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Childhood Obesity: The Healthy, Hunger-Free Kids Act and School-Aged Children

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This is to certify that the doctoral dissertation by

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Abstract

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Health Care – Public Health Policy

MA, Eastern University, 2012

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Submitted in Fulfillment

Of the Requirements for the Degree of

Doctor of Philosophy

Public Health Policy

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Abstract

Obesity among children in America is at an all-time high, 57.3% of the nation's children will be obese by the age of 35. The purpose of this study was to examine the effectiveness of the Healthy, Hunger-Free Kids Act (HHFKA) policy. The HHFKA modified the nutritional and physical policies in order to reduce the obesity rates by changing their expenditures. Schools in all 50 states that are subject to federal, state and local nutrition regulations were researched. This was a quantitative, non-experimental, correlation study that measured state compliance with the USDA guidelines and tested for an association between compliance score/rate and the school-aged children's obesity rates using descriptive statistical analysis. Energy Imbalance Theory (EIT) is the theoretical framework used for understanding obesity. A hierarchical linear regression was used to show the strength of the relationship between childhood obesity rates and compliance scores by state while controlling for median income and urbanization. The overall model demonstrates a correlation with school aged students' obesity rates, compliance scores, income and urbanization. However, the findings from this study suggest the most significant correlation was found between the obesity rates and median income. No significance was found between obesity in children and compliance scores or urbanization with the results can be used by communities to encourage healthy behaviors in children and raise awareness of activities aimed at reducing obesity in children who live in low income families in the United States.

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Dedication

Getting a Doctorate degree was a life goal that I set for myself and to have completed this goal is awesome. It was not easy and at times I wanted to quit but I kept the faith and pushed myself. I had a wonderful supportive team that encouraged me to continue and reminded me that nothing good comes easy. Looking back on the day I started this journey words cannot explain the feeling of completing.

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Chapter 1: Introduction to the Study

Background of the Study

Childhood obesity is a complex health issue. Moreover, it is an increasing issue in the United States. Since 1980, the childhood obesity rates for children ages 2 to 19 years of age have tripled, with the rates of obese children 6 to 11 years of age more than doubling from 7%to 17.5% and the rates of obese teens ages 12 to 19 years of age quadrupling from 5% to 20.5% (Ogen, et al.2016).A child is considered overweight when their Body Mass Index (BMI) is equal to or greater than 85% and a child is considered obese when their BMI is equal to or greater than 95%. To help diminish this epidemic, the Healthy, Hunger-Free Kids Act (HHFKA) was passed on December 2, 2010, by the United States Congress. The HHFKA mandated changes to nutritional and physical education within schools and high poverty communities. Utilizing a national school nutritional policy to impact students' obesity was ideal to some. In this study, I addressed the gap in research regarding the effectiveness of using state and federal school nutrition policy to influence students' obesity.

Problem Statement

Obesity in children occur when a child is above the normal and healthy weight for their age and height, which is, equal to or greater than 95% (Ogden, et al. 2016). While environmental and genetic factors may play a role in causing obesity, the Centers for Disease Control and Prevention, CDC claimed behavioral factors, such as dietary patterns and physical activity, have the largest effect at the population level (2018).There are several causes of childhood obesity; however, bringing awarenessis a potential way to

help prevent or slow down childhood obesity. There are various programs to help fight childhood obesity. The former first lady of the United States, Mrs. Michelle Obama, brought attention to this issue during her 8 years in the White House. Mrs. Obama stated childhood obesity in America is an “economic threat and a national security issue.” She started a campaign called Let’s Move to bring awareness to the obesity issue in children (Batchelder,et al.2014). Her campaign was seen on television shows, news stations, magazines and social media sites all around the United States for Americans who watched certain stations.

There are several factors that contribute to unhealthy eating. Exposure to poor-quality food environments has many effects on adolescent eating patterns (Evans, et al.2015). Healthy foods are more expensive and less accessible and unhealthy foods are less expensive and more accessible (Rao, et al. 2013). The healthiest diets cost approximately$1.50 more per day than the least healthy diets, according to new research from Harvard School of Public Health (HSPH). This finding is based on the most comprehensive examination to date comparing prices of healthy foods and diet patterns versus less healthy ones (Rao, et al. 2013). For the everyday middle class and low-income families, eating healthy at times may be a financial hindrance and an availability burden. Because of this, many families rely on schools to provide healthy lunch options (Rao, et al. 2013).

Access to healthier food options can become a hardship depending on the child’s situation, such as the community, the family’s financial status, or the accessibility to healthy foods (Rao, et al. 2013). Across the United States, the majority of foods available

are processed, precooked, and chemically manufactured, with very little to no nutritional value (Rao, et al. 2013). These foods are easily accessible and low in cost. Choosing healthy foods maybe difficult for some parents who live in areas with an overabundance of food retailers that tends to sell less healthy food, such as convenience stores and fast food restaurants (Rao, et al. 2013).Schools play a significant role in exposing healthy eating to their students (Rao, et al. 2013). The lunches provided by the school may help to decrease as well as lower obesity (Rao, et al. 2013). Different schools provide different lunches for their children. Most, if not all, public schools in the United States are mandated by the government to abide by guidelines, policies and processes, such as the National School Lunch Program (NSLP) and the Healthy Hunger Free Kids Act (HHFKA). These schools must provide healthier optionsand help toward improving good nutrition (United States Department of Agriculture, 2015). My research assessed the HHFKA of 2010for school-aged students to determine if or if not it contributed to lowering childhood obesity rates.

Children who are obese are more likely to become obese adults (Reilly, et al 2010).Adult obesity is associated with a number of serious health conditions including heart disease, diabetes, metabolic syndrome, and cancer (Centers for disease control and prevention, 2018). Obesity throughout childhood can have a damaging outcome on a child's body in many different ways; the child may have a greater risk of high blood pressure and high cholesterol, which are risk factors for cardiovascular disease. In one study, 70% of obese children had at least one cardiovascular disease risk factor, and 39% had two or more (Reilly, et al 2010). The overweight or obese child may have an

increased risk of impaired glucose tolerance, insulin resistance and Type 2 diabetes (Duffey, et al. 2010). Other risks are breathing problems, such as sleep apnea, and asthma (Han, et al. 2010), joint problems and musculoskeletal discomfort (Han, et al. 2010). Another risk is the fatty liver disease, gallstones, and gastro-esophageal reflux (i.e., heartburn (Reilly, et al. 2010).Psychological stress such as depression, behavioral problems, and issues in school (Morrison, et al. 2015). According to (Morrison, et al. 2015) low self-esteem and low self-reported quality of life are risk factors, along with, impaired social, physical, and emotional functioning (Morrison, et al.2015).

Nature of the Study

In this study, I used four variables: which are, compliance scores/rates, degree of urbanization, school-aged students' obesity rates and the state median income. I used a quantitative approach with a cross-sectional design for this study. The data for this study came from various sources. I collected the compliance scores/rates from the State School Health Policy Database. I collected data regarding the degree of urbanization from the U.S. Census Bureau (U.S. Census Bureau, 2010); I used the year 2010 due to the 10 year timeframe for pulling urban and rural data through the Census Bureau. The Census Bureau only pulls this data every 10years. I collected school-aged students' obesity rates from the Center for Disease Control (CDC, 2018) and state median income from the Census Bureau website (Census Bureau, 2017).

I examined data for all schools subject to federal, state and local nutrition regulations. This data included schools that comply with the federal school nutrition policies in the United States. I examined those schools that comply with the state's

policies. The data I reviewed were forth year 2017. I compiled statistical information from governmental sources, such as: The Centers for Disease Control, Census Bureau and State School Health Policy database, and State School Health Policy Database of the National Association of School Boards of Education. These sources include information regarding obesity rates, compliance scores/rates, state median income and degree of urbanization.

Research Question

Research Question 1 (RQ1) Is there an association between the students' obesity rates (state level) and the HHFKA compliance score/rate after controlling for median income and degree of urbanization?

Null Hypothesis ($H_0 1$): There will be no significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Alternative Hypothesis ($H_a 1$): There will be a significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Purpose of the Study

The purpose of this study was to provide statistical information regarding the association of the HHFKA compliance scores/rates and students' obesity rates after controlling for state median income and degree of urbanization. Improving child nutrition was the focal point of the HHFKA (USDA, 2013). The effectiveness of the HHFKA was determined by reviewing and researching the data found from this study. The HHFKA's

goal is to diminish childhood obesity and health risks by helping schools provide balanced meals, through policies and guidelines, in order for children to have access to healthy foods. (USDA 2013)

Eating behaviors develop during the first years of a child's life. Different cultures, ethnicity, and economicstatuses play a major role in a child's eating behavior. Schools are major contributors to childrens' iunderstanding of healthy and unhealthy food choices and eating habits (Robert Wood Johnson Foundation, 2018). With the help from schools, this epidemic is likely to be reversed (Robert Wood Johnson Foundation, 2018). Schools offer foods and beverages to their students in many ways beyond the federally regulated school meal program, such asvending machines, snack stores, concession areas, fundraising events, school parties, and à la carte food items in the cafeteria (Robert Wood Johnson Foundation, 2018). Food items include: candy, gum, and sugary carbonated beverages. These items should not be accessible in the school's cafeteria (Robert Wood Johnson Foundation, 2018).Caregivers (parents and child-care providers) can influence a child's eating practices and habits by controlling the availability and accessibility of foods, meal structure, food modeling, food socialization practices, and food-related parenting style (Palfreyman, et al. 2014). Schools are caregivers for 8hours a day, 5days a week for some children. The selection of foods within the different schools serve as models of eating that children learn to emulate, which can be used as feeding practices to encourage the development of culturally appropriate eating patterns and behaviors in children. In this study, I correlated students' obesity rates with policy compliance. The study's dependent variable was state level obesity rates from the CDC 2017and the

independent variable was compliance scores/rates and the degree of urbanization and median income.

Theoretical Framework

I used energy imbalance theory (EIT) as the theoretical framework for this study. The Centers for Disease Control and Prevention (CDC) explained that while there are simple solutions, any opportunity for learning about ways to prevent and address childhood obesity would be optimal. For school-aged children, schools can help influence healthy eating, daily activity and living a healthy lifestyle, which is impactful.

In the area of childhood obesity, research has been guided by two primary conceptual foundations: the social-ecological model and the social-cognitive theory (Perry, et al. 2015). Within the social-ecological a researcher will gain an understanding of the social and physical environment of the child and how it affects their behavior (Perry, et al.2015). Within the social-cognitive theory, a researcher will gain an understanding of human behavior by examining changes in environments or conditions. I used EIT in this study to understand the role of a policy on health outcomes. EIT studies show that child and adult obesity are explained by a long-term, chronic imbalance between individual energy intake and expenditure (Hill, et al. 2012). Energy intake recommendations are intended to maintain health, promote optimal growth and maturation, and support a desirable level of physical activity (Porter, et al, 2016). Equations for determining energy requirements are included in the dietary reference intakes (DRIs) as estimated energy requirements (EERs). Estimated energy requirements are calculated using age, gender, weight, height, and one of four physical activity levels

(sedentary, low active, active, and very active) reflecting energy expended beyond that required for the activities of daily living, see table below (Center for Nutrition Policy and Promotion, 2012). For children and adolescents, an additional factor is included for energy deposition (growth). Variability in EERs between girls and boys arises from variations in growth rates and physical activity (Porter, et al. 2016).Human energy intake comes from consuming protein, carbohydrates, fat, and alcohol. Humans expend energy doing physical activity and in maintaining basic metabolic functions (i.e. energy expended absorbing and metabolizing food). In this study, I aimed to isolate the effect of changing school lunch nutrition, or energy intake, and school-aged children's obesity rates. In Chapter 2, I will examine the specifics of EIT and its potential to understand federal intervention in school nutrition. Figure 1.shows the estimated energy requirements, recommended dietary allowances, and adequate intake for water, energy and energy nutrients.

Estimated Energy Requirements (EER), Recommended Dietary Allowances (RDA), and Adequate Intakes (AI) for Water, Energy, and the Energy Nutrients

Age(yr)	Reference BMI (kg/m²)	Reference height, cm (in)	Reference weight, kg (lb)	Water[a] AI (L/day)	Energy EER[b] (kcal/day)	Carbohydrate RDA (g/day)	Total fiber AI (g/day)	Total fat AI (g/day)	Linoleic acid AI (g/day)	Linolenic acid[c] AI (g/day)	Protein RDA (g/day)[d]	Protein RDA (g/kg/day)	
Males													
0–0.5	—	62 (24)	6 (13)	0.7[e]	570	60	—	31	4.4	0.5	9.1	1.52	
0.5–1	—	71 (28)	9 (20)	0.8[f]	743	95	—	30	4.6	0.5	13.5	1.5	
1–3[g]	—	86 (34)	12 (27)	1.3	1046	130	19	—	7	0.7	13	1.1	
4–8[g]	15.3	115 (45)	20 (44)	1.7	1742	130	25	—	10	0.9	19	0.95	
9–13	17.2	144 (57)	36 (79)	2.4	2279	130	31	—	12	1.2	34	0.95	
14–18	20.5	174 (68)	61 (134)	3.3	3152[h]	130	38	—	16	1.6	52	0.85	
19–30	22.5	177 (70)	70 (154)	3.7	3067[h]	130	38	—	17	1.6	56	0.8	
31–50				3.7	3067[h]	130	38	—	17	1.6	56	0.8	
>50				3.7	3067[h]	130	30	—	14	1.6	56	0.8	
Females													
0–0.5	—	62 (24)	6 (13)	0.7[e]	520	60	—	31	4.4	0.5	9.1	1.52	
0.5–1	—	71 (28)	9 (20)	0.8[f]	676	95	—	30	4.6	0.5	13.5	1.5	
1–3[g]	—	86 (34)	12 (27)	1.3	992	130	19	—	7	0.7	13	1.1	
4–8[g]	15.3	115 (45)	20 (44)	1.7	1642	130	25	—	10	0.9	19	0.95	
9–13	17.4	144 (57)	37 (81)	2.1	2071	130	26	—	10	1.0	34	0.95	
14–18	20.4	163 (64)	54 (119)	2.3	2368	130	26	—	11	1.1	46	0.85	
19–30	21.5	163 (64)	57 (126)	2.7	2403[i]	130	25	—	12	1.1	46	0.8	
31–50				2.7	2403[i]	130	21	—	12	1.1	46	0.8	
>50				2.7	2403[i]	130	21	—	11	1.1	46	0.8	
Pregnancy													
1st trimester				3.0	+0	175	28	—	13	1.4	+25	1.1	
2nd trimester				3.0	+340	175	28	—	13	1.4	+25	1.1	
3rd trimester				3.0	+452	175	28	—	13	1.4	+25	1.1	
Lactation													
1st 6 months				3.8	+330	210	29	—	13	1.3	+25	1.1	
2nd 6 months				3.8	+400	210	29	—	13	1.3	+25	1.1	

Figure 1. The Estimated Energy Requirements, Recommended Dietary Allowances, and Adequate Intakes for Water, Energy and Energy Nutrients. From Adapted from the Dietary Reference Intakes series, National Academies Press. Copyright 1997, 1998, 2000, 2001, 2002, 2004, by the National Academies of Sciences.

Definitions

Body Mass Index is a weight-to-height ratio, calculated by dividing one's weight in kilograms by the square of one's height in meters and used as an indicator of obesity and underweight.

Caregiver is defined as a person who gives help and protection to someone (such as a child, an old person, or someone who is sick. In this study a caregiver is someone who gives help to a child.

Childhood Obesity: is defined as abnormal or excessive fat accumulation that may impair health that affects children and teenagers. The policy statement for the American Academy of Pediatrics defines childhood obesity using BMI as an indicator. BMI in children can be calculated using kilograms (kg) and centimeters (m) [BMI = (weight (kg) ÷ height (cm) ÷ height (cm) x 10,000] or pounds (lbs) and inches (in) [BMI = weight (lbs) ÷ height (in) ÷ height (in) x 703]. Once the BMI is calculated, it is plotted using the Centers for Disease CDC growth charts (CDC, 2017). A BMI between the 5th and 85th percentile on an age/gender appropriate growth chart is considered healthy weight. A BMI between 85th and 95th percentile specific for age/gender is considered at-risk for overweight. A BMI at or above the 95% on age/gender specific chart is considered overweight or obese.

Compliance Score/Rate is the percentage of school food authorities in each state meeting the updated nutrition standards. Compliance score/rate is the dependent variable for all schools in the United States.

Degree of Urbanization refers to the proportion of people living in localities or urban settlements among the population of a municipality whose place of residence can be defined by coordinates. Before the 2000 census and locality delimitation the degree of urbanization was calculated by proportioning the population living in localities to the total population of the municipality, which also included the persons without coordinates

(e.g. homeless and institutional population). Since the 2000 census the institutional population with coordinates has been included in the population living in localities if the institution belongs to a locality or forms a locality on its own. There is a ten year data review timeframe for urban and rural census to be pulled through the Census Bureau.

Energy expenditures are the sum of the basal metabolic rate (the amount of energy expended while at complete rest), the thermic effect of food (TEF, the energy required to digest and absorb food) and the energy expended in physical activity.

Energy Imbalance Theory is a fundamental principle of nutrition and metabolism - body weight change is associated with an imbalance between the energy content of food eaten and energy expended by the body to maintain life and to perform physical work.

Energy Intake is measured by the amount of calories consumed from food and fluids. Energy intake is modulated by hunger, which is primarily regulated by the hypothalamus, and choice, which is determined by the sets of brain structures that are responsible for stimulus control.

Healthy, hunger-Free Kids Act (HHFKA), is a federal statute signed into law by President Barack Obama on December 13, 2010. The bill is part of the reauthorization of funding for child nutrition. The bill funds child nutrition programs and free lunch programs in schools. In addition, the bill sets new nutrition standards for schools, and allocates $4.5 billion for their implementation.

Median Income refers to the income level earned by a given household where half of the homes in the area earn more and half earn less. It is used instead of the average or

mean household income because it can give a more accurate picture of an area's actual economic status. Median household incomes are frequently used to determine housing affordability.

Obesity: is defined as a complex, multifactorial chronic disease which involves the interaction of both genotype and environment (National Heart, Lung &Blood Institute, [NHLBI], 2006). Integrating factors of behavioral, social, cultural, physiological, genetic and metabolic are involved. (National Heart, Lung &Blood Institute, [NHLBI], 2006). Overweight and obesity is determined by measuring Body Mass Index (BMI), a calculation of weight in relation to height. The formula: weight in kilograms divided by height in meters squared (weight (kg)/height (m2). In adults, healthy weight is 18–25BMI, overweight is 25–29 BMI, obese is a BMI of 30 or greater and morbidly obese is a BMI of > 40.

Pediatric providers: is a general term used to define primary care providers, general practitioners and pediatricians, including medical doctors (MD), doctors of osteopathy (DOs), physician assistants (PAs), and nurse practitioners (NPs), who care regularly for children.

Assumptions

Assumptions are issues and facts that are in existence in a research study such that they affect relationships from the known existence of other facts. In this study, I assumed that the information retrieved from governmental sources is accurate. I also assumed that there will be no variation of compliance scores/rates. I assumed that there would be several schools compliant with the policies of the HHFKA which would help decrease childhood obesity. For the variables not measured Ceteris paribus assumption (all other things remaining equal) was used in order to isolate the independent variables which have an influence on the dependent variable.

Limitations

Previous researchers have found that social economic status, genetics, race, gender, and psychosocial variables can be associated with childhood obesity (Pampel, et al. 2012). A limitation in this study was the use of state-level data. State-level data was collected from reliable federal sources. Another factor was researcher biases. These biases should be limited or there should be no biases because of the use of data collected from governmental sources.

Scope

In this study, I assessed the association between compliance with HHFKA school nutrition policy and school-aged students' obesity rates for all 50 states. The scope of the study was focused on school-aged students in the United States, which include the review of the association of the compliance scores/rates.

Delimitations

This study analyzed the HHFKA school nutrition policy. Schools that are subject to federal, state, and local nutritional regulations have requirements that they must meet in order to receive a portion of the subsidy. Schools must follow these requirements, in order to be eligible for the performance-based cash assistance within their state.

Significance of the Study

The study assessed the effectiveness of a regulatory policy addressing school aged students' obesity. Improving child nutrition is the focal point of the HHFKA of 2010. The research results provided the effectiveness of using federal school nutrition policies to effect obesity rates. There is a gap in the published literature regarding the relationship between school meal policy and childhood obesity rates. Providing statistical data that explain how schools influence unhealthy eating habits was the goal of this study. The contribution of the study toward childhood obesity was to show how these healthy eating programs can help with childhood obesity effectively or ineffectively.

Summary

The United States is in the midst of an obesity epidemic that is affecting the lives of both children and adults. Each year, the United States spends an estimated $190 billion on obesity-related conditions, or 21% of all U.S. health care costs (Cawley, et al. 2012). Among children, 23.9 million (or 31.8 %) are overweight, and of these, 12.7 million are obese (Mozaffarian, et al. 2013). In children today, obesity is the most common metabolic and nutritional disease, whereas thirty years ago, obesity was rarely seen in children. In the past 20 years, there has been an exponential increase in the incidence of

obesity among children (Reilly, et al. 2010).This quantitative study examined the relationship between compliance with state and federal nutritional policies and students' obesity rates. This study is an assessment of compliance with a specific nutritional policy. The study consisted of the most recent data and statistics from the Centers for Disease Control for the obesity rates, Census Bureau for the state median income and the degree of urbanization and State School Health Policy Database for the compliance rats. In Chapter 2, I will focus on the research of obesity, the theory of obesity, the nutrition regulation, and the effectiveness of obesity involvement.

Chapter 2: Literature Review

Introduction

Childhood obesity is a serious public health problem in the United States. Today, nearly a third of our youth are overweight or obese. That is more than 23 million children and teenagers (U.S. Census Bureau, 2016).Children who are obese are at risk for developing serious and harmful health problems, such as: Type 2 diabetes, cardiovascular problems, high blood pressure, and other chronic medical disorders (Güngör. 2014).Many children spend a majority of their time at school, making schools an accessible and convenient place to implement programs that seek to reduce and prevent childhood obesity (Faulkner, et al. 2014). While available to all populations at full, minimal, or no cost, federal standards on school lunches did not guarantee that the lunches contain the nutritional value necessary for fighting the childhood obesity epidemic prior to 2010 (Schanzenbach, 2012).

In schools, the contents of children's lunches are often controlled by federal subsidies such as the National School Lunch Program (NSLP), which provides lunches to 30.4million school children nationwide (USDA, 2019). Through the NSLP, 48% of students receive lunch for free and 9% received their lunch at a reduced price (Schanzenbach, 2012). Given their nutritional value, children who ate school lunches consumed 60 extra calories per day, which is significant enough to impact the increasing rates of childhood obesity (Schanzenbach, 2012). By making the school lunches healthier, schools have the possibility of reducing and/or preventing the prevalence of childhood obesity (Tingting, et al. (2016).

Improving child nutrition is the focal point of the HHFKA. The legislation authorizes funding and sets policy for USDA's core child nutrition programs: the National School Lunch Program, the School Breakfast Program, the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), the Summer Food Service Program, and the Child and Adult Care Food Program. The HHFKA allows USDA the opportunity to make reforms to the school lunch and breakfast programs by improving the critical nutrition and hunger safety net for millions of children.

In Chapter 2, I will review (a) school-aged students' obesity, (b) governmental nutrition intervention, (c) legislation and policy, (d) school nutrition policy structure, and (e) the effectiveness of school nutrition policy to frame the analysis of the 2010 HHFKA. This literature review reviews the history of governmental intervention in nutrition. It describes state and local regulations which affect the federal law and evaluates theoretical frameworks for nutrition policy. The goal of this study was to examine the association between state school nutrition policy and school-aged students' obesity rates. Chapter 2includes the following: the literature search strategy, the theoretical foundation, conceptual framework, literature related to key variables and concepts, and a summary.

Literature Search Strategy

The following websites were searched: National Collaborative on Childhood Obesity Research (NCCOR), National School Lunch Program (NSLP), Centers of Disease Control and Prevention (CDC), National Health and Nutrition Examination Surveys (NHANES), United States Department of Agriculture (USDA), National Alliance for Nutrition and Activity (NANA), Action for Healthy Kids (AFHK), Trust for

America's Health (TFAH), Every Student Succeeds Act (ESSA), American Society of Nutrition (ASN), National Survey of Children's Health (NSCH).The keywords that were used to search are: *childhood obesity, causes of childhood obesity, childhood obesity prevention, research for childhood obesity, Healthy Hunger Free-Kids Act, federal laws and regulations for nutrition,* and *USDA nutrition policy.* The literature review consisted of state and federal studies, state and federal policies, state and federal regulations, state and federal research, scholarly articles, dissertations, journals (peer reviewed), and books, as well as, research databases such as: social science research network and public library of science. The year that was reviewed was 2017. This year was chosen in order to review current and up to date data. There were a total of 10 different contents reviewed, where eight were referenced and two provided quality content. The search consists of, approximately, 80% quantitative theory and 20% qualitative theory. The reference topics used were: childhood obesity, causes of childhood obesity, childhood obesity prevention, research for childhood obesity, HHFKA, federal laws and regulations for nutrition, and USDA nutrition policy.

Theoretical Framework

Energy imbalance theory was used for the theoretical framework. Obesity arises from long-term deregulation of energy balance. The energy imbalance required for weight gain from increased energy intake and/or decreased physical activity in children remains uncertain (Hall, et al. 2012). Energy requirements for storing energy in body tissues may differ in growing children given the strong anabolic drive to deposit not only fat but also lean tissue (Hall, et al. 2012).A fundamental principle of nutrition and

metabolism is that body weight change is associated with an imbalance between the energy content of food eaten and energy expended by the body to maintain life and to perform physical work (The American Journal of Clinical Nutrition, 2012).Figure 2. shows the component of the pathway that links changes in energy balance to changes in body weight (Hall, et al. 2012).

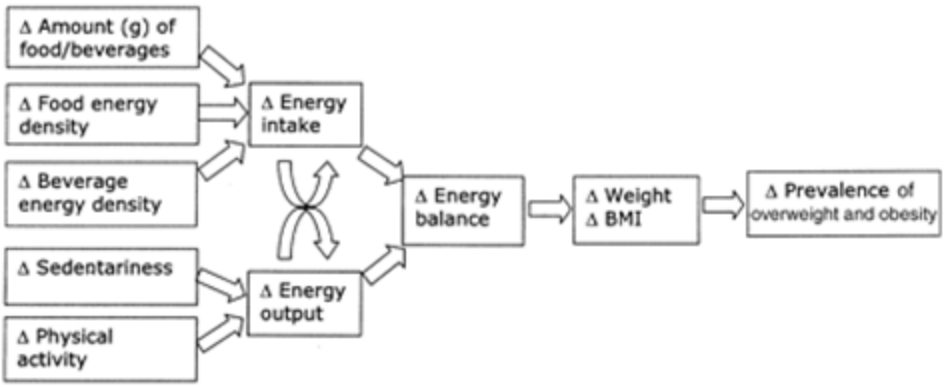

Figure 2. The Components of the Pathways of Energy Balance in Body Weight

Obesity is often considered to be a result of either excessive food intake and/or insufficient physical activity (Hall, et al. 2012). There is a great debate about which behavior deserves the most responsibility, but this approach has not yet produced effective or innovative solutions. Researchers believe that obesity can best be viewed in terms of energy balance. Energy balance is made up of energy intake, which is food consumed; energy expenditure, which is movement of the body; and energy storage, which is the storing of food. When energy intake equals energy expenditure, the body is in energy balance and body energy is stable. However, when energy intake does not equal

energy expenditure, the body is in energy unbalance and body energy is not stable (Hill, et al. (2012). Despite the evidence for a control system, most people in today's environment gain significant excess body weight and body fat over their adult years. However, research shows an increase in children in today's environment gaining significant excess body weight and body fat. This does not argue against an energy balance control system but suggests that there may be limits to the body's ability to match intake and expenditure under the prevailing conditions in the modern environment. Energy intake is the total number of calories taken in daily whether ingested or by parenteral routes. Energy expenditure is the amount of energy (or calories) that a person needs to carry out a physical function such as breathing, circulating blood, digesting food, or physical movement. Total daily energy expenditure is the total number of calories that are burned each day. To understand what energy expenditures are you need to understand how your body creates energy. To provide fuel for movement and daily functions, your body creates energy in the form of heat. The energy is measured in the form of kilocalories, or calories. The total number of calories you burn for energy each day is your total daily energy expenditure. Total daily energy expenditure can vary from person to person depending on body size, gender, body composition, genetics, and activity level. The total energy expenditure for a small sedentary woman may be 1800 calories or less per day and the total daily energy expenditure for a large man may be 2000 calories or more.

There is increasing recognition that the physical environment affects behavior (Faulkner, et al.2014) and there are increasing efforts to understand and modify the

physical environment to help people achieve healthier lifestyles (Chen, et al. 2010). However, it is unlikely that modifying the environment sufficiently so that most people would maintain a healthy lifestyle without conscious effort. There is belief that there is a great need to evaluate the potential impact of teaching our children about energy balance (i.e., how energy in food interacts with energy expenditure to determine body weight) and about how food and physical activity choices affect energy balance (Hill, et al. (2012).

The means of obesity development is not completely understood and is considered to be a disorder with numerous sources (Sahoo, et al. 2015). Environmental factors, lifestyle preferences, and cultural environment play pivotal roles in the rising prevalence of obesity (Sahoo, et al. 2015). Obesity is assumed to be the result of an increase in caloric and fat intake. There is supporting evidence that excessive sugar intake by consuming soft drinks, increased portion size, and steady decline in physical activity play a major role in the rising rate of obesity, (USDA, 2012). Childhood obesity can profoundly affect a child's physical health, social, and emotional well-being, and self-esteem (Sahoo, et al. 2015).

According to (Sahoo, et al. 2015), it is widely accepted that increase in obesity results from an imbalance between energy intake and expenditure, with an increase in positive energy balance being closely associated with the lifestyle adopted and the dietary intake preferences. Many social and environmental factors have negatively influenced the physical activity and eating behaviors of children and adolescents in the United States. The CDC states, behaviors that influence excess weight gain include eating high-calorie, low-nutrient foods and beverages, not getting enough physical activity, sedentary

activities such as watching television or other screen devices, medication use, and sleep routines (2017).

Regular physical activity in children and adolescents is important for promoting lifelong health and well-being and preventing various health conditions (Janssen, et al. 2010). The 2018 U.S. Physical Activity Guidelines for Americans recommend that children and adolescents aged 6 to 17 years should have 60 minutes (1 hour) or more of physical activity each day (CDC, 2018). Unfortunately, many children and adolescents do not meet the recommendations set forth in the Physical Activity Guidelines for Americans.

Energy intake is often related to disease risk because of associations between physical activity or body size and the probability of disease (Hall, et al, 2012). In theory, the differences in disease incidence may also be related to metabolic efficiency and therefore to total energy intake. Because intakes of most specific nutrients, particularly macronutrients, are correlated with total energy intake, they may or may not be causally associated with disease as a result of confounding by total energy intake (Hall, et al. 2012). In addition, extraneous variation in nutrient intake resulting from variation in total energy intake that is unrelated to disease risk may weaken associations. Furthermore, individuals or populations must alter their intake of specific nutrients primarily by altering the composition of their diets rather than by changing their total energy intake, unless physical activity or body weight are changed substantially (Hall, et al. 2012). Thus, adjustment for total energy intake is usually appropriate in epidemiologic studies to control for confounding, reduce extraneous variation, and predict the effect of dietary

interventions (Chung, 2010). Failure to account for total energy intake can obscure associations between nutrient intakes and disease risk or even reverse the direction of association. Several disease-risk models and formulations of these models are available to account for energy intake in epidemiologic analyses, including adjustment of nutrient intakes for total energy intake by regression analysis and addition of total energy to a model with the nutrient density which is nutrient divided by energy (Chung, 2010).

Energy expenditure is measured by indirect calorimetric or calculated using mathematical equations. Indirect calorimeter determines energy expenditure by measuring the body's oxygen consumption and carbon dioxide production using a computerized metabolic cart (Hills, et al. 2014). Energy expenditure can be calculated by using the Harris-Benedict equation. These regression equations were developed in 1919 by using indirect calorimetric to estimate resting energy expenditure (REE) (Hills, et al. 2014). The accuracy of these equations has been evaluated by numerous researchers (Hills, et al. 2014). Research has demonstrated that the Harris-Benedict equations accurately predict the REE of healthy, adequately nourished persons within +14% of REE measured by indirect calorimeter. In malnourished, ill patients, the Harris-Benedict equations tend to underestimate REE by as much as 22% (Porter, et al. 2016). The total daily expenditure is based on the REE or BEE. (The terms BEE [basal energy expenditure] and REE [resting energy expenditure] are used interchangeably) (Porter, et al. 2016). Energy needs can be calculated by using empirical formulas. Healthy individuals require approximately 25 calories per kilogram of body weight to meet basal metabolic needs (Porter, et al. 2016).

During childhood and adolescence, excess fat accumulates when total energy intake exceeds total energy expenditure. This energy imbalance can result from excessive energy intake and/or reduced energy expenditure, the latter is usually a consequence of a sedentary lifestyle. This is particularly associated with excessive television viewing, excessive computer use, and insufficient physical activity (Huh, et al. 2011). In infancy, excess fat deposition occurs when excess energy is provided, especially when the protein-to-energy ratio is altered. This is often seen when feedings are supplemented with additives such as carbohydrates or fat and protein content remains the same. In addition, one study reported an increased incidence of obesity at age 3 years in infants weaned to solid foods by 4 months (Huh, et al. 2011).

Rationale for Use of Energy Imbalance Theory

The basic components of energy balance include energy intake, energy expenditure, and energy storage (Hall, et al. 2012). Body weight can change only when energy intake is not equal to energy expenditure over a given period of time. Humans take in energy in the form of protein, carbohydrate, fat, and alcohol. Humans expend energy through resting metabolic rate (RMR), which is the amount of energy necessary to fuel the body at rest; the thermic effect of food, which is the energy cost of absorbing and metabolizing food consumed; and the energy expended through physical activity (Hall, et al. 2012). RMR is proportional to body mass, particularly the amount of fat-free mass. The thermic effect of food is proportional to the total food consumed and, in a typical mixed diet, makes up 8%to 10%of total energy ingested (Hall, et al. 2012). The energy expended through physical activity, the most variable component of energy expenditure,

consists of the amount of physical activity performed multiplied by the energy cost of that activity. Total energy consumption and expenditure are the two components of energy balance, and determine the long-term content of body fat (Zheng, et al. 2014). The current evidence suggests that energy consumption could increase the risks of various cardiovascular diseases (CVDs), cancers and diabetes mellitus (DM) while energy expenditure (EE) may have an inverse relationship with those conditions (Zheng, et al. 2014).The 2010 USDA Guidelines applied mandates to both energy intake and energy expenditure. Energy intake is affected by a reduction in the total calorie count for breakfast and lunch, and nutrient composition is changing in favor of fruits and vegetables (Hall, et al 2012). With the HHFKA, this is the first time congress is using a nutritional policy to help toward childhood obesity by improving the nutritional quality of all food in schools by providing USDA with the authority to set nutritional standards for all foods sold in schools, including in vending machines, the "a la carte" lunch lines, and school stores (USDA, 2012).

A study by (Bergman, et al. 2014) revealed significant improvements in both selected and consumed key nutrients when comparing meals before implementation of the HHFKA (2012) to the meals after implementation of the HHFKA (2013) nutrition standards. These included reductions in sodium and the percentage of calories from saturated fat and a significant increase in fiber. A reduction in calcium selected and consumed was also observed. For schools achieving Healthier U.S. Schools Challenge awards serving second through fifth grade students were selected to participate. The results revealed significant improvements in both selected and consumed key nutrients

when comparing meals before implementation of the HHFKA (2012) to the meals after implementation of the HHFKA (2013) nutrition standards. These included reductions in sodium and the percentage of calories from saturated fat and a significant increase in fiber. A reduction in calcium selected and consumed was also observed.

Conceptual Framework

The concepts for this study are the causes and history for childhood obesity. The following section examines childhood obesity and federal government involvement in school nutrition as it relates to the changes promulgated by the HHFKA and the 2010 USDA Guidelines. Childhood obesity is a serious medical condition that affects children and adolescents. Children who are obese are above the normal weight for their age and height. These sections reviewed the roles of the federal government, state government, and the school, in implementing federal school nutrition legislation and policy. There have been a few federal government policies for school nutrition but none that focus on childhood obesity or created to help fight obesity in children. The conceptual framework covered childhood obesity and the nutritional policy.

Childhood obesity is a national epidemic (Barbara, et al. 2017). Nearly 1 in 6 children (ages 2–19) in the United States is overweight or obese, putting them at risk for serious health problems. (CDC, 2018) explains, today about 1 in 3 kids is overweight or obese. And studies show that overweight kids are likely to become overweight and obese adults. Additionally, overweight children are disproportionately affected by adverse physical and psychosocial health outcomes, including hypertension, diabetes, low self-esteem, and increased engagement in high-risk behaviors (CDC, 2018). Figure 3.shows the

probability of obesity at the age of 35 years, according to current age and obesity status (Panel A) and BMI category (Panel B). The shaded areas indicate 95% uncertainty intervals.

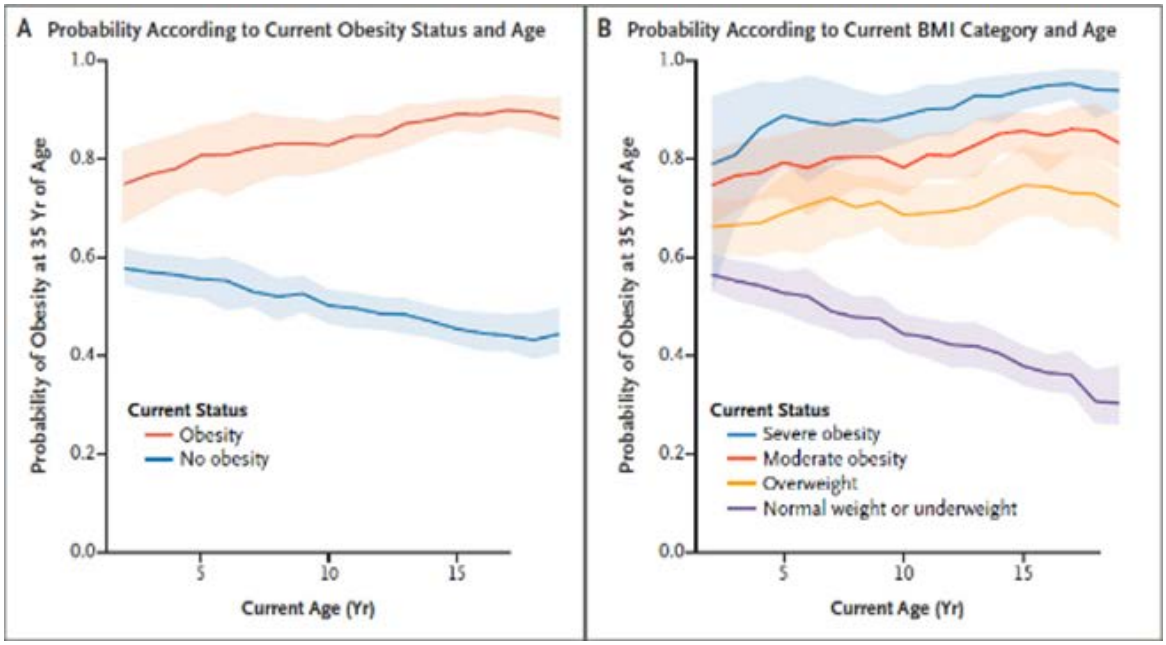

Figure 3. Predicted Probability of Obesity at the Age 35 years, According to Current Age, Obesity Status, and BMI Category

Obese and overweight children are at risk for a number of serious health problems such as: Diabetes - Type 2 diabetes was once called adult-onset diabetes. Now with the rise in childhood obesity, there is a dramatic rise in the number of children suffering from type 2 diabetes. Untreated, this can be a life-threatening condition. Asthma - extra weight can make it harder to breathe and can inflame the respiratory tract. There is a rise in childhood asthma and children with serious asthma are more likely to be overweight.

Heart Failure - being overweight makes the heart work harder. Overweight children are more likely to grow up to be overweight adults who develop heart problems.

Today, about one in three American kids and teens is overweight or obese, nearly triple the rate in 1963 (American Heart Association (AHA), 2014). Among children today, obesity is causing a broad range of health problems that previously were not seen until adulthood (AHA, 2014). There are also psychological effects: obese children are more prone to low self-esteem, negative body image and depression (AHA, 2014), excess weight at young ages has been linked to higher and earlier death rates in adulthood (AHA, 2014).

Using body mass index (BMI) criteria, the most recent national surveys demonstrate that 21–24%of American children and adolescents are overweight and 16–18% are obese (Ogden, et al. 2012). A 2012 study noted a 16.9% prevalence of obesity in children and adolescents in 2009–2010, which is comparable to the prevalence rates reported in 2007–2008 (Ogden, et al. 2012). These findings indicate that the prevalence of overweight (BMI ≥ 85%) children and adolescents in the U.S. has increased by 50–60% in a single generation, and the prevalence of obesity has doubled (Ogden, et al. 2012). The prevalence of obesity in American Indians, Hawaiians, Hispanics, and blacks is 10–40%higher than in whites (Ogden, et al. 2012).

As stated, there are several factors to contribute toward childhood obesity and overweight children. It is widely recognized that the family and home environment significantly influence child diet and physical activity behaviors (Showell, et al.2013). Three recent systematic reviews have highlighted the importance of these influences on

child obesity prevention and treatment, mainly for young children (Skouteris, et al. 2011). A 2011 review identified studies that supported a small to moderate effect of parenting interventions on weight-related outcomes (Skouteris, et al. 2011). Another 2011 review identified studies that reported a favorable effect of key parental variables (e.g., parental feeding practices, parental style, etc.) on risk behaviors for child obesity in preschool-aged children (Skouteris, et al. 2011). The third review reported that the majority of studies reported a favorable effect of family and home-based interventions on the treatment of overweight and obesity among young children aged 2 to 7 years (Knowlden, et al. 2012).

Factors effecting childhood obesity. According to the National Collaborative on Childhood Obesity Research (NCCOR), 1 out of 3 children are obese or overweight before their 5th birthday (2017). And approximately 12.5 million or 17%of children and adolescents aged 2 to 19 years are obese. These rates are even higher for economically disadvantaged children. Genes, epigenetic, the intrauterine environment, home environments, parenting practices, metabolism, as well as, early life influences play a role in whether or not a child is obese.

According to (Guo, 2009) preventing obesity during childhood is critical. He explains habits formed during childhood often move into adulthood. (Guo, 2009) states an obese 4-year-old has a 20%chance of becoming obese as an adult. This epidemic needs to be reversed or we are in jeopardy of having a generation of children who will be sicker and dying younger (Journal of the American Medical Association, 2013). Overweight and obesity are associated with a 52% and 60% increased risk, respectively,

for new diagnoses of asthma among children and adolescents (Gilliland, et al. 2013).Although traditionally viewed as an illness mainly diagnosed as an adult, the rise in childhood obesity has related to an increasing percentage of children with type 2 diabetes (Journal of the American Medical Association, 2013). Obese children have been found to have risk factors for cardiovascular disease, including high cholesterol levels, high blood pressure and abnormal glucose tolerance (Journal of the American Medical Association, 2013). In a population-based sample of 5–17year-olds, 7%of obese children had at least one cardiovascular disease risk factor while 39% had two or more cardiovascular disease risk factors (Journal of the American Medical Association, 2013).

Federal Government Intervention in School Nutrition

Schools play a critical role in improving the dietary and physical activity behaviors of children and adolescents. Schools can create environments that are supportive of healthy eating and physical activity by implementing policies and practices. Providing students with learning opportunities that support healthy eating and regular physical activity is also important for students to learn about and practice these behaviors.

CDC synthesized research and best practices related to promoting healthy eating and physical activity in schools, culminating in nine guidelines. These guidelines were informed by the Dietary Guidelines for Americans (U.S. Department of Agriculture, etal.2010), the Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services, 2018) and the Healthy People 2020 objectives related to healthy eating and physical activity among children, adolescents, and schools (U.S. Department

of Health and Human Services, 2010). The guidelines serve as the foundation for developing, implementing, and evaluating school-based healthy eating and physical activity policies and practices for students.

In the 19th century, there were no school lunches. Children had to go home for lunch, did not eat, or purchased food outside of school with the money received by their parents. Lunchrooms became a standard part of school architecture; schoolchildren were weighed and measured for signs of malnutrition. Most school-lunch programs were still volunteer efforts. Then, by the '60s and '70s, the food-service companies and corporate brands would send their posters to schools, and they would put those up on cafeteria walls so that the brands were visible.

During the Great Depression, the volunteer programs could not handle the influx of children who now relied on school lunches as their major source of sustenance. Meanwhile, farmers across what was still a largely agricultural country were struggling, and the federal government feared the economy would implode. Economists at the U.S. Department of Agriculture hit upon an elegant solution that would serve two purposes: The government would pay farmers for their surplus foods, and then donate that food to needy schools to use. In 1933, Congress passed the Agricultural Adjustment Act, one of the core pieces of legislation of the New Deal, and, for good or ill, paving the way for the school lunch as we know it today. The problems with relying on a vast bureaucracy to turn surplus commodities into school lunches quickly became obvious. Among the most ludicrous was the fact that schools got whatever foods farmers had to get rid of lots of, which led to situations where school officials had to make hundreds of children's school

lunches out of nothing but onions or olives or grapefruit. It was becoming clear, Levine says, that for the USDA, feeding schoolchildren healthy meals was secondary to keeping farmers afloat. The government and activists were not the only ones who saw a future in getting involved in what kids were eating. In 1935, the very first themed lunch box was released, and it had Walt Disney's seven-year-old star, Mickey Mouse, on it, grinning as he carried his schoolbooks. As the U.S. prepared to enter World War II, the entire country had to re-engineer itself for war—and many saw an opportunity to re-engineer children's eating habits, as well. As FDR observed, "food and nutrition would be at least as important as metals and munitions." This kid learning about ration coupons in 1943 knew that, too.

Signed by President Harry Truman in 1946, the National School Lunch Program (NSLP) is a federally assisted meal program operating in public and nonprofit private schools and residential child care institutions. It provides nutritionally balanced, low-cost or free lunches to children each school day. The national School Lunch Act (NSLA) of 1946 provided states with commodity and cash support so that they can provide nutritious school lunches to children, free or at a reduced cost. The purpose of the NSLA is twofold: to provide nutritious meals to school children and to support America’s agriculture markets by donating surplus commodities for school lunches. There are three legislative acts that gave the USDA authority to purchase commodities for the school lunch program: (1)Section 6 of the Richard B. Russell National School Lunch Act, (2) Section 32 of the Agriculture Act of 1935, and (3) Section 416 of the Agricultural Act of 1949. All three Acts give the USDA control over nutrition. Pursuant to the legislative acts,

schools used two groups of commodities in their meal programs: Group A- Commodities includes perishables: beef, pork, fish, poultry, egg products, fruits and vegetables. Group B- Commodities include nonperishable: cereals, grains, peanut products, dairy products, and oils.

An agency of the USDA may purchase items from these groups to limit surplus and stabilize prices (USDA, 2012). In addition to commodities, the USDA provided states with a cash reimbursement based on the number of lunches served and family need (USDA, 2012). Today, because of USDA involvement, “Over 31 million school children receive a nutritious school lunch each school day in over 100,000 participating public and private nonprofit schools and institutions” (USDA, 2007).The language of the Dietary Guidelines continued to morph through the 1980’sand early 1990’s until the publication of the 1992 Food Guide Pyramid. This guide introduced seven groups in a hierarchical graphic, a pyramid, with the least servings; i.e., foods to be used sparingly – fats, oils, and sweets - at the top and the most servings (6–11daily) - bread, cereal, rice, and pasta - at the bottom, or foundation, of the pyramid. Since the publication of the Food Pyramid in 1992, the serving sizes of all seven groups have not changed except that the daily meat group servings went from 2–3 servings of 5–7ounces to 2–3 servings of 4–9 ounces. The “meat group” includes meat, poultry, fish, dry beans, eggs, and nuts.

In 1994, Congress passed the Healthy Meals for Healthy Americans Act (HMHAA). This Act required all meals under the NSLP and SBP to meet the HMHAA Dietary Guidelines (DGA) (USDA, 2007). After the passing of the Healthy Meals Act, the USDA published a manual, The Road to SMI Success. The purpose of this manual

was “to help foodservice directors, supervisors, and managers successfully implement the36USDA’s School Meals Initiative for Healthy Children (SMI) regulations within the scope of daily practice” (USDA, 2007).None of the history of government legislation or the creation of the 2010 USDA Guidelines is associated with any theory of childhood obesity. Every five years experts study the DGA and issue a report. The DGA is technical, scientific, and written for policymakers, nutrition educators, nutritionists, and healthcare providers. It contains a vast amount of information not intended for the general public to comprehend; rather, “The intent of the Dietary Guidelines is to summarize and synthesize knowledge regarding individual nutrients and food components into recommendations for a pattern of eating that can be adopted by the public” (USDA, 2007).

It is a state’s right to consider the school nutrition regulation. Each state must adopt the2011 NSLP guidelines, in order to receive part of the $11.1 billion of federal subsidies. The USDA published nutrition guidelines, 2010 USDA Guidelines, which constitute federal nutrition policy. The federal requirements NSLP guidelines include: 1.) nutrition guidelines, 2.) physical activity, 3.) a plan to implement the policy, and 4.) must involve parents, students, the school board, school staff, and the community. The 2010 USDA Guidelines do not tell schools what foods to serve, nor does it spell out how much physical activity students must receive. However, the USDA withholds NSLP subsidies for failure to comply with the guidelines. As a result, each state must create its own nutrition policy legislation.

Some states have taken seriously the need to develop state nutrition policy beyond the minimum federal requirements; other states have adopted, practically verbatim, the federal language into their own policy. Arizona banned the sale of junk food and soda machines at the elementary and middle school level in 2004, Oklahoma prohibited serving foods of minimal nutritional value in elementary schools. It also required elementary students to have at least 60 minutes of physical activity weekly. North Carolina requires K–8 students to have 30 minutes of physical activity each day (Arch PediatrAdolesc Med. 2012). The Connecticut House and Senate passed legislation removing sodas and junk food completely from all schools and requiring 20 minutes of daily physical activity for all students (Arch PediatrAdolesc Med, 2012). The Connecticut House and Senate passed legislation removing sodas and junk food completely from all schools and requiring 20 minutes of daily physical activity for all students (Arch PediatrAdolesc Med, 2012).

Key Variables and Concepts

Research and reviews on childhood obesity show that there are many factors such, behavior, race, socio-economic status and community environment that have a significant effect on childhood obesity rates (CDC, 2017).Consuming more energy from foods and beverages than the body uses for healthy functioning, growth, and physical activity can lead to extra weight gain over time (Hill,et al. 2012). The Dietary Guidelines for Americans encourage children and adolescents to maintain calorie balance to support normal growth and development without promoting excess weight gain, per the U.S. Department of Agriculture and U.S. Department of Health and Human Services,

2015. Energy imbalance is a key factor behind the high rates of obesity seen in the United States and globally (Swinburn, et al.2011).This quantitative study is to review the association with all fifty states in the United States' compliance with HHFKS regulations and the states' level school aged children's obesity rate.

Dependent Variable

The dependent variable, childhood obesity is defined as a BMI at 95%or greater for children of the same age and sex. According to the Robert W. Johnson Foundation, State of Obesity, 2018, the national childhood obesity rate is 18.5%. The rate varies among different age groups and rises as children get older: 13.9% of 2–5year-olds, 18.4% of 6–11year-olds and 20.6% of 12–19year-olds have obesity. There also are striking racial and ethnic disparities, 25.8% of Latino children and 22% of black children have obesity. The study focused on the CDC's reports on school-aged children's obesity rates.

Independent Variable

The independent variable, state compliance score/rate, represents the extent to which a state nutrition policy is consistent with the 2010 USDA Guidelines. Each state must pass legislation and regulations to implement the 2010 USDA, while they can add or accelerate policies or practices they deem appropriate and in their best interest to promote student nutrition. For the purpose of this study, all 50 states were reviewed. The state-level latitude created significant differences between states in the actual school nutrition policies, which are significant. The impact of the changes to school nutrition policy mandated by the 2010 USDA guidelines is filtered through the myriad state and local nutrition policies. The Department of Agriculture, Food and Nutrition Service

(FNS), published a final rule in the Federal Register on January 3, 2014, - (79 FR 325), concerning necessary changes made to the National School Lunch Program (NSLP) to conform to requirements contained in the Healthy Hunger-Free Kids Act of 2010. Defining compliance: SFAs must be compliant with breakfast and lunch meal pattern requirements to receive the performance-based 6 cent lunch reimbursement. All meal components must be present in appropriate quantities. The meals offered to students must also comply with sodium, calorie, saturated fat, Trans fat standards, etc., see Appendix A. Ongoing compliance: SFAs must be held compliant with meal pattern and nutrient standards at subsequent State administrative reviews to remain eligible for the performance-based lunch reimbursement.

This section defines, the 2010 USDA Guidelines which focus is to reduce energy intake and increase energy expenditure. It is required that each state meet the 2010 USDA Guidelines in order to be complaint with the regulations and receive the award. The 2010 USDA Guidelines for school breakfast and lunch programs were phased. In overtime and were required to be 100%operative for the school year ending in 2014.

The energy intake requirements are as follows:

1. Control total calorie intake to manage body weight.

2. Reduce daily sodium intake to less than 2,300 milligrams.

3. Consume less than 10%of daily calories from saturated fatty acids by replacing them with monounsaturated and polyunsaturated fatty acids.

4. Consume less than 300 mg per day of dietary cholesterol.

5. Keep Trans fatty acid consumption as low as possible by limiting foods that contain synthetic sources of trans fats, such as partially hydrogenated oils, and by limiting other solid fats.

6. Reduce the intake of calories from solid fats and added sugars.

Schools need to help students understand the benefits of healthy lifestyles and the relationship between calorie intake and energy expenditure to achieve energy balance at a healthy weight (IOM, 2005). “School physical education programs offer the best opportunity to provide physical activity to all children and to teach them the skills and knowledge needed to establish and sustain an active lifestyle”, according to the National Council of State Legislatures (NCSL). In “The State of Play”, a NCSL recess report released in February 2009, 8 out of 10 principals reported that recess has a positive impact on academic achievement. The same report cited that 96%and 97% of principals respectively reported that recess positively impacted social development and general wellbeing. School-age children need approximately1,600 to 3,200 calories per day as illustrated in Figure 4.

	Source of goal [a]	Child 1-3	Female 4-8	Male 4-8	Female 9-13	Male 9-13	Female 14-18	Male 14-18
Calorie level(s) assessed		1,000	1,200	1,400, 1,600	1,600	1,800	1,800	2,200, 2,800, 3,200

Figure 4. Caloric levels for Children ages 1–18 From Institute of Medicine. Dietary Reference Intakes: The essential guide to nutrient requirements. Washington (DC): The National Academies Press; 2006.

Policy and Environmental Recommendations – Center for Disease Control

- Promote healthy physical activities and schedule them into the school day, after school and before school.
- Establish joint use agreements for recreational opportunities for a student using city facilities and recreation departments using school facilities when available.
- Ensure school children get the 30–60 minutes of physical activity each day at school between physical education, recess, after school programming or before school activities.
- Institute Walk-to-School or Bike-to-School programs.

The concept of high energy flux in which energy intake is pulled by energy expenditure is illustrated in Figure 5.

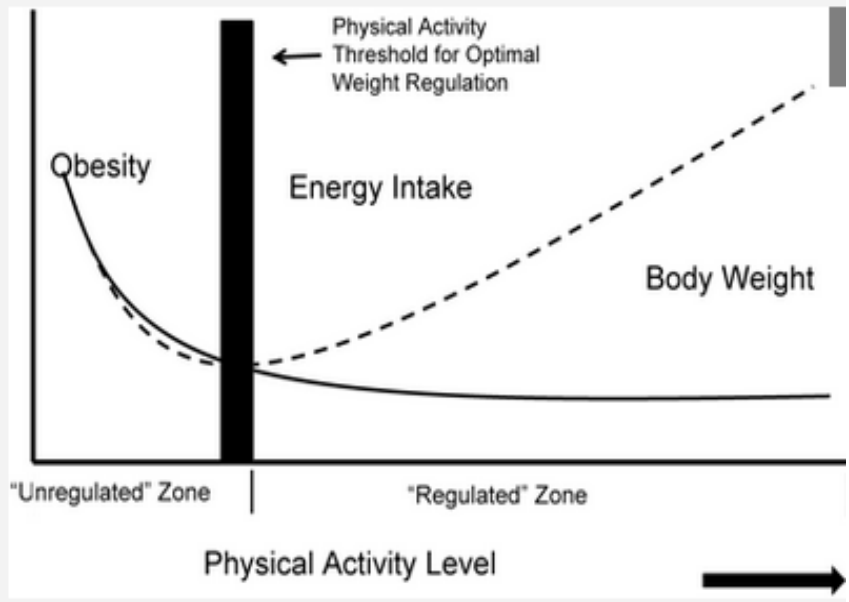

Figure 5. Physical Activity Level From Source: Institute of Medicine. Dietary Reference Intakes: The essential guide to nutrient requirements. Washington (DC): The National Academies Press; 2006.

Policy and Environmental Recommendations – Center for Disease Control – continued

- Schools offer and promote only healthy foods and beverages.
- Improve nutritional quality of competitive foods and beverages.
- Allow schools to purchase from local sources of foods like Farm to School Programs.
- Provide free fresh food and vegetable snakes in schools.
- Implement school policy prohibiting nutrient poor foods and replace with healthy snacks.

The Action for Healthy Kids (AFHK), National Alliance for Nutrition and Activity (NANA), and the School Nutrition Association (SNA) contributed to creating the nutritional requirements for the 2010 USDA Guidelines. Action for Healthy Kids (AFHK) is “the nation’s leading non-profit and largest volunteer network fighting childhood obesity and undernourishment by working with schools to improve nutrition and physical activity(PA) to help our kids eat right, be active every day, and be ready to learn” (USDA,2010). The National Alliance for Nutrition and Activity (NANA) is made up of more than 300 organizations, including steering committee members such as the American Cancer Society, the American Diabetes Association, and the National Association for Sport and Physical Education (NANA, 2013). The School Nutrition Association (SNA) is “a national, nonprofit professional organization representing more than 55,000 members who provide high-quality, low-cost meals to students across the country” (SNA, 2013).

The USDA has recommended amounts of calorie patterns, ranging from 1,000 calories to 3,200 calories. Patterns at 1,000, 1,200, and 1,400 calorie levels meet the nutritional needs of children ages 2 to 8 years. Patterns at 1,600 calories and above meet the needs for adults and children ages 9 years and older. The USDA states individuals should follow a pattern that meets their estimated calorie needs, which can be found in the "Energy Levels Used for Assignment of Individuals to USDA Food Patterns", shown in Appendix A.

Childhood Obesity Intervention

The purpose of (Sharifi M, et al. 2017), study Cost-Effectiveness of a Clinical Childhood Obesity Intervention was to estimate the cost-effectiveness and population impact of the national implementation of the Study of Technology to Accelerate Research (STAR) intervention for childhood obesity. The conclusion showed a childhood obesity intervention with electronic decision support for clinicians and self-guided behavior-change support for parents may be more cost-effective than previous clinical interventions (Sharifi, et al. 2017).

The study of (Gortmaker, et al. 2015), presents results of evidence review and micro simulation modeling project concerning the cost-effectiveness and population-level impact of seven interventions identified as potentially important strategies for addressing childhood obesity(Gortmaker, et al. 2015).The interventions are as follows: an excise tax of one cent per ounce on sugar-sweetened beverages, applied nationally and administered at the state level; the elimination of the tax deductibility of advertising costs for television ads seen by children and adolescents for nutritionally poor foods and beverages; restaurant menu calorie labeling, modeled on the federal menu regulations to be implemented under the Affordable Care Act; implementation of nutrition standards for federally reimbursable school meals sold through the National School Lunch and School Breakfast Programs, modeled on U.S. Department of Agriculture (USDA) regulations implemented under the Healthy, Hunger-Free Kids Act of 2010; implementation of nutrition standards for all foods and beverages sold in schools outside of reimbursable school meals, modeled on USDA regulations implemented under the Healthy, Hunger-

Free Kids Act; improved early childhood education policies and practices, including the national dissemination of the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) program; and a nationwide fourfold increase in the use of adolescent bariatric surgery (Gortmaker, et al. 2015).

Both studies examined cost effective interventions addressing childhood obesity. Health care costs attributable to obesity demand effective and efficient strategies (Sharifi, et al. 2017). To facilitate appropriate resource allocation, economic evaluations can aid explicit assessments of intervention efficiency and allow for comparisons between interventions (Sharifi, et al. 2017). Such analyses are lacking in pediatric obesity management (Sharifi, et al. 2017). According to U.S. Department of Health and Human Services, (2014), obesity and its associated health problems have a significant economic impact on the U.S. health care system. The costs of medical needs connected with childhood obesity could involve direct as well as indirect costs.

Legislative-Based Interventions

Researchers identified three interventions that would more than pay for themselves by reducing healthcare costs related to obesity: an excise tax on sugar-sweetened beverages; elimination of the tax subsidy for advertising unhealthy food to children; and nutrition standards for food and drinks sold in schools outside of school meals. Implemented nationally, these interventions would prevent 576,000, 129,100, and 345,000 cases of childhood obesity, respectively, in 2025. The projected net savings to society in obesity-related health care costs for each dollar spent would be $30.78, $32.53, and $4.56, respectively (Gortmaker, et al. 2015). Additional interventions modeled

include restaurant menu calorie labeling, increased access to adolescent bariatric surgery, improved early care and education, and nutrition standards for school meals. The study points out that the improvements in nutrition standards for both school meals and foods and beverages sold outside of meals through current Smart Snacks in School regulation make the Healthy, Hunger-Free Kids Act of 2010 one of the most important national obesity prevention policy achievements in recent decades (Gortmaker, et al. 2015).

State Legislation to Address Childhood Obesity, examining patterns to target policy interventions - From April 2009 to September 2011, researchers, Amy Eyler, PhD, CHES, and Ross C. Brownson, PhD, at the Prevention Research Center in St. Louis, a joint venture of Washington University in St. Louis and St. Louis University analyzed state legislation on childhood obesity enacted from 2006 to 2009 to identify patterns in the topics addressed, the presence of evidence-based components, and factors that predict successful enactment. The project expanded on and updated an earlier Robert Wood Johnson Foundation project, which supported a similar analysis of legislation from 2003 to 2005 and found that community- and school-based bills were most likely to be enacted.

School-based Interventions, “School-based [obesity] prevention programs are likely to be cost effective uses of public funds and warrant careful consideration by policy makers and policy planners.” (Gortmaker, et al. 2015).A summary of randomized control trials and literature reviews published in peer-reviewed journals within the past ten years provides evidence that school-based interventions targeting childhood obesity are effective in the following ways: Reducing BMI in at risk populations - The Planet

Health program, a nation-wide two year intervention targeting ethnically diverse middle school students, includes strategies such as: reducing television viewing; increasing physical activity; decreasing consumption of high fat foods; and increasing fruit and vegetable intake. Increasing healthy behaviors in youth - Two recent literature reviews on the effectiveness of school-based nutrition and fitness programs found that school-based interventions were generally effective in improving health behaviors, such as increasing fruit and vegetable intake, increasing more vigorous physical activity, increasing health knowledge, and decreasing sedentary behavior (Ickes, et al. 2014).Preventing kids from becoming overweight- a multidisciplinary obesity intervention in the schools use a combination of school self-assessment, nutrition education, nutrition policy, social marketing, and parent outreach. A two-year follow-up study of participants found that 50% fewer children in the intervention schools became overweight compared to the study's controlled schools (Mahmood, et al. 2014). The CATCH program, an intervention targeting low income schools with a large population of Hispanic students, includes components in nutrition, health curriculum, physical education, and family involvement. A study of the effects of the intervention showed that two years after the program had ended; participants had significantly smaller increases in overweight and risk of overweight compared to children in the control group (Coleman, 2002). The Wellness, Academics &You (WAY) school-based intervention employs health curriculum integrated throughout the school year in classes such as physical education and biology. A study of fourth and fifth graders in four different states who were enrolled

in the program showed significantly lower increases in BMI, improvements in diet, and increases in physical activity levels compared to control classes (Spiegel, 2012).

Summary

School aged children's obesity rates are at an all-time high. The government intervened and implemented a policy to help with regulating nutrition and physical activity in school. There have been numerous studies supported the fact that in order to fight this epidemic we need governmental assistance. There was significant discussion in much of the literature regarding the sources and causes of childhood obesity. Obesity is a complicated issue influenced by many factors such as: community, family, and schools. The effectiveness of using federal intervention in school meal planning is not known. There is no precedent for using school nutrition policy to affect childhood obesity (Perryman, 2011). Chapter three reviewed the research design, sample, statistical tests, and data analysis plan to address the research question.

Chapter 3: Research Method

Introduction

A quantitative methodology was used for this study. Quantitative research is the gathering and analysis of measurable data to generate statistical models and numbers to explain the data. According to (Leedy, et al. 2012), there were many advantages to using quantitative methodology: 1.) there is a clear identification of independent and dependent variables, 2.) the research problem can be clearly stated and hypotheses tested, and 3.) high levels of reliability are available relative to other methods. Researchers and scholars have different opinions about the respective merits of the two approaches, quantitative and qualitative, largely because of different views about the nature of knowledge and how knowledge is best acquired. Qualitative work refers to open-ended data collection methods such as in-depth interviews embedded in structured research (Patton, 1990). (Johnson, et al.2004) defined mixed methods research as "mix[ing] or combine[ing] quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study." The theoretical theory's goal is to explain the effectiveness or ineffectiveness of a federal nutritional policy for school-aged children. The Centers for Disease Control and Prevention (CDC) explains, while there are simple solutions, any opportunity for learning about ways to prevent and address childhood obesity would be optimal. From grade school-aged children to high-school teens, schools can influence healthy eating, daily activity, and living a healthy lifestyle.

This chapter presents a description of the research design and approach, sample and setting, and data analysis. It also includes the rationale for the specific research

design, methodology, and the data collection procedure. The study used data collected from published governmental sources.

Research Design and Approach

The obesity rate of the school-aged students was the dependent variable and compliance score/rate was the independent variable. The covariates are state median income and degree of urbanization. The median income and degree of urbanization were assessed prior to controlling them for the study. This quantitative study used a correlation research design. Correlation research is a type of non-experimental research in which the researcher measures two variables and assesses the statistical relationship (i.e., the correlation) between them with little or no effort to control extraneous variables(MahdaviDamghani, 2013). The correlation design seeks to determine how the dependent variable changes with variations in the independent variable. The correlation research design for this study increased the probability of generating reliable and valid results (Leedy, et al. 2012).The methodology measured state compliance with the USDA guidelines and test for an association between compliance score/rate and the school-aged children's obesity rates. According to (MahdaviDamghani,2013),a correlation study determines whether or not two variables are correlated. This means to study whether an increase or decrease in one variable corresponds to an increase or decrease in the other variable (MahdaviDamghani, 2013).Correlation research is supported by relational theories that attempt to test relationships between dimensions or characteristics of individuals, groups or situations or events (MahdaviDamghani, 2013).These theories

explain how phenomena or their parts are related to one another (MahdaviDamghani, 2013).

Population

The target population was school aged children in all 50 states in the United States. School aged means ages 10–17. According to U.S. Department of Education, National Center for Education Statistics (2018), there are approximately 29.87 million elementary school students in 67,648 elementary schools and approximately 15.55 million high school students in 15,222 high schools within the United States, not including private. Data from 2015–2016 show that nearly 1 in 5 school-aged child, 6–19 years of age in the United States, is obese (Hales, 2016).

Sampling and Sampling Procedure

The study sample included schools that receive public funding and subject to federal, state and local nutrition regulations in all 50 states. Also, the compliance score/rates from the State School Health Policy Database compiled by the National Association of State Boards of Education (NASBE, 2018) was included.

Procedures for Data Collection

Obesity rates were collected for school-aged children from the National Survey of Children's Health (NSCH). The NSCH provides data on multiple, intersecting aspects of children's lives including physical and mental health, access to quality health care, and the child's family, neighborhood, school, and social context. Compliance score/rate data was collected from the State School Health Policy Database compiled by the National

Association of State Boards of Education (2018). The NASBE data was checked against state government websites for reliability.

Operation of Variables

Compliance Score/Rate represents the percentage of school food authorities in each state meeting the updated nutrition standards

School-aged children obesity rate is the rate reported by the Center for Disease Control (CDC, 2017) for each state in the U.S.

Median Income: Median income is the income reported per state by the Census Bureau (2017).

Degree of urbanization is reported by the Census Bureau (2010).

This information is reflected in Figure 6. The figure reflects provides a visual review.

Variables, Scales of Measurement Variable Type, and Operationalization(at state level)			
Variable	Scales of Measurement	Variable Type	Source
Obesity Rate	Continuous	Dependent Variable	Center for Disease Control (2017)
Compliance Score/Rate	Interval	Independent Variable	State School Health Policy Database (2017)
Median Income	Continuous	Mediating Independent Variable	Census Bureau (2017)
Degree Of Urbanization	Continuous	Mediating Independent Variable	Census Bureau (2010)

Figure 6. Variable, Scales of Mearsurement Variable Type, and Operationalization

The nutrition policy was compared to the USDA Guidelines for breakfast and lunch. Each state's compliance score/rate was collected from the Robert Wood Johnson

Foundation (RWJF) report on The State of Obesity: Better Policies for healthier America 2014 (RWJF, 2014). The breakfast categories are: fruit cups, grains, and fluid milk the school lunch categories are: fruit cups, vegetables, grains, meat, and fluid milk. Appendix B contains the breakfast meal and lunch meal pattern.

Data Analysis Plan

Secondary data were used as the data resource for this study. Statistical data, records, and tables from scholarly reputable sources, such as governmental agencies and organization were also be used. The study sample included schools subject to federal, state and local nutrition regulations. Data were calculated using the Statistical Package for the Social Sciences (SPSS) 25.0. The Pearson correlation matrix were conducted to assess the association between variables. The study's data included an obesity rate, a compliance score/rate, a median income and a degree of urbanization for all 50states. The effect of compliance score/rates on obesity after controlling for median income and rurality was included in the study. All 50 states were divided into three areas: compliant, semi compliant and noncompliant. The research provided the mean for obesity rates, a compliance score/rate, a median income and a degree of urbanization for all four areas. A scatter plot was created to identify all outliers and/or missing data. This information helped to determine if there is an association between school's obesity rates and compliance score/rate, which supported the research question asking is there an association between the students' obesity rates (state level) and the HHFKA compliance score/rate?

Research Question

Research Question 1 (RQ1) Is there an association between the students' obesity rates (state level) and the HHFKA compliance score/rate after controlling for median income and degree of urbanization?

Null Hypothesis($H_0$1): There will be no significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Alternative Hypothesis (H_a1): There will be a significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Instrumentation and Materials

Data were calculated using the Statistical Package for the Social Sciences (SPSS) 25.0. The degree of urbanization and state median income was assessed prior to controlling them for the study. School-aged students' obesity rate data were collected from the United States Centers for Disease Control and Prevention's website and were added to a spreadsheet. The compliance score/rate data was collected capturing the rating and was added to a spreadsheet. I generated a scatter plot to identify all outliers and/or missing data. The dependent and independent variables were transferred to SPSS for review.

Threats to Validity

There was a potential threat to internal validity, which is the ambiguous temporal precedence, when it is not known if a change was because of the HHFKA. There was a

potential threat to external validity, which is the real world versus the experimental world. Any number of factors could have confounded the relationship between state nutrition policy and school-aged students' obesity rates. Childhood obesity is a well-known and carefully vetted issue, which removes any threat of validity. The use of standard statistical procedures on 100% of the target population reduces threats to statistical conclusion validity but does not eliminate all threats. The primary threat to statistical conclusion validity is the potential for an unmeasured covariate with greater explanatory value the independent variable.

Summary

This is a study using a quantitative methodology with a correlation design, showing relational (leading to correlation analysis) and predictive (leading to regression analysis).The purpose of this study was to examine the statistical effectiveness of the HHFKA policy childhood obesity rates. The study used statistics to support the hypothesis. Chapter 4 shows the characteristics of the study sample and review the mythological issues found in the research process.

Chapter 4: Results

Introduction

Congress passed the Healthy Hunger-Free Kids Act (HHFKA) in 2010 to help ensure every child living in the United States had access to the nutrition they need to grow into healthy adults. The law was implemented to help reduce childhood obesity and health risks for children. The objective was to help schools in all 50 states produce balanced meals, in order for children to have access to healthy foods during the school day. The USDA based the new school meal standards on independent, expert recommendations from the Institute of Medicine to ensure kids are being fed healthy food while they are at school (USDA 2019).

This study was conducted to measure the association in the relationship between compliance with the HHFKA and school-aged children's obesity rates, at the state level. Improving child nutrition is the focus of the HHFKA. Therefore, the HHFKA's purpose mandated changes to nutrition within schools. The HHFKA requires schools to follow the nutrition standards that include more fruits, vegetables, whole grains, low-fat dairy and lean protein, and limit saturated fat, added sugars, and salt (see appendix B). As an incentive, the HHFKA gives a 6-cent lunch reimbursement to all school districts that are in compliance with the meal patterns. The reimbursement is an investment toward improving the quality of school meals. To date, there has not been a study focusing on the relationship between nutrition regulations in schools and school-aged children's obesity rates, while controlling the income median and the degree of urbanization. This study's goal was to show the relationship between school-aged children obesity rates and state

policy compliance with 2010 USDA guidelines of the HHKFA, at the state level. The hypothesis was that there will be a significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Research Question:

Research Question 1 (RQ1) Is there an association between the students' obesity rates (state level) and the HHFKA compliance score/rate after controlling for median income and degree of urbanization?

Null Hypothesis($H_0$1): There will be no significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Alternative Hypothesis (H_a1): There will be a significant association between students' obesity rates (state level), and HHFKA compliance scores/rates after controlling for median income and degree of urbanization.

Chapter 4 provides data collection for all four variables, results from the statistical analysis and a summary of the findings for the association for school aged children's obesity rates and the HHKFA for all 50 states**.**

Data Collection

The data collected were the Compliance Scores/Rates, school-aged children obesity rates for ages 10–17, median income, and the degree of urbanization for all 50 states. The Compliance Scores/Rates were collected from the U.S. Department of

Agriculture (2017), compiled from the Centers of Disease Control (CDC), which were gathered, for this study, from the Robert Wood Johnson Foundation (RWJF) report on The State of Obesity: Better Policies for a Healthier America 2017 (RWJF, 2017).School-aged children obesity rates data were collected from the Health Resources and Services Administration, Maternal and Child Health Bureau - National Survey of Children's Health - State School Health Policy Database. According to the NSCH, they collect information on the health of children in the U.S. who are 10–17 years of age. The NSCH requests that parents and/or caregivers report their child's height and weight. This information was used to determine body-mass index (BMI) for children 10–17 years of age. The Health Resources and Services Administration's Maternal and Child Health Bureau (HRSAMCHB) develops survey content along with the U.S. Census Bureau. The Robert Wood Johnson Foundation (RWHF) works with the HRSAMCHB to distribute the most updated obesity rate data. The median income data was collected from the 2017 U.S. Census Bureau, through the American Community Survey (ACS). The ACS is a primary source for housing information, such as income, in the United States. The degree of urbanization was collected from the 2010 U.S. Census through the Population Estimates Program (PEP). The PEP produces estimates of the population for the United States. Data was calculated and entered in the Statistical Package for the Social Sciences (SPSS) 25.0. The degree of urbanization and state median income was assessed prior to controlling for them in the study.

The descriptive statistics of the study are shown in Table 1. Table 1 shows the mean for the obesity rate was 15.0180% (*SD*= 3.19787%), the mean for urbanization was

73.590% (*SD* =14.562%), the mean for the median income was $59,870.4400 (*SD*= $9,892.42437). the mean for the Compliance Score/Rate was 98.8520% (*SD* = 1.99584%).

Table 1

Descriptive Statistics

	Mean	Std. Deviation	N
Obesity Rate	15.0180%	3.19787%	50
Urbanization	73.590%	14.5652%	50
Median Income	$59,870.4400	$9,892.42437	50
Compliance Rate	98.8520%	1.99584%	50

Results

In order to control for both median household income and percentage of urbanization to see the effects of the compliance rate on the obesity rate I ran a hierarchical linear regression. Using SPSS to calculate statistical methods, I was able to create a hierarchical linear regression equation, using median household income, urbanization percentage, and compliance rate to predict each state's obesity rate. The assumptions of childhood obesity and compliance score were assessed to ensure no violations. Assumptions of outliers, normality and homoscedasticity were violated (see figures 4.1, 4.2 and 4.3 respectively). A histogram was used to represent the distribution of numerical data. The histogram (Figure 7) depicts an outlier evidenced by a case > 3 *SD* from the mean. A normal probability plot of regression standardized residual was used to

compare the normal distribution, which reflects a large positive relationship: Pearson *r* = .054.The Normal P-P Plot (Figure 8) depicts residuals (dotted line) which do not hover closely around the true value (solid line). A scatter plot was used to identify all outliers and/or missing data. The scatterplot (Figure 9) depicts further evidence the assumptions were violated; it appears there is an uneven distribution of the residuals.

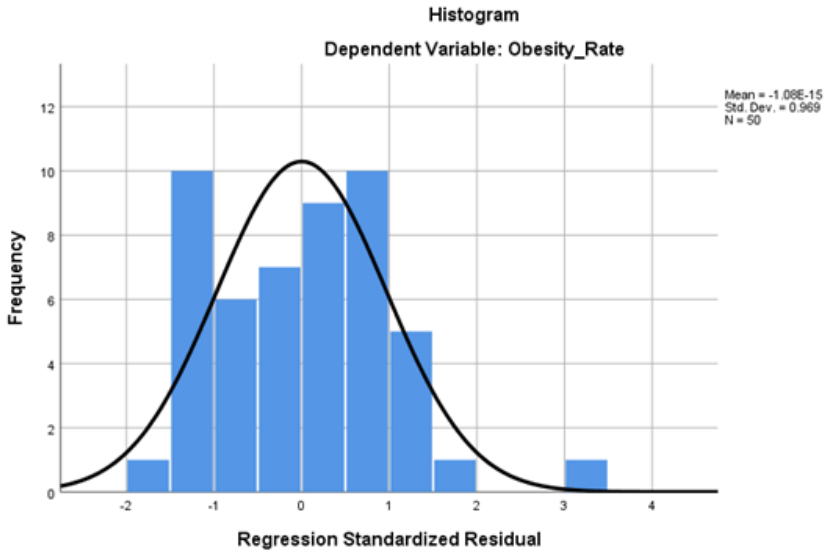

Figure 7. Histogram representing the distribution of numerical data

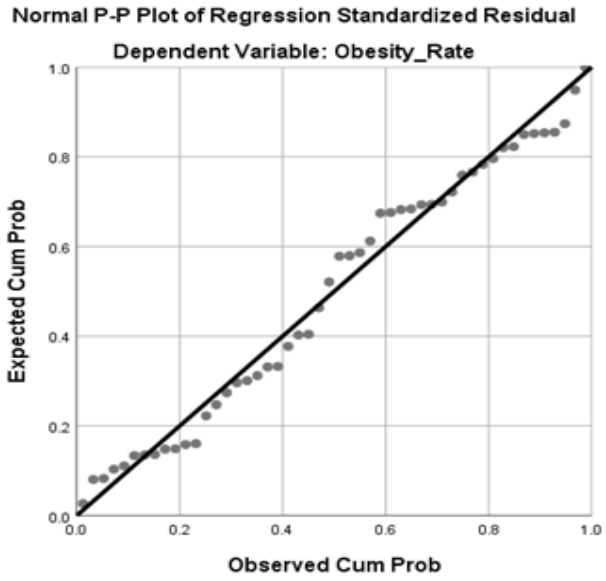

Figure 8. Normal Probability Plot of Regression Standardized Residual comparing the normal distribution

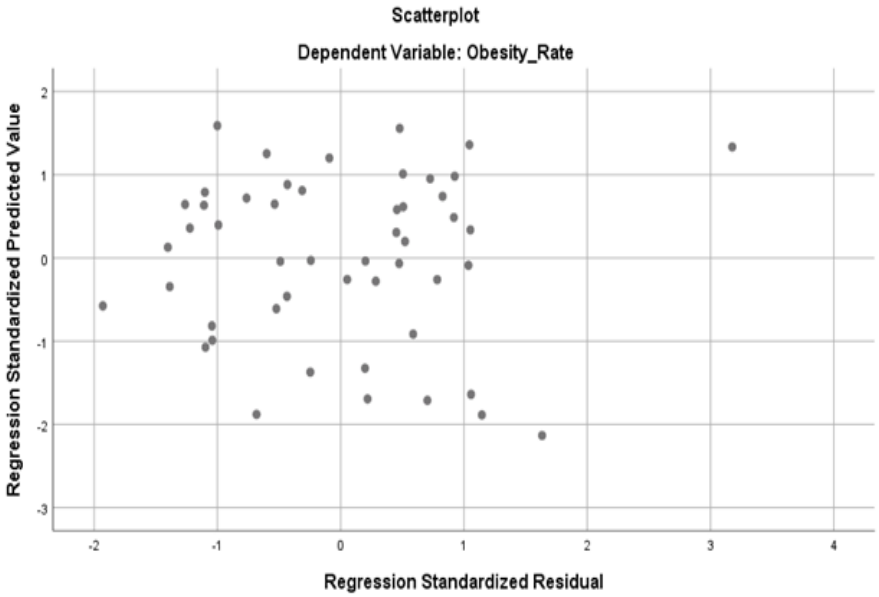

*Figure 9.*Scatter Plot identifying all outliers and/or missing data.

Urbanization and median income (control variables) were entered at step 1, explaining 31% of the variance in obesity rates, $F(2, 47) = 10.512$, $p < .001$. After entry of compliance rates in step 2, the total variance explained by the model as a whole remained at 31%, R^2 change = .001, F change (1, 46) = .036, $p = . < .01$.

This indicates the control variables were significantly able to predict the dependent variable, $F(2, 49) = 10.512$, $p < .01$, $R^2 = .309$. There was very slight variation in the obesity rate that was accounted. However, inclusion of the predictor variable did not add any significant variability in the dependent variable after controlling for the control variables. The regression summary is presented at Table 2 The final regression equation is: Obesity (Y)= 28.223 + .038(urbanization)+ .000(median income) - .038(compliance rate).

The correlation (Pearson Correlation) equation is shown below. The correlation of the study is shown in Table 3. The Predictor Analysis model summary of the study is shown in Table 4. The ANOVA of the study are shown in Table 5. The coefficients of the study are shown in Table 6.

The correlation between school aged students' obesity rates, urbanization and compliance score/rates was not found to be statistically significant. In these results, the p-values for the correlation between the obesity rates and compliance scores/rates does not show significance level of 0.05, which indicates that the correlation coefficients are not significant. The p-value between obesity rates and compliance scores/rates is 0.054.Because the p-value is not significance level of 0.05, there is evidence about the

significance of the association between the two variables. The r values are .054, .047 and -.110, which are not significant with the p values of .354, .373, .224.

Table 2

Step 1 and Step 2 of Linear Regression

Variable	*B*	*SE B*	β	R^2	ΔR^2	p
Step 1				0.309		0
Urbanization	0.038	0.032	0.172			0.242
Median Income	0	0	-0.631			0
Step 2				0.31	0.001	
Urbanization	0.038	0.032	0.175			0.241
Median Income	0	0	-0.635			0
Compliance Rates	-0.038	0.199	-0.024			0.85

Table 3

Correlation of Obesity Rates, Urbanization and Median Income

Correlations

		Obesity Rate	Urbanization	Median Income
Pearson Correlation	Obesity Rate	1.000	-.173	-.537
	Urbanization	-.173	1.000	.546
	Median Income	-.537	.546	1.000
	Compliance Rate	.054	.047	-.110
Sig. (1-tailed)	Obesity Rate		.115	.000
	Urbanization	.115	.000	
	Median Income	.000	.000	
	Compliance Rate	.354	.373	.224
N	Obesity Rate	50	50	50
	Urbanization	50	50	50
	Median Income	50	50	50
	Compliance Rate	50	50	50

Table 4

Predictor Analysis

					Change Statistics			
Model	R	R Square	Adjusted R Square	Std. Error of Estimate	R Square Change	F Change	df1	df2
1	.566[a]	0.309	0.28	2.71%	0.309	10.512	2	47
2	.566[b]	0.31	0.265	2.47%	0.001	0.036	1	46

a. Predictors: (Constant), Median Income, Urbanization

b. Predictors: (Constant), Median Income, Urbanization, Compliance Rate

c. Dependent Variable: Obesity Rate

The median income and urbanization were used as control variables(entered in block 1 of 1), compliance rates was the predictor variable, and obesity rate was the dependent variable.

Table 5

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	154.874	2	77.437	10.512	.000[b]
	Residual	346.22	47	7.366		
	Total	501.094	49			
2	Regression	155.147	3	51.716	6.877	.001[c]
	Residual	345.947	46	7.521		
	Total	501.094	49			

a. Dependent Variable: Obesity Rate

b. Predictors: (Constant), Median Income, Urbanization

c. Predictors: (Constant), Median Income, Urbanization, Compliance Rate

The model as a whole, including all variables is significant, ($F(3, 49) = 6.877$, $p = .001$,$R2 = .310$. However, the predictor, median income, did add significant value.

Table 6

Coefficients[a]

Model		Unstandardized Coeffiecents		Standardized Coeffiecents			Correlations		
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	Constant	24.454	2.511		9.738	0.000			
	Urbanization	0.038	0.032	0.172	1.185	0.242	-0.173	-0.170	0.144
	Median Income	0.000	0.000	-0.631	-4.357	0.000	-0.537	-0.536	-0.528
2	Constant	28.233	20.006		1.411	0.165			
	Urbanization	0.038	0.032	0.175	1.188	0.241	-0.173	0.173	0.146
	Median Income	0.000	0.000	-0.635	-4.286	0.000	-0.537	-0.534	-0.525
	Compliance Rate	-0.038	0.199	-0.024	-0.190	0.850	0.054	-0.028	-0.0223

a. Dependent Variable: Obesity Rate

Summary

According to the study, there is no correlation between school aged children's obesity rates and compliance rates/scores and no relationship between school aged children's obesity rates and urbanization. However, there is correlation between school aged student's obesity rates and median income. Therefore, there is a no relationship between school aged children's obesity rates and compliance rates/scores and no relationship between school aged children's obesity rates and urbanization.

The HHFKA represents a major breakthrough in the nation's attempt to offer children healthy food in school. According to the 2017 USDA over 31 million children receive meals through the school lunch program and many children receive most, if not all, of their meals at school. According to the 2017 USDA there are over seventeen million children living in households with little to no food and one out of three children are considered overweight or obese, schools are often faced with the challenge to combat childhood obesity and improve children's overall health. With the information provided

from this study, it will provide researchers data to defend ways to fight childhood obesity on a local, state and federal level.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to provide statistical information on the Healthy Hunger-Free Kids Act (HHFKA) compliance scores/rates and students' obesity rates after controlling for state median income and degree of urbanization. The HHFKA mandated changes to nutrition and physical education within schools and high poverty communities in 2010. The HHFKA modified the nutritional and physical policies in schools in order to affect the obesity rates in students by changing their expenditures. My goal for this study was to determine the effectiveness of having a mandated policy within the school system. The research question focuses on the association between the students' obesity rate at state level, the HHFKA compliance score/rate, the degree of urbanization and state median income. The degree of urbanization and state median income were assessed prior to controlling them for the study. Statistical public data were collected for all four variables. The data collected were used to find the mean, median and standard deviation for all variables. The results found that there is relation between compliance and the obesity rates in school-aged children in the United States.

Research Question 1 (RQ1) Is there an association between the students' obesity rates (state level) and the HHFKA compliance score/rate after controlling for median income and degree of urbanization?

Interpretation of Findings

The theoretical framework used was energy imbalance theory (EIT). EIT is a deficiency in nutrition and/or exercise. In this study, we reviewed how governmental programs can or cannot help with childhood obesity. According to (James, et al, 2012), reducing obesity requires modifying both energy intake and energy expenditure and not focusing just one. The Healthy Hunger-Free Kids Act (HHFKA) focuses on schools providing healthy foods and offering physical activity. Both are what is used to help combat obesity. The HHFKA does not focus on if a child lives in a low income home and how living in a low income home can affect a child's health or help obesity. The research shows there is no relationship between the HHFKA compliance scores/rates and the obesity rates in school-aged children living in the United States. The correlation between the obesity rates and compliance scores/rates does not show significance level of $p<0.05$, which indicates that the correlation coefficients are not significant. The correlation between school aged students obesity rates was found to be statistically significant with median income. The data collected shows all 50 states are actively adhering to the policy, some at higher rates than others, but the obesity rates fluctuate. The histogram depicts an outlier evidenced by a case > 3 *SD* from the mean. The Normal P-P Plot depicts residuals (dotted line) which do not hover closely around the true value (solid line). The scatterplot depicts further evidence the assumptions were violated; it appears there is an uneven distribution of the residuals. In these results, the *p*-value for the correlation between the

obesity rates and compliance scores/rates, based on the correlation coefficient between the two variables of .054, is greater than established alpha significance level of 0.05 (*p*-value 0.354 > 0.05), which indicates that the correlation coefficient is not statistically significant. The correlation between obesity rates and compliance scores/rates is 0.054. Because the *p*-value is greater than the significance level of 0.05, we fail to reject the null hypothesis and conclude that there is not enough evidence to find a statistically significant association between the two variables. Assumptions of normality and outliers were violated. The *r* 2 value produced from this analysis shows that 30.9% of the variation in obesity rate, my dependent variable, can be explained by the linear regression of obesity rate on compliance scores my independent variable. This indicates the control variables were able to predict the dependent variable relatively well, $F(2, 49) = 10.512$, $p < .01$, $R\ 2 = .309$. Because of our assumption of normality based on the normal plot, we do not have to make any adjustment or transformation to our data. Therefore, the data shows there is no association between the compliance score and school-aged children's obesity rate.

Limitations of the Study

There are several factors that play a pivotal role in obesity, such as: lifestyle, culture, environment and many more. In general, being overweight and/or obese is assumed to be the results of an increase in caloric and fat intake (excessive sugar intake and increased portion size) and a decrease in eating healthy and physical activity. Childhood obesity can profoundly affect children's physical health, social, and emotional well-being, and self-esteem. A limitation faced in the study is the fact that all states are

now compliant. Some may be higher than others in the scoring and rating but over all states are 90% of higher in compliance. Another limitation is surveys rely heavily on self-reported or parent reported height and weight to assess obesity, which is not as accurate as direct measurement of height and weight. One way to counter this limitation is by having physicians report the measurement of height and weight.

Recommendations

Scientists predict that more than half of today's children will be obese by the age of 35 if current trends continue (Ward, et al. 2017). There are several ways to help change this trajectory toward childhood obesity, which are:

According to the (CDC, 2018), the Federal government can:

- Provide funds to communities in order to put into action healthy eating and physical activity programs.
- Measure trends and the risk factors in the obesity of children.
- Provide funds for research for the cause and effect of childhood obesity
- Identify interventions.
- Provide training and resources to help prevent childhood obesity through initiatives to encourage healthy eating and physical activity.
- Continue to help low-income families to get affordable, nutritious foods through programs which have guidelines and policies.

According to the (CDC, 2018), State and Local Officials can:

- Start partnerships within the community of the low income to make changes that promote healthy eating and physical activity.

- Make it easier to purchase healthier and affordable foods.
- Provide free drinking water.
- Provide help and assistance for local schools to open and reopen school gyms, community playgrounds and sports fields during non-school.

According to the (CDC, 2018), doctors and nurses can:

- Measure body mass index routinely.
- Counsel parents about healthy eating and physical activity.
- Connect families with community resources which provide nutrition education and support services.

According to the CDC, 2018), childcare providers and parents can:

- Have fruits and vegetables and other nutritious foods for meals and snacks available.
- Be role models by eating healthy meals and snacks.
- Serve water.
- Limit TV and/or computer use.
- Support and encourage physical active every day.

We all must work to together toward this epidemic. Whatever approach chosen should not make physical activity and healthy eating feel like a chore, but make it interesting and enjoyable for the children.

Implications

There are several factors that contribute to obesity in children and some are more crucial than others. Researchers put a lot of their attention on ways to prevent childhood obesity but lack research on the factors that cause childhood obesity. Understanding the reason for obesity would and should be the first attempt toward trying to eliminate it in the United States. One way to prevent obesity is through healthy eating and physical activity. Healthy eating and physical activity interventions conducted within the communities is more effective at fighting obesity. If parents taught healthier lifestyles at home, many childhood obesity problems could be avoided. Children learn healthy eating habits, exercising routines and making the right nutritional choices from home. With this foundation these habits and routines will cascade into other aspects of their life. This will have an impact on their choices when selecting foods at school and fast-food restaurants as well as choosing to be active. Putting our focus on this may, over time, help decrease childhood obesity and lead to a healthier country.

Positive Social Change

A positive social change is to reduce obesity rates in children. This study provides insight and recommendations for governmental officials, schools, teachers, caregivers, etc. Also, this study can be used as a tool to help support anyone trying to raise awareness toward the issue of childhood obesity in low income communities. This study provides data which helps understand that the cost of food is a big issue. Improvement in the health of children can have a long-term effect in the country. Having a reputation as one of the countries with the highest obesity rates in children is alarming, see figure below. It

is time to take action and starting with our children is ideal. Eating healthier and living a more active lifestyle can become a behavior adapted by all. It takes one initiative to begin the cycle of awareness.

Conclusion

In conclusion, overweight and obesity have become major issues for children in the United States. Childhood obesity is stated to be a substantial public health issue for the reason that a majority of the processes that result in obesity begin during childhood. According to the (CDC, 2018), childhood obesity can be associated with significant health risks. Monitoring childhood obesity is an important part for public health especially for public health programs that focus on reducing or preventing obesity. Communicating to children about eating healthy and being physically active can have a great impact on obesity. The HHKFA was put in place to help children have access to healthy and nutritional foods. However, these foods are accessible in the schools and may not be accessible in the children's homes. School-based interventions may have little to no impact on childhood obesity without other efforts being presented. Initiatives which focus on childhood obesity may be further negotiated by the lack of importance to the main message the initiative sends to children and families. Methods that target obesity are based on the theory that body weight is within personal control and that individuals can change their weight. Many believe change will not occur unless individuals believe they have the power to change. Many believe it is the individuals' mindset that gives them the power to lose weight. Obesity can be reduced if society emphasize health and health behaviors and not emphasize weight. One way of doing this is by communicating this at

an early age. We must raise awareness of the factors that contribute to eating healthy and being active.

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Appendix A: Estimated Calorie Needs per Day by Age, Gender, and Physical Activity Level

Estimated Calorie Needs per Day by Age, Gender, and Physical Activity Level

Estimated amounts of calories needed to maintain calorie balance for various gender and age groups at three different levels of physical activity. The estimates are rounded to the nearest 200 calories for assignment to a USDA Food Pattern. An individual's calorie needs may be higher or lower than these average estimates (Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002).

	Male			Female[c]		
Activity level[b]	Sedentary	Moderately active	Active	Sedentary	Moderately active	Active
Age (years)						
2	1,000	1,000	1,000	1,000	1,000	1,000
3	1,200	1,400	1,400	1,000	1,200	1,400
4	1,200	1,400	1,600	1,200	1,400	1,400
5	1,200	1,400	1,600	1,200	1,400	1,600
6	1,400	1,600	1,800	1,200	1,400	1,600
7	1,400	1,600	1,800	1,200	1,600	1,800
8	1,400	1,600	2,000	1,400	1,600	1,800
9	1,600	1,800	2,000	1,400	1,600	1,800
10	1,600	1,800	2,200	1,400	1,800	2,000
11	1,800	2,000	2,200	1,600	1,800	2,000
12	1,800	2,200	2,400	1,600	2,000	2,200
13	2,000	2,200	2,600	1,600	2,000	2,200
14	2,000	2,400	2,800	1,800	2,000	2,400
15	2,200	2,600	3,000	1,800	2,000	2,400
16	2,400	2,800	3,200	1,800	2,000	2,400
17	2,400	2,800	3,200	1,800	2,000	2,400
18	2,400	2,800	3,200	1,800	2,000	2,400

a. Based on Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age-gender group. For children and adolescents, reference height and weight vary. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and

weighs 126 pounds. EER equations are from the Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.

b. Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life. Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life. Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

Appendix B: Lunch Meal and Breakfast Meal Pattern

USDA, United States Department of Agriculture - Effective July 1, 2019 (SY 2019-2020)

Lunch Meal Pattern

	Grades K-5	Grades 6-8	Grades 9-12
Food Components	Amount of Food[a] per Week (minimum per day)		
Fruits (cups)[b]	2½ (½)	2½ (½)	5 (1)
Vegetables (cups)[b]	3¾ (¾)	3¾ (¾)	5 (1)
Dark green[c]	½	½	½
Red/Orange[c]	¾	¾	1¼
Beans and peas (legumes)[c]	½	½	½
Starchy[c]	½	½	½
Other[c d]	½	½	¾
Additional Vegetables to Reach Total[e]	1	1	1½
Grains (oz eq)[f]	8-9 (1)	8-10 (1)	10-12 (2)
Meats/Meat Alternates (oz eq)	8-10 (1)	9-10 (1)	10-12 (2)
Fluid milk (cups)[g]	5 (1)	5 (1)	5 (1)

Other Specifications: Daily Amount Based on the Average for a 5-Day Week			
Min-max calories (kcal)[h]	550-650	600-700	750-850
Saturated fat (% of total calories)[h]	<10	<10	<10
Sodium Target 2 (mg)[h i]	≤935	≤1,035	≤1,080
Trans fat[hj]	Nutrition label or manufacturer specifications must indicate zero grams of trans fat per serving.		

[a] Food items included in each group and subgroup and amount equivalents. Minimum creditable serving is ⅛ cup.

[b] One quarter-cup of dried fruit counts as ½ cup of fruit; 1 cup of leafy greens counts as ½ cup of vegetables. No more than half of the fruit or vegetable offerings may be in the form of juice. All juice must be 100% full-strength.

[c] Larger amounts of these vegetables may be served.

[d] This category consists of "Other vegetables" as defined in paragraph (c)(2)(iii)(E) of this section. For the purposes of the NSLP, the "Other vegetables" requirement may be met with any additional amounts from the dark green, red/orange, and beans/peas (legumes) vegetable subgroups as defined in paragraph (c)(2)(iii) of this section.

[e] Any vegetable subgroup may be offered to meet the total weekly vegetable requirement.

[f] At least half of the grains offered weekly must be whole grain-rich as specified in FNS guidance, and the remaining grain items offered must be enriched.

[g] All fluid milk must be fat-free (skim) or low-fat (1 percent fat or less). Milk may be unflavored or flavored provided that unflavored milk is offered at each meal service.

[h] The average daily calories for a 5-day school week menu must be within the range (at least the minimum and no more than the maximum values). Discretionary sources of calories (solid fats and added sugars) may be added to the meal pattern if within the specifications for calories, saturated fat, trans fat, and sodium. Foods of minimal nutritional value and fluid milk with fat content greater than 1 percent are not allowed.

[i] Sodium Target 1 is effective from July 1, 2014 (SY 2014-2015) through June 30, 2024 (SY 2023-2024). Sodium Target 2 (shown) is effective July 1, 2024 (SY 2024-2025).

[j] Food products and ingredients must contain zero grams of trans fat (less than 0.5 grams) per serving.

Breakfast Meal Pattern

	Grades K-5	Grades 6-8	Grades 9-12
Food Components	Amount of Food[a] per Week (minimum per day)		
Fruits (cups)[b c]	5 (1)	5 (1)	5 (1)
Vegetables (cups)[b c]	0	0	0
Dark green	0	0	0
Red/Orange	0	0	0
Beans and peas (legumes)	0	0	0
Starchy	0	0	0
Other	0	0	0
Grains (oz eq)[d]	7-10 (1)	8-10 (1)	9-10 (1)
Meats/Meat Alternates (oz eq)[e]	0	0	0
Fluid milk (cups)[f]	5 (1)	5 (1)	5 (1)

Other Specifications: Daily Amount Based on the Average for a 5-Day Week			
Min-max calories (kcal)[g h]	350-500	400-550	450-600
Saturated fat (% of total calories)[h]	<10	<10	<10
Sodium Target 2 (mg)[h i]	≤485	≤535	≤570
Trans fat[h j]	Nutrition label or manufacturer specifications must indicate zero grams of trans fat per serving.		

[a] Food items included in each group and subgroup and amount equivalents. Minimum creditable serving is ⅛ cup.

[b] One quarter cup of dried fruit counts as ½ cup of fruit; 1 cup of leafy greens counts as ½ cup of vegetables. No more than half of the fruit or vegetable offerings may be in the form of juice. All juice must be 100% full-strength.

[c] Schools must offer 1 cup of fruit daily and 5 cups of fruit weekly. Vegetables may be substituted for fruits, but the first two cups per week of any such substitution must be from the dark green, red/orange, beans and peas (legumes) or "Other vegetables" subgroups, as defined in §210.10(c)(2)(iii) of this chapter.

[d] At least half of the grains offered weekly must be whole grain-rich as specified in FNS guidance, and the remaining grain items offered must be enriched. Schools may substitute 1 oz. eq. of meat/meat alternate for 1 oz. eq. of grains after the minimum daily grains requirement is met.

[e] There is no meat/meat alternate requirement.

[f] All fluid milk must be fat-free (skim) or low-fat (1 percent fat or less). Milk may be unflavored or flavored provided that unflavored milk is offered at each meal service.

[g] The average daily calories for a 5-day school week menu must be within the range (at least the minimum and no more than the maximum values).

[h] Discretionary sources of calories (solid fats and added sugars) may be added to the meal pattern if within the specifications for calories, saturated fat, trans fat, and sodium. Foods of minimal nutritional value and fluid milk with fat content greater than 1 percent milk fat are not allowed.

[i] Sodium Target 1 is effective from July 1, 2014 (SY 2014-2015) through June 30, 2024 (SY 2023-2024). Sodium Target 2 (shown) is effective July 1, 2024 (SY 2024-2025).

[j] Food products and ingredients must contain zero grams of trans fat (less than 0.5 grams) per serving.