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Examination of the Efficacy of the Healthy Hunger-Free Kids Act to Reduce High School Childhood Obesity Rates System

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MPH, Walden University, 2010

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Dissertation Submitted in Fulfillment

of the Requirements for the Degree of

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Abstract

The rapid rise in U.S. high school student obesity rates to 20.8% in 2018 presented significant risks to the health and well-being of American children and foreshadowed increased future healthcare costs. To address high school obesity, Congress passed the Healthy Hunger-Free Kids Act (HHFKA) in 2010 that mandated the U.S. Department of Agriculture develop regulations to nutrition to improve the nutrition of school cafeteria breakfasts and lunches. The purpose of this quantitative study was to test for changes between 2009 and 2016 in high school obesity rates attributable to the HHFKA using Youth Risk Behavior Surveillance System data, adjusted for known covariates of median income, population density, and ethnicity. A quantitative explanatory research design was employed to evaluate the efficacy of USDA 2010 Nutritional Guideline compliance to reduce high school obesity rates. Mean differences between state-level obesity rates were tested with paired *t* tests conducted with SPSS 24®. Twenty-seven (54%) states achieved 100% compliance with USDA 2010 Nutritional Guideline and 23 (46%) states were, on average, 86% compliant. During the period from 2010 to 2017, mean high school obesity rates increased by 2.3% from 12.5% (SD = 2.4%) to 14.8% (SD = 2.9%), $p > .000$. The increase in mean high school obesity rates were significant ($p < .000$) after controlling for median income, population density, and ethnicity. The causes of high school obesity are complex and intractable. While the HHFKA was a commonsense approach to addressing obesity, mean high school obesity rates continued to climb. The devastating personal and societal cost of high school obesity demands additional research and interventions to improve students' lives.

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Chapter 1: Introduction to the Study

Introduction

Nationwide childhood obesity rates more than doubled from 7.0% in 1980 to 17.0% in 2014 nationwide despite widespread recognition of the financial and health risks associated with childhood obesity (Centers for Disease Control [CDC], 2017). Obesity increases cardiovascular disease (CVD) and type II diabetes, while reducing life expectancy by three or more years (Owens, 2013). Congress, public policy makers, educators, doctors, and parents, are concerned and have implemented a few initiatives to reduce high school obesity rates. The use of federal school nutritional policy to address childhood obesity was significant due to the amount of time high school students spend at school and the National School Lunch Program (NSLP, 2016). The NSLP subsidized 31.5 million students' meals attending Grades K-12 during the 2013-2014 school year (NSLP, 2016). Federal NSLP subsidies are contingent upon compliance with 2010 U.S. Department of Agriculture Guidelines (USDA), making the NSLP a powerful tool for policy implementation (USDA, 2010).

Researchers found that genetic, psychological, and environmental factors combined in complex ways influenced childhood obesity rates (Jain & Langwith, 2013; Owens, 2013). Genetic factors included familial tendencies and metabolic rates; psychological factors included one's emotional state, coping strategies, and problem-solving skills; and environmental factors included availability of high calorie, low-cost foods, and socio-economic status (SES) (CDC, 2016). Owens (2013) found an association between psychological stress and metabolic rate, such that increased stress reduced metabolic rate and increased the probability of obesity. The CDC (2017) reported associations between childhood obesity rates and race/ethnicity, population density, and even regional clusters.

Background

Research on school-based interventions to reduce obesity rates showed mixed results (Kain, Concha, Moreno, & Leyton, 2014; Khambalia, Dickinson, Hardy, Gill, & Baur, 2012; Sobol-Goldberg, Rabinowitz, & Gross, 2013). School-based behavioral intervention studies included one that combined three meta-analyses of 54 quantitative studies on a variety of interventions to reduce childhood obesity (Khambalia et al., 2012). The study's findings were mixed in the short-term and no significant reductions in long-term obesity were reported. While the meta-analysis included controlled experiments, many potentially confounding variables were excluded, reducing the reliability of the findings. In another large-scale obesity research meta-analysis, 38 quantitative studies were aggregated to evaluate the effect of school-based intervention programs on body mass index (BMI), body weight, and incidence of overweight students (Sobol-Goldberg et al., 2013). The study found no long-term improvements in BMI of overweight incidence for interventions to improve diet and increase physical activity. The HHFKA was the first federal government obesity intervention using federal school nutrition policy and the NSLP to reduce childhood obesity rates.

HHFKA compliance was slow and uneven; as of the December 2014, no state was 100% HHFKA compliant and only 23 states had partial compliance (Grills, 2015). HHFKA compliance was mandatory for the 2014-2015 school year for school districts to qualify for their share of the $12 billion in subsidies distributed annually under the NSLP (2016). Despite the NSLP subsidy incentives, Education Week reported that certain school districts have opted-out of HHFKA compliance while others have lobbied Congress for changes to HHFKA regulations (Shah, 2013).

Problem Statement

The rapid rise in U.S. high school student obesity rate to 20.8% in 2012 presented a significant risk to the health and well-being of American children and foreshadows dramatic future increases in healthcare costs for CVD and type II diabetes treatment (CDC, 2017; Owens, 2013). Seventy percent of obese high school students already had one or more CVD and Type II Diabetes risk factors, which negatively affects quality of life, future disease incidence, and life expectancy (CDC, 2017; Owens, 2013). Race/ethnicity, SES, gender, and region of the country explained significant proportions of the variations in high school obesity rates. While such factors contributed to the high school obesity rates, most of the variance associated with obesity was attributed to genetics, diet, and level of physical activity.

To reduce childhood obesity, Congress passed the HHFKA in 2010, which mandated that the U.S. Department of Agriculture develop regulations to improve the nutritional content of school cafeteria breakfast and lunches (USDA, 2010). Two meta-analyses of school-based obesity studies using increased exercise, and/or improved dietary behaviors as interventions reported mixed results (Jain & Langwith, 2013; Sobol-Goldberg et al., 2013). Most studies showed little improvement in childhood obesity and only one study demonstrated benefits one year after treatment cessation. There was a gap in the literature on a large-scale study on the long-term effects of legislating school nutrition to affect obesity. The study examined the efficacy of the HHFKA to reduce childhood obesity six years after passage.

Purpose of the Study

The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using Youth Risk Behavior Surveillance System (YRBSS) data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). The HHFKA mandated substantial changes in school lunch and breakfast menus without a large-scale study demonstrating a relationship between school nutrition and childhood obesity (Sobol-Goldberg et al., 2013). Empirical data were collected for all 50 states on state-level high school obesity rate, compliance with 2010 USDA Nutritional Guidelines, median income, population density, and ethnicity. USDA Nutritional Guideline Compliance using the State Policy Index (State Policy Index, 2016), and the U.S. Census Bureau provided state-level data for high school obesity rate, median income, population density, and ethnicity (U.S. Census Bureau, 2019).

Research Questions and Hypotheses

RQ1**.** Which states are HHFKA compliant today and to what degree?

H_o1**:** All state nutrition policy and implementations are 100% HHFKA compliant.

H_a1**:** Less than all state nutrition policy and implementation are 100% HHFKA compliant.

RQ2**.** What effect did the HHFKA have on each states' high school obesity *rate*?

H_o2: There was no statistically significant change in state high school obesity *rates* in the six years since passage of the HHFKA?

H_a2**:** There was a statistically significant change in state high school obesity *rates* in the six years since passage of the HHFKA?

RQ3**:** What effect did the HHFKA have on each states' high school obesity *rate*, after controlling for school district median income, population density, and ethnicity?

H_o3: There was no statistically significant change in each states' high school obesity *rate* in the six years since passage of the HHFKA, after controlling for median income, population density, and ethnicity.

H_a3: There was a statistically significant change in each states' high school obesity *rate* in the six years since passage of the HHFKA, after controlling for median income, population density, and ethnicity.

Conceptual Framework

Kingdon (1984) developed a multiple streams approach to understanding the creation, selection, and persistence of public policy agendas to explain the fragmented U.S. public policy process. Kingdon posited that public policy opportunities and success are a function of three interdependent streams of problems, policies, and politics. The *problem stream* is characterized by problems that are perceived by the public to require government action to resolve. Citizens perceive a situation as a problem based upon its variance to the desired state of affairs. The *policy stream* includes opinions of domain experts and policy analysts who examine problems the myriad possibilities for policy action are identified, assessed, and narrowed to a set of feasible options. Finally, the *political stream* is composed of factors such as national mood swings, executive or legislative approval ratings, and special interest advocacy, which effect the body politic. These streams flow independently of one another until, at a specific point in time, there is a confluence of streams that creates a *policy window* opens.

Multiple streams conceptual framework analysis has become common practice in policy sciences. Since initial development, researchers examined more than 300 public policy case studies using the multiple streams approach, which proved valuable in explaining policy dynamics and the convergence of multiple societal phenomena to precipitate an “idea whose time has come” (Jones et al., 2016). This framework highlights the interaction between policy agents, implementation, agreed-upon policy images, a shared view regarding how a problem should be interpreted and solutions that are most appropriate, which can be re-opened after empirical evidence regarding the efficacy of the public policy becomes available (Zahariadis, 2016).

Low HHFKA compliance rates as the end of 2014 (Grills, 2015), and the continuing debate and potential legislative relief to address perceived HHFKA deficiencies, continue without the necessary predicate for ending the debate; a large-scale longitudinal study regarding the efficacy of the existing HHFKA and regulation promulgated under the 2010 USDA Nutritional Guidelines. This study represents an input to the problem, and policy streams that determine equilibrium in public policy. Therefore, this study was designed to further the theory and practice on public policy for addressing obesity.

Nature of the Study

Research for this study used a quantitative explanatory research design that examined the relationship between high school obesity rate and passage of the HHFKA and subsequent 2010 USDA Nutritional Guidelines (USDA, 2010). Quantitative research designs involve the collection of empirical data (observations), creation of testable hypotheses, and inferential statistics are either accepted or rejected based upon observations (Leedy & Ormrod, 2015). A quantitative methodology involves large numbers of participants, high levels of validity and reliability, and a desire to generalize findings. A quantitative explanatory research design was an appropriate choice for the study because a large volume of numerical secondary data exists for all 50 state's study variables and there was a desire to generalize study findings to all school districts in the U.S.

Definitions

Compliance Score: Compliance Score is the number of nutritional elements from the 2010 USDA Guidelines present in 2007 state nutrition policy. Compliance score is the dependent variable.

Ethnicity: The study will employ the same ethnicity categories as the CDC: White, African America, Hispanic, and other (CDC, 2017).

High school obesity rate: High school obesity rate is the proportion of obese high school students, by state, reported by the CDC (2017). High school obesity rate is the independent variable.

Median income: Median income is the amount reported by the Census Bureau for each state (U.S. Census Bureau, 2019).

Population density: Number of residents per square mile of land (U.S. Census Bureau, 2019).

Assumptions

The primary assumptions for the study were state nutrition policy changes mandated by the 2010 USDA Guidelines translated slowly and unevenly to actual changes in school cafeteria breakfast and lunch menu choices (Grills, 2015; Shah, 2013). Sufficient time passed since full HHFKA compliance occurred for high school obesity rate to be affected, and high school students were consuming the revised cafeterias food. Research for the study makes a *ceteris paribus* assumption for all unmeasured variables to isolate the variance attributable to HHFKA compliance.

Scope and Delimitations

Research for this study examined the relationship between HHFKA school nutrition policy compliance and high school obesity rates. Compliance scores reflected the degree of school cafeteria menu-compliance with 2010 USDA Guidelines. The compliance score was based on an analysis of state nutrition policy, but compliance was verified by evaluating whether all schools in the state were NSLP (2016) compliant. The magnitude of the NSLP economic subsidies made the probability high that all schools would be complaint. The scope of the study was nationwide, which mirrors the nationwide mandate for 2010 USDA Guideline compliance. All 50 states' nutrition policies were examined in detail using a standardized scoring system.

Limitations

The study was limited to high school obesity rate, and State Compliance score as main study variables, and controlled for median income, population density, and ethnicity. Obesity was a complex phenomenon, and SES, genetics, race, and several psychosocial variables were found to effect high school obesity rates (Gonzalez-Suarez, Worley, Grimmer-Somers, & Dones, 2009). Limiting the study to five study variables created the potential for other minor covariates to be responsible for some of the variance in the findings. Differences between states implementation of the school breakfast and lunch menu could provide a confounding variable. Other potential sources of unmeasured variance were the considerable variation in nutritional value between schools within a single district, or state. Potential variance in high school obesity rates not accounted for by the independent variables limit the validity of the results. As a result, study findings might not generalize to other age groups, geographies, and cultures (Leedy & Ormrod, 2015).

Significance

The quantitative explanatory research study was significant because it evaluated the efficacy to reduce high school obesity of the HHFKA passed by Congress in 2010 and promulgated under the 2010 USDA Nutritional Guidelines regulation using the $11 billion annual budget of NSLP (2015) to enforce compliance (CDC, 2016; USDA, 2010). Implementation of the 2010 USDA Nutritional Guidelines across 50 states, 13,506 government school districts, and 98,817 school cafeteria menus was an enormous undertaking (National Center for Education Statistics, 2016).

Research reported the level of 2010 USDA Nutrition Guidelines compliance at the state level as of the end of 2016, which was approximately 21% in December 2014 (Grills, 2015). By controlling for school district median income, population density, and ethnicity, research for this study aimed to isolate the effect of the 2010 USDA Nutrition Guidelines. By examining the efficacy 2010 USDA Nutrition Guidelines, study findings established the efficacy of using federal legislative interventions at the school cafeteria level to influence high school obesity rates and inform public policy. The study was significant because it came at a time when certain high school districts opted out of NSLP and lost federal subsidies, and several Bills were introduced to modify the HHFKA.

Summary

Nationwide childhood obesity rates more than doubled from 7.0% in 1980 to 17.0% in 2014, thereby creating an epidemic that threatened the health and welfare of a generation (CDC, 2017). Childhood obesity increases lifetime risks of CVD and Type II Diabetes (Owens, 2013). Childhood obesity is a complex phenomenon with genetic, psychological, and environmental causes (Jain & Langwith, 2013; Owens, 2013). The use of federal school nutritional policy to

address childhood obesity was used due to the fact that the NSLP subsidized 31.5 million students' meals annually (NSLP, 2016). Federal NSLP subsidies were contingent upon complaince with 2010 USDA Guidelines, making the NSLP a powerful tool to enforce complaince (USDA, 2010). The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using Youth Risk Behavior Surveillance System (YRBSS) data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). Research for the proposed study used a quantitative explanatory research design and examined the relationship between high school obesity rate and passage of the HHFKA and subsequent 2010 USDA Nutritional Guidelines (USDA, 2010). The main research question was: What effect did the HHFKA have on each states' high school obesity rate, after controlling for school district median income, population density, and ethnicity?

Chapter 2 provides a review of the literature regarding childhood and high school obesity, expansion on the concept of multiple streams approach, description of the 2010 USDA Guidelines effecting NSLP breakfasts and lunches, and a synthesis of existing research. Chapter 3 includes the research design, population, sample powering, and descriptions for technical data collection procedures.

Chapter 2: Literature Review

Introduction

Obesity within the U.S. high school population has been on a steady rise with 20.8% of students considered obese. This current trend carries with it the risk of increased health concerns related to excessive weight gains, such as CVD and Type II diabetes (CDC, 2015; Owens, 2013). Obesity compounds existing risk factors for such diseases and presents a threat to health, general quality of life, and life expectancy (CDC, 2015; Owens, 2013). There are a wide range of variables that contribute to variations in obesity such as ethnicity, family, social norms, and psychological factors. Other factors that lead to variance in obesity include genetics, diet, and the overall level of physical activity. Of the many variables that contribute to obesity only a few can be directly altered, such as diet and exercise.

In the hope of positively influencing diet and thereby contributing to a downward trend in the obesity rate Congress passed the HHFKA, which mandated the regulation of nutritional content in school cafeteria breakfast and lunch (USDA, 2010). This new oversight of the meals provided in public schools fell under the jurisdiction of the USDA. However, since the beginning of the program, there has been little research into the impact of legislation on school nutrition and any resulting impact on obesity. The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using Youth Risk Behavior Surveillance System (YRBSS) data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017).The research was significant because it examined any existing relationship between the passage of federal laws regarding nutrition and childhood obesity rates.

In the years following the HHFKA multiple stakeholders, including members of Congress as well as food suppliers, issued a variety of complaints concerning the new food regulations (Halper, 2015). Such complaints included concerns of government overreach into student meals, complaints originating among food companies who felt the new rules were too severe, students who complained about the reduction in meal types, and complaints from food preparers who felt the regulations limited their ability to satisfy hunger among the student population. Such complaints drew enough concern that Congress considered suspending tighter components of the regulations, including the law's emphasis on more wheat and less sodium, in favor of previous food standards (Czinn, 2016). The findings of the study could inform all stakeholders regarding the outcome of the law on obesity and its potential benefits to student health.

Previous research into school-based interventions has thus far demonstrated mixed results (Kain et al., 2014; Khambalia et al., 2012; Sobol-Goldberg et al., 2013). These studies revealed no significant reduction in obesity over a long period of time. The HHFKA itself has problems specific to its effectiveness, such as the uneven integration of its regulations and the slow pace at which these regulations have been adopted (Grills, 2015). It was only in the 2014-2015 school year that school districts were required to become HHFKA compliant to receive federal funding in subsidies (NSLP, 2016). With nearly 2.1 million obese high school children in 2012, the health of American children was at risk should obesity not be addressed (Malik, Pan, Willett, & Hu, 2013).

Tackling obesity is a concern nationally and globally (Ng et al., 2014). The percentage of individuals globally classified as obese increased from 28.8% to 36.9% between 1980 and 2013. This growth in obesity occurred particularly among child and adolescent populations throughout

developed countries, with 23.8% of boys and 22.6% of girls classified as overweight or obese in 2013. This paralleled a growth of obesity in developing countries where the percentage of overweight or obese boys grew from 8.1% to 12.9% while the percentage of overweight or obese girls grew from 8.4% to 13.4%.

Chapter 2 is composed in the following order: (a) Multiple Streams Approach, (b) childhood obesity, (c) the health consequences of childhood obesity, and (d) factors affecting childhood obesity, (e) obesity treatment, (f) and federal intervention into school nutritional policy. This literature review first produces an overview of the multiple streams approach, its propositions, and research conducted using it as a framework. Following this, an overview of obesity and its many health consequences is undertaken. Contributing factors to obesity are then examined as well as current obesity solutions. Finally, an examination of federal intervention in school nutritional policies is conducted. The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using YRBSS data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). Chapter 2 is structured in the following manner to best address the research question: literature search strategy, theoretical framework, literature related to key variables, and a summary.

Literature Search Strategy

While constructing this literature review, the following databases were searched: EBSCOhost, Emerald, ERIC, Google Scholar, JSTOR, ProQuest, and Research Gate. In addition to these databases, multiple websites were searched for information relating to nutrition and policies, including CDC, The European Food Information Council (EUFIC), The Food Research and Action Center, Let's Move!, The National Heart, Lung, and Blood Institute (NHLBI), The

U.S. Department of Agriculture, The White House government website, and the World Health Organization (WHO; 2016). The development of key search words occurred in an ongoing process. Databases were searched using an initial set of keywords, which included *obesity, childhood obesity, high school obesity, childhood obesity research, obesity origins, causes of obesity, causes of childhood obesity, legislation and obesity, obesity interventions, regulations and obesity, laws and childhood obesity, regulations and childhood obesity, federal laws and childhood obesity, school obesity interventions, high school obesity interventions, nutrition policies, state nutrition policies, federal nutrition policies,* and *school nutrition policies.*

Retained for inclusion in this literature review were peer-reviewed journal articles, state and federal laws and regulations regarding nutrition, books, and dissertations. Most of the works retained for the purposes of this literature review were published between 2012 and 2016, although some older foundational works were included that detailed the history of nutritional policy in the United States. Eighty separate works were reviewed, and of these, 40 were chosen for inclusion. Approximately 80% of all the works reviewed here were quantitative with the remaining 20% being qualitative in nature. Research articles were chosen for inclusion based on their discussion of obesity, childhood obesity, federal, state, and local regulations regarding school nutrition policies, the health consequences of obesity, theories regarding energy imbalance and nutrition, and interventions designed to reduce obesity.

Nutritionists and policy makers have discussed childhood obesity and its relationship to school-based nutrition, but the HHFKA was the first nationwide legislation attempt by the federal government to actively reduce childhood obesity through school-based nutrition. Other initiatives that arose simultaneously during this time, such as Let's Move! (2016) were designed to encourage greater physical activity among American children of all ages. The HHFKA was

passed concurrent to initiatives such as Let's Move! that were designed to encourage public awareness of obesity, its health risks, and the benefits of better diet and increased levels of exercise. Other initiatives, such as the Child Obesity Task Force, were also passed in 2010 to develop recommendations for reducing childhood obesity in the United States (White House, 2010). However, the HHFKA carried behind it the weight of law as well as mechanisms for enforcement, such as its connection to federal subsidies for schools. Despite being the first attempt to create national legislation targeting childhood obesity through school-based nutrition, six years after the passing of the HHFKA there remains a lack of information regarding its effectiveness in relation to its intended goal. A history of attempts to influence school cafeteria meals was provided to illustrate the environment surrounding the HHFKA and its creation.

Theoretical Framework

The Multiple Streams Approach (MSA) is a framework that explains how governments make choices under ambiguous conditions (Zahariadis, 2014). MSA was employed to explain policy decision making across cultures and forms of government cited at more than 10,000 times since development by Kingdon (Zahariadis, 2014). This approach identifies three streams in which the policy system flows: problems, policies, and politics. Problem streams consist of issues, as perceived by the general public that require government action (Kingdon, 1984). A policy streams is characterized by domain experts examining a problem and identifying potential responses. Finally, political streams consist of other factors, such as special interest advocacy or shifting national priorities that impact decision-making. When these policy streams converge, they form a policy window, which are spearheaded by policy entrepreneurs (Zahariadis, 2014). This creates a timeframe in which policy makers can adopt policy solutions to address problems. A meta-review of the multiple-streams approach revealed that it had been applied to 65 different

countries and 22 policy areas at varying levels of governance across the world (Jones et al., 2016). This review initially considered 2,000 articles, selected 311 for inclusion, and demonstrated the prolific nature of the model. However, the researchers warned that further operationalization of the model was required to further refine the theory.

As indicated by Zahariadis (2014) and Jones et al. (2016), the multiple streams approach has been used widely. A study of its impact revealed that this approach had spawned new policy theories, indicating that the model's value extended beyond its own application and included new research and models (Cairney & Jones, 2015). It had also been empirically tested in several contexts. The researchers noted, though, that the types of policies addressed by this model were typically broad, leaving room for the model to be applied in a deeper way and with greater specificity. Other areas for refinement include considering policy from a global context (Lovell, 2016). Jones et al. (2016) operationalized the model for a parliamentary context, but Lovell noted that policy can globalize and that non-state actors can influence policy. The multiple-streams approach was conceptualized in the U.S. However, policy can move internationally. Policy transfer is the process in which knowledge about policies in one context can guide policy development in another. Increased globalization has created circumstances in which policy transfer can occur at the international level. Australia, as an example, researched smart metering in other nations prior to its own policy development. Future research should better capture the impact of international dimensions on policy creation.

When multiple streams converge and create a policy window, policy entrepreneurs play an important role in advocating for specific solutions (Paredis & Block, 2013). The motivations of these entrepreneurs are diverse. They pursue these solutions either due to their concern for the problem, because of the values of the policy, or out of a desire to benefit themselves in some

way. These entrepreneurs come from diverse backgrounds, but of interest to the multiple streams model is that they take on a critical role in proposing solutions and coupling multiple streams. The central role of individuals, such as the problem entrepreneur, may be expanded and at least one proposal has been made to further refine the problem stream and identify a figure known as the knowledge broker (Knaggard, 2015). The knowledge broker is a figure that frames public problems and attempts to persuade policy makers to accept that framing. To do so, they acquire knowledge of the problem, perceive that problem through their own values, and drive the framing through their own emotions attached to the issues. However, while many people can fulfill these functions, the knowledge broker requires access to policy makers, credibility that adds to their framing, and persistence in the face of obstacles.

Application

In at least one instance, the multiple-streams framework has been preferred over a more straightforward cost-benefit analysis during the policy making process (Weber, 2014). Review of literature regarding biking and pedestrians revealed that cost-benefit analysis did not successful account for the adoption of related policies and could not account for individuals such as policy entrepreneurs. This was considered a limitation of cost-benefit analysis and demonstrated the ability for the multiple-streams model to more comprehensively account for policy making regarding this form of transportation policy. The ability for the model to account for individuals such as policy entrepreneurs should be considered a strength of the model and taken into consideration when analyzing policy decision making (Weber, 2014).

Kingdon's framework was recently applied to explain significant shifts in energy policy that occurred in the U.K. between 2006 and 2010 (Carter & Jacobs, 2013). The researchers examined this period and identified the period in which the problem, politics, and policy streams

converged into a period during which a policy window opened. However, the researchers noted that the policy window remained open far longer than anticipated in the traditional streams mode. They attributed this to both parties agreeing that there was a problem to be addressed, which prolonged how long the window remained open in a parliamentary system. Paredis and Block (2013) previously noted the importance of policy entrepreneurs in creating a policy window. Carter and Jacobs (2013) noted that in the parliamentary system, government ministers can play a critical role in supporting the confluence of streams. The greater the policy and problem become within their narrative, the larger role they can take on in identifying solutions.

The resulting policies that a policy entrepreneur can generate rely on both the entrepreneur's power in addition to coherence of the coalition that the entrepreneur can build (Saurugger & Terpan, 2015). A study of the hardening or softening of government policies in times of crisis revealed that the outcome carried dependent on these conditions. When there is a wide window of opportunity and an entrepreneur can create a coherent coalition, the entrepreneur has a greater chance of successfully maintaining policies within the norms of the existing government. The softening of laws is more likely under conditions in which a coalition is not coherent and the time to respond is shorter.

The role of narrative may be important in supporting moves toward policy development (Walhart, 2013). Research into human papillomavirus revealed that anal cancer is typically characterized as a problem of HIV-positive individuals. As such, the related human papillomavirus that can contribute to it has been an object of limited policy value restricted to a segment of the population. However, all sexually active individuals can contract the virus. The researchers suggested that broadening how the virus was characterized might provide momentum toward driving further research into anal cancer as policies related to human papillomavirus

grow in number. Narrative impacts framing as well, and researchers suggested that the problem of climate change could only be integrated into forest policy to the degree that the two were framed together (Storch & Winkel, 2013). This study of climate change related forest policy compared to Laenders in Germany, Bavaria, and North Rhine Westphalia. In Bavaria, forest policy was linked to factors such as climate change and problem entrepreneurs advocating for linked policies. North Rhine Westphalia did not pass forest policy related to climate change as the same factors did not exist. Narratives set a framework, but the forest sector in Bavaria was also better prepared to substantiate the necessity of the link.

As noted by Carter and Jacobs (2013), there are specific elements of the parliamentary process that can distinguish it apart from policy making in the U.S., such as the potential for ministers to fill the problem entrepreneur role. However, other refinements were suggested by Herweg, Hub, and Zohlnhofer (2015), including the need to more greatly emphasize the role of political parties in a parliamentary democracy. In this context, the policy stream is constituted partly of party policy experts who promote policy alternatives that are consistent with their respective parties' approaches. Political leaders adopt these solutions in the political stream. The researchers also more rigorously defined terms from the multiple streams model in a parliamentary context.

The multiple streams model was applied in the context of smoke-free policies in the U.S., where tobacco production remained a significant contributor to domestic revenues (Mamudu et al., 2013). The Non-Smoker Protection Act was enacted in Tennessee, despite the state being the third largest producer of tobacco in the nation. During this period, support was found among local groups as well as the state Governor. However, the researchers noted that while there was a convergence of streams, local health proponents failed to capitalize on attitude shifts toward

tobacco, leading to a weaker bill than initially proposed. The findings suggested there are moments in policy making history when groups should be aware of attitude shifts and attempt to capitalize on these to achieve as much policy success as possible (Mamudu et al., 2013).

Application of the multiple-streams approach was made to assess maternal health policies in Madhya Pradesh, India (Jat, Deo, Goicolea, Hurtig, & Sebastian, 2013). The researchers noted that guaranteeing the security of women during motherhood had become an increasing priority in different nations. Maternal health also emerged as a policy issue in India. Qualitative data was collected using interviews and document analysis. The researchers concluded that several events came together to increase maternal health as a priority. These factors included, among others, evidence of a high level of maternal mortality, the increasing framing of maternal mortality as a human rights violation, and increasing pressure created by media attention. This was a top-down occurrence in which national policy began to reflect these changes, which was then followed by state level responses. The researchers noted that several events came together to form the policy window regarding maternal health (Jat et al., 2013).

In at least one study, comparison of policy outcomes regarding a similar problem revealed there are several variables that can influence such outcomes (Mosier, 2013). Policies regarding sugar-sweetened-beverage taxes were implemented in both the states of Colorado and Kansas in 2010, though the outcome were different in both states. The researchers noted that the policy stream was impacted by the severity of the existing gap budget. Other variables that impacted the outcomes involved state partisan politics, how the policies were framed, and the nature of the tax's design. These findings suggested that policy may be influenced by narratives outside that of the core problem. While the central issue regarding these taxes was reducing

consumption of sugar-sweetened-beverages, narratives concerning revenue needs affected the strength of the resulting tax (Mosier, 2013).

Literature Related to Key Variables

Childhood Obesity

In terms of concrete numbers, the number of children considered overweight or obese is estimated to be as high as 43 million (Pulgaron, 2013). This created an increase in studies related to childhood obesity and growing concern related to the types of health risks posed by the growing prevalence of obese children. Specific to the U.S., it is estimated that 12.5 million, or 17% of the child and adolescent population fit the definition of obese between 2009-2010 (Dooyema, Belay, Foltz, Williams, & Blanck, 2013). However, obesity prevalence stalled between 2003-2004 and 2011-2012, with obesity prevalence rates plateauing (Ogden, Carroll, Kit, & Flegal, 2014). Despite this relatively positive news regarding obesity among youth, the overall obesity rate remains high. For this reason, many public health initiatives in the U.S. continue to target obesity.

Previous research revealed that obesity prevention, rather than obesity reduction, should be attempted given the tendency of the human body to hold onto weight once it is gained (Hill, Wyatt, & Peters, 2012). Studies into childhood obesity revealed that obesity onset declined with age, indicating prevention of obesity onset in early childhood could prevent the onset of obesity in adolescence (Cheung, Cunningham, Narayan, & Kramer, 2016). The rates of obesity declined during the three stages of childhood. The incidence of obesity onset among pre-school aged children (2.0 - 4.9 years) was 4.0%, was 3.2% among elementary school aged children (5.0 - 12.9 years), and 1.8% among adolescence (13.0 - 18.0 years). The findings demonstrated a declining trend of obesity incidence among children as age increased. Obesity reducing efforts

that target childhood may have benefits that extend well into age ranges associated with secondary education students.

Health consequences of childhood obesity. There are a variety of negative health consequences to obesity that range from psychological to physical (Karnik & Kanekar, 2015). Psychological risks include lower self-esteem, which can lead to nervousness centering on a child's appearance. Depression may also result, and children may feel distanced from their peers due to social stigma. Obese children are also at risk of cardiovascular disease, increased cholesterol levels, and higher blood pressure. Obesity can also contribute to Type 2 Diabetes, respiratory problems such as asthma and sleep apnea. Increased weight on joints may also contribute to a general increase in physical discomfort (Karnik & Kanekar, 2015).

Childhood obesity is associated with health disorders not only during childhood but also later in life (Barton, 2012). While diabetes, arterial hypertension, and coronary artery disease are all commonly associated risks with obesity, fatty liver disease can also occur. Polycystic ovarian syndrome, renal complications, and infertility also occur at increased rates among obese children (Kelsey, Zaepfel, Bjornstad, & Nadeau, 2014). Obesity is also linked to an increased progression rate of atherosclerosis and can also lead to premature vascular aging (Barton, 2012). The same symptoms that would be anticipated in older age occur in early life when obesity is present. Increased asthma risk is another of the health consequences of childhood obesity not as commonly considered as coronary or vascular disorders (Black, Zhou, Takayanagi, Jacobsen, & Koebnick, 2013). However, studies into asthma prevalence found the adjusted risk of asthma for overweight, moderately obese, and extremely obese youth when compared against non-obese peers to be 1.16 (95% CI: 1.13, 1.20), 1.23 (95% CI: 1.19, 1.28), and 1.37 (95% CI: 1.32, 1.42) respectively ($p < 0.0001$). This increased risk of asthma in obese youth was strongest among

young girls between the ages of six and ten, as well as among Asian/Pacific Islanders. Among the moderately and extremely obese, asthma occurred more frequently and required more emergency treatment. These findings suggested that the health risks of obesity include severe forms of asthma.

As childhood obesity rises, there is a concurrent rise in cardiovascular disease (Cote, Harris, Panagiotopoulos, Sandor, & Devlin, 2013). Previously, observable cardiovascular damage limited to adults has been increasingly observed in obese children. Epicardial fat deposits, which is a predictor of cardiovascular disease, has been found in increasing quantity in obese children. Other physical alterations that affect the heart among the obese include pre-clinical shifts in systolic function. Increased carotid intima-media thickness, a clinical marker of atherosclerosis, has been found in obese children. These physical indicators of declining cardiovascular health, along with several others such as vascular stiffness, have been found as childhood obesity has increased. Negative shifts in childhood health track into adulthood alongside obesity (Gupta, Shah, Nayyar, & Misra, 2013). Obesity is difficult to reduce, and the negative health consequences of obesity progress as children age. Despite the many health complications among adults who experienced childhood obesity, the adulthood consequences of childhood obesity are not limited to health declines, but can include early morbidity (Kelsey et al., 2014).

Factors affecting childhood obesity. Childhood obesity is a complex phenomenon. Childhood obesity can arise due to several factors. Children are influenced by family, culture, community, and by the broader population (Gurnani, Birken, & Hamilton, 2015). The framework for the proposed study to causes and potential treatments for childhood obesity is multiple streams approach (Kingdon, 1984). The increase in calories causing this imbalance can often be

traced to consumption of energy dense foods such as sugary beverages and snack foods. In combination with a low activity level, these foods contribute to childhood obesity. However, the consumption of this food is often encouraged by society and culture, as noted by Gurnani et al. (2015) and is often used as a means of reward. It is also often used as a facilitator for socialization and so increased consumption of this food is encouraged (Sahoo et al., 2015). This can lead to an unhealthy relationship between an individual and food.

Unhealthy food consumption is encouraged not only by society but also by the environment created in a family (Sahoo et al., 2015). Families make foods available to children and can influence obesity through the types of food they keep stocked and the types of meals they prepare. Families that indulge in unhealthy eating influence their children to do the same. However, families influence not only diet, but physical activity. Families that are highly sedentary influence their children to do the same. Family environments that are highly sedentary, but also maintain unhealthy diets, contribute to childhood obesity. However, while there are many social and family factors behind childhood obesity, there are also intrinsic psychological factors (Sahoo et al., 2015). Depression and anxiety often cause individuals to eat as a form of comfort. A higher lifetime prevalence of anxiety is associated with obesity.

At least one study suggested that BMI relates to the types of social circles an individual kept (Leahey, Doyle, Xu, Bihuniak, & Wing, 2015). In social circles where friends were overweight or held high BMIs, individuals typically had a high baseline BMI although they did not necessarily qualify as obese. The study revealed that being a member of a social circle characterized by unhealthy eating practices was likely to promote a higher baseline BMI. Among participants in the study, baseline social norms that included unhealthy eating were predictive of poorer weight loss outcomes. Therefore, social norms influenced both baseline BMI and total

weight loss. The results illustrated the powerful influence social norms have on obesity development.

Obesity Treatment

Several federal government programs have been proposed to address childhood obesity, at least three of which hold the promise (Gortmaker et al., 2015). Research into these plans suggested that (a) an excise tax on sugar-sweetened beverages, b) elimination of tax subsidies for the advertisement of unhealthy foods, and c) the implementation of nutrition standards for school meals would all save more than the cost of implementation due to savings drawn from health care costs. The associated reduction in obesity and the diseases resulting from it would create enough savings for the health care system to offset the initial losses in revenue.

While these programs emphasize large scale approaches that deal with tax incentives and nutrition programs, research has also focused on small, more focused programs. Family-based group treatments have demonstrated the promise of assisting in weight loss without excessive financial costs (Epstein et al., 2014). Due to the influence of families on children and obesity development, treatment deals with the family level factors that contribute to childhood obesity. A study of age eight through twelve-year-old children with overweight parents found that intervention programs, which addressed the entire family in a single setting, reduced the costs associated with participating in a weight reduction program per unit of weight loss.

Among socioeconomically disadvantaged children, obesity reduction attempts focused on increasing self-monitoring, counseling, endorsements from primary care providers, and optional group support sessions (Bennett et al., 2012). This trial emphasized highly supportive environments and measured changes after 24 months. When compared with peers in a traditional weight loss program, those in the highly supportive intervention experienced greater weight loss.

The health benefits of both the traditional and highly supportive interventions included slowed systolic blood pressure increases and improved blood pressure control.

While national programs and narrow studies have examined both large and tailored approaches, medical practitioners continue to have the following three avenues of obesity treatment that have been consistently used over the last few decades: diet and increased physical activity, drugs, and surgical interventions (Wyatt, 2013). Better diet and increased physical activity have remained a standard recommendation. A wide variety of diets have been studied, ranging from Mediterranean to low fat or low carbohydrate diets. However, no diet has appeared superior following randomized, controlled studies, and the best predictor of weight loss is simple adherence to the diet. All diets hold the potential to decrease weight when they are adhered to without any significant differences in outcome.

Drug therapy for obesity has entered a new phase as new types of drugs have entered the market (Wyatt, 2013). Drugs targeting serotonin receptors, or those inducing norepinephrine release, operate by reducing food cravings. These drug treatments still rely on the principle of calorie reduction and promote that reduction by reducing food intake via the reduction of food cravings. Drugs currently awaiting FDA approval, such as naltrexone, rely on not only reducing food intake, but promoting energy expenditure while an individual is at rest. Finally, surgical treatments remain an option in certain cases. Bariatric surgery is typically recommended only when individuals exceed a BMI of 35 kg/m^2. However, surgical treatments are not conclusively successful at reducing the associated health risks of obesity. In at least one study, 75% of gastric bypass patients underwent diabetes remission. Surgical treatments may not assist in the alteration of food habits leading to obesity related to diseases.

Federal Government Intervention in School Nutrition

The NSLP was established by President Harry Truman in 1946 and has grown to provide food for 30 million children to the cost of $8 billion in the year 2006 (Ralston, Newman, Clauson, Guthrie, & Buzby, 2008). The program was later altered by the Child Nutrition Act of 1966 and further amendments designed to reduce the subsidies allocated for paid meals while increasing the range of children who qualified for free meals. By the 1990s and through the early 21st century, further changes such as the School Meals Initiative began to require that schools meet dietary guidelines and limit the fat content of meals served. The 2004 Child Nutrition and WIC Reauthorization Act further required that schools develop wellness policies for the foods served.

The HHFKA was therefore another in a series of modifications to the national meals program and occurred during the reauthorization of the Child Nutrition Act (HHFKA, 2010). The bill provided funding to free lunch programs while setting new school nutrition standards approved by the USDA. Annual federal government spending increased from $70 billion in 2010 to $80 billion in 2015 partially to meet updated USDA nutritional standards (Statistica, 2018). In addition, the program was designed to help the development of local farms and school gardens to encourage local food growth. The general approach of the program was to set nutritional and wellness standards, including not only the mandate of healthier food consumption, but the promotion of increased exercise and education regarding how food is grown. The program attempted to increase the number of eligible children as well. As of 2016, the U.S. Department of Agriculture reported that 30.5 million children across more than 98,413 schools received either free lunches or lunches at a reduced price thanks to funding from the NSLP (Ralston et al., 2008).

At the school level, the response to the passing of the HHFKA has been mixed. In at least one study, foodservice managers in Indiana began to increase the amount of raw food costs (Thiagarajah, Getty, Johnson, Case, & Herr, 2015). However, a larger study across five states revealed that as of 2012, school meals did not meet the recommended daily minimum servings of fruits, grains, vegetables, milk, and meat. Of the meals served, only 47 percent contained the appropriate number of calories (Echon, 2014). These studies demonstrate the uneven results of the HHFKA and the lack of consistent adherence to nutritional recommendations.

Summary

The growing rate of childhood obesity presents a serious threat to the health and well-being of individuals, not only at childhood but throughout adulthood. Diseases ranging from cardiovascular disorders to breathing complications become more common with obesity. To address the problem of childhood obesity, the HHFKA was passed in 2010 reauthorizing subsidies for school cafeteria meals while setting new guidelines for mealtime nutrition. This marked the first time the federal government attempted to specifically target childhood obesity via school meals. However, obesity is a complex phenomenon. Individual variation makes weight loss easier or more difficult for different individuals. Further, individuals are influenced toward obesity not only as a matter of biology, but also by population, social, and family level influences. Psychological factors may also play a part in driving excessive consumption.

There continues to be considerable debate regarding the most effective response to obesity. Research demonstrates a relationship between increased caloric consumption and reduced physical activity, but the appropriate means by which to reduce obesity seems to extend beyond straightforward advisements of energy intake reduction. Effective, non-surgical and non-drug approaches to obesity focus on family and social variables which play a role in the

development of obesity. In contract, school-based interventions to reduce obesity have produced mixed results with little demonstration of long-term obesity reduction.

Despite extensive study into the causes of childhood obesity, the health consequences, and the impact of various nutritional interventions, the specific influence of the HHFKA on childhood obesity remains unknown. The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using YRBSS data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). This study built upon previous work examining the HHFKA. This study distinguishes itself by drawing on a larger set of data collected over a longer period, which provides greater insight into the effectiveness of the HHFKA to influence nutrition, and consequently, obesity.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using YRBSS data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). The study was designed to evaluate the efficacy of federal school nutrition policy to effect high school obesity rates. Effectively, federal school nutritional policy was being used to address childhood obesity (NSLP, 2016). Federal subsidies for the NSLP subsidized meals for 31.5 million students, and those subsidies were contingent upon schools adhering to the 2010 guidelines set by the USDA (2010). This research was significant because it might inform public policy regarding the potential for mandated changes in school breakfast and lunch menus to affect childhood obesity (Sobol-Goldberg et al., 2013).

This chapter includes a description of the study design, sample powering, and data analysis. The chapter also includes a rationale presented for the research design used, the methodology employed, and procedures for data collection. The data used for this study was collected from all 50 states, and referenced compliance with the 2010 USDA Nutritional Guidelines, state-level high school obesity rates, median income, population density, and ethnicity. Data was drawn from the State Policy Index to determine USDA Nutritional Guideline Compliance, while the U.S. Census Bureau was referenced to collect state-level data on high school obesity rates, median income, population density, and ethnicity.

Research Design and Rationale

The dependent variable was compliance score and the independent variable was high school obesity rate. This quantitative study used an explanatory research design. The methodology employed examined the relationship between high school obesity rates and the

passage of the HHFKA and subsequent 2010 USDA Nutritional Guidelines (USDA, 2010). Quantitative research requires the collection of empirical data that can be used to test a hypothesis.

From the data collection, inferential statistics were either accepted or rejected based on the resulting observations (Leedy & Ormrod, 2015). The use of quantitative methodology required many participants, high degrees of validity and reliability, and generalizable results. A quantitative explanatory research design was the most appropriate choice for the current study because there exists a significant amount of data for all 50 states and the required study variables. Given the desire to generalize the findings across the larger population, the quantitative explanatory model remained the most appropriate research design available.

Explanatory research design was also appropriate when there was a variation in one phenomenon, here the high school obesity rate, causing shifts in another phenomenon, here the compliance score. This method of research design was justified when empirical associations existed between variables within an appropriate relationship in time. The study addressed the effect of HHFKA on high school obesity rate, with a potential for compliance with the HHFKA to affect those obesity rates.

Research for this study examined the relationship between HHFKA and high school obesity rate after controlling for demographic variables. Research for the study sought to understand to what degree states were HHFKA compliant. A quantitative explanatory research design creates empirical results consistent with high levels of reliability and validity necessary to generalize findings (Leedy & Ormrod, 2015). The researcher did not attempt to make any changes in behavior among any individuals or entities during this study, which made the study non-experimental in nature. No known resource or time constraints erre associated with the use

of this specific research design. Both the dependent and independent variables were continuous and collected from reliable governmental sources, and hypotheses accepted or rejected based on inferential statistics (Leedy & Ormrod, 2015). The quantitative methodology was advantageous in this case, as the independent and dependent variables were clearly identifiable, research problems and hypotheses were capable of being tested, and there were high levels of reliability available within this approach.

Methodology

Population

For this study, the target population included all 31.5 million high school students who were currently participating in the meals program subject to both state and federal nutrition requirements. Childhood obesity rates as of 2014 were estimated to have reached 17.0% and as of 2012, there were nearly 2.1 million obese high school children (Malik et al., 2013). As such, this placed considerable numbers of children across the U.S. at risk. However, there was also the potential for the HHFKA to reach millions of students and potentially influence obesity.

Sampling and Sampling Procedures

Research for the study used all 50 U.S. states, excluding tribal reservations, in the study sample; therefore, no sampling strategy was needed to calculate minimum sample size (Faul, Erdfelder, Buchner, & Lang, 2009).

Procedures for Data Collection

USDA Nutritional Guideline compliance data were collected from the State Policy Index at the state level (State Policy Index, 2016). Compliance scores were calculated by evaluating state compliance, as of 2016, in each of the 17 USDA breakfast and lunch nutritional categories. One point was awarded to each nutritional category using the compliance scoring sheet in

Appendix A (USDA, 2010). State policy was examined for compliance in eight breakfast nutritional categories and nine lunch nutritional categories. USDA school cafeteria breakfast-policy categories were as follows: calories, non-fat milk, fruit, grains, protein, saturated fat, sodium, and trans-fat. USDA school cafeteria lunch-policy categories are as follows: calories, non-fat milk, fruit, grains, protein, saturated fat, sodium, trans-fat, and vegetables. The maximum compliance score was 17 and the minimum was zero, resulting in an equal weighting for each category. A summary for state compliance data for Alabama was depicted in Appendix B. Appendix B is an example of an Excel spreadsheet of state compliance data for Alabama.

High school obesity rate, median income, population density, and ethnicity data were downloaded from the Census Bureau database in Excel spreadsheet format (U.S. Census Bureau, 2019). State Policy Index and U.S. Census Bureau datasets compiled and validated by governmental instrumentalities were considered reliable for scholarly use (Leedy & Ormrod, 2015). Procedures for identifying outliers or missing data were addressed in the Data Analysis section.

Operationalization of Constructs

Compliance score. Compliance was operationalized using compliance scores calculated for each state by examining each state's nutritional policy. The State Policy Index database was used for compliance with 17 breakfast and lunch nutritional categories (USDA, 2010). One point was awarded for each nutritional category that met or exceeded the 2010 USDA Nutritional Guidelines for that category, resulting in a maximum potential compliance score of 17 for total compliance. Compliance score was an independent variable.

Ethnicity. The CDC categories for ethnicity were adopted for this study. The CDC collected and reported ethnicity data for White, African American, Hispanic, and other (CDC, 2017).

High school obesity rates for 2010 and 2016. High school obesity rate was defined by the CDC as an individual with a body mass index equal to or greater than 30 (CDC, 2017). High school obesity rate was the proportion of obese high school students by state as reported by the CDC (2017). High school obesity rates for 2010 and 2016 were operationalized using YRBSS data, which has been collected annually since 1991 to monitor health risk behaviors among youth and adults in the United States that contribute to the leading causes of death, disability, and social problems. During the period from 1991 to 2016, the YRBSS collected data on 3.8 million high school students using 1,700+ separate surveys.

Median income. Median income was household income that represents the 50th percentile of income for each state (U.S. Census Bureau, 20169. Median income was a covariate.

Population density. Population density was the number of residents per square mile of land (U.S. Census Bureau, 2019).

Table 1

Operationalized Variables

Variable	Scales of Measurement	Variable Type	Source
Compliance Score	Interval	Independent Variable	State Policy Index (2016)
Ethnicity	Interval	Covariate	Centers for Disease Control (2017)
High School Obesity Rates for 2010 and 2016	Continuous	Dependent Variable	YRBSS
Median Income	Continuous	Covariate	U.S. Census Bureau (2019)
Population Density	Interval	Covariate	U.S. Census Bureau (2019)

Data Analysis Plan

Both descriptive and inferential statistics were calculated using the Statistical Package for the Social Sciences 23 (SPSS). Data for high school obesity rates were downloaded from the CDC website and entered into an Excel spreadsheet. Median income, ethnicity proportions, and population density data for calendar year ending 2016 were retrieved from the Census Bureau database in Excel spreadsheet format for analysis (U.S. Census Bureau, 2019). Scatterplots were created to identify outliers, or missing data, for all study variables (Rousseeuw & Leroy, 2003). Compliance score data, as described in the *Operationalization of Constructs* and *Procedures for Data Collection* sections, for each state was added to the Excel spreadsheet and transferred to SPSS for analysis. Each study variable was tested for skewness and kurtosis to validate the assumption for normalcy. Descriptive statistics was conducted, and reported, to characterize the sample. Hypotheses were addressed as shown in Table 2. Hypothesis 1 was addressed using a t-test to compare the mean compliance score to the perfect compliance score of 17. Hypothesis 2 was addressed using a t-test to compare mean nationwide obesity rates between 2010 and 2016. Hypothesis 3 was addressed by conducting ANOVA to isolate the variance in changes in obesity rate attributable to compliance score.

Table 1

Statistical Tests for Null Hypotheses

Hypothesis	Variable	Statistics
$H1_o$. All state nutrition policy and implementation are 100% HHFKA compliant.	Compliance score	*t*-test

$H2_o$. There was no statistically significant change in state high school obesity rates in the six years since passage of the HHFKA?	State obesity rate 2010, State obesity rate 2016	*t*-test
$H3_o$ There was no statistically significant change in each states' high school obesity rate in the six years since passage of the HHFKA, after controlling for median income, population density, and ethnicity.	Compliance score, state obesity rate 2010, state obesity rate 2016, median income, population density, ethnicity	ANOVA

Known covariates for this study included median income, population density, and ethnicity. The reason for the inclusion of these variables is that obesity is a complex phenomenon into which many factors contribute. Race, socioeconomic status, and other variables can affect high school obesity rates (Gonzalez-Suarez et al., 2009). Limiting the study to five variables left the potential for other variables to contribute to the high school obesity findings. However, the variables included in the study were known covariates for high school obesity. Data were processed using ACOVA analysis. The results were assessed using the output derived from both SPSS and ACOVA results. From this, the null hypotheses will either be accepted or rejected.

Threats to Validity

One consideration often considered is external validity, characterized by the generalizability of these findings onto other settings and populations. For the purpose of this study, there were no threats to external validity noted. Findings may generalize to other cultures or populations with different compositions of income, ethnicity, or population density. Internal validity is concerned with the rigor with which the study was constructed. A potential threat to internal validity that should be noted was the amount of time that passed from the last time compliance scores were documented to the time high school obesity rates were recorded. Compliance scores were calculated within one year of high school obesity rate data availability to minimize the potential threat.

Childhood obesity is well recognized in the literature and has been thoroughly explored as a construct, which serves to remove it as a threat to construct validity. Because statistical analysis was applied across 100% of the target population, there was little threat of risk regarding statistical conclusion validity. However, there was always the risk that the validity of the study's statistical conclusions was threatened by covariates not explored in the study.

Ethical Procedures

Because this research involved participants, there were several ethical considerations. Agreements with individuals and organizations to access the data, and availability of the data, was contingent upon the participants agreeing to the study. However, in the case of data drawn from publicly available sources, individual agreement for participation was not only unnecessary, but unlikely given the size of a data set as large as high school population.

Because the study did not involve human participants, there was no concern regarding the treatment of human subjects, or procedures used. Data were drawn prior to this study, and human participants did not interact in the study itself. Therefore, there was no reason to gain permission through organizations such as the IRB prior to conducting the study. Given the lack of human participants, there was no recruitment procedure and consequently no need to be concerned with recruitment materials and procedures. The data collected was already anonymized and therefore, there was no concern regarding data collection. Data were publicly available and procedures to mask participants were previously been addressed. Given the number of reasons listed above, there were far fewer ethical concerns present when conducting a survey of this nature that worked with a large, anonymized, publicly available data set.

Summary

This study used a quantitative explanatory design to determine any potential relationship between compliance scores and high school obesity rates. The explanatory research design was appropriate in circumstances when there was a potential empirical relationship that existed between a dependent and independent variable, given that these variables were explored within an appropriate scope of time in relation to one another. The study included the use of both descriptive statistics and ANOVA inferential statistics to describe the findings that emerged, as well as to the three hypotheses presented. Chapter 4 will present the study's findings as well as characterize the study.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to test for changes between 2010 and 2017 in childhood obesity rates that are attributable to the HHFKA, using YBRRS data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). Congress passed the HHFKA in 2010 to address the childhood obesity epidemic through mandated changes to school cafeteria breakfast and lunch menus (USDA, 2010). This study examined state school nutrition policy compliance with the 2010 USDA Guidelines and the relationship between high school obesity rates and state policy compliance. The working hypothesis was that enactment of the 2010 USDA Guidelines would result in lower high school obesity rates, after controlling for median income and region of residence (rural or urban) and known covariates of high school obesity rates.

Chapter 4 includes a discussion of research design issues, data collection methods, and study findings. Descriptive and demographic statistics are presented for all 50 states taken together in 2010 and in 2017, the latest year YBRRS data was available. Statistical analyses, hypothesis tests, and results are detailed and discussed. Study findings are summarized and Chapter 5: Conclusions and Recommendations is introduced.

Data Collection

The study sample included 15.9 million students that attended high school in 2017 and were subject to federal, state, and local nutrition regulation (NCES, 2019), of which 2.9 million, or 18.5%, met the definition for obesity (CDC, 2019). Study data were collected for each of the 50 states for compliance scores, high school obesity rates, median income, and rurality. State rurality and median income data were collected from the 2017 U.S. Census Bureau tables

(Census Bureau, 2019). High school obesity data were drawn from two sources. The 2017 Youth Risk Behavior Survey was used for the 42 states that responded to the survey (YBRRS, 2018), and data for the remaining eight states (California, Colorado, Indiana, Iowa, Minnesota, Pennsylvania, Oregon, and Washington) was drawn from the Robert Wood Johnson Foundation (RWJF) report on *The State of Obesity: Better Policies for a Healthier America 2018 (*RWJF, 2018). High school obesity by state detail for all study variables is included in Appendix B.

State compliance with 2010 USDA Guidelines was collected and scored during November and December 2019 from the State School Health Policy Database compiled by the National Association of State Boards of Education (NASBE, 2019). The 2010 USDA Guidelines were compared to each state's school nutrition policy for eight breakfast and nine lunch components (Appendix A). While the 2010 USDA Standards for vegetable descriptive indicators included separate categories for dark green vegetables, orange vegetables, legumes, and starchy vegetables, this study combined the vegetable-related indicators into a single category called vegetables. Data was available for all 50 states and was scored as compliant or non-compliant for each of the 17 nutritional components. Sufficient information was available for all states in the school nutrition policy database to determine compliance.

Demographics and Study Variable Data

Table 3 reports mean and standard deviation for 2010 obesity rate, 2017 obesity rates, compliance score, proportion of residents living in rural areas, 2017 median income, and proportion of White individuals. The mean nationwide high school obesity rate increased 2.3% from 12.5% (*SD* = 2.4%) in 2010 to 14.8% (*SD* = 2.9%) in 2017. The mean compliance score was 15.8 (*SD* = 1.8) while 17 represented 100% compliance. As of the 2017 census, 26.4% of the population lived in rural areas while the remaining 73.6% lived in urban or suburban

communities. At the same time, the proportion of the total U.S. population that self-identified as White was 72%.

Table 3

High School Obesity Rate, State Compliance Score, Rurality, Income and Ethnicity

	2010 Obesity Rate	2017 Obesity Rate	State Compliance Score	% Rural Population	2017 Median Income	Ethnicity (% White)
Mean	12.5%	14.8%	15.8	26.4%	$55,693	72.0%
SD	2.4%	2.9%	1.8	14.4%	$ 9,091	12.2%

N=50

Results

RQ1: Which states are HHFKA compliant today and to what degree?

$H_0 1$: All state nutrition policy and implementations are 100% HHFKA compliant.

$H_a 1$: Less than all state nutrition policy and implementation are 100% HHFKA compliant.

As shown in Table 4, twenty-seven states were in perfect compliance and 23 reported less than perfect compliance with the 2010 USDA Guidelines for school nutrition. Arizona, California, Hawaii, and Maine had the lowest compliance with 11 of 17 food nutrition categories in compliance. Only California, Connecticut, and Florida reported lower high school obesity rates between 2010 and 2017. For the purposes of this analysis, the 50 states were divided into two samples, those with perfect compliance (Compliant) with 2010 USDA Guidelines, and states

with compliance scores less than perfect, non-compliance (semi-compliant). The mean high school obesity rate for the Compliant states was 14.2% (*SD* = 2.3%) compared to 15.3% (*SD* = 2.7%) for semi-compliant states, a significant difference at $p \leq 0.05$. The mean population residing in rural areas for the complaint states was 27.2% (*SD* = 15.1%) compared to 25.4% (*SD* = 12.9%) for non-compliant states, although not a significant difference at $p \leq 0.05$. Twenty-three of the 50 state samples were not 100% HHFKA compliant, therefore the null hypothesis was rejected, and the alternative hypothesis accepted: almost half of all states were non-compliant.

Table 4

Compliant and Semi-compliant Mean Obesity Rates and Compliance Scores

	2017 Obesity Rate	% Rural Population	2017 Median Income	Compliance Score
Compliant States (*n*=27)				
Mean	14.2%	27.2%	$56,235	17.0
SD	2.3%	15.1%	$6,009	
Semi-Compliant States (*n*=23)				
Mean	15.3%	25.4%	$55,151	14.6
SD	2.7%	12.9%	$7,314	2.3
All 50 States				
Mean	14.8%	26.4%	$55,693	15.8
SD	2.9%	14.4%	$7,338	1.8

RQ2**.** What effect did the HHFKA have on each states' high school obesity rate?

$H_0$2: There was no statistically significant change in state high school obesity rates in the seven years since passage of the HHFKA?

*H_a2***:** There was a statistically significant change in state high school obesity rates in the seven years since passage of the HHFKA?

As shown in Table 5, the mean high school obesity rate increased by 2.3% (*SD* = 1.5%) from a mean of 12.5% (*SD* = 2.4%) in 2010 to 14.8% (SD = 2.9%) in 2017 based on YBBRS data. Appendix B reports 2017 and 2010 high school obesity rates ethnicity, median income, and rural population proportion change in high school obesity by state.

Table 5

High School Obesity Rate Mean Difference 2010 to 2017

	Mean	*N*	*SD*	Std. Error
Obesity Rate 2017	14.8%	50	*2.9%*	0.41%
Obesity Rate 2010	12.5%	50	2.4%	0.33%
Mean difference	2.3%		1.5%	0.36%

A paired-samples *t*-test was conducted to compare 2017 high school obesity rates and 2010 high school obesity rates for each state. The mean difference of 2.3% (SD = 1.5%) was significant at t (49) = 10.89, p = 000. Therefore, null hypothesis two was rejected and the alternative hypothesis two was accepted.

RQ3**:** What effect did the HHFKA have on each states' high school obesity rate, after controlling for school district median income, population density, and ethnicity?

*$H_0$3***:** There was no statistically significant change in each states' high school obesity rate in the six years since passage of the HHFKA, after controlling for median income, population density, and ethnicity.

*H_a3***:** There was a statistically significant change in each states' high school obesity rate in the six years since passage of the HHFKA, after controlling for median income, population density, and ethnicity.

Table 6 reports the results of the ANOVA statistics to test hypothesis 3. There was no significant effect for Compliance Score on high school obesity after controlling for the effects of ethnicity, median income, and proportion of rural population, F (4, 46) = 1.353, p = .257. Compliance Score was not a statistically significant contributor to explaining the change in high school obesity rates, after controlling for ethnicity, median income, proportion of rural population. Only median income demonstrated a significant effect at $p < .05$ on the change in high school obesity rates between 2017 and 2010, F (4, 46) = 7.531, p = .043. Only median income was a significant covariate for F (2, 47) = 7.531, p = .043.

Table 6

Effect of Compliance Score on obesity after Controlling for Median Income and Rurality

Dependent Variable (Obesity change)	*F*	*Sig*.
Rural population	1.018	.319
Median Income	7.531	.043*
Ethnicity	0.288	.595
Compliance Score	1.353	.257

Note. *Significant at $p < .05$.

Summary

The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA using Youth Risk Behavior Surveillance System data after adjusting for known covariates of school district median income, population density, and ethnicity. Compliance Score data were calculated by comparing state school nutrition policy to 2010 USDA Guidelines. As shown in Table 4, the mean 2017 nationwide high school obesity rate was 14.8% (*SD* = 2.9%), mean rurality was 26.4% (*SD* = 14.4%), median income was $55,693 (*SD* = $7,338), and mean compliance score was 15.8 (*SD* = 1.8). Null hypothesis one was rejected; 27 states reported 100% compliance with 2010 USDA

Guidelines for school nutrition and 23 reported less than 100% compliance. Arizona, California, Hawaii, and Maine had the lowest compliance with 11 of 17 food nutrition categories in compliance. Only California, Connecticut, and Florida reported lower high school obesity rates between 2010 and 2017. Null hypothesis two was rejected, there was a significant increase of 2.3% in high school obesity rates from 2010 to 2017. Null hypothesis three was rejected; Compliance Score was not a statistically significant contributor to explaining the change in high school obesity rates, after controlling for ethnicity, median income, proportion of rural population. Chapter 5 includes a discussion of the findings, conclusions, and recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative study was to test for changes in childhood obesity rates attributable to the HHFKA, as measured by 2010 and 2017 Youth Risk Behavior Surveillance System (YRBSS) data after adjusting for known covariates of school district median income,

population density, and ethnicity (CDC, 2018). The study was conducted using data from the YRBSS and was adjusted for known covariates, including school district median income, population density, and ethnicity (CDC, 2018). Previous research indicated that high school student obesity could potentially lead to several problems in adulthood, including cardiovascular disease and Type II diabetes (CDC, 2018; Owens, 2013).

The HHFKA was passed in 2010 to help develop regulations that would improve the existing nutritional content of school cafeteria breakfast and lunches (USDA, 2010). Consequently, the HHFKA may lead to a reduction of obesity as a risk factor for disease by encouraging healthier eating and weight loss among students. However, research suggested that interventions, including diet and exercise, produced only mixed results and did not definitively help improve health (Jain & Langwith, 2013; Sobol-Goldberg et al., 2013). The current study was developed to better understand whether the HHFKA as an intervention was linked to reductions in student obesity. Three research questions were developed to guide the study. These questions included the following:

RQ1**:** Which states are HHFKA compliant today and to what degree?

RQ2**:** What effect did the HHFKA have on each states' high school obesity rate?

RQ3**:** What effect did the HHFKA have on each states' high school obesity rate, after controlling for school district median income, population density, and ethnicity?

Following collection of the data, the following findings were uncovered. First, only 27 states in the United States were in perfect compliance with the HHFKA. The remaining 23 states reported less than perfect compliance with the HHFKA. Second, there was a statistically significant decline in high school obesity rates between the introduction of the HHFKA in 2010 and the obesity rates of students in 2017. Third, after controlling for school district median

income, population density, and ethnicity, the data suggested that there was no significant relationship between compliance with the HHFKA and declines in high school obesity. The only factor that has a significant effect on changes in high school obesity within the timeframe of 2010 and 2017 was median income. These findings are discussed in greater detail below.

Interpretation of the Findings

State Nutrition Policy Mostly Complied with HHFKA Standards

The first finding of the study was that only 27 of states within the United States were perfectly compliant with the HHFKA. A total of 23 states were only partly compliant, which meant that nearly half of the states within the nation had yet to enter full compliance with the law. Unfortunately, the existing literature did not provide any indications regarding compliance with the HHFKA or previous laws meant to improve nutrition in schools, suggesting that the current finding acted as a unique entry to the existing research. While earlier researchers found (a) no significant change in National School Lunch Program (NSLP) participation attributed to the HHFKA (Vaudrin, Lloyd, Yedidia, Todd, & Ohri-Vachaspati, 2018); and (b) school administrators responsible for implementing HHFKA guidelines found the regulations cumbersome-and harmful for maintaining calorie intake in normal students (Cornish, Askelson, & Golembiewski, 2016), however no earlier study examine compliance with the HHFKA, which is fundamental to efficacy. Earlier research on school district compliance with 2010 USDA Nutrition Guidelines were mixed (Echon, 2014; Thiagarajah et al., 2015). Indiana school foodservice managers reported a significant increase in food cost and an increase in the volume of food discarded by students, and responded by ignoring certain regulations (Thiagarajah et al., 2015). Echon (2014) reported that only 47% of breakfast and lunch meals met the required

calorie count. This study confirmed earlier studies regarding HHFKA compliance, in that compliance was uneven.

Increase in High School Obesity Rates between 2010 and 2017

The mean high school obesity rate increased by 2.3% from a mean of 12.5% in 2010 to 14.8% in 2017. Seven years after HHFKA implementation high school obesity rates significantly increased nationally increased, and in 48 of 50 states. Despite federal, state, and local governmental efforts to reduce high school obesity rates, high school obesity rates increased by 18%. The level of complexity and number of covariates involved in high school obesity limits the ability to isolate variance associated with a single variable, such as HHFKA implementation. Having noted the issue with identifying causality, the continuing trend in high school obesity rates present a national health crisis.

An estimated 17% of children and adolescents fit the definition of obese between 2009 and 2010 (Dooyema et al., 2013). These high rates of overweight and obese children pose a potentially significant consequence for the future, as there were both psychological and physical consequences associated with being either overweight or obese (Karnik & Kanekar, 2015). Children and adolescents who fit these two categories were at greater risk of lower self-esteem, anxiety, and social stigma. Further, obese children were at greater risk of cardiovascular disease, increased cholesterol levels, and high blood pressure. Obesity was also linked with the onset of Type 2 diabetes, respiratory problems, and weakened joints (Karnik & Kanekar, 2015).

Considering the multiple negative outcomes associated with obesity, the decline in overweight and obese children between 2010 and 2017 is a positive outcome. However, it cannot be associated with the HHFKA itself. Previously, rates of overweight and obese children stalled between the years 2003-2004 and 2011-2012 (Ogden et al., 2014). As such, the finding

that there were declines in childhood obesity rates could be associated with previous such occurrences and attributed to multiple causes rather than the HHFKA itself. However, exploration of the data did indicate that there was at least one variable associated with the decline in obesity, which formed the foundation of finding number three.

Median Income and Obesity Rates

After controlling for school district median income, population density, and ethnicity, the resulting data indicated that there was no significant relationship between compliance with the HHFKA and declines in high school obesity. This finding was consistent with previous research into health intervention, which indicated that school-based interventions designed to reduce obesity rates only produced mixed results (Kain et al., 2014; Khambalia et al., 2012; Sobol-Goldberg et al., 2013).

Meta-analysis indicated that interventions meant to reduce childhood obesity produced only mixed short-term results and no significant declines in long-term obesity (Khambalia et al., 2012). A second meta-analytical examination of school-based interventions and outcomes revealed that there were no long-term improvements to BMI despite programs including both those that involved physical activity and diet (Sobol-Goldberg et al., 2013). Consequently, the current research was consistent with the existing literature.

The current study did find that median income did play a role in reducing obesity among students. Median income was the only variable controlled for that had a significant impact on changes in high school obesity within the timeframe of 2010 and 2017. However, the literature that was generated for this study did not imply that income played a role in reducing obesity. Consequently, while the finding that compliance with the HHFKA did not lead to reduced

obesity, the finding that income was associated with reduced obesity over time did form a novel contribution to the existing literature.

Limitations of the Study

The study was limited to an examination of high school obesity rates. State compliance scores acted as the main study variable. Variables that were controlled for included median income, population density, and ethnicity. The causes of obesity are numerous and may range from genetics to race, psychosocial variables, and socioeconomic status, all of which can impact high school obesity rates (Gonzalez-Suarez et al., 2009). However, in limiting the study to compliance scores, median income, population density, ethnicity, and obesity, there arose the potential for other variables to potentially impact the outcomes of the research.

As one example of potential variables that went unstudied, differences in how states complied with the HHFKA may act as a confounding variable that went unaccounted for in the current study. Other examples of potentially unaccounted for covariates included variation in nutritional value between schools, school districts, and states. Consequently, there are a number of potential covariates that could limit the study finding's generalizability to different groups, other geographic regions, and cultures (Leedy & Ormrod, 2015).

Recommendations

The current study indicated that the HHFKA does not improve obesity rate, which is consistent with previous research that school based interventions may not be successful at improving obesity outcomes (Kain et al., 2014; Khambalia et al., 2012; Sobol-Goldberg et al., 2013). As such, the use of school-based interventions alone cannot be recommended as a means of addressing obesity in students. However, this study suggested that median income may be related to addressing obesity in students.

Given that this study revealed a link between median income and obesity outcomes in students, it may be that those of higher income may have access to higher quality foods in the home, may promote healthier eating habits, and generally may promote healthier behaviors that address obesity among students. Consequently, in the future, it may be that recommendations can be made based on the habits of those of higher income, using their behaviors as a basis for making recommendations for home-based behaviors that would address obesity.

However, given the lack of current understanding regarding what behaviors differentiate those of higher income from those of lower income regarding behaviors that address obesity, the best recommendation that can be made at this time is for future research. Future research should be focused on better understanding why students from higher income brackets were associated with lower obesity. Research could be qualitative and designed around understanding common themes that typify behaviors in the home related to healthy behavior. Later research could use surveys to collect quantitative data, which would help to determine strengths of relationships and determine what behaviors among higher income families were most strongly associated with reduced obesity.

Implications for Further Research

Unfortunately, there are few implications for change that can be drawn from the current study. The current study suggests that school-based interventions are ineffective, and that federal attempts to address childhood obesity using school-based programs do no help improve obesity. As such, for positive improvements to occur, there must first be further research conducted that helps to better illuminate what does work in addressing obesity among students. The implication of the current research is that school based interventions are ineffective at producing societal change in the form of obesity reduction among students. However, future

research may reveal alternative approaches to student obesity that help address the growing problem of obesity among young individuals.

Implications for Social Change

Continuing growth in high school obesity rates pose a significant threat to student health and well-being and portends a heavy cost for future societal healthcare. High school obesity is a complex phenomenon whose causes are well understood, but interventions have so far proven unsatisfactory. The HHFKA served as a large-scale, longitudinal studies on the efficacy of federal governmental intervention to affect obesity. While this study has significant limitations, the failure of the HHFKA to blunt growth in high school obesity suggests that federal government intervention in school nutrition policy was ineffective. While HHFKA compliance was widespread, the fact that a significant number of school districts opted-out of compliance suggest that a one-size-fit all federal approach to obesity may need modification.

Conclusions

The purpose of this quantitative study was to test for changes between 2009 and 2016 in childhood obesity rates that were attributable to the HHFKA, using YRBSS data after adjusting for known covariates of school district median income, population density, and ethnicity (CDC, 2017). Covariates that were explored included median income, population density, and ethnicity. Following a review of the data, the research found that only 27 states complied with USDA guidelines. However, though obesity rates dropped following introduction of the law, it was not associated with the introduction of the law itself. Obesity rates stabilized during smaller time frames besides the period of 2010 and 2017, suggesting that reduction of obesity did not necessarily occur in response to the introduction of the law. Further, the covariable of median income was found to be the only variable associated with reduction of obesity in student.

The current findings of this study indicate that to achieve obesity reduction among young people, research must be conducted into the habits of families from higher income brackets. These families may encourage diet or exercise patterns associated with reduced obesity that could cause the lower obesity rates associated with higher income brackets. However, this study did not explore what caused these lower obesity rates, necessitating further research that clarifies what differentiate families from higher median income levels from those in lower median income levels regarding behaviors that impact obesity.

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Appendix A.1: Compliance Scoring Sheet for 2010 USDA Guidelines: Grades 9-12

State Name_____

Breakfast Item (weekly amounts)	Compliant = 1	Lunch Item (weekly amounts)	Compliant = 1
Calories (525 ± 75)		Calories (800 ± 50)	
Fluid Milk (5 cups)		Fluid Milk (5 cups)	
Fruit (5 cups)		Fruit (5 cups)	
Grains (9-10 oz.)		Grains (9-10 oz.)	
Protein (7-10 oz.)		Protein (10-12 oz.)	
Saturated Fat (10%)		Saturated Fat (10%)	
Sodium (≤ 740 mg)		Sodium (≤ 740 mg)	
Trans-fat (0)		Trans-fat (0)	
		Vegetables (5 cups)	
Sub-Score =			
Total Score =			

Appendix B.1: Compliance Score Tracking Spreadsheet

			BREAKFAST Grades 9-12			LUNCH Grades 9-12		
State	Policy	Meal_Pattern	Status			Status		
AL	Y	Fruit	N	Non-Compliant		N	Non-Compliant	
AL	Y	Vegetables				N	Non-Compliant	
AL	Y	Vegetables_DarkGreen				N	Non-Compliant	
AL	Y	Vegetables_Oranges				N	Non-Compliant	
AL	Y	Vegetables_Legumes				N	Non-Compliant	
AL	Y	Vegetables_Starchy				N	Non-Compliant	
AL	Y	Vegetables_Other				N	Non-Compliant	
AL	Y	Grains	N	Non-Compliant		N	Non-Compliant	
AL	Y	Meats	N	Non-Compliant		N	Non-Compliant	
AL	Y	Fluid Milk	C	Compliant		C	Compliant	
AL	Y	Calories	N	Non-Compliant		N	Non-Compliant	
AL	Y	Saturated_Fat	C	Compliant		C	Compliant	
AL	Y	Sodium	N	Non-Compliant		N	Non-Compliant	
AL	Y	Trans_fat	C	Compliant		C	Compliant	
AL		Compliance Sub-scores	3			3		
AL		Compliance Score	6					

Appendix A.2: Compliance Score Scoring Data by State

			BREAKFAST				LUNCH			
			Grades 9-12				Grades 9-12			
State	Policy	Meal_Pattern	B912_Text	B912_Compliance	B912_Compliance_	B912_Footnote	L912_Text	L912_Compliance	L912_Compliance_	L912_Footnote
AL	Y	Fruit		C	Compliant			N	Non-Compliant	
AL	Y	Vegetables		N	Non-Compliant			C	Compliant	
AL	Y	Vegetables_DarkGreen		N	Non-Compliant			C	Compliant	
AL	Y	Vegetables_Oranges		N	Non-Compliant			C	Compliant	
AL	Y	Vegetables_Legumes		N	Non-Compliant			C	Compliant	
AL	Y	Vegetables_Starchy		N	Non-Compliant			C	Compliant	
AL	Y	Vegetables_Other		N	Non-Compliant			C	Compliant	
AL	Y	Grains		C	Compliant			C	Compliant	
AL	Y	Meats		C	Compliant			C	Compliant	
AL	Y	Fluid Milk		C	Compliant			C	Compliant	
AL	Y	Calories		C	Compliant			C	Compliant	
AL	Y	Saturated_Fat		C	Compliant			C	Compliant	
AL	Y	Sodium		C	Compliant			C	Compliant	
AL	Y	Trans_fat		C	Compliant			C	Compliant	
AK	N	Fruit		C	Compliant			C	Compliant	
AK	N	Vegetables		C	Compliant			C	Compliant	
AK	N	Vegetables_DarkGreen		C	Compliant			C	Compliant	
AK	N	Vegetables_Oranges		C	Compliant			C	Compliant	
AK	N	Vegetables_Legumes		C	Compliant			C	Compliant	
AK	N	Vegetables_Starchy		C	Compliant			C	Compliant	
AK	N	Vegetables_Other		C	Compliant			C	Compliant	
AK	N	Grains		C	Compliant			C	Compliant	
AK	N	Meats		C	Compliant			C	Compliant	
AK	N	Fluid Milk		C	Compliant			N	Non-Compliant	
AK	N	Calories		C	Compliant			C	Compliant	
AK	N	Saturated_Fat		C	Compliant			C	Compliant	
AK	N	Sodium		C	Compliant			C	Compliant	
AK	N	Trans_fat		C	Compliant			C	Compliant	
AZ	Y	Fruit		C	Compliant			N	Non-Compliant	
AZ	Y	Vegetables		C	Compliant			C	Compliant	
AZ	Y	Vegetables_DarkGreen		C	Compliant			C	Compliant	
AZ	Y	Vegetables_Oranges		C	Compliant			C	Compliant	
AZ	Y	Vegetables_Legumes		C	Compliant			C	Compliant	
AZ	Y	Vegetables_Starchy		C	Compliant			C	Compliant	
AZ	Y	Vegetables_Other		C	Compliant			C	Compliant	
AZ	Y	Grains		C	Compliant			N	Non-Compliant	
AZ	Y	Meats		C	Compliant			C	Compliant	
AZ	Y	Fluid Milk		C	Compliant			N	Non-Compliant	
AZ	Y	Calories		C	Compliant			C	Compliant	
AZ	Y	Saturated_Fat		N	Non-Compliant			C	Compliant	
AZ	Y	Sodium		N	Non-Compliant			C	Compliant	
AZ	Y	Trans_fat		N	Non-Compliant			C	Compliant	

Appendix B.2: Obesity, State Compliance, Rurality, Income and Ethnicity by State

State	Obesity Rate 2010	Obesity Rate 2017	State Complaince	% of Compliance	% Rural Population	Median Income 2017	Population 2017	Ethnicity (% White)
Alabama	17.0%	20.1%	16	94%	41.0%	$ 44,758	4,864,745	69.1%
Alaska	12.0%	13.7%	16	94%	34.0%	$ 74,444	741,504	65.3%
Arizona	11.0%	12.3%	11	65%	10.2%	$ 51,340	6,945,452	82.8%
Arkansas	15.0%	21.7%	17	100%	43.8%	$ 42,336	2,990,410	79.1%
California	15.1%	13.9%	11	65%	5.0%	$ 63,783	39,209,127	72.1%
Colorado	7.0%	9.5%	17	100%	13.8%	$ 62,520	5,540,921	87.1%
Connecticut	13.0%	12.7%	16	94%	12.0%	$ 71,755	3,578,674	80.0%
Delaware	12.0%	15.1%	16	94%	16.7%	$ 61,017	949,216	69.5%
Florida	12.0%	10.9%	14	82%	8.8%	$ 48,900	20,629,982	77.3%
Georgia	15.0%	17.7%	17	100%	24.9%	$ 51,037	10,304,763	60.5%
Hawaii	13.0%	14.2%	11	65%	8.1%	$ 71,977	1,428,105	25.6%
Idaho	9.0%	11.4%	16	94%	29.4%	$ 49,174	1,682,930	93.0%
Illinois	12.0%	14.8%	16	94%	11.5%	$ 59,196	12,826,895	76.9%
Indiana	15.0%	17.7%	17	100%	27.6%	$ 50,433	6,633,344	85.1%
Iowa	13.0%	15.3%	17	100%	36.0%	$ 54,570	3,131,785	90.7%
Kansas	10.0%	13.1%	17	100%	25.8%	$ 53,571	2,911,263	86.4%
Kentucky	17.0%	20.2%	17	100%	41.6%	$ 44,811	4,438,229	87.6%
Maine	11.5%	14.3%	11	65%	61.3%	$ 45,652	1,331,370	94.0%
Louisiana	16.0%	17.0%	16	94%	26.8%	$ 50,826	4,678,215	62.9%
Maryland	12.0%	12.6%	17	100%	12.8%	$ 76,067	6,004,692	58.8%
Massachusetts	10.0%	11.7%	17	100%	8.0%	$ 70,954	6,826,022	80.8%
Michigan	12.0%	16.7%	17	100%	25.4%	$ 50,803	9,951,890	79.3%
Minnesota	14.0%	16.5%	13	76%	26.7%	$ 63,217	5,523,409	84.1%
Mississippi	16.0%	18.9%	17	100%	50.7%	$ 40,528	2,988,298	59.1%
Missouri	13.5%	16.6%	16	94%	29.6%	$ 49,593	6,087,203	83.0%
Montana	9.0%	11.7%	17	100%	44.1%	$ 48,380	1,040,863	89.0%
Nebraska	12.0%	14.6%	17	100%	26.9%	$ 54,384	1,905,924	88.3%
Nevada	11.0%	14.0%	14	82%	5.8%	$ 53,094	2,919,772	74.3%
New Hampshire	12.0%	12.8%	16	94%	39.7%	$ 68,485	1,342,373	93.0%
New Jersey	11.0%	13.0%	14	82%	5.3%	$ 73,702	8,874,516	72.0%
New Mexico	13.0%	15.3%	17	100%	22.6%	$ 45,674	2,092,789	82.0%
New York	11.0%	12.4%	16	94%	12.1%	$ 60,741	19,641,589	69.7%
North Carolina	13.0%	15.4%	17	100%	33.9%	$ 48,256	10,156,679	70.6%
North Dakota	11.0%	14.9%	17	100%	40.1%	$ 59,114	754,353	87.0%
Ohio	15.0%	17.7%	17	100%	22.1%	$ 50,674	11,635,003	81.9%
Oklahoma	17.0%	17.1%	14	82%	33.8%	$ 48,038	3,926,769	74.2%
Oregon	9.9%	11.7%	15	88%	19.0%	$ 53,270	4,091,404	86.8%
Pennsylvania	13.5%	13.7%	17	100%	21.3%	$ 54,895	12,783,538	81.8%
Rhode Island	11.0%	15.2%	17	100%	9.3%	$ 58,387	1,057,063	83.9%
South Carolina	13.0%	17.2%	17	100%	33.7%	$ 46,898	4,958,235	68.5%
South Dakota	10.0%	11.8%	17	100%	43.3%	$ 52,078	862,890	84.4%
Tennessee	15.0%	20.5%	17	100%	33.6%	$ 46,574	6,645,011	78.5%
Texas	16.0%	18.6%	17	100%	15.3%	$ 54,727	27,937,492	78.8%
Utah	9.0%	9.6%	17	100%	9.4%	$ 62,518	3,042,613	90.7%
Vermont	10.0%	12.6%	12	71%	61.1%	$ 56,104	623,644	94.0%
Virginia	11.0%	12.7%	17	100%	24.5%	$ 66,149	8,410,946	69.5%
Washington	10.0%	11.8%	16	94%	16.0%	$ 62,848	7,294,680	78.9%
West Virginia	15.0%	19.5%	17	100%	51.3%	$ 42,644	1,830,929	93.5%
Wisconsin	10.0%	13.7%	15	88%	29.8%	$ 54,610	5,772,958	87.1%
Wyoming	11.0%	13.0%	17	100%	35.2%	$ 59,143	584,290	92.6%

Appendix C: Walden University IRB approval number

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