cases. Of the 4737 participants, there were 1294 who are still in progress and do not have complete data sets with weight status or ACEs, leaving 3443 participants. There were 2449 of the remaining 3443 with no ACEs, since the ACEs was

implemented as an additional component after the study already had completed participants who completed the study prior to the implementation and do not have ACEs scores. After the removal of cases with missing data, the final data set included $N = 994$ complete cases for analysis. There were 645 (64.9%) males and 349 (35.1%) females in the sample. Ages of children ranged from 5.06 years to 21.82 years ($M = 10.04$, $SD = 3.26$). Regarding SES, most families had an annual income $150K or above, 360 (36.2%). This was followed by an annual income between 100K and 149.9K, 57 (19.9%). The remaining 43.9% of families made less than $100K per year. For child's BMI, most were a healthy weight, 635 (63.9%). This was followed by overweight, 167 (16.8%); Obese, 157 (15.8%); and underweight, 35 (3.5%). Thus, classifying 837 (84.2%) as not obese and 157 (15.8%) as obese. Looking at the child's race, most were White, 529 (53.2%). There were 134 (13.5%) Black; Ninety-four (9.5%) Hispanic; and 29 (2.9%) Asian. There were 208 (20.09%) that denoted some other race. For family type, most were traditional, 710 (71.4%). This was followed by single parent, 256 (25.8%); and 15 (1.5%) extended family. There were 13 (1.3%) that denoted some other family type.

Table 1
Demographics

Variable	*N*	*%*
Sex		
Male	645	64.9
Female	349	35.1
SES		
Less than 10,000	23	2.3
10,000 - 19,999	21	2.1
20,000 - 29,999	32	3.2
30,000 - 39,999	40	4.0
40,000 - 49,999	22	2.2
50,000 - 59,999	28	2.8

Variable	*N*	*%*
60,000 - 69,999	35	3.5
70,000 - 79,999	27	2.7
80,000 - 89,999	33	3.3
90,000 - 99, 999	57	5.7
100,000 - 149,999	198	19.9
150,000 or above	360	36.2
Choose not to disclose	118	11.9
BMI Range		
Healthy weight	635	63.9
Obese	157	15.8
Overweight	167	16.8
Underweight	35	3.5
Weight category		
Not Obese	837	84.2
Obese	157	15.8
Child race		
White/Caucasian	529	53.2
Black	134	13.5
Hispanic	94	9.5
Asian	29	2.9
Other	208	20.9
Family type		
Traditional	710	71.4
Single parent	256	25.8
Extended family	15	1.5
Other	13	1.3

For sleep duration, most children slept between 9-11 hours, 464 (46.7%). This was followed by 8-9 hours, 320 (32.2%); 7-8 hours, 138 (13.9%); 5-7 hours, 67 (6.7%); and less than five hours, 5 (0.5%). Lastly, there were 857 (86.2%) participants that did not live in a food desert region and 137 (13.8%) that did. Tables 2 through 3 depict this information.

Table 2
Sleep Duration

	Frequency	Percent
9-11 hrs	464	46.7
8-9 hrs	320	32.2
7-8 hrs	138	13.9
5-7 hrs	67	6.7
less than 5 hrs	5	.5
Total	994	100.0

Table 3
Food Desert Region

	Frequency	Percent
No	857	86.2
Yes	137	13.8
Total	994	100.0

In addition to the demographic variables presented thus far, data on Consensus diagnosis of Trauma or Stressor-related disorders and Adverse Childhood Experiences (ACE) were measured. Consensus diagnosis of trauma or stressor-related disorder are a set of binary variables with values of Anxiety spectrum, Depression spectrum, ADHD type, developmental/learning disorders (NEURO), and SPMI. The Adverse Childhood Experiences variable was measured as a continuous variable using an index value for various adverse childhood experiences measured by the Adverse Childhood Experiences Scale (ACES) instrument. These variables served as independent or predictor variables for the study. The dependent variable of this study was whether or not the child was obese.

Table 4 below depicts the frequency and percentages of the presence or absence of a particular stressor/trauma. Most children had ADHD, 669 (67.3%). This was followed by developmental/learning disorders (NEURO), 567 (57.0%); Anxiety, 411 (41.3%); SPMI, 115

(11.6%); and depressive, 90 (9.1%). The events were not mutually exclusive, i.e., a child may have more than one disorder.

Table 4
Consensus Diagnosis of Trauma or Stressor-related Disorders

Trauma/Stressor	*N*	*%*
Anxiety		
No	583	58.7
Yes	411	41.3
Depression		
No	904	90.9
Yes	90	9.1
ADHD		
No	325	32.7
Yes	669	67.3
Neurological Disorders		
No	427	43.0
Yes	567	57.0
SPMI		
No	879	88.4
Yes	115	11.6

The ACEs is made up of ten questions, each having to do with a different form of traumatic exposure during childhood. For each question that the participant had experienced,

they were given one point and that makes up a composite score that evaluates their risk of impact later in life. The questions included were:

1- Did a parent or other adult in the household often or very often… Swear at you, insult you, put you down, or humiliate you? or Act in a way that made you afraid that you might be physically hurt?

2- Did a parent or other adult in the household often or very often… Push, grab, slap, or throw something at you? or Ever hit you so hard that you had marks or were injured?

3- Did an adult or person at least 5 years older than you ever… Touch or fondle you or have you touch their body in a sexual way? or Attempt or actually have oral, anal, or vaginal intercourse with you?

4- Did you often or very often feel that … No one in your family loved you or thought you were important or special? or Your family didn't look out for each other, feel close to each other, or support each other?

5- Did you often or very often feel that … You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? or Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?

6- Were your parents ever separated or divorced?

7- Was your mother or stepmother: Often or very often pushed, grabbed, slapped, or had something thrown at her? or Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? or Ever repeatedly hit at least a few minutes or threatened with a gun or knife?

8- Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?

9- Was a household member depressed or mentally ill, or did a household member attempt suicide?

10- Did a household member go to prison?

The variable ACE score was created by summing the responses of these 10 yes/no questions. Possible ranges were from 0 to 10 with higher scores indicating more trauma/stress. The responses ranged from 0 to 9 ($M = 0.99$, $SD = 1.44$). This indicates low trauma/stress in the sample.

The assumptions required for the statistical tests for Chi square and binary logistic regression do not include normality, as they are considered non-parametric tests. The Chi-square test has three assumptions: two categorical variables, independence of observations, and all cells should have expected counts greater than five. Chi-square analysis were only performed on the nominal variables, thus first condition was met. Independence of observations means that there is no relationship between the observations in the groups of the categorical variables. The data set contained individuals /observations that were not related in any way. Expected cell counts were all greater than five. For the assumptions of binary logistic regression, these include having a dependent variable that is dichotomous, which is the case in this study, as obesity is classified as either no "0" or yes "1" and no outliers. There were no standardized regression residuals larger than 3, thus no issues with outliers.

What now follows are the results of statistical analysis conducted.

Results

Both Chi-square tests of association and binary logistic regression were conducted in order to address this first research question and hypothesis:

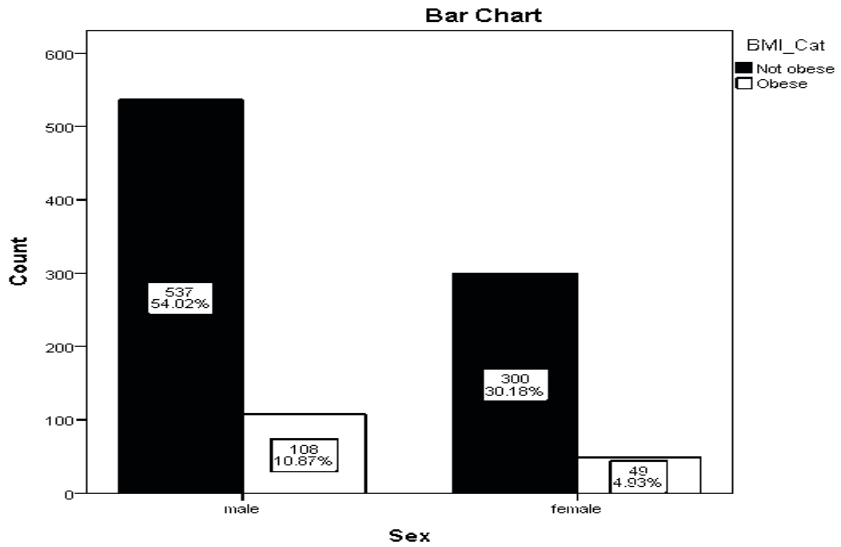
RQ1. What relationship, if any, exists between demographics factors of sex, age, family socioeconomic status, the family type, and race/ ethnicity and the outcome of childhood obesity?

H1A: There is a statistically significant relationship between one or more of the demographic factors of sex, age, family socioeconomic status, the family type, race/ ethnicity and the outcome of childhood obesity.

The relationship between sex and BMI was tested by conducting a Chi-square test. The Results were not significant, $\chi 2(1) = 1.245$, $p = .265$. Although there were more males categorized as obese, 108 (10.87%) than females, 49 (4.93%), the difference in proportions were not significant (Figure 1).

Figure 1.

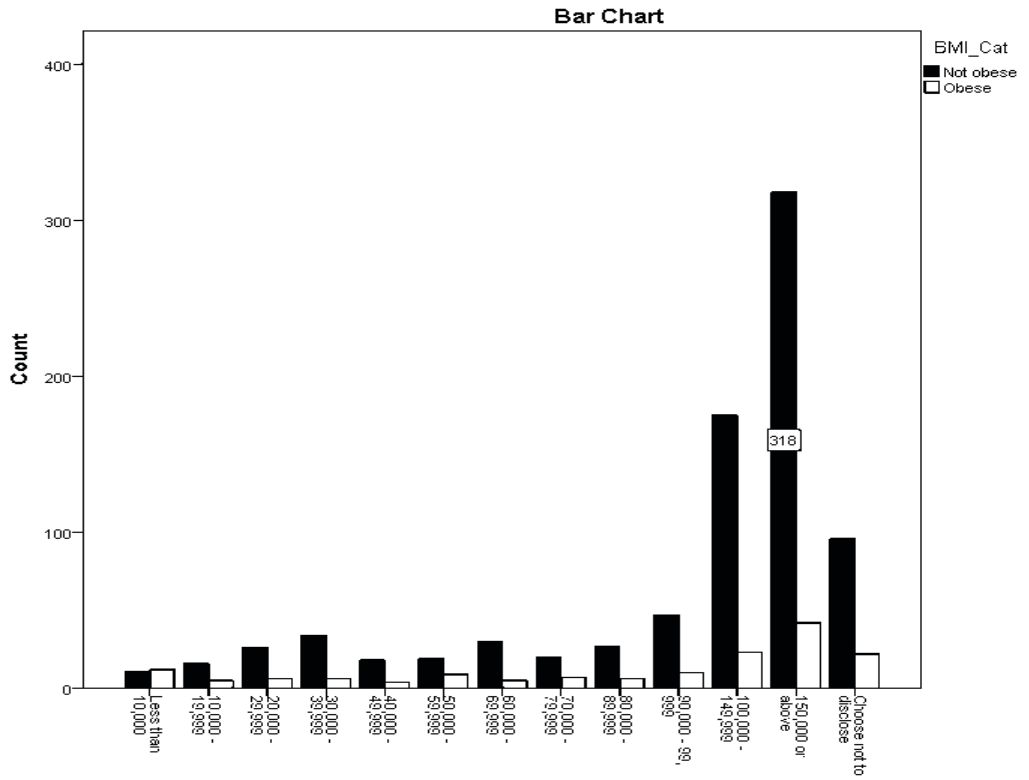
Bar chart for BMI by Sex ($\chi 2 = 1.245$, $p = .265$)



The relationship between SES and BMI was tested by conducting a Chi-square test. The Results were significant, $\chi 2(12) = 40.199$, $p < .001$. Of all of the SES categories, the 150K or above had the greatest of frequency of children not categorized as obese (Figure 2).

Figure 2.

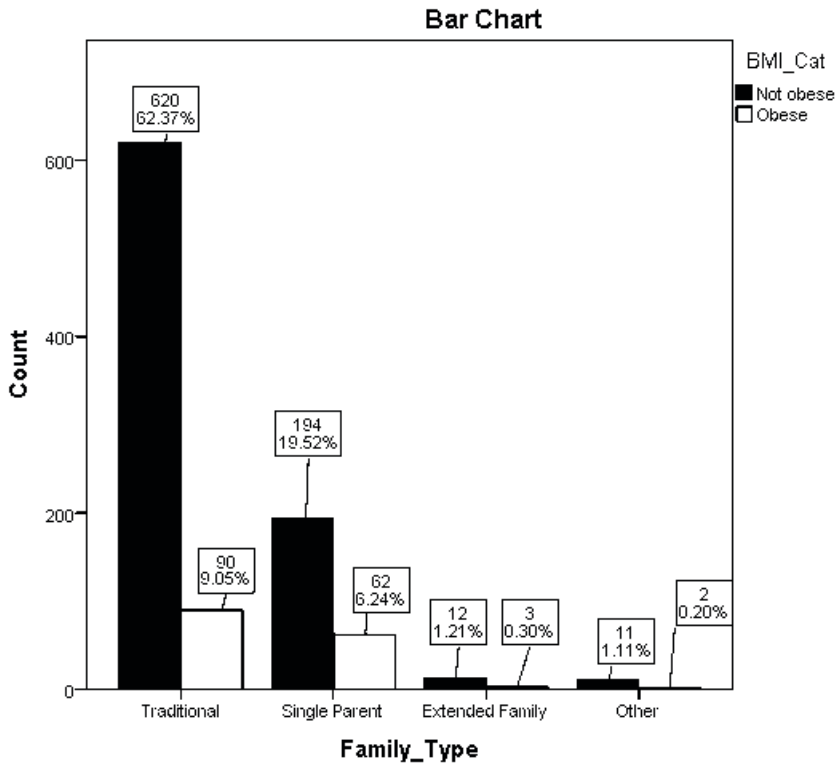
Bar chart of BMI by SES ($\chi 2 = 40.199$, $p < .001$)



The relationship between family type and BMI was tested by conducting a Chi-square test. The results were significant, $\chi 2(3) = 19.052$, $p < .001$. Those with a traditional family type and the greatest number of children that were not obese, 620 (62.37%) (Figure 3).

Figure 3.

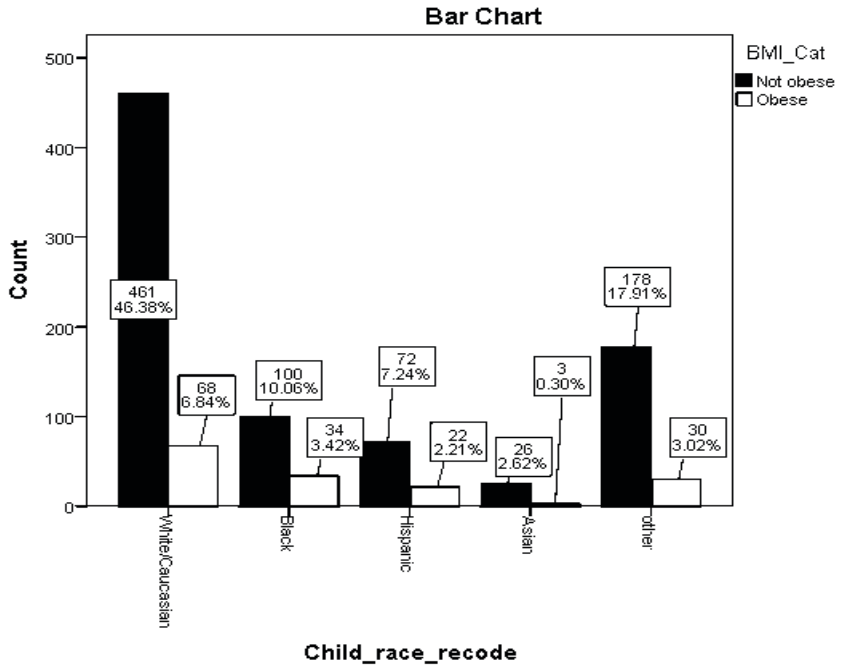
Bar chart of BMI by Family Type ($\chi 2 = 19.052$, $p < .001$)



The relationship between race and BMI was tested by conducting a Chi-square test. The results were significant, $\chi 2(4) = 17.717$, $p = .001$. White/Caucasian had the greatest frequency of not being obese, 461 (46.38%). Figure 4 depicts this information.

Figure 4.

Bar chart of BMI by child race (χ2 = 17.717, p =.001)



Binary logistic regression was conducted in order to further assess the predictive power of the combined variables on obesity. The overall model was significant, $\chi2(10) = 32.829$, $p < .001$. SES and ethnicity were significant. Increasing household income was associated with decreased odds of obesity ($B = -.069$, $p = .029$), $OR = 0.934$. Additionally, compared with White children, Black children had increased likelihood of being obese ($B = 0.532$, $p = .048$, $OR = 1.703$). Table 5 depicts this information.

Table 5

Coefficient Table for RQ 1

	B	*S.E.*	Wald	*df*	*p*	*OR*	95% C.I.for OR	
							Lower	Upper
Sex	-.232	.205	1.285	1	.257	.793	.531	1.184
Age	.001	.030	.001	1	.973	1.001	.944	1.062
SES	-.069	.031	4.740	1	.029	.934	.878	.993
Family Type (Other)*			4.248	3	.236			
Traditional	-.118	.818	.021	1	.885	.888	.179	4.412
Single parent	.352	.814	.187	1	.665	1.422	.288	7.012
Extended family	.143	1.122	.016	1	.899	1.153	.128	10.394
White*			6.692	4	.153			
Black	.532	.270	3.894	1	.048	1.703	1.004	2.890
Hispanic	.312	.329	.898	1	.343	1.366	.716	2.606
Asian	-.499	.755	.437	1	.509	.607	.138	2.666
Other	-.172	.270	.408	1	.523	.842	.496	1.428
Constant	-1.193	.865	1.901	1	.168	.303		

*Not computed due to the item representing the reference category.

Both Chi-square tests and binary logistic regression were conducted in order to address the following research question and hypothesis:

RQ2. What relationship, if any, exists between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity?

H2A: There is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity.

Chi-square tests were conducted to measure the association between obesity and ADHD, anxiety, depression, trauma, developmental/learning disorders (NEURO), and SPMI. The only significant association was between BMI and NEURO, $\chi2(1) = 8.347$, $p = .004$. Those with developmental/learning disorders had greater instances of obesity than those without. All other associations were not significant ($p > .05$). Table 6 depicts this information.

Table 6

Chi-Square Tests for RQ2

Association	χ2	*df*	*p*
BMI and NEURO	8.347	1	.004
BMI and ADHD	1.379	1	.240
BMI and Anxiety	.478	1	.489
BMI and Depressive	.004	1	.948
BMI and Trauma	2.188	1	.139
BMI and SPMI	2.518	1	.113

Results of binary logistic regression were significant, $\chi2(5) = 13.872$, $p = .016$. Children with developmental/learning disorders (NEURO) and SPMI had increased likelihood of being obese. Specifically, for NEURO ($b = 0.516$, $p = .005$, $OR = 1.675$), there was an increase likelihood of being obese by 1.675. Children with SMPI had 1.903 increased likelihood of being obese ($b = .644$, $p = .040$, $OR = 1.903$). Table 7and 8 depict this information.

Table 7

Omnibus Tests of Model Coefficients for RQ 2

	Chi-square	*df*	*p*
	13.872	5	.016

Table 8
Coefficients Table for RQ 2

	B	S.E.	Wald	*df*	*p*	*OR*	95% C.I.for OR	
							Lower	Upper
ANXIETY	-.134	.183	.534	1	.465	.875	.611	1.252
DEPRESSIVE	-.368	.388	.900	1	.343	.692	.323	1.481
ADHD	.179	.193	.856	1	.355	1.196	.819	1.746
NEURO	.516	.186	7.709	1	.005	1.675	1.164	2.412
SPMI	.644	.313	4.224	1	.040	1.903	1.030	3.517
Constant	-2.110	.209	101.484	1	.000	.121		

a. Variable(s) entered on step 1: ANXIETY, DEPRESSIVE, ADHD, NEURO, SPMI.

Binary logistic regression was conducted in order to address this third research question:

RQ3. What relationship, if any, exists between children's Adverse Childhood Experiences and the outcome of childhood obesity?

H3A: There is a statistically significant relationship between children's Adverse Childhood Experiences and the outcome of childhood obesity.

Results of binary logistic regression were significant, $\chi 2(1) = 6.089$ $p = .014$. A one unit increase in ACE score results in an increased likelihood of being obese (b = 0.137, p = .011, OR = 1.147). Tables 9 and 10 depict this information.

Table 9
Omnibus Tests of Model Coefficients

Chi-square	*df*	*p*
6.089	1	.014

Table 10
Coefficients Table for RQ 3

	B	S.E.	Wald	*df*	*p.*	*OR*	95% C.I.for OR	
							Lower	Upper
ACE Score	.137	.054	6.492	1	.011	1.147	1.032	1.275
Constant	-1.823	.108	283.536	1	.000	.162		

a. Variable(s) entered on step 1: ACE_Score.

Binary logistic regression was conducted in order to address this fourth research question:

RQ4. What relationship, if any, exists between children's bedtimes and the outcome of childhood obesity?

H4A: There is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity.

Results of binary logistic regression were significant, $\chi 2(1) = 6.824$, p = .009. Increasing hours of sleep duration was associated with a decreased likelihood of obesity (*b* = -.231, *p* = .008, *OR* = 0.794). Tables 11and 12 depict this information.

Table 11
Omnibus Tests of Model Coefficients for RQ 4

Chi-square	*df*	*p*
6.824	1	.009

Table 12
Coefficients Table for RQ4

	B	S.E.	Wald	*df*	*p*	*OR*	95% C.I.for OR	
							Lower	Upper
Sleep Duration_	-.231	.087	7.049	1	.008	.794	.669	.941
Constant	-.724	.362	3.998	1	.046	.485		

a. Variable(s) entered on step 1: Sleep Duration.

Binary logistic regression was conducted in order to address this fifth research question:

RQ5. What relationship, if any, exists between food availability and the outcome of childhood obesity?

H5A: There is a statistically significant relationship between food availability and the outcome of childhood obesity

The results of binary logistic regression were not significant, $\chi2(1) = 3.223$, $p = .073$. Food desert was not a significant predictor of the occurrence of obesity ($b = .425$, $p = .065$, $OR = 1.529$). Tables 13 and 14 provide this information.

Table 13
Omnibus Tests of Model Coefficients for RQ 5

Chi-square	*df*	*p*
3.223	1	.073

Table 14
Variables in the Equation

	B	*S.E.*	Wald	*df*	*p*	*OR*	95% C.I.for *OR*	
							Lower	Upper
Food Desert	.425	.230	3.410	1	.065	1.529	.974	2.401
Constant	-1.740	.096	329.517	1	.000	.176		

a. Variable(s) entered on step 1: Food Desert.

Supplementary Analysis

An additional binary logistic regression was conducted in order to test the model which contained all significant predictors found in the previous research questions, namely income (SES measured at the interval level), NEURO, SPMI, ACE score, and hours of sleep. The resulting model was significant in predicting likelihood of obesity, $\chi2\ (5) = 31.258$, $p < .001$. Table 15 below provides the coefficients of the predictors in the model. Two of the five predictors were significant: SES ($b = -0.088$, $p = .001$, $OR = .915$), and NEURO ($b = 0.465$, $p =$

.022, *OR* = 1.591). An increase in SES category decreases the likelihood of being obese by 1.09 times (1/.915 = 1.09). Children with a NEURO condition has increased likelihood of being obese by 1,591 times. SPMI (*b* = .426, *p* = .124, *OR* = 1.531), ACE (*b* = .077, *p* = .226, *OR* = 1.080), and sleep duration (*b* = .139, *p* = .167, *OR* = 1.149) were not significant predictors of obesity.

Table 15
Coefficients Table for Supplementary Logistic Regression

	B	*S.E.*	Wald	*df*	*p*	*OR*
SES*	-.088	.028	10.126	1	.001	.915
NEURO	.465	.203	5.225	1	.022	1.591
SPMI	.426	.277	2.367	1	.124	1.531
ACE_	.077	.064	1.469	1	.226	1.080
Sleep Duration	.139	.100	1.911	1	.167	1.149
Constant	-1.669	.385	18.783	1	.000	.188

*SES was treated as interval from 1 to 11 where each unit increment corresponds to a $10,000 increase in annual income.

BMI was also measured at the interval level of measurement and ranged from 9.69 to 42.48 (*M* = 18.72, *SD* = 4.411). BMI marginal means were computed based on the levels of income, NEURO, SPMI, ACE score (High vs. low), and hours of sleep. Tables 16 through 20 below depict the marginal estimated means and standard errors of BMI measured at different levels. Higher mean levels of BMI are shown in the lower income levels, less amount of sleep, NEURO, SPMI, and high ACE scores (categorized as an ACE score greater than or equal to 3).

Table 16
BMI Marginal Means by SES Level

SES	*M*	*SE*	95% Confidence Interval	
			Lower Bound	Upper Bound
Less than 10,000	22.70	.903	20.933	24.477
10,000 - 19,999	21.46	.937	19.626	23.304
20,000 - 29,999	21.57	.849	19.903	23.235
30,000 - 39,999	19.73	.777	18.206	21.256
40,000 - 49,999	19.84	.979	17.915	21.757
50,000 - 59,999	21.33	.881	19.604	23.064
60,000 - 69,999	20.97	.815	19.372	22.570
70,000 - 79,999	21.12	.894	19.362	22.872
80,000 - 89,999	21.62	.827	19.992	23.240
90,000 - 99, 999	21.19	.710	19.800	22.586
100,000 - 149,999	20.39	.539	19.328	21.445
150,000 or above	20.54	.512	19.533	21.545

Table 17
BMI Marginal Means by Sleep Duration

Sleep Duration	*M*	*SE*	95% Confidence Interval	
			Lower Bound	Upper Bound
9-11 hrs	18.52	.343	17.847	19.192
8-9 hrs	20.34	.343	19.669	21.015
7-8 hrs	21.00	.423	20.172	21.831
5-7 hrs	22.16	.577	21.029	23.294
less than 5 hrs	23.17	2.034	19.177	27.161

Table 18
BMI Marginal Means by NEURO

NEURO	*M*	*SE*	95% Confidence Interval	
			Lower Bound	Upper Bound
No	20.89	.494	19.917	21.857
Yes	21.19	.494	20.221	22.159

Table 19
BMI Marginal Means by SPMI

SPMI	*M*	*SE*	95% Confidence Interval	
			Lower Bound	Upper Bound
No	20.21	.475	19.272	21.138
Yes	21.87	.566	20.761	22.984

Table 20
BMI Marginal Means by Ace Level

Ace Level	*M*	*SE*	95% Confidence Interval	
			Lower Bound	Upper Bound
< 3	20.88	.473	19.947	21.802
≥3	21.20	.562	20.099	22.306

Summary

The goal of this study was to evaluate childhood obesity, and the factors that predict it. Specifically, the following research questions and corresponding hypotheses were addressed:

RQ1. What relationship, if any, exists between demographics factors of sex, age, family socioeconomic status, the family type, and race/ ethnicity and the outcome of childhood obesity?

RQ2. What relationship, if any, exists between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity?

RQ3. What relationship, if any, exists between children's Adverse Childhood Experiences and the outcome of childhood obesity?

RQ4. What relationship, if any, exists between children's bedtimes and the outcome of childhood obesity?

RQ5. What relationship, if any, exists between food availability and the outcome of childhood obesity?

In the first research question, results of binary logistic regression were that increasing annual household income was associated with lower risk of obesity. These results were consistent with Chi-square tests of association. The second research question, children with developmental/learning disorders (NEURO) and SPMI had increased likelihood of being obese. Specifically, for NEURO, there was an increase likelihood of being obese by 1.675. Children with SMPI had 1.903 increased likelihood of being obese. Investigation into the third research question revealed that increasing childhood trauma experiences, as measured by ACE score, was association with increased likelihood of obesity by 1.147 times. In the fourth research question, increasing hours of sleep duration was associated with a decreased likelihood of obesity. Lastly, the fifth research question, food desert was not a significant predictor of the occurrence of obesity.

Chapter VIII: Discussion

Introduction

This chapter will discuss the research findings detailed previously. The later parts of this section will present the implications, contributions, and recommendations for future research. The study problem was the identification of predictors of obesity among children and how those with significant impact could be addressed to aid in curbing the epidemic and treating those with childhood obesity.

There are a number of complexities that surround obesity and its predictors among children, and more investigation was required to examine the role of factors such as demographics, with race complexity as a moderating factor (Assari, 2018), sleep (Hanlon et al., 2019), and the multifaceted approaches to obesity prevention (Lee & Yoon, 2018), as well as food availability, mental health diagnosis, and early childhood trauma. The purpose of conducting this quantitative non-experimental correlational research was to evaluate childhood obesity and the factors that predict it.

Interpretation of Findings

The data analysis process was conducted using the following research questions and hypotheses:

RQ1. What relationship, if any, exists between demographics factors of sex, age, family socioeconomic status, family type, and race/ ethnicity and the outcome of childhood obesity?

H1A: There is a statistically significant relationship between one or more of the demographic factors of sex, age, family socioeconomic status, the family type, race/ ethnicity and the outcome of childhood obesity.

RQ2. What relationship, if any, exists between children's class of consensus diagnosis of trauma or stressor-related disorders and the outcome of childhood obesity?

H2A: There is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor-related disorders and the outcome of childhood obesity.

RQ3. What relationship, if any, exists between children's Adverse Childhood Experiences and the outcome of childhood obesity?

H3A: There is a statistically significant relationship between children's Adverse Childhood Experiences and the outcome of childhood obesity.

RQ4. What relationship, if any, exists between children's bedtimes and the outcome of childhood obesity?

H4A: There is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity.

RQ5. What relationship, if any, exists between food availability and the outcome of childhood obesity?

H5A: There is a statistically significant relationship between food availability and the outcome of childhood obesity

H1A: There is a statistically significant relationship between one or more of the demographic factors of sex, age, family socioeconomic status, the family type, race/ ethnicity and the outcome of childhood obesity.

The results under this hypothesis illustrated that there is no positive relationship between sex and BMI. Although more males were found to be obese, the proportional

differences were not significant. In the literature review section, none of the studies reviewed demonstrated any relationships between sex and BMI. However, there was a significant relationship between socioeconomic status (SES) and BMI. This finding was supported by a study conducted by Ochoa and Berge (2017), who documented that sleep duration, food security/socioeconomic status, sedentary behavior/physical activity, screen time, and parental impacts were the five main environmental factors that were linked to childhood obesity.

Literature by Alexander et al. (2017) also illustrated that there was a developing number of evidence signifying that the relationship between socioeconomic status and the emergence of childhood obesity. Hemmingsson (2018) also supported this finding in the explanation of ever-widening income gaps and the continued negative impact of low socioeconomic status on weight, especially in communities where the obesity rate was already high.

The results in hypothesis H1A also demonstrated that there was a significant relationship between family type and BMI. This finding was also explored by Beets et al. (2019) with the social, physical and family contexts that impact childhood obesity through direct and indirect influences. In the view of Beets et al. (2019), parental nurturing and parental education tend to minimize the obesity threat among girls while shared household meals, the use of electronic media, and family food context are three key environmental predictors that broadly impact childhood obesity through behavioral means.

Lei et al. (2019) also supported by stating that family food preferences and control of appetite are formulated early in life, and there is a strong association between parental obesity and the status of the weight of kids. In addition, Schultz et al. (2018) investigated and concluded that the link between environmental stressors with obesity among children included the

efficiency of the communication between family members, parental anxiety, maltreatment, and adverse life experiences.

Moreover, there was a significant relationship between race and BMI. Race as a predictor of childhood obesity was discussed by Hanlon et al. (2019), who found the relationship between obesity in children included race and sleep duration as moderating factors, which leads to the need for a multifaceted approach to curbing childhood obesity. This finding was also supported by Williams et al. (2018), who stated that the failure to eat dinner as a family, parental smoking, birth weight, race and socioeconomic status is linked with preschool-aged kids being overweight or obese.

Nonetheless, the outcomes of a study conducted by Isong et al. (2018) demonstrated that the rate of risk factors fluctuated substantially by ethnicity or race. Black American kids had the highest occurrence of risk factors, where Asian kids had the least prevalence. The socioeconomic gaps among the kids from diverse ethnicities were found to be key contributors to the differences in the prevalence of childhood obesity among kids from diverse races. However, a study conducted by Rodgers et al. (2015) demonstrated that the impact of race or ethnicity was not mathematically significant to childhood obesity.

H2A: There is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor related disorders and the outcome of childhood obesity.

Under this hypothesis, the study found a significant relationship between developmental/learning disorders (NEURO) and the outcome of childhood obesity. Bennett et al. (2017) supported this finding by stating that minors with developmental and psychological disabilities in the U.S. are more vulnerable to obesity as compared to youth and kids without

disabilities. The results also found that there was no significance between ADHD, anxiety, depression, trauma, and BMI. However, children with developmental/learning disorders and SPMI had increased chances of being obese.

H3A: There is a statistically significant relationship between children's Adverse Childhood Experiences and the outcome of childhood obesity.

Under this hypothesis, a one unit increase in ACE score results in an increased likelihood of being obese. This finding aligns with the outcomes of a study by Davies et al. (2019) who documented that ACEs were directly related to weight conditions and that teenagers with more ACEs were more obese and severely obese as linked to those with no ACE. In their study, Davies et al. (2019) argued that the evaluation of Adverse Childhood Experiences (ACEs) during infancy is especially problematic due to the compulsory reporting necessities, which require reporting of kids' exposure for various ACEs, both sexual and physical abuse to authorities. There is a progressing probability of reporting prejudice when parents or guardians are inquired to report on their kids' ACEs.

H4A: There is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity.

Under this hypothesis, it was found that an increased duration of sleeping hours was associated with a decreased likelihood of obesity. Sleeping hours as a predictor of childhood obesity was illustrated by Hanlon et al. (2019) who found that race and sleep are among the moderating factors of obesity among children. Moreover, literature by Ochoa and Berge (2017) stated that five environmental factors that were linked to childhood obesity include sleep duration, socioeconomic status, physical activity, screen time, and parental interventions. Besides, a study by Wang et al. (2018) also found a found a u-shaped association between sleep

period and obesity threat among girls, with the minimal risk among girls who slept for 8 hours. The authors concluded that sufficient sleep period is a significant component of the prevention of obesity among teenagers. Last but not least, Li et al. (2017) suggested that parents focus on adequate sleep duration as part of the plan to treat children with childhood obesity.

H5A: There is a statistically significant relationship between food availability and the outcome of childhood obesity

Under this hypothesis, it was found that food unavailability was not a significant predictor of the occurrence of obesity. This finding is in line with a study conducted by D'Alonzo et al. (2020) who used the Geographic Information System (GIS) to conceptualize and manage locational based data. According to data collected on child obesity in relation to fresh food availability across US states, D'Alonzo et al. (2020) mapped out hot spot zip codes that led to an identification of relationships between fresh food shortages in specific US states and the prevalence of child obesity. According to the findings of their research, the zip codes 48228 and 48227 depicted high and increasing rates of child obesity despite the existence of sufficient grocery stores. Furthermore, an attempt by Kaiser et al. (2017) to explain the relationship between food availability and childhood obesity in their study illustrated that geographical locations and the availability of fresh foods have little to do with child obesity compared to the food options engaged by parents.

Implications and Conclusions

The findings of this research are significant at the individual, organizational, and policy levels in theory and practice. At the individual levels, the outcomes of this research will aid the parents and caregivers of children with obesity to find ways to cope and address their weight.

The outcomes of this research concluded that there is a strong statistically significant relationship between the demographic factors of age, family socioeconomic status, the family type, race/ ethnicity, and the outcome of childhood obesity, as well as sleep duration, some mental health diagnoses, and early childhood trauma related to the ACEs. This outcome will be significant for educating parents on the predictors that lead to childhood obesity so that interventions for preventable predictors and appropriate measures for those that aren't preventable can be taken. For instance, Nittari et al. (2019) pointed out the importance of parents and guardians to ensure that their children are kept physically active and engage them in activities that are suitable for their developmental capability and level. This includes aiding children to adopt healthy lifestyles with a reduction in caloric intake in combination with physical activity to prevent overweight and obesity.

In a social work practice, the findings of this study impact development to clinical, policy, and education practice. Specifically, the findings of the impact of the ACEs score on predicting childhood obesity and how that changes given each additional increase in the total score. This is in line with other findings like Witt et al (2017), who found that in addition to obese children facing negative body image issues that can cause eating disorders, over 2 million children with obesity had a history of trauma, be it sexual, verbal or physical abuse. Belli et al. (2019) also found that trauma is a cause of obesity. Dye (2018) found that children who encountered abuse were four times more likely to be obese. By understanding this finding and furthering the knowledge on this, social workers in clinical practice can add the ACE as a measurement tool and guide decision making in treatment, possibly using Trauma-Informed Care, to better influence weight loss or prevent childhood obesity in the first place by addressing the trauma these children have experienced. In addition, the most recommended forms of weight

loss include CBT methods to modify behaviors associated with food consumption, calorie reduction, and exercise (Forman et al., 2019).

The findings of this research are also imperative at policy and organizational levels due to the role they play in influencing childhood obesity, its prevention, and the predictors that influence the disorder among children. Understanding and addressing the predictive factors of the problem of childhood obesity can yield guiding principles on addressing the issue. For example, since we know there is a higher link of childhood obesity to socioeconomic status in some communities as it was in this study and in Rogers et al. (2015), those concerns can start to be addressed by social workers in the field through linking families to resources that provide better foods, development of programming to ensure access as well as advocacy and policy changes to ensure needs are being addressed. Looking at other predictors, like the use of electronic media in Karachaliou et al. (2020), and the impact of familial behavior on success in preventing or treating obesity in children (Hayes et al. 2019, Staiano et al., 2017) and developing policies to aid families in being more educated and changing behavioral patterns will also help to reduce the number of children impacted. By developing policies that allow families and practitioners to help in addressing some of the predictors, the overall impact can be reduced.

The knowledge acquired from this research can also aid educators and leaders of community organizations to know how each of the predictors of childhood obesity discussed can be monitored and controlled. For instance, Williams et al. (2018) illustrated that various adaptable risk aspects for obesity in kids are linked to socioeconomic status, encompassing watching television, drinking soda, smoking, and neighborhood security. School and other significant organizations can teach children the consequences of exposure to these risks.

The field of social work education can also adopt the findings from this study to shift how social workers perceive the problem of childhood obesity. By understanding this concern as a health issue and not a moral issue, through the lens of Theory of Planned Behavior and the Ecological Systems Theory, social work education can start influencing the problem far earlier. By addressing how theory can explain a broad range of behaviors and how to understand that to change, the perspective of thinking shifts. In training new social workers to think about how they use theory to understand a problem that is occurring, they have more tools to address it. Looking at the Theory of Planned Behavior and understanding the impact on obesity, we can look for ways to change those patterns (Qi & Ploeger, 2019; Andrews et al., 2010). In addition, by changing the way we train professionals to think about obesity and increasing the understanding of the causes and the way in which it negatively affects lives, we can improve outcomes for those in our care. By applying a theoretical understanding in a different way, like Ecological Systems theory (Noursi et al., 2020; Reifsnider et al., 2020), we can educate social workers understanding that childhood obesity has linked to so many other social issues that may be causal, and we can be better able to address them on a micro, macro, and community level.

Limitation of the Study

All research has inherent limitations or weaknesses (Balnaves & Caputi, 2001). Some of these weaknesses relate to the methodology. In particular, the proposed study adopts a correlational research design. Hence, it is necessary to acknowledge that the results of the study can only prove correlation between predictors of childhood obesity and obesity, not that any one or more of the factors cause childhood obesity. Typically, using a secondary source of data would impose certain limitations on the variables that could be studied, but the broad range of data available through the Healthy Brain Network negates that limitation.

Related to limitations are issues of validity. In quantitative research, validity is divided into external and internal validity (Balnaves & Caputi, 2001). External validity refers to the extent to which the study's findings can be generalized beyond the context in which the study was conducted (Balnaves & Caputi, 2001). This study is expected to have particularly good external validity. On one hand, external validity can be generated by a large sample size, ensuring that the results have the necessary statistical power. Given that the full sample size of the Healthy Brain Network's dataset is 10,000, this aspect is addressed without question. The second component of external validity is representativeness. Although the Healthy Brain Network participants were recruited from one geographic area in New York, New York is a highly diverse state. Moreover, the inclusion of key demographic predictors in this study should help determine to what extent, if any, the local context plays a role in shaping the study's results.

Internal validity is instead a measure of how well the study measures the key issues (Balnaves & Caputi, 2001). The strongest way in which internal validity will be created in this study is through a careful alignment of study components. The research questions for the study are derived directly from a combination of the problem statement and the study's theoretical framing. The variables are in turn derived directly from the research questions. The measures for those variables are all either intrinsic measures or existing, validated instruments such as the ACES instrument. Hence, issues of internal validity will be addressed thoroughly.

Areas of Future Research

The findings from this research illustrated that there was no significant between the class of diagnoses related to ADHD, anxiety, depression, trauma, and SPMI, and childhood obesity. However, a number of other studies found that there were. For instance, Schultz et al. (2018)

found that there is a direct relationship is between depression and obesity among adults and children and that the association between depression and obesity can be caused by environmental etiologies, typical genetic or usual pathways through dysregulation of the hypothalamic-pituitary-adrenal configuration. On the contrary, Aggarwal and Jain (2018) stated that pediatric obesity has a similar impact on adults because it leads to serious health issues, including mental health disorders such as depression. Therefore, the future researcher should dwell on the cause and effects of depression and anxiety on childhood obesity and vice versa so that the exact outcomes of these predictors are acknowledged.

Future research could also benefit by conducting studies using a mixed research methodology to acquire qualitative and quantitative data to conduct similar studies on childhood obesity. A mixed methodology will allow the researchers to integrate both qualitative and quantitative data and possibly shed more light on the indicators and predictors of childhood obesity.

Conclusion

The purpose of conducting this quantitative non-experimental correlational research was to evaluate childhood obesity and the factors that predict it. The major aim of this research was to determine the factors that predict the outcome of childhood obesity and thus learn how to address this issue. Due to the complexities that surround obesity and its predictors among children, more investigation was required to examine the role of factors such as sleep, race complexity as a moderating factor, and the multifaceted approaches to obesity prevention.

Five key findings were significant in the study that answered the research questions used to guide the study. The first finding is that there is a strong statistically significant relationship between the demographic factors of age, family socioeconomic status, family type, race/

ethnicity, and the outcome of childhood obesity. However, there is no significant relationship between sex as a demographic factor and BMI among children. The second finding is that there is a statistically significant relationship between children's class of consensus diagnosis of trauma or stressor-related disorders and the outcome of childhood obesity. However, there is no significance between ADHD, anxiety, depression, trauma, and SPMI and BMI, only neurological disorders like developmental and speech and language disorders. The third finding is that there is a statistically significant relationship between children's Adverse Childhood Experiences (ACEs) and the outcome of childhood obesity. Finding number four states that there is a statistically significant relationship between children's bedtimes and the outcome of childhood obesity. Lastly, food availability, or lack thereof, was not a significant predictor of the occurrence of obesity among children. The findings that have significant outcomes are imperative for both future research and practice in the field of those dealing with and seeking to study childhood obesity in future.

\References

Aggarwal, B., & Jain, V. (2018). Obesity in children: definition, etiology and approach. *The Indian Journal of Pediatrics*, *85*(6), 463-471. DOI: 10.1007/s12098-017-2531-x

Agnihotri, A., Xie, A., Bartalos, C., Kushnir, V., Islam, S., Islam, E., & Altawil, J. (2018). Real-world safety and efficacy of fluid-filled dual intragastric balloon for weight loss. *Clinical Gastroenterology and Hepatology*, *16*(7), 1081-1088.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211.

Akhter, Z., Rankin, J., Ceulemans, D., Ngongalah, L., Ackroyd, R., Devlieger, R., & Heslehurst, N. (2019). Pregnancy after bariatric surgery and adverse perinatal outcomes: A systematic review and meta-analysis. *PLoS medicine*, *16*(8), e1002866.

Albaugh, V. L. (2018). Surgical treatment of obesity. *F1000 Research*, 7.

Alexander, L. M., Escalera, J., Ai, L., Andreotti, C., Febre, K., Mangone, A., & Litke, S. (2017). An open resource for transdiagnostic research in pediatric mental health and learning disorders. *Scientific Data*, 4, 170181.

Anderson, P. M., Butcher, K. F., & Schanzenbach, D. W. (2019). Understanding recent trends in childhood obesity in the United States. *Economics & Human Biology*, *34*, 16-25.

Andrews, K. R., Silk, K. S., & Eneli, I. U. (2010). Parents as health promoters: a theory of planned behavior perspective on the prevention of childhood obesity. *Journal of Health Communication*, 95-107.

Arifin, R. M., & Teh, K. S. M. (2020, May). How to Create a System Ecological Theory of The Environment in Revolution 4.0 Era?. In *Journal of Physics: Conference Series* (Vol. 1529, No. 5, p. 052074). IOP Publishing.

Armstrong, S. C., Bolling, C. F., Michalsky, M. P., & Reichard, K. W. (2019). Pediatric metabolic and bariatric surgery: evidence, barriers, and best practices. *Pediatrics*, *144*(6).

Armitage, C. J., Conner, M., Loach, J., & Willetts, D. (2010). Different perceptions of control: Applying an extended theory of planned behavior to legal and illegal drug use. *Basic And Applied Social Psychology*, *21*(4), 301-316.

Assari, S. (2018). Family income reduces risk of obesity for white but not black children. *Children*, *5*(6), 73. doi: 10.3390/children5060073

Ayine, P., Parra, E. P., Jeganathan, R. B., & Thangiah, G. (2018). Influence of race, ethnicity, and behavioral factors on childhood obesity. *Diabetes, 67*(Supplement 1): -.https://doi.org/10.2337/db18-2083-P

Asieba, I. O. (2016) Racial/Ethnic Trends in Childhood Obesity in the United States. Journal of Childhood Obesity 1:1. DOI: 10.21767/2572-5394.100001

Bagheri, A., Bondori, A., Allahyari, M. S., & Damalas, C. A. (2019). Modelling farmers' intention to use pesticides: An expanded version of the theory of planned behavior. *Journal of environmental management*, *248*, 109291.

Bahia, L., Schaan, C. W., Sparrenberger, K., de Azevedo Abreu, G., Barufaldi, L. A., Coutinho, W., & Schaan, B. D. (2019). Overview of meta-analysis on the prevention and treatment of childhood obesity. *Jornal de Pediatria (Versão em Português)*, *95*(4), 385-400.

Balnaves, M., & Caputi, P. (2001). *Introduction to quantitative research methods: An investigative approach*. Thousand Oaks, CA: Sage.

Bashir, S., Khwaja, M. G., Turi, J. A., & Toheed, H. (2019). Extension of planned behavioral theory to consumer behaviors in green hotel. *Heliyon*, *5*(12), e02974.

Beets, M. W., Brazendale, K., Weaver, R. G., & Armstrong, B. (2019). Rethinking behavioral approaches to complement biological advances to understand the etiology, prevention, and treatment of childhood obesity. *Childhood Obesity*, *15*(6), 353-358.

Belli, H., Ural, C., Akbudak, M., & Sagaltıcı, E. (2019). Levels of childhood traumatic experiences and dissociative symptoms in extremely obese patients with and without binge eating disorder. *Nordic journal of psychiatry*, *73*(8), 527-531.

Bennett, E. A., Kolko, R. P., Chia, L., Elliott, J. P., & Kalarchian, M. A. (2017). Treatment of Obesity Among Youth With Intellectual and Developmental Disabilities: An Emerging Role for Telenursing. *Western Journal of Nursing Research*, 1-14.

Brady, T. M. (2017). Obesity-related hypertension in children. *Frontiers in pediatrics*, *5*, 197.

Bronfenbrenner, U. (1992). *Ecological systems theory*. Jessica Kingsley Publishers.

Bumpass, L. L. & Sweet, J. A. (2020). National Survey of Families and Households Series. *ICPSR.org.* Retrieved from https://www.icpsr.umich.edu/web/ICPSR/series/193/variables?q=eat

Campbell, J., Ramirez, N., & Derenne, J. (2019). Current Pharmacological Treatments for Childhood-Onset Eating Disorders. *Current Treatment Options in Psychiatry*, *6*(4), 367-379.

Campbell, M. K. (2015). Biological, environmental, and social influences on childhood obesity. *Pediatric Research*, 205-211.

Carrasco-Pozo, C., Cires, M. J., & Gotteland, M. (2019). Quercetin and epigallocatechin gallate in the prevention and treatment of obesity: from molecular to clinical studies. *Journal of medicinal food*, *22*(8), 753-770.

Chatham-Stephens, K., Taylor, E., Chang, A., Peterson, A., Daniel, J., Martin, C., & Klontz, K. (2017). Hepatotoxicity associated with weight loss or sports dietary supplements, including OxyELITE Pro™—the United States, 2013. *Drug testing and analysis*, *9*(1), 68-74.

Cheng, O. Y., Yam, C. L., Cheung, N. S., & Lee, P. L. (2019). Extended Theory of Planned Behavior on Eating and Physical Activity. *American Journal of Health Behavior*, 569-581.

Chiu, L. B., Yie, C. K., & Ling, T. S. (2020). Healthcare Worker's Intention to Donate Blood: An Application of the Theory of Planned Behaviour.

Cossrow, N., & Falkner, B. (2004). Race/ethnic issues in obesity and obesity-related comorbidities. *The Journal of Clinical Endocrinology & Metabolism*, *89*(6), 2590-2594.

Chiu, L. B., Yie, C. K., & Ling, T. S. (2020). Healthcare Worker's Intention to Donate Blood: An Application of the Theory of Planned Behaviour. *Clinical Research Center*, 1-18.

Conner, C. J. (2010). Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *British Journal of Social Psychology*, 1-16.

Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2016). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review*, 148–167.

Dai, W., & Jiang, L. (2019). Dysregulated Mitochondrial Dynamics and Metabolism in Obesity, Diabetes and Cancer. *Frontiers in Endocrinology*, *10*, 570. DOI: 10.3389/fendo.2019.00570

Davies, Barnes, Gross, Ryder and Shlafer (2019) . Adverse Childhood Experiences and Weight Status among Adolescents. *Journal of Pediatrics*, 204, 71-76.e1.

D'Alonzo, K. T., Vilaró, F. M., Joseph, M. E., Oyeneye, V., Garsman, L., Rosas, S. R., & Vivar, M. (2020). Using Concept Mapping within a Community–Academic Partnership to Examine Obesity among Mexican Immigrants. *Progress in Community Health Partnerships: Research, Education, and Action*, *14*(2), 173-185.

Daneschvar, H. L., Aronson, M. D., & Smetana, G. W. (2016). FDA-approved anti-obesity drugs in the United States. *The American journal of medicine*, *129*(8), 879-e1.

Davis, L., Barnes, A. J., Gross, A. C., Ryder, J. R., & Shlafer, R. J. (2019). Adverse childhood experiences and weight status among adolescents. *The Journal of Pediatrics*, *204*, 71-76.

Deng, T., Lyon, C. J., Bergin, S., Caligiuri, M. A., & Hsueh, W. A. (2016). Obesity, inflammation, and cancer. *Annual Review of Pathology: Mechanisms of Disease*, *11*, 421-449. DOI: 10.1146/annurev-Pathol-012615-044359

Du, Y. (2013). Should antidepressants be used to treat childhood depression? *Shanghai Archives of Psychiatry*, 48-49.

Dye, H. (2018). The impact and long-term effects of childhood trauma. *Journal of Human Behavior in the Social Environment*, *28*(3), 381-392.

Faisal, M., Chunping, X., Akhtar, S., Raza, M. H., Khan, M. T. I., & Ajmal, M. A. (2020). Modelling smallholder livestock herders' intentions to adopt climate-smart practices: An extended theory of planned behavior. *Environmental Science and Pollution Research*, 1-18.

Rahmati-Najarkolaei, F., Pakpour, A. H., Saffari, M., Hosseini, M. S., Hajizadeh, F., Chen, H., & Yekanineja, M. S. (2017). Determinants of lifestyle behavior in Iranian adults with prediabetes: Applying the theory of planned behavior. *Archives of Iranian medicine*, *20*(4), 198-204.

Felso, R., Lohner, S., Hollódy, K., Erhardt, É., & Molnár, D. (2017). Relationship between sleep duration and childhood obesity: Systematic review including the potential underlying mechanisms. *Nutr Metab Cardiovasc Dis*, 751-761.

Forman, E. M., Manasse, S. M., Butryn, M. L., Crosby, R. D., Dallal, D. H., & Crochiere, R. J. (2019). Long-term follow-up of the Mind Your Health project: acceptance-based versus standard behavioral treatment for obesity. *Obesity*, *27*(4), 565-571.

Gold, A. L., Bennett, K., Jansen, R. J., Mobley, A. R., Procter, S. B., Smathers, C., & Oscarson, R. (2020). Ripple effects of the communities preventing childhood obesity project. *Health promotion practice*, *21*(2), 308-318.

Grandone, A., Di Sessa, A., Umano, G. R., Toraldo, R., & Del Giudice, E. M. (2018). New treatment modalities for obesity. *Best Practice & Research Clinical Endocrinology & Metabolism*, *32*(4), 535-549.

Grossman, D. C., Bibbins-Domingo, K., Curry, S. J., Barry, M. J., Davidson, K. W., Doubeni, C. A., & Landefeld, C. S. (2018). Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. *Jama*, *317*(23), 2417-2426. DOI: 10.1001/jama.2017.6803

Grover, S., & Basu, S. (2017). Measuring student learning in introductory block-based programming: Examining misconceptions of loops, variables, and boolean logic. In *Proceedings of the 2017 ACM SIGCSE technical symposium on computer science education* (pp. 267-272).

Gusenbauer, M. (2019). Google Scholar to overshadow them all? Comparing the sizes of 12 academic search engines and bibliographic databases. *Scientometrics*, *118*(1), 177-214.

Hagman, E., Danielsson, P., Brandt, L., Svensson, V., Ekbom, A., & Marcus, C. (2017). Childhood obesity, obesity treatment outcome, and achieved education: a prospective cohort study. *Journal of Adolescent Health*, *61*(4), 508-513.

Hanlon, E. C., Dumin, M., & Pannain, S. (2019). Sleep and obesity in children and adolescents. In *Global Perspectives on Childhood Obesity* (pp. 147-178). Academic Press.

Hayes, J. F., Balantekin, K. N., Conlon, R. P. K., Brown, M. L., Stein, R. I., Welch, R. R., & Saelens, B. E. (2019). Home and neighbourhood built environment features in family-based treatment for childhood obesity. *Pediatric obesity*, *14*(3), e12477.

Hemmingsson, E. (2018). Early childhood obesity risk factors: socioeconomic adversity, family dysfunction, offspring distress, and junk food self-medication. Current obesity reports, 7(2), 204-209.

Hughes, S., Power, T., Micheli, N., Baker, S., Barale, K., Lanigan, J., & Garcia, K. (2019). NP14 use of online videos with feeding content to enhance an EFNEP program in preventing childhood obesity. *Journal of Nutrition Education and Behavior*, *51*(7), S16.

Isong, I. A., Rao, S. R., Bind, M. A., Avendaño, M., Kawachi, I., & Richmond, T. K. (2018). Race and ethnic disparities in early childhood obesity. *Pediatrics*, *141*(1).

Jagim, A. R., Harty, P. S., Fischer, K. M., Kerksick, C. M., & Erickson, J. L. (2020). Adverse events reported to the United States Food and Drug Administration related to caffeine-containing products. In *Mayo Clinic Proceedings* (Vol. 95, No. 8, pp. 1594-1603). Elsevier.

Jebeile, H., Gow, M. L., Baur, L. A., Garnett, S. P., Paxton, S. J., & Lister, N. B. (2019). Treatment of obesity, with a dietary component, and eating disorder risk in children and

adolescents: A systematic review with meta-analysis. *Obesity Reviews*, *20*(9), 1287-1298.

Johnson, B. (2001). Toward a new classification of nonexperimental quantitative research. *Educational Researcher*, *30*(2), 3-13. doi: 10.3102/0013189X030002003

Johnston, K. L., & White, K. M. (2003). Binge-drinking: A test of the role of group norms in the theory of planned behaviour. *Psychology and Health*, *18*(1), 63-77.

Juul, F., Martinez-Steele, E., Parekh, N., Monteiro, C. A., & Chang, V. W. (2018). Ultra-processed food consumption and excess weight among US adults. *British Journal of Nutrition*, *120*(1), 90-100. https://doi.org/10.1017/S0007114518001046

Kaiser, M. L., Rogers, C., Hand, M. D., Hoy, C., & Stanich, N. (2017). Finding our direction: The process of building a community-university food mapping team. *Journal of Community Engagement and Scholarship*, *9*(2), 3.

Karachaliou, F., Vlachopapadopoulou, E., Psaltopoulou, T., Manios, Y., Koutsouki, D., Bogdanis, G., & Michalacos, S. (2020). Prevalence of asthma symptoms and association with obesity, sedentary lifestyle and sociodemographic factors: Data from the Hellenic National Action Plan for the assessment, prevention and treatment of childhood obesity (MIS301205). *Journal of Asthma*, *57*(1), 55-61.

Kassem, N. O., Modeste, N., & Johnston, P. (2003). Understanding soft drink consumption among female adolescents using the Theory of Planned Behavior. *Health Education Research*, 278-291.

Kassie, A., Azale, T., & Nigusie, A. (2020). Intention to donate blood and its predictors among adults of Gondar city: Using the theory of planned behavior. *PloS one*, *15*(3), e0228929.

Kelly, B., West, J., Yang, T. C., Mason, D., Hasan, T., & Wright, J. (2019). The association between body mass index, primary healthcare use and morbidity in early childhood: findings from the Born In Bradford cohort study. *Public Health*, *167*, 21-27.

Khera, R., Pandey, A., Chandar, A. K., Murad, M. H., Prokop, L. J., Neeland, I. J., & Singh, S. (2018). Effects of weight-loss medications on cardiometabolic risk profiles: a systematic review and network meta-analysis. *Gastroenterology*, *154*(5), 1309-1319.

Kumar, S., & Kelly, A. S. (2017, February). Review of childhood obesity: from epidemiology, etiology, and comorbidities to clinical assessment and treatment. In *Mayo Clinic Proceedings* (Vol. 92, No. 2, pp. 251-265). Elsevier.

Lambert, L. G., Chang, Y., & Mann, G. (2020). College Students' Intention to Select Healthy Snacks: An Application of the Theory of Planned Behavior. *American Journal of Health Education*, *51*(4), 215-224.

Larson, E. A. (2020). Threshold occupational science concepts for lifestyle change: "Doing" wellness in a course for US college students. *Journal of Occupational Science*, *27*(2), 274-287.

Latifah, E., & Dewi, Y. L. R. (2020). Physical Activity, Sensory Threshold of Sweetness, and Waist-to-Height Ratio (WHtR) in Adolescents. *Electronic Journal of General Medicine*, *17*(5).

Laerd (2021). Binomial Logistic Regression using SPSS Statistics. *Laerd.com.* https://statistics.laerd.com/spss-tutorials/binomial-logistic-regression-using-spss-statistics.php

Lee, C. Y., Ledoux, T. A., Johnston, C. A., Ayala, G. X., & O'Connor, D. P. (2019). Association of parental body mass index (BMI) with a child's health behaviors and a child's BMI depends on a child's age. *BMC obesity*, *6*(1), 11.

Lei, X. Y., Li, Y. J., Ou, J. J., & Li, Y. M. (2019). Association between parental body mass index and autism spectrum disorder: A systematic review and meta-analysis. *European Child & Adolescent Psychiatry*, *28*(7), 933-947.

Lee, E. Y., & Yoon, K. H. (2018). Epidemic obesity in children and adolescents: risk factors and prevention. *Frontiers of Medicine*, *12*(6), 658-666. doi: 10.1007/s11684-018-0640-1

Li, L., Zhang, S., Huang, Y., & Chen, K. (2017). Sleep duration and obesity in children: A systematic review and meta-analysis of prospective cohort studies. *Journal of Paediatrics and Child Health*, 1-17.

Lieb, D. C., Snow, R. E., & DeBoer, M. D. (2009). Socioeconomic Factors in the Development of Childhood Obesity and Diabetes. PMC, 349–378.

Medina-Albaladejo, F. J., & Calatayud, S. (2020). Unequal access to food during the nutritional transition: evidence from Mediterranean Spain. *The Economic History Review*, *73*(4), 1023-1049. https://doi.org/10.1111/ehr.12993

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.

Moore, R. L., Seger, M. V., Garber, S. M., Smith, A. B., Nguyen, R. T., Shieh, M. K., & Sullivan, S. (2019). Clinical safety and effectiveness of a swallowable gas-filled intragastric balloon system for weight loss: consecutively treated patients in the initial year of US commercialization. *Surgery for Obesity and Related Diseases*, *15*(3), 417-423.

Morales-Camacho, W. J., Molina-Díaz, J. M., Plata-Ortiz, S., Plata-Ortiz, J. E., Morales-Camacho, M. A., & Calderón, B. P. (2019). Childhood obesity: Aetiology, comorbidities, and treatment. *Diabetes/Metabolism Research And Reviews*, *35*(8), e3203.

Nehus, E., & Mitsnefes, M. (2019). Childhood obesity and the metabolic syndrome. *Pediatric Clinics*, *66*(1), 31-43.

Neto, I. L., Matsunaga, L. H., Machado, C. C., Günther, H., Hillesheim, D., Pimentel, C. E., & D'Orsi, E. (2020). Psychological determinants of walking in a Brazilian sample: An application of the Theory of Planned Behavior. *Transportation Research Part F: Traffic Psychology and Behaviour*, *73*, 391-398.

Nittari, G., Scuri, S., Petrelli, F., Pirillo, I., Di Luca, N. M., & Grappasonni, I. (2019). Fighting obesity in children from the European World Health Organization member states. Epidemiological data, medical-social aspects, and prevention programs. *Clin. Ther*, *170*, e223-e230.

Norman, P., Conner, M. T., & Bell, R. (2002). The Theory of Planned Behavior and Healthy Eating. *Health Psychology, 21*, 194-201. Doi.org/10.1037/0278-6133.21.2.194

Noursi, S., Saluja, B., & Richey, L. (2020). Using the Ecological Systems Theory to Understand Black/White Disparities in Maternal Morbidity and Mortality in the United States. *Journal of racial and ethnic health disparities*, 1-9.

Ochoa, A., & Berge, J. M. (2017). Home environmental influence on childhood obesity in the latino population: a decade review of literature. *Journal of Immigration Minor Health*, 430–447.

Ogden, C. L., Fryar, C. D., Hales, C. M., Carroll, M. D., Aoki, Y., & Freedman, D. S. (2018). Differences in obesity prevalence by demographics and urbanization in US children and adolescents, 2013-2016. *Jama*, *319*(23), 2410-2418. DOI: :10.1001/jama.2018.5158

Olfert, M. D., King, S. J., Hagedorn, R. L., Barr, M. L., Baker, B. A., Colby, S. E., & White, A. A. (2019). Ripple effect mapping outcomes of a childhood obesity prevention program from youth and adult dyads using a qualitative approach: iCook 4-H. *Journal of nutrition education and behavior*, *51*(3), S41-S51.

Petersen, R., Pan, L., & Blanck, H. M. (2019). Peer-Reviewed: Racial and Ethnic Disparities in Adult Obesity in the United States: CDC's Tracking to Inform State and Local Action. *Preventing chronic disease*, *16*.

Psaltopoulou, T., Hatzis, G., Papageorgiou, N., Androulakis, E., Briasoulis, A., & Tousoulis, D. (2017). Socioeconomic status and risk factors for cardiovascular disease: impact of dietary mediators. Hellenic Journal of Cardiology, 58(1), 32-42.

Qi, X., & Ploeger, A. (2019). Explaining consumers' intentions towards purchasing green food in Qingdao, China: The amendment and extension of the theory of planned behavior. *Appetite*, *133*, 414-422.

Qiao, J., Dai, L. J., Zhang, Q., & Ouyang, Y. Q. (2020). A meta-analysis of the association between breastfeeding and early childhood obesity. *Journal of Pediatric Nursing*, *53*, 57-66.

Rehman, S. U., Bhatti, A., Mohamed, R., & Ayoup, H. (2019). The moderating role of trust and commitment between consumer purchase intention and online shopping behavior in the context of Pakistan. *Journal of Global Entrepreneurship Research*, *9*(1), 1-25.https://doi.org/10.1186/s40497-019-0166-2

Reifsnider, E., Jeong, M., & Chatterjee, P. (2020). An ecological approach to obesity in Mexican American children. *Journal of Pediatric Health Care*, *34*(3), 212-221.

Robinson, T. N., Banda, J. A., Hale, L., Lu, A. S., Fleming-Milici, F., Calvert, S. L., & Wartella, E. (2017). Screen media exposure and obesity in children and adolescents. *Pediatrics*, *140*(Supplement 2), S97-S101. doi: 10.1542/peds.2016-1758K

Robinson, C. D., Tomek, S., & Schumacker, R. E. (2013). Tests of moderation effects: Difference in simple slopes versus the interaction term. *Multiple Linear Regression Viewpoints*, *39*(1), 16-24.

Rogers, R., Eagle, T. F., Sheetz, A., Woodward, A., Leibowitz, R., Song, M., & Jackson, E. A. (2015). The relationship between childhood obesity, low socioeconomic status, and race/ethnicity: lessons from Massachusetts. Childhood Obesity, 11(6), 691-695.

Santos, D. R. L. D., Lira, P. I. C. D., & Silva, G. A. P. D. (2017). Excess weight in preschool children: the role of food intake. *Revista de Nutrição*, *30*(1), 45-56. https://doi.org/10.1590/1678-98652017000100005

Sanyaolu, A., Okorie, C., Qi, X., Locke, J., & Rehman, S. (2019). Childhood and Adolescent Obesity in the United States: A Public Health Concern. *Global Pediatric Health Journal*, 1-11.

Schultz, J. A., Collie-Akers, V. L., Fawcett, S. B., Strauss, W. J., Nagaraja, J., Landgraf, A. J., & Rauzon, S. M. (2018). Association between community characteristics and implementation of community programmes and policies addressing childhood obesity: the Healthy Communities Study. *Pediatric obesity*, *13*, 93-102.

Si, H., Shi, J. G., Tang, D., Wen, S., Miao, W., & Duan, K. (2019). Application of the theory of planned behavior in environmental science: a comprehensive bibliometric

analysis. *International Journal of Environmental Research And Public Health*, *16*(15), 2788.

Skinner, A. C., Ravanbakht, S. N., Skelton, J. A., Perrin, E. M., & Armstrong, S. C. (2018). Prevalence of obesity and severe obesity in US children, 1999–2016. *Pediatrics*, *141*(3), 1-9.

Staiano, A. E., Marker, A. M., Comeaux, J., Frelier, J. M., Hsia, D. S., & Broyles, S. T. (2017). Family-Based Behavioral Treatment for Childhood Obesity: Caretaker-Reported Barriers and Facilitators. *The Ochsner Journal*, 83–92.

Sutaria, S., Devakumar, D., Yasuda, S. S., Das, S., & Saxena, S. (2019). Is obesity associated with depression in children? Systematic review and meta-analysis. *Archives of Disease in Childhood*, *104*(1), 64-74. DOI: 10.1136/archdischild-2017-314608

Taghipour, A., Shahroudi, M. V., Tabesh, H., Safari-Moradabadi, A., & Anbarani, M. A. (2019). The effect of educational intervention based on the theory of planned behavior and stages of change construct on women's physical activity. *Journal of Education and Health Promotion*, *8*.

Tapera, R., Mbongwe, B., Mhaka-Mutepfa, M., Lord, A., Phaladze, N. A., & Zetola, N. M. (2020). The theory of planned behavior as a behavior change model for tobacco control strategies among adolescents in Botswana. *PloS one*, *15*(6), e0233462.

Tylavsky, F. A., Ferrara, A., Catellier, D. J., Oken, E., Li, X., Law, A., & Breton, C. V. (2020). Understanding childhood obesity in the US: the NIH environmental influences on child health outcomes (ECHO) program. *International Journal of Obesity*, *44*(3), 617-627.

Vitiello, B., & Ordóñez, A. (2016). Pharmacological treatment of children and adolescents with depression. *PubMed.gov*, 2273-2279.

Wang, H., Hu, R., Du, H., Fiona, B., Zhong, J., & Yu, M. (2018). The relationship between sleep duration and obesity risk among school students: a cross-sectional study in Zhejiang, China. *Nutrition & Metabolism volume*, 1-16.

Wexler, J., Ajibewa, T., Lee, J., Toledo-Corral, C., & Hasson, R. E. (2020). Community violence exposure and cortisol awakening responses in adolescents who are overweight/obese. *Psychoneuroendocrinology*, 104842.

Williams, A. S., Ge, B., Petroski, G., Kruse, R. L., McElroy, J. A., & Koopman, R. J. (2018). Socioeconomic status and other factors associated with childhood obesity. *The Journal of the American Board of Family Medicine*, *31*(4), 514-521.

Witt, C. E., Arbabi, S., Nathens, A. B., Vavilala, M. S., & Rivara, F. P. (2017). Obesity in pediatric trauma. *Journal of pediatric surgery*, *52*(4), 628-632.

Wootan, M. G., Almy, J., Ugalde, M., & Kaminski, M. (2019). How Do Nutrition Guidelines Compare for Industry to Market Food and Beverage Products to Children? World Health Organization Nutrient Profile Standards versus the US Children's Food and Beverage Advertising Initiative. *Childhood Obesity*, *15*(3), 194-199.

World Health Organization. (2018). *The state of food security and nutrition in the world 2018: building climate resilience for food security and nutrition*. Food & Agriculture Org..

Wu, C. H., Lin, C. Y., Hsieh, Y. P., Strong, C., Meshki, C., Lin, Y. C., & Tsai, M. C. (2019). Dietary behaviors mediate the association between food insecurity and obesity among socioeconomically disadvantaged youth. *Appetite*, *132*, 275-281.

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APPROVAL NOTICE
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DATE:	11 Jan 2021
TO:	Michael Milham, M.D., Ph.D.
PROTOCOL:	Child Mind Institute, Healthy Brain Network (Pro00012309)
APPROVAL DATE:	5 Jan 2021

IRB APPROVED:

Documentation:
- Protocol Version V (Dated 12/24/2020)

The IRB has reviewed and approved the above referenced documentation.

The IRB determined there were no changes required to the current Consent Forms. Please continue using the Consent Forms electronically available on your Advarra CIRBI Platform workspace under the "IRB Issued Documents" tab.

Please review the IRB Handbook located in the "Reference Materials" section of the Advarra CIRBI™ Platform (www.cirbi.net). A copy of the most recent IRB roster is also available.

Thank you for continuing to use Advarra IRB to provide oversight for your research project.