

EVALUATION OF THE USE OF THE UNITED STATES FEDERAL MENU-LABELING
POLICY IN FAST FOOD AND CHAIN RESTAURANTS BASED ON CHRONIC DISEASE
DIAGNOSIS AND OBESITY

By

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ABSTRACT

Chronic diseases are the leading cause of mortality and morbidity in the United States (U.S.). For most chronic diseases, obesity is a risk factor. Because approximately one in three adults in the U.S. has obesity and chronic disease, it is the leading cause of preventable death in the U.S., addressing the obesity epidemic and associated high rates of chronic disease population-based policy intervention is a warranted public health strategy. This study evaluates the federal menu-labeling policy to better understand the usefulness of the policy and its implications for addressing high rates of obesity and chronic disease. The federal menu-labeling policy utilizes choice architecture and principles of libertarian paternalism from the field of behavioral economics to nudge consumer purchase behavior when eating food away from home (FAFH).

I examined menu-labeling use based on consumers' weight and chronic disease state utilizing responses from 12,286 participants from Mississippi and West Virginia in the 2016 Behavioral Risk Factor Surveillance System (BRFSS). Non-parametric chi-square tests and logistic regression models indicated that individuals with diabetes and obesity were more likely to use menu-labeling than those with heart disease, had a heart attack, or stroke. Findings also

indicated age, education, income and race/ethnicity were significant indicators of menu-labeling use.

This evaluation of the menu-labeling policy informs policymakers of the effectiveness in using nudging as an intervention policy strategy to combat the public health crisis of rising rates of obesity and chronic disease. The findings reveal the need for targeted intervention and modifications of the nudges to increase effectiveness.

INDEX WORDS: food away from home (FAFH), federal food policy, obesity, chronic disease, menu-labeling

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Fulfillment of the Requirements for the Degree

DOCTOR OF PUBLIC HEALTH

ATHENS, GEORGIA

2020

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December 2020

ACKNOWLEDGMENTS

I would like to acknowledge Mary Frances Early, the first African American to graduate from the University of Georgia in 1962, fourteen years before I was born. She opened the door for countless other African American students and me to attend and graduate with their degree from UGA. I am forever grateful to a praying mother who has continuously sacrificed for my never-ending education. I may gain the title; however, this degree is a recognition of the gifts she saw in me and encouraged its development. I am thankful to my dad for constantly asking me, ‘when are you going to get you doctorate,’ when it was the furthest thing on my mind. This degree is a group effort that was supported and prayed for by my mom, dad, Luther, brother, sister-in-law, nieces, nephew, aunts and cousins, who at times served as my dog walker and sitter when I had classes. Joseph, words cannot express how much I appreciate your daily counsel, countless emails, and texts on the latest developments on menu-labeling, nutrition and obesity. Your weekly menus during this journey helped me stay on track with my weight goals. You kept me on track even when life wanted to derail me. Thank you.

I am thankful to Dr. Gohanna for committing to getting me to the finish line of this degree; your encouragement, guidance, and feedback would have made this process more taxing than it needed to be. I will forever be grateful. Dr. Brown, your patience with me throughout my data analysis was insurmountable; your knowledge and expertise were fundamental in completing this great work. I am thankful to my cousin Rhonda for referring me to Attorney Crystal James as an option to serve on my committee. Thank you, Atty. James, for committing to serve and supporting me in this endeavor. I also acknowledge and am thankful to my chair Dr. Thapa and Dr. Chen, for committing to serve. I am thankful for my dissertation reviewers,

proposal and defense preparation audiences; your good humor, incredible energy, and pragmatism really gave me the confidence and endurance to finish this academic achievement.

Dr. Brittani Harmon, your clear-eyed vision on what is needed to graduate with a doctorate degree is the reason I can now be addressed as Dr. O. Thank you for seeing in me the contribution that I can make to the field of public health! I pray the talent you saw in me and that God gave me are manifested to their full potential to give others the knowledge they need to make decisions to improve their lives.

Finally, to my husband and the love of my life Demetris Deon Cook, you arrived at the perfect time. If I knew I had to finish this degree to become truly open to having a life partner, I would have finished this degree a long time ago. I am thankful I get to start the next phase of my life with you!

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CHAPTER 1 INTRODUCTION

The retail food environment in the United States (U.S.) has drastically changed since the 1980s. The advent of the automobile, the increased numbers of women working away from home, and families having more disposable income paved the way for the establishment of retail food environments (Saksena, et al., 2018). It was also during this time that restaurants like McDonald's, Kentucky Fried Chicken, and Burger King became franchises and established as a mainstay in the national retail food environment. From 1967 to the mid-1980s, away-from-home food establishments grew from 135,000 to 270,000 (Saksena, et al., 2018). As a result, more and more American consumers began eating food away from home (FAFH). It is essential to the health of the nation and U.S. healthcare spending that when Americans do eat out, they are adequately informed of the nutritional quality of the food they consume.

There is a growing body of research that suggests regular eating food-away-from-home (FAFH) meals are contributing to the obesity epidemic and the chronic disease burden. A study conducted by the National Center for Health Statistics (NCHS) found that 36.6% of adults consume food-away-from-home on any given day (NCHS, 2018). It is well documented that foods consumed away from home tend to be higher in calories, have poor nutritional value, and the portion sizes are larger which results in overconsumption (An, 2016a). A study reviewing changes in portion size, energy density, and micronutrients over the past thirty years found that increased portion size leads to increased food consumption that is not balanced out in subsequent meals increasing the risk for obesity (McCrary, Harbaugh, Appeadu, & Roberts, 2019). When forty-five percent of the U.S. population has a chronic disease and two in three adults are

overweight or obese, it is evident a public health problem associated with food choice behavior exists (NCHS, 2018).

Chronic diseases, such as diabetes, heart disease, and stroke are among the leading causes of death and disability in the U.S. (NCHS, 2018). The rising obesity epidemic exacerbates this impact because obesity is a chronic disease in itself and is a risk factor for acquiring the aforementioned chronic diseases. In response, as the retail food environment was growing, the US Department of Health and Human Services (USDHHS) established what is called Healthy People goals. Healthy People goals set 10-year national objectives to improve the health of all Americans. The most recent objectives set in Healthy People 2020 had the goal of decreasing adult obesity from 34% to 30.5% (Office of Disease Prevention and Health Promotion (ODPHP), 2018). Unfortunately, this goal was not met. According to the Centers for Disease Control and Prevention as of 2018, 42.4% of the adult population is obese (Hales, Carroll, Fryar, & Ogden, 2020). The growth in the obesity rates in the U.S. emphasize the importance of identifying risk factors and effective policies to prevent obesity.

The increase in obesity and chronic disease rates have an impact on healthcare costs. The economic burden of chronic disease is estimated to be \$3.5 trillion in annual health care costs (Buttorff, Ruder & Bauman, 2017). The key lifestyle risk factors for the development of chronic disease include poor nutrition, tobacco use, lack of physical activity, and excessive alcohol consumption. Other risk factors include diets high in saturated fat and sodium. Research has overwhelmingly concluded that healthy dietary behaviors such as diets high in fruit and vegetable consumption, low in saturated fats, and added sugars decrease one's risk of chronic disease (Ford, Zhao, Tsai, & Li, 2011). Chronic diseases are responsible for seven out of ten deaths in the U.S. (Buttorff et al., 2017). The causes of chronic diseases vary. Of the identified

risk factors, diet is the most modifiable. Evidence-based research has continually suggested an association between an unhealthy diet and chronic disease (Brownson, Chiqui & Stamatakis, 2009, Conklin, Forouhi, Brunner & Monsivais, 2014). In response, public health advocates have continually presented public health policies in an attempt to promote opportunities to improve dietary intake at the population level. It is with this recognition that public health advocates promote food policies that target the source of food options as an intervention method to create the maximum population-level impact (Steeves, Martins & Gittelsohn, 2014)

American consumers were first provided nutrition information in 1990 in response to the passage of the Nutrition Labeling and Education Act (NLEA) (H.r.3562, 1990). NLEA mandates nutrition information such as the serving size, the number of calories per serving, and total fat and saturated fat, per serving be displayed on food products. Research on the impact of NLEA found that almost half of consumers changed their purchasing decisions based on nutrition label information (Drichoutis, Lazaridis, & Nayga, 2006). It is with this knowledge that policymakers advocated menu-labeling be made available to consumers as a means of positively altering food choice when eating away from home (Federal Register, 2014).

Twenty years after the passage of NLEA, the Patient Protection and Affordable Care Act (ACA) of 2010 Title IV: Prevention of Chronic Disease and Improving Public Health (Patient Protection and Affordable Care Act of 2010) was passed into law. It requires specific nutrition information to be displayed for standard menu items in restaurants and retail food establishments, with twenty or more locations. The ACA amended the Federal Food, Drug and Cosmetic Act of 1938 to require restaurants and other food establishments that serve food for immediate consumption or prepared food that is eaten on the premises, while walking away, or soon after arriving at the location with twenty or more locations to do the following;

- Post calorie information on menus and menu boards for all standard menu items,
- Disclose calorie information on signs adjacent to foods on display and self-service foods that are standard menu items,
- Include a succinct statement concerning suggested daily caloric intake and a statement of availability for written nutrition information on menus and menu boards, and
- Require written nutrition information be available on the premises of the chain restaurant or similar retail food establishment upon request (Food and Drug Administrations (FDA) Menu Labeling, 2020).

The Food and Drug Administration (FDA) is tasked with safeguarding America's public health. Their role was recently expanded to include overseeing the implementation, education, and outreach on the menu-labeling policy (Federal Register, 2014). This policy was put in place to allow consumers to make informed decisions when eating away from home based on their individual nutritional needs.

Statement of the Problem

The obesity epidemic and its role as a major risk factor in chronic diseases such as diabetes, heart disease, and stroke make addressing obesity and chronic disease an essential public health issue. The data supports this assertion by the fact that forty-two percent of the U.S. population is obese, and the obesity-related conditions listed are major causes of preventable, premature death in the U.S. (CDC Adult Obesity Facts, 2019). The wider public health community acknowledges the changing retail food environment, which has included increased access, portion, and low price of high-calorie foods as the driver of poor diets (Bleich, Wolfson, Jarlenski, 2017). Due to the chronic disease burden, it is well understood that improving dietary behavior is an important public health issue (Fox & Horowitz, 2013).

The impact of the newly implemented federal menu-labeling policy on food choice behavior is an important consumer and public policy issue. Findings on the use of menu-labeling from a cross-section of consumers will provide policymakers and public health advocates with evidence-based knowledge on how and if chronic disease diagnosis or weight status influences the usage of calorie information when making food choices

Study Aims

The study aim is to evaluate the use of menu-labels, put in place under the federal menu-labeling policy, based on chronic disease and weight status. The goal of the current study is to evaluate whether the implementation of the menu-labeling policy influences usage by those with these health conditions. This study will provide policymakers insight into how individuals, based on their health condition, use nutrition information to inform the effectiveness of the federal food environment policies. It is critical to identify which disease diagnosis elicits increased use of menu-labeling and how that can be incorporated in policy approaches to encourage use across the population rather than menu-labeling use being a response to a health condition.

The study will use quantitative methods to systematically evaluate menu-labeling policy use by identifying the nutrition information user group based on chronic disease diagnosis and obesity. The research aims will be accomplished by testing the following hypotheses;

H₀

Menu-labeling policy implementation has no effect on use by those with chronic disease diagnosis.

H₁

Menu-labeling policy implementation leads to increased use by those with a chronic disease diagnosis.

H₀

Menu-labeling policy implementation has no effect on use by individuals with obesity.

H₁

Menu-labeling policy implementation leads to increased use by individuals with obesity.

Research Design

This study analyzes secondary cross-sectional data from the 2016 Behavioral Risk Factor Surveillance System (BRFSS). BRFSS is a health-related telephone survey administered to about 400,000 residents covering all 50 states, the District of Columbia, and three US territories. BRFSS has three components; core, optional, and state-added questions (CDC, BRFSS Questionnaire, 2020). The first part is the core component, which consists of fixed core questions, rotating core questions, and emerging core questions. The fixed core is a standard set of questions asked by all states, such as demographic information. The rotating core is two distinct sets of questions that are asked by all states in alternating years. Lastly, new questions are added to the fixed or rotating, attempting to focus on an evolving health concern. States can elect to use the optional module questions. Optional module questions include sugar-sweetened beverage consumption and menu-labeling usage.

The following study analyzes data from the core component and the optional module nine that provided the menu-labeling question. The study will include a subgroup analysis based on chronic disease diagnosis and weight status. Findings from the analysis will be used to assess

how successful the policy has been in achieving its stated purposes and goals of increasing consumer knowledge of nutritional information and subsequent use of information in purchase behavior when eating away from home.

Chapter Summary

Chapter one outlined the changes in the retail food environment since the 1980s that increased eating of food away from home (FAFH) and has been linked to the rising chronic disease and obesity epidemic in the U.S. The use of public policies such as NLEA, as a population-level intervention method, is presented as the basis for the enactment of the federal menu-labeling policy. Evaluating the benefit of such a population-based intervention approach is presented as the basis of the current research study.

Chapter two will review the existing research on the menu-labeling policy, discuss the specific research questions being investigated, and present hypotheses for these questions. Chapter three will discuss the research design used for investigating the above-mentioned research questions, including research methods, units of analysis, and data collection. Chapter four will report the quantitative findings of this research, and chapter five will conclude with recommendations and public health implications.

CHAPTER 2 LITERATURE REVIEW

Theoretical Frameworks

Theoretical frameworks are important tools to better understand the factors that influence menu-labeling utilization and health outcomes. The framework utilized in the current study is libertarian paternalism, which has been used in behavioral economics as it applies to food policy with success (Satia, Barlow, Armstrong-Brown, & Watters, 2010, Shaffer, 2017 & Scrinis & Parker, 2016).

Dr. Thomas Frieden, former director of the Centers for Disease Control and Prevention (CDC), changed how CDC addressed intervention strategies in every aspect of public health. The approach he developed was a five-tier pyramid to address public health interventions (2010). The pyramid in Figure 1 suggests population-level interventions at the bottom of the pyramid and moving up the pyramid to individual-level interventions. The second tier changing the context to make individuals' default decisions healthy, addresses the environment to make healthy choices easier. The federal menu-labeling policy would fall in this tier as it is an example of a population-level approach. The menu-labeling policy provides consumers with information to assist them in making healthier food choices. Frieden (2010) stresses the increasing role of policies being used in chronic disease prevention and control.

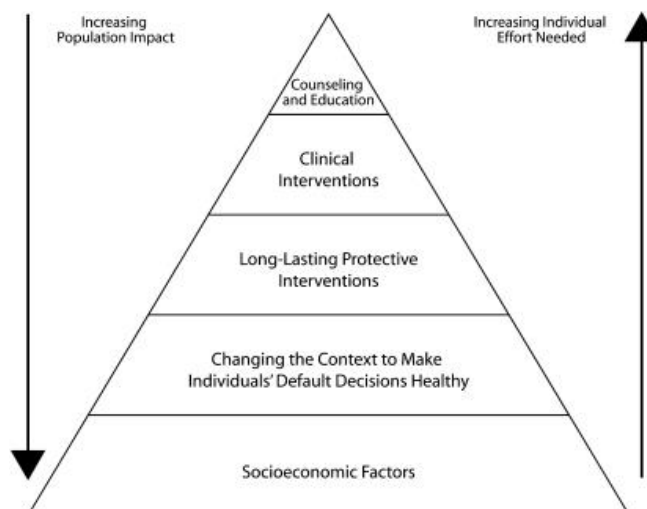


Figure 1: Five-tier Public Health Pyramid. This figure displays the individual to population intervention impact. (Frieden, 2010)

There have been varied responses to how to address chronic disease and obesity at the population level. Examples of food policies in the tiered approach can be seen in setting nutrition standards, such as USDA's MyPlate, restricting food advertising to children, and providing incentives and guidance to create healthy food environments (Hawkes, Jewell, & Allen, 2013). The current research on the federal menu-labeling policy implemented in restaurants and retail food establishments is another example of such a food policy.

Thaler and Sunstein (2003) suggest policies are a form of paternalism in their libertarian paternalism framework. The premise is that policies are enacted to force individuals' choices that will make their life better, which is paternalistic. Conversely, libertarian paternalism is an approach that grants an individual the freedom of choice but allows institutions such as the federal government in the instance of menu-labeling policy to steer consumers in the direction that will promote health without being prescriptive and taking away choices. It is with this recognition that aspects of libertarian paternalism, such as nudges and choice architecture, are used as the theoretical framework to investigate how these approaches encourage individuals to adopt healthier eating.

Menu-labeling improves food choices while not restricting individual freedom of choice. In the case of the menu-labeling policy, consumers are provided information on the nutritional and calorie content of food, which is intended to improve their knowledge while they still have the option to choose an unhealthy option, but it is hoped that the knowledge gained will 'nudge' the consumer to the healthier option. An additional key to nudging is understanding the motivation of the chooser, the consumer in the current study. A component of nudging is choice architecture. Choice architecture refers to the organization of the context in which individuals are provided with information to make decisions. Before the implementation of the menu-labeling policy, the food industry structured food options based on their goals. After the implementation of the menu-labeling policy, the choice architecture changed to include the calorie and nutritional content of the food options. Choice architecture serves as a non-intrusive form of paternalism because it does not hinder the consumer from opting for the unhealthy option. The six principles of good choice architecture, according to Thaler and Sustein (2009) are incentives, understanding mapping, recognizing defaults, giving feedback, expected error, and structuring of complex choices. The six principles are not present in the menu-labeling policy. However, recommendations suggested later demonstrate how they all can be incorporated to ensure long term success of the menu-labeling policy. A challenge of choice architecture occurs when the choice and the consequences of the choice are separated in time. For example, the twenty-pound weight gain is separated from the thousand calories fast food meal consumed twice a week for the past year. The incorporation of all the principles of choice architecture can address this challenge.

Understanding the real-world use of menu-labeling is best understood by using a conceptual framework that recognizes that individuals' behavior can be 'nudged.' Nudging, as

discussed is an aspect of choice architecture that alters people's behavior predictably without forbidding any options or significantly changing their economic incentives (Thaler & Sunstein, 2008). Nudging encourages rather than requires certain behavior to elicit better decision making by consumers. There have been mixed reviews on the utility of aspects of libertarian paternalism (Otto, et al., 2020, & Thunstrom, 2019). In an investigation of whether nudges lead to a reduction of calories purchased concluded nudges are useful in heightening consumer motivation to eat healthier (Otto, et al., 2020). Additionally, the study highlighted the role of normative behavior in influencing consumer choices when eating FAFH. This is important in future discussions of public health implications of menu-labeling. Others have argued the use of nudges evokes negative emotions, resulting in what is termed in the literature as an “emotional tax (Thunstrom, 2019).” It is purposed that this emotional tax results in pain, anxiety, fear, and guilt. In answering the research question of whether the emotional tax is worth the distributional effects of the nudge the research found it was dependent on an individual’s level of self-control. Those with low self-control were emotionally taxed, while those with high self-control were emotionally subsidized by the calorie labeling nudge. Suggesting nudges are not universally effective for all groups and might not be the most effective policy intervention.

The libertarian paternalism is the theoretical framework utilized in the current research to evaluate the effectiveness of the menu-labeling policy on consumer purchase behavior. It was identified as the best framework due to its use of nudges, choice architecture, and incentives, all elements that impact the use of menu-labeling by consumers. The current research study will explore how these elements influence consumer choice and, ultimately, how food policy can be used effectively to positively change the burden of chronic disease and obesity on the U.S. population.

Research Hypotheses

This study will test two hypotheses related to the menu-labeling policy, each with implications for future public health policy and chronic disease management. The findings can have far-reaching implications for numerous stakeholders, including consumers, policymakers, and public health advocates. The first hypothesis asks, 'Is menu-labeling policy usage associated with increased use by those with a chronic disease?' The second hypothesis asks, 'Is menu-labeling policy usage associated with increased use by those with obesity, identified as those with a BMI greater than or equal to thirty?'

Foundation of the Study

The present study contributes to the literature by examining the menu-labeling policy that changes the FAFH choice architecture to nudge healthy food selection regardless of health condition and obesity. However, weight status and health conditions can play a role in the utilization of nudges. Research on the use of menu-labeling requires further investigation because policymakers and public health advocates need to know whether the menu-labeling policy has effectively achieved its legislative intent. Those intentions included protecting the public's health and reducing and preventing obesity and related chronic diseases, reducing the cost of obesity and obesity-related diseases such as diabetes, heart disease, and stroke, promoting informed decision making by consumers and lastly, preventing consumer confusion over calorie and nutritional content of food eaten away from home (Pomeranz & Brownell, 2008).

Food Away From Home

According to USDA Economic Research Service over the past twenty years, consumers have steadily eaten less food at home and more food away from home (Okrent, Elitzak, Park, &

Rehkamp, 2018). Research has found a higher frequency of eating away from home food associated with a higher BMI for females and males (Seguin, Aggarwal, Vermeulen, & Drewnowski, 2016). It is widely accepted that high BMI is associated with an increased risk of chronic diseases such as hypertension, obesity, and diabetes (Kivimäki et al., 2017). Food away from home is energy-dense and has grown in portion sizes over the past thirty years (Seguin, et al., 2016). In reviewing the 2017 total food expenditures, food away-from-home accounted for 54.4 percent an increase from 50.1 percent in 2009 (Saksena et al., 2018). This aligns with the total percentage of calories eaten away from home. Food away from home accounted for thirty-two percent of total calories consumed (Saksena et al., 2018).

Eating food away from home in fast food or sit-down restaurants is influenced by personal preference, food prices, income, and time constraints, which affect food quality. In a landmark study researching the difference between the dietary quality of away from home food to the food eaten at home, found food eaten away from home increased caloric intake and resulted in a reduction in diet quality (Mancino, Todd, & Lin, 2009). The study found that when lunch and dinner were eaten away from home greatly influenced total daily calorie consumption and lowered overall diet quality. Consumers tend to choose less healthful foods when eating away from home, even when controlling for individual differences in dietary awareness and food preferences (Mancino, Todd, & Lin, 2009). The researchers found this occurs even among those thought to have a strong incentive to make healthy food choices such as those on diets or consumers who are with obesity.

Food Policies

In the U.S., evidenced-based food policies have centered on four areas; food price in the form of taxation, reformulation of food to reduce unhealthy nutrients, marketing to promote healthy eating, and labeling of nutritional content on packaged food and FAFH (Huang et al.,

2018). The focus of the current study is food labeling policies, which have addressed the disclosure of nutritional quality information on packaged food and foods eaten away from home. Implementation of effective food policy has implications for long term success in reducing chronic disease and obesity that results from consumer behavior change.

Given the multiple approaches taken by policymakers to develop food policies designed to improve the food environment, it is critical to assess the value and outcomes of such policies. The conceptual diagram depicted in Figure 2, models how four of the most common food policies and health outcomes intersect, providing insight on drivers and barriers to policy implementation and usefulness. The most notable food reformulation policy was the restriction of trans fat in packaged and commercially prepared foods (Huang et al., 2018). Unlike other food policies, this policy relies on the food industry and does not rely on individual consumption behavior and has an immediate health benefit to the population and the food environment at home and when eating away from home. Alternatively, taxation impacts consumers directly. An investigation of price elasticity of food provided the basis of implementing taxation on unhealthy food (Fox & Horowitz, 2013). Similar to menu-labeling, taxation relies on the consumer's willingness to pay and provides freedom of choice, which is essential for libertarian paternalism. Unlike menu-labeling, as taxes increase freedom of choice and equity diminishes as it distinguishes those who have higher means and willingness to pay. The intended policy outcome is consistent across policies; improve the food environment, improve health, and decrease healthcare expenditures. Differences occur in the magnitude of the change, which is the result of the intended audience of the change, i.e., the consumer or the food industry.

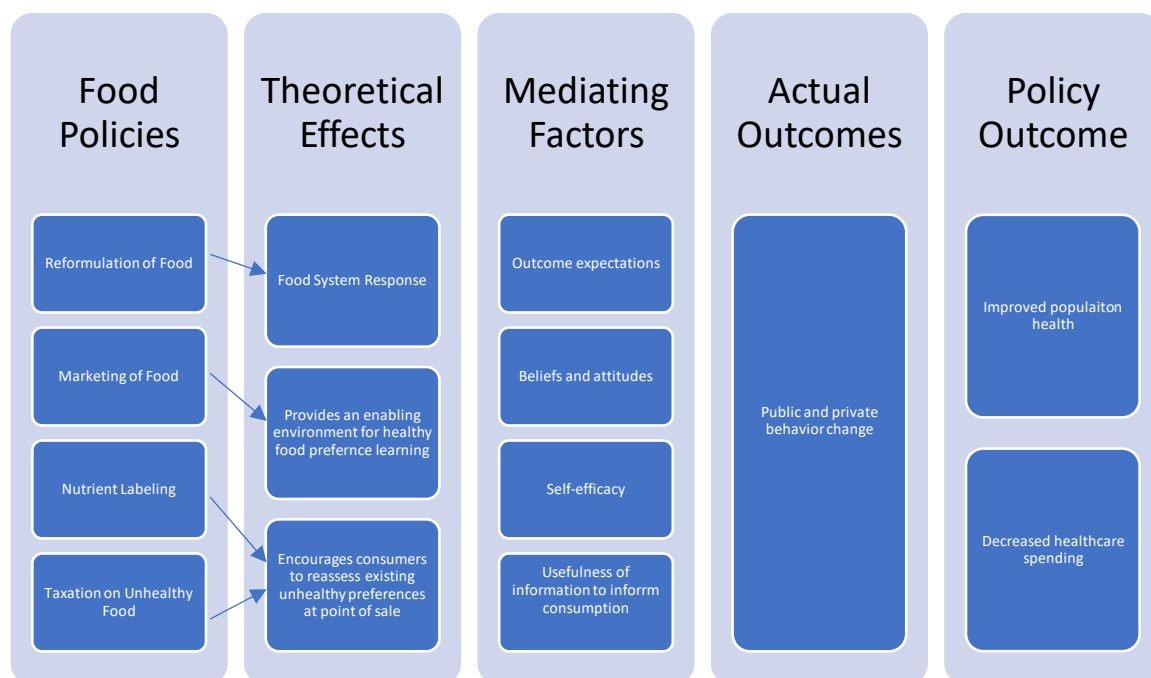


Figure 2 Conceptual diagram of food policies

Governmental Policies

Developing a population-wide strategy for addressing the obesity epidemic and the rise in chronic disease has led to the focus on food policy as an intervention method. Upon thorough review of the history of the American food environment, created directly or indirectly by governmental policies, one can easily recognize that chronic disease and obesity must be addressed from more than an individual level. The role of government in the food environment is unquestioned in light of the influence of the US Farm Bill. The Farm Bill is a multi-year law that addresses agricultural and food programs (What is the Farm Bill, 2019). It sets the direction and funding for commodity subsidies to farmers, federal food programs such as the Supplemental Nutrition Assistance Program (SNAP), and trade and international food aid. The use of subsidies to farmers on such commodities as corn makes it cheaper to use corn-derived sweeteners than traditional cane and beet sugars in processed energy-dense foods (Kammer, 2012). In a study of

the seven major subsidized food commodities (corn, soybeans, wheat, rice sorghum dairy, and livestock) found that half of all calories consumed in the U.S. originate from subsidized food commodities (Siegel et al., 2016). This results in inadvertently or deliberately lowering the cost of unhealthy food and increasing the perceived cost of healthy food. This creates a nationwide food environment that makes unhealthy food more affordable.

Unhealthy nationwide food environments created by federal policies will require population-wide food policies that combat their impact on chronic disease and obesity that require more than just personal responsibility. Numerous studies have examined the effectiveness of food policies in reducing obesity and chronic disease rates, recommending population-based strategies as the best response (Fox & Horowitz, 2013, Hawkes, et al., 2015, & Huang, et al., 2018). Several factors contribute to the adoption of food policies. There are three domains for the passage of evidence-based public health policy; policy process, policy content, and policy outcomes (Brownson, Chiqui, & Stamatakis, 2009). These domains were the foundation of the federal menu-labeling policy. Factors that facilitate policy processes are multifaceted. One must understand the problem, the policy, and politics. Often a lack of understanding of the politics involved can lead to the failure of sound policies. The menu-labeling policy encountered delayed implementation due to this lack of understanding. The ACA was passed in 2010 under the Democratic Obama Administration, however, the FDA final compliance date for menu-labeling was not until 2018 under the Republican Trump Administration. The final passage was a result of advocates from both political parties recognizing the opportunities that the policy could provide in terms of a decrease in healthcare spending, improved quality of life for millions and improved decision making on the part of consumers (Health Policy Brief: The FDA's Menu-Labeling Rule, 2015). The focus on policy

content involves ensuring the elements of the policy will be effective. This is often based on evidenced-based research in the policy area (Brownson, et al., 2009). In the case of the menu-labeling policy, the success of NLEA (Drichoutis, et al., 2006) aided in the development of the menu-labeling policy. Lastly, documenting policy outcomes once implemented are important for future evidence-based policies. This can be completed in the form of policy evaluation. The current study serves as such, evaluating the usefulness of the federal menu-labeling policy in modifying the food behaviors of consumers.

Policymakers' Expectations

Policymakers expected with the implementation of the menu-labeling policy there would be a domino effect. Consumers would use the information to make healthier food choices, resulting in a decrease in chronic disease and obesity, which would result in a decrease in healthcare spending (Federal Register, 2014). To achieve the stated research objectives, this study analyzes policymakers' expectations against actual results. Policymakers' expectations are important drivers for policy implementation, making them a valuable source in effecting future public health policies. In evaluating the menu-labeling policy, a thorough understanding of the policy expectations is needed. The expected results provide a means to measure the actual outcomes.

According to the FDA Final Rule, listing calorie and nutrition information as part of the menu-labeling policy would provide consumers direct, accessible, and consistent calorie and nutrition information when eating away from home to assist in making healthy dietary choices (Federal Register, 2014). Consumers are often unaware and underestimate the calorie content of food when eating away from home and providing this information in a consistent format would have a positive effect on consumer choices by minimizing the selection of unhealthy options and

encouraging the selection of options lower in calories and higher in nutritional value.

Additionally, the Federal Register (2014) states labeling would assist consumers in making informed choices and favorable changes and the outcomes have the potential to assist consumers in maintaining a healthy weight and thus combat the chronic disease and obesity epidemic.

Diet-Disease Relationship

It is well understood and documented the diet-disease relationship of diabetes, heart disease, obesity, stroke, and some cancers (Osonoi, et al., 2016, Rahkovsky, Anekwe, & Gregory, 2018). One way to measure dietary quality is through dietary energy density. Dietary energy density is the number of calories/energy in the weight of the food (CDC, Low-Energy Dense Foods....., 2020). It is most commonly presented as the number of calories in a gram of food. The number of calories/energy a person consumes is vital for weight management. Foods that have a low energy density, such as fruits and vegetables have fewer calories per gram of food. Whereas foods that have a high energy density, such as french fries and pizza, have higher calories (CDC, 2020). High energy-dense foods are more palatable due to the high fat and sugar content, in which humans have a taste preference (Drewnowski & Darmon, 2005). Foods prepared away from home are higher in calories, fat, sodium, and sugar compared with foods prepared in the home (Bruemmer, Krieger, Saelens, & Chan, 2012). Studies have observed that for each additional away from the home meal, a person consumes an additional 100-200 calories a day (Nguyen & Powell, 2014).

In reviewing the 2015-2020 Dietary Guidelines for Americans, eighty percent of consumers intake at or above the recommended daily levels of sodium (USDHHS & USDA, 2015). It is well understood that excessive sodium intake puts one at an increased risk of cardiovascular disease (Kong, Baqar, Jerums, & Ekinci, 2016). Additionally, food away from

home food tends to be higher in added sugar (Bruemmer et al., 2012). Added sugars are defined by USDA as those sugars and syrups added to foods during processing or preparation including those added at the table (Bowman, 2017). Excess sugar consumption is a risk factor for type 2 diabetes (Stanhope, 2016). The Dietary Guidelines for Americans recommends a maximum of 10% of total calories come from added sugars per day (2015). Researchers have reported that individuals that consume 10% - 24.9% of calories from added sugars are 1.30 times at risk of cardiovascular disease. Risk increases to 2.75 for those who consume 25% or more of calories from added sugars (Yang et al., 2014). Recognizing the dietary quality of FAFH is lower than foods eaten at home and puts one at increased risk of acquiring a chronic disease and/or becoming obese makes ensuring consumers are aware of the diet-disease relationship vitally important.

Chronic Disease

The CDC defines a chronic disease as a 'condition that lasts for a year or more and requires ongoing medical treatment or limits activities of daily living or both (CDC, 2019).' Among the leading causes of death are chronic diseases such as heart disease, stroke, and diabetes (Johnson, Hayes, Brown, Hoo & Ethier, 2014). A shortlist of risk factors includes tobacco use, poor nutrition, lack of physical activity, and excessive alcohol consumption. Poor nutrition is the most influential among all other factors and is the focus of the current study of the impact of chronic disease diagnosis and obesity on food consumption behavior.

Diabetes affects how the body turns food into energy. When food is consumed, the human body turns the food into blood sugar, called glucose. This causes the blood sugar to increase signaling the pancreas to release insulin (CDC, 2020). When the body does not make enough insulin or cannot use the insulin released, affected individuals are diagnosed with type 1

or type 2 diabetes, respectively. According to the National Diabetes Statistics Report, 90% of all diabetes diagnoses are type 2 (2020).

Diabetes is the seventh leading cause of death in the U.S. in 2017 (CDC, 2020). Patients with diabetes are especially sensitive to the consumption of foods high in sugar, salt, and fat. Also, they must monitor their intake of carbohydrates and are encouraged to eat a variety of fruits and vegetables. According to the CDC, 34.1 million adults over 18 years of age have diabetes. This represents 13% of US adults. In addition, 7.3 million adults met the clinical criteria for diabetes, but they are unaware (CDC, 2020). American Indians/Alaska Natives have the highest prevalence of diagnosed diabetes of 14.7%, while non-Hispanic whites have the lowest of 7.5%. Education, a known indicator of socioeconomic status, has been identified as a variable that influences diabetes prevalence. In the study by the CDC, 13% of adults with less than a high school education had diagnosed diabetes while only 9.7% with high school education and only 7.5% of those with more than a high school education (CDC, 2020).

Individuals diagnosed with diabetes have been found to have risk factors that increase their risk of complications from the disease. The National Diabetes Statistic Report documents that among persons with diabetes, 21% were tobacco users, 89% were overweight or obese and 68.4% had high blood pressure (CDC, 2020). The report also found if a person has diabetes they are twice as likely to have heart disease compared to someone without diabetes. This further highlights the association between diabetes and heart disease. High blood sugar damages the blood vessels and nerves that flow to the heart. Heart disease refers to the build-up of plaque on the coronary arteries, which are the blood vessels that supply blood and oxygen to the heart (CDC, Heart Disease and Stroke, 2019). When there is decreased blood flow to the heart, a heart attack occurs. When there is decreased blood flow to the brain, it causes a stroke. One-third of all

deaths in the U.S. each year are from heart disease, stroke, and other cardiovascular diseases (CDC, 2020).

It is widely recognized that diets high in sodium are at increased risk for high blood pressure and heart attack. This is based on scientific research that determines that blood volume is influenced by sodium and water content (Kong, et al., 2016). The 2015-2020 Dietary Guidelines (2015) for sodium intake suggest 2,300 milligrams (mg) per day for the general population and less than 1,500 mg/day for persons at risk of chronic disease. Unfortunately, most Americans consume more than 3,400 mg per day (CDC, 2017). Research has found that the biggest source of increased sodium intake is not the salt at the dinner table but processed food and restaurant meals, which account for more than 70% of total sodium intake (CDC, Sodium's Role in Processed Foods, 2017). In addition to increased heart rate, sodium has been shown to affect insulin sensitivity (Kong, et al., 2016).

High blood pressure is a risk factor for having a stroke. In addition, persons that are overweight or have obesity, have diabetes or heart disease put one at increased risk for a stroke (CDC, 2020a). According to the CDC, 80% of strokes can be prevented with lifestyle changes and working with a healthcare provider to control risk factors. A known risk factor for the chronic diseases discussed diabetes, heart disease, and stroke is obesity (CDC, 2017).

Epidemiology of Obesity

The World Health Organization (WHO) (2015a) defines obesity as a disease in which excess body fat has accumulated to such an extent that health is adversely impacted. Body mass index (BMI) is a measure of body fat calculated by dividing weight in pounds by height in inches squared then multiplied by 703. It is a standard measure used to classify weight status (National Institutes of Health, 2015). A BMI of 30 or more is considered obese. In 2018, the prevalence of

obesity was 42% up from 30.5% in 2000. Also, severe obesity (BMI \geq 40) increased from 4.7% to 9.2% (Hales et al., 2020). Figure 3 highlights the obesity rate across the U.S. Upon review, one will notice nine states Alabama, Arkansas, Iowa, Kentucky, Louisiana, Mississippi, Missouri, North Dakota, and West Virginia have an obesity rate of 35% or more among the adult population (CDC, 2019a). In countries like the U.S., obesity rates are more likely to be prevalent in disadvantaged regions and among groups with lower income, lower educational attainment, and low social class status (Conklin et al., 2014). In an investigation of the impact of poverty on health in the U.S., six of the aforementioned states were identified as the poorest states in the US having higher smoking prevalence, obesity rates and more likely to be physically inactive than the richest states in the US (Egen, Beatty, Blackley, Brown, & Wykoff, 2017).

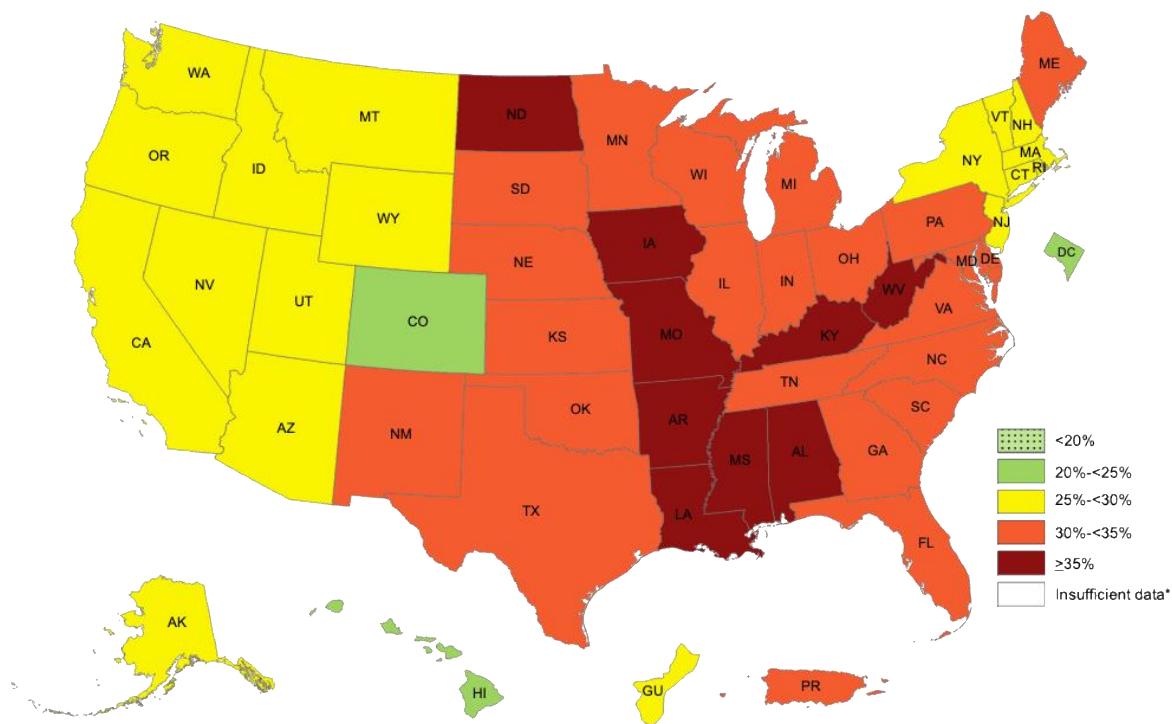


Figure 3: CDC Obesity Prevalence Map (2019). This map displays the percent of adults who are obese across the U.S. Source: <https://www.cdc.gov/obesity/data/prevalence-maps.html>

Healthcare Costs

Half of the US population has a chronic disease (NCHS, 2018). A little less than half has two or more chronic diseases. The increased number of chronic diseases increases healthcare utilization. Research on healthcare spending found that those with five or more chronic diseases, which account for 12% of the US population and account for 41% of healthcare spending (Buttorff, et al., 2017). Whereas those with three or four chronic diseases account for 26% and those with one or two chronic diseases account for 23% of healthcare spending. Due to the healthcare demands of treating chronic disease, it puts tremendous stress on the healthcare

system, economic productivity due to disease-related disability and contributes to poor quality of life for millions of Americans. It is suggested that the diagnosis of a chronic illness is a teachable moment. Described as a “naturally occurring health or life event that motivates individuals to spontaneously engage in risk-reducing health-promoting behavior (McBride, Emmons, & Lipkus, 2003).” Persons diagnosed with a chronic disease or persons intent on maintaining a healthy weight would uniquely benefit from using menu-labeling to assist with managing their dietary needs by having the information needed to assist them in making informed food choices when eating away from home.

Current Evidence on Menu-labeling Policy

Menu-labeling is an important public health strategy to inform consumers of the calorie and nutritional content of food eaten away from home. This is more important than ever as more and more calories are consumed away from home and consumers tend to underestimate the calorie content of food eaten away from home (Block et al., 2013). This lack of knowledge leads to increased consumption and unhealthy weight gain. Putting consumers at increased risk of developing cardiovascular disease, type 2 diabetes, and becoming overweight or obese (Bahadoran, Mirmiran, & Azizi, 2015). A positive response by the restaurant industry has included menu modifications that include more lower-calorie items. A systematic review of menu-labeling research found that consumers consumed, ordered, or selected significantly less energy-dense content foods when menu-labeling was present compared to consumers who were not provided menu-labeling (Littlewood, 2016).

Many studies have researched public health policies role in addressing the obesity epidemic and the rise in chronic disease in the U.S. population. These studies have researched the increase in eating away from home and the use of menu-labeling by various segments of the

population (Breck, Cantor, Martinez & Elbel, 2014, Green, Brown & Ohri-Vachaspati, 2015). None have compared the use of menu-labeling by chronic disease diagnosis or among those with a BMI greater than or equal to thirty, considered obese. Specifically looking at menu-labeling, one study designed to predict who sees and utilizes menu labeling, the step necessary to influence consumer choice found consumer purchases were influenced by preferences (Breck et al., 2014). Most notable consumers who based their purchases on perceived nutritional content or nutritional content and taste were more likely to notice and use calorie information in making purchase decisions.

There is limited literature on comparing knowledge before and after the implementation of the menu-labeling policy. One study examining differences in knowledge before and after implementation of the federal menu-labeling found that prior to implementation 60% of consumers underestimated calories (Petimar et al., 2019). One study found that adults who reported noticing and using nutrition labeling when eating away from home to inform their food selection consumed more salads and ate out less often than adults who did not notice nutrition labels (Vadiveloo, Dixon, & Elbel, 2011). Also, adults who noticed nutrition labels but did not use them ate out less and were less likely to order caloric beverages than adults who did not notice the nutrition labels. This research sheds light on the important benefit of consumers noticing nutrition labels, one of the expectations of policymakers mentioned earlier.

In a study designed to test whether menu-labeling influenced total calories ordered during a meal and food after the meal found menu-labeling reduced the total amount of calories consumers ordered and consumed, improved their ability to estimate calories consumed and influenced their subsequent eating (Roberto, Larsen, Agnew, Baik, & Brownell, 2010). A notable finding of this study is that when the daily caloric requirement was present on the menu in

addition to the nutritional content information about the menu item, there was a 250-calorie decrease compared to consumers who were only provided caloric information about the particular menu item. This highlights the importance of consumers knowing more than just the nutrition content information of the food options available on the menu but the context of what those calories mean in relation to their daily requirement. Calorie information alone assumes consumers know the number of calories they should consume to maintain a healthy weight. The menu-labeling policy requires daily calorie intake to be placed on the menu. However, it is not written next to each menu and nutritional content information is to be made available upon request by the consumer.

An examination of the association between sociodemographic characteristics and noticing menu-labeling found income as the only variable that was associated with noticing menu labeling. Consumers with incomes over \$50,000 were three times more likely to notice and use calorie information in making food selection than those of lower-income (Green, 2015). Also, those who used calorie information in making food selection purchased 146 fewer calories than those who did not.

County and State Policies

Before the introduction of the ACA menu-labeling policy, there was sporadic menu-labeling policy implementation across the country. California, Maine, Massachusetts, and Oregon passed menu-labeling legislation (Hawkes, et al., 2015). Also, cities and counties around the country, most notably, due to nationwide attention New York City, San Francisco, Philadelphia, and Washington's King County. New York City was the first city to introduce labeling requirements for fast-food restaurant chains. The New York City Department of Health and Mental Hygiene took the approach that it is responsible for preventing and controlling

disease, including chronic diseases among its residents. The legislation cites the obesity prevalence among residents and its associated risk factor for heart disease, stroke, cancer and diabetes, the leading causes of death in New York before the legislation (New York City Department of Health and Mental Hygiene: Notice of Intention to Repeal and Reenact Sec 81.50 of the New York City Health Code, 2007). Policymakers acknowledged that food environments contributed to the obesity epidemic and the chronic disease burden in New York.

Research conducted several years after New York City implemented its mandatory menu-labeling law found that calories purchased decreased by 6% (Restrepo, 2016). Estimating that the calorie reduction resulted in 38 fewer calories consumed per day by New York City consumers, resulting in a half a pound loss per year. This may seem negligible to the consumer at first. However, when the trend had been an increase in pounds per year one must acknowledge the benefits of the policy. Additionally, this study highlights the success of New York's policy in reducing BMI and the risk of obesity. Such results can be seen nationally in response to the federal menu-labeling policy.

Federal Policy

As the menu-labeling policy becomes the standard information provided to consumers when eating away from home, it is important to evaluate its usefulness as a food policy. Research on the menu-labeling policy has attempted to answer the question of whether its implementation has achieved its intended aims. Studies investigating menu-labeling usage have had varying findings. Bowers and Suzuki (2014) found that users of menu-labeling followed a healthier lifestyle of eating fruits and vegetables, drinking fewer sodas and other sugar-sweetened beverages (SSBs), and participated in regular exercise compared to non-users. Whereas another study found racial differences in menu-labeling usage (Breck, Cantor, Martinez, & Elbel, 2014).

Non-Hispanic whites and Hispanics were more likely to use menu-labeling when compared to other groups. In an examination of racial differences in menu-labeling usage, controlling for dietary habits, exercise, and health status, Hispanics were found to use menu-labeling more than non-Hispanic whites (Shikdar and Suzuki, 2018). Also, this study estimated the prevalence of menu-labeling usage to be fifty-five percent. The study found menu-labeling users to be female, highly educated, have higher incomes, exercise more, and drink less SSB.

Many food retailers implemented the menu-labeling policy guidance before the final compliance date of May 7, 2018 (Cleveland, Simon, & Block, 2018). The policy encountered numerous delays to implementation due to multiple barriers spearheaded by food retailers and food industry lobbyists who cited providing nutrition information was burdensome and costly. Considering the impact of obesity and the influence of away from home food has on obesity and chronic disease along with the associated healthcare cost, the \$45,720 average cost for a restaurant to revise their menus to include nutrition information was negligible (Center for Science in the Public Interest, 2015).

Food Industry Response

Before the required implementation of menu-labeling many restaurants self-regulated and provided nutritional information. In research investigating menu modification throughout the menu-labeling roll out, restaurants introduced food items that averaged 60 calories less from 2012 to 2013 than in previous years (Bleich et al., 2015). The decrease in calories has persisted over time (Bleich et al., 2016). The decrease in calorie offerings over time has the potential to reduce excess daily calories eaten away from home. The average adult consumes an excess of 220 calories a day when eating away from home (Hall et al., 2011).

In an exploration of whether the mean calorie content of newly introduced menu food items was higher before the introduction of the ACA menu-labeling policy than after found that after the passage of the federal menu-labeling policy new introduced food items contained 68 calories less when compared to before (Bleich et al., 2017). This has important implications for the menu-labeling policy over time. The policy has the potential to influence the restaurant menu options by offering lower-calorie food items, which improves the food environment for consumers enabling them to have healthier food options when eating away from home.

Multiple studies have researched menu-labeling use among consumers however none have taken a direct look at usage among those with a chronic disease who would uniquely benefit from menu-labeling usage compared to those without a chronic disease. A study related to the current study compared nutrition facts label usage among individuals diagnosed with diabetes and prediabetes with individuals that are undiagnosed with diabetes and prediabetes. This study found that those with diagnosed diabetes and prediabetes were significantly more likely to use nutrition facts labels (An, 2015). What this study and others have not investigated is how menu-labeling on food eaten away from home varies by chronic disease diagnosis in comparison to those that do not have a diagnosed chronic disease and the difference in usage among those with obesity and those that are not with obesity.

Chapter Summary

Studying menu-labeling use among those with a chronic disease or obesity is important as consumers continue to eat more food away from home. Recognizing the role diet plays in chronic disease diagnosis and the economic burden of chronic disease on healthcare spending and the health of the nation, the menu-labeling policy was enacted as part of the 2010 Patient

Protection and Affordable Care Act (ACA). The intention of providing such information is evident; however, the effect on use behavior is uncertain. It is reasonable to conclude that those with a chronic disease would benefit from using menu-labeling in their decision making due to the diet-disease relationship, however, little research has been conducted comparing the differences between people with a chronic disease and those without chronic disease and their use of menu labeling. Similarly, research has not focused on those with obesity using menu-labeling. Recent research found that consumers are more likely to use calorie information if they find the information relevant (Roseman, Mathe-Soulek, & Higgins, 2013). It is proposed based on the diet-disease relationship those with a chronic disease or obesity will find it relevant to use such information in their decision making when eating away from home.

The scarcity of research on the menu-labeling policy and its use among those with a chronic disease or obesity, who would most benefit, suggests the need to examine how the menu-labeling policy can influence chronic disease and obesity rates and subsequently improve the health of the nation and decrease healthcare spending. There is an identified need for more research to build upon evidence-based policies that improve population health. The implementation of the federal menu-labeling policy provides a unique opportunity for public health advocates and policymakers to promote prevention efforts through innovative population-level strategies.

CHAPTER 3 METHODOLOGY

The purpose of this quantitative study is to evaluate the use of calorie menu-labeling in restaurants as required by the federal menu-labeling policy based on chronic disease diagnosis and weight status. This chapter describes the research design and approach under the following sub-headings; data from the Behavioral Risk Factor Surveillance System (BRFSS), study population, operational measures, and analytic approach. The study population includes 12,286 respondents from Mississippi and West Virginia. Variables selected from BRFSS for the analyses include demographic, socioeconomic, chronic disease diagnosis, and weight status.

Data

Secondary data from the 2016 BRFSS was used to evaluate the relationship between menu-labeling usage and chronic disease diagnosis and obesity. BRFSS was selected because it is a cross-sectional survey administered annually by state health departments in all 50 states, the District of Columbia, and U.S. territories. The survey provides national and state-level data on preventative health practices and risk behaviors with an emphasis on factors that have the potential to impact health-related behaviors linked to chronic disease. The BRFSS survey is comprised of a core component, consisting of the fixed core, rotating core, and emerging core questions, optional modules, and state-added questions. States can elect whether to administer the optional module questions (CDC BRFSS Questionnaires, 2019).

Data for this study included participants 18 years and older in Mississippi and West Virginia, two states that administered the optional menu labeling module in the 2016 BRFSS (CDC 2016 BRFSS Modules Used by Category, 2017). Data was extracted from landline and

cell phone survey responses to create a combined data sample. The sample size for the menu-labeling module in the 2016 BRFSS data set was 12,286. This was the third time the optional menu-labeling module was available to administer. Before 2016, the menu-labeling module was administered in 2011 by three states Hawaii, Minnesota, and Wisconsin (CDC 2011 BRFSS Modules Used by Category). Subsequently in 2012, it was administered in eleven states, Delaware, Georgia, Hawaii, Minnesota, Mississippi, Montana, Nevada, New Hampshire, New York, South Dakota, and Tennessee (CDC 2012 BRFSS Modules Used by Category). The current study utilizes 2016 data due to the initial compliance date for the menu-labeling policy was December 1, 2015 (Federal Register, 2014). The use of the later data covers more time in which most consumers would have been introduced to the menu-labeling policy. It is important to acknowledge two additional compliance dates were enacted in which the final date for compliance was May 7, 2018 (Federal Register, 2014). However, based on industry trends most retail food establishments covered by the menu-labeling policy had begun posting menu-labeling before the initial compliance date (Bleich, et al., 2015).

Study Population

The top three causes of death in Mississippi are heart disease, stroke, and diabetes (CDC 2017 Stats of the State of Mississippi, 2018). Similarly, striking numbers exist for West Virginia, where diabetes is first, heart disease is tenth and stroke is the twelfth leading cause of death (CDC 2017 Stats of the State of West Virginia, 2018). The disease ranking in these states, along with a high rate of obesity among the adult population (30% in Mississippi and 40% in West Virginia), makes insight on population behavior as a response to the menu-labeling policy in

these states a worthy research topic (CDC Adults Obesity Prevalence Maps, 2019). Mississippi contributed 5,135 and West Virginia 7,151 to the study population.

Operational Measures

The primary outcome of this study is the use of restaurant menu-labeling. The menu-labeling module asked, 'When calorie information is available in the restaurant, how often does this information help you decide what to order?' Response options included; answered 'always', 'most of the time', 'about half of the time', 'sometimes', 'never', 'never noticed', 'never looked for calorie information', and 'do not eat at fast food or chain restaurants.' The responses were dichotomized into two categories users and non-users. Respondents were categorized as users if they answered 'always', 'most of the time', 'about half of the time' and 'sometimes.' Respondents were categorized as non-users if they answered 'never', 'never noticed' or 'never looked for calorie information.' Respondent answers that were put to missing are those who responded, 'do not eat at fast food or chain restaurants.' The response variable, menu labeling was recoded such that if a respondent used menu labeling information at all, they were given a value of 1. If they did not, then they were given a value of "0."

The primary independent variables are diagnosed case of at least one of the following chronic health conditions: diabetes, heart attack, heart disease, and stroke. The prologue to chronic health condition questions stated, 'Has a doctor, nurse, or other health professional ever told you that you had any of the following?.' Available responses were 'yes', 'no', and 'not sure.'

In addition, weight status as determined by body mass index (BMI) was included in the analysis as an independent variable. BMI is a calculated variable using height and weight to determine obesity. BMI is calculated by dividing weight in kilograms by height in meters

squared. For example, for a weight of 150 lbs. and a height of 65 inches is calculated $\{150/(65)^2\} \times 703 = \text{BMI } 24.96$, which would be considered overweight. The four BMI categories utilized by the CDC were used. BMI < 18.5 is underweight, BMI $18.5 - 24.9$ is considered a healthy weight, BMI $25-29.9$ is overweight and BMI ≥ 30 is obese (CDC, Assessing Your Weight, 2020). Obese weight status was an independent variable of interest along with diagnosed chronic health conditions. Independent variables of interest that could confound the association between weight status, chronic disease condition and use of menu-labeling that were included are demographic and socioeconomic variables such as race/ethnicity, age, education, and income. The literature has found disparities in chronic disease and race by each of these variables hence they are included in the analysis (Peterson, Pan & Banck, 2019 & Samanic et al., 2020). Variable selection was based on a literature review that highlights the association of menu-labeling usage with demographic and behavioral factors. Those variables included BMI, exercise, age, education, gender, household income, and race/ethnicity (Breck et al., 2014, Green, 2015, Vadiveloo et al., 2011, & Bowers, & Suzuki, 2014).

All variables except income and age are dichotomous. For the state fixed effect West Virginia was the reference group. For sex, the reference group is female. Marital status was recoded such that a value of "1" represents someone married and a value of "0" represents someone who is not. All of the chronic disease variables have a value of "1" if the person had the disease and a value of "0" if they did not. For race variables, a value of "1" means the respondent is a member of that given race, and a value of "0" means they are not. If "Black," "Latinx," and "Other Race" indicator variables are all "0," then this means the respondent is white. A similar interpretation is given to the age category variables where the reference group is the 18-34 group as well as the education status variable, where the reference group is non-high school graduates.

Table 1 highlights the variables in the survey and the operational measures selected as dependent, independent, and control variables. The dependent variable is a binary self-reported measure of menu-labeling use (1 if user and 0 nonuser). The indicator variables are diabetes, heart attack, heart disease, stroke, and obesity. Covariates include demographic (sex, age, race/ethnicity) and socio-economic (education, marital status, and household income level). Three categories were created for age: 18 – 34, 35 – 54 and 55, and older. Gender was dichotomized, male or female. Four categories were created for race/ethnicity; non-Hispanic white, non-Hispanic Black, Hispanic, and other/multiracial. Education was divided into three categories: less than 12 years, high school graduate, and more than 12 years.

Table 1. Description of operational measures.

<i>Variables</i>	<i>Survey Question</i>	<i>Response Category</i>	<i>Type of Variable</i>
<i>Menu Labeling</i>	When calorie information is available in the restaurant, how often does this information help you decide what to order	Yes No	<i>Categorical</i>
<i>BMI</i>	Derived Variable	1= BMI \geq 30	<i>Nominal</i>
<i>Diabetes</i>	(Ever told) you have diabetes	yes no Don't know/Not sure Refused	<i>Binomial</i>
<i>Heart Attack</i>	(Ever told) you had a heart attack, also called a myocardial infarction?	yes no Don't know/Not sure Refused	<i>Binomial</i>
<i>Heart Disease</i>	(Ever told) you had angina or coronary heart disease?	yes no	<i>Binomial</i>

		Don't know/Not sure Refused	
<i>Stroke</i>	(Ever told) you had a stroke	yes no Don't know/Not sure Refused	<i>Binomial</i>
<i>Age</i>	Age in years	18 – 34 34 – 54 55 or older	<i>Categorical</i>
<i>Educational Attainment</i>	What is the highest grade/year completed?	Less than 12 years Grade 12/High school graduate More than 12 years	<i>Binomial</i>
<i>Gender</i>	Self-Identified Gender	1 male 2 female	<i>Nominal</i>
<i>Household Income</i>	Annual household income from all sources	< \$10,000 < \$20,000 < \$25,000 < \$35,000 < \$50,000 < \$75,000 \$75,000 or more	<i>Ordinal</i>
<i>Race/Ethnicity</i>	Which one of these groups would you say best represents your race?	NH White NH Black Hispanic Other/Multiracial	<i>Nominal</i>

Analytic Approach

Frequencies were used to assess menu-labeling use prevalence by overall demographics. A Chi-square test was used to determine if menu-labeling use differed by weight status, the number of diseases and type of disease diagnosis. P-value < .05 was considered statistically significant. An Akaike's Information Criteria (AIC) statistic was used for model selection. The AIC provides an estimate of the amount of information lost by a given model. The multinomial model had an AIC of 5420.5, whereas the logistic regression had an AIC of 1916.7. Less

information is lost with logistic regression and thus it was selected as the analytic model.

Logistic regression examined the relationship between chronic disease diagnosis, obesity, and the use of menu-labeling among adults, adjusted by individual characteristics. Logistic regression was used to assess the association between menu-labeling usage and predictor variables. A sensitivity analysis was conducted by addressing the missing variable with multiple imputations and complete case analysis. Multiple imputations allow for the use of existing data to impute values approximating the real value while maintaining the ambiguity of the missing values (Patrician, 2002). While complete case analysis allows for analysis of respondent data with no missing data for the variables of interest. Lastly, two by two contingency tables were used to assess the relationship between the number of chronic disease diagnosis/weight status and the use of menu labeling where the group with no disease diagnosis or obesity was used as the comparison group.

All statistical analysis was conducted using R (R Core Team, 2017). The present analysis used BRFSS de-identified publicly available data that does not meet the definition of human subject research as defined by federal regulations, thus deemed exempt by the University of Georgia Institutional Review Board. BRFSS data uses a raking weighting methodology that includes design weights and raking to address assumptions (Weighting BRFSS Data, 2016). Assumptions include; each record has equal probabilities of being selected and noncoverage and nonresponse are equal among all segments of the population. Weighting of each record helps adjust for these assumptions.

Research Questions and Hypotheses

After an exhaustive literature review, there were no studies that investigated menu-labeling use and chronic disease and obesity. I hypothesized that individuals with a chronic disease or obesity would use menu-labeling more when eating FAFH than those without chronic disease or obesity. Based on the gaps in the literature, this study asks the following research questions:

1. Is the menu-labeling policy associated with increased use by those with a chronic disease diagnosis?

Ho1: There is no association between the menu-labeling policy and use by those with a chronic disease diagnosis.

Ha1: There is an association between the menu-labeling policy and use by those with a chronic disease diagnosis.

The dependent variable was menu-labeling usage which was recoded to yes or no. The independent variables were chronic disease diagnosis of either diabetes, heart attack, heart disease, and stroke. Covariates included gender, age, household income, education, and geographic location. Logistic regression and chi-square analysis were conducted. The null hypothesis was rejected if $p \leq .05$.

2. Is the menu-labeling policy associated with increased use by those with a BMI greater than 30?

Ho1: There is no association between the menu-labeling policy and use by those considered obese.

Ha1: There is an association between menu-labeling policy and use by those considered obese obesity.

The dependent variable was menu-labeling usage which was recoded to yes or no. The independent variable of obesity was created by calculating height and weight as previously described. Covariates included gender, age, household income, education, and geographic location. Logistic regression and chi-square analysis were conducted. The null hypothesis was rejected if $p \leq .05$.

Chapter Summary

The methodology of the study was described in this chapter. This is a quantitative cross-sectional study approach using secondary data from BRFSS. BRFSS 2016 data was used from Mississippi and West Virginia. Chi-square tests and logistic regression with and without multiple imputation were described as the analytic approaches used to evaluate the relationship between menu-labeling usage and chronic disease diagnosis and BMI.

CHAPTER 4 RESULTS

I examined the relationship between menu labeling use and chronic disease diagnosis (diabetes, heart disease, heart attack, and stroke) and obesity (BMI > 30) utilizing chi-square analysis and logistic regression models. The sample for this study was from Mississippi and West Virginia, states that participated in the BRFSS for 2016 and administered the menu-labeling module. This chapter presents descriptive statistics, and results based on the two study hypotheses. The research hypotheses that will be tested are ‘Is the menu-labeling policy associated with increased use by those with a chronic disease diagnosis?’ and ‘Is the menu-labeling policy associated with increased use by adults with obesity?’

Descriptive and Bivariate Analysis

Results based on BRFSS data show the prevalence of obesity in Mississippi and West Virginia is over thirty-five percent in the study population as documented in Table 2. The table also highlights that diabetes is the most prevalent chronic disease in both states, with over seventeen percent of the study population with a chronic disease. The sum of frequencies of each variable presented in tables 2 and 3 may not add up to the total number of complete observations due to missing data. Multiple imputations were used only in the regression models.

Table 2. Weight status and chronic disease prevalence by state, two-state BRFSS, 2016

	Mississippi N= 5,135	West Virginia N=7,151
BMI (%)		
Underweight	102 (1.5%)	86 (1.7%)
Normal weight	1726 (26.0%)	1234 (25.5%)
Overweight	2263 (34.1%)	1635 (33.9%)

Obese	2534 (38.2%)	1866 (38.6%)
Diabetes (%)	889 (17.4%)	1229 (17.3%)
Heart Attack (%)	350 (6.8%)	596 (8.3%)
Heart Disease (%)	387 (7.6%)	653 (9.2%)
Stroke (%)	329 (6.4%)	361 (5.0%)

Summary statistics by menu-labeling use are presented in Table 3. All variables are dichotomous categorical variables and presented in a frequency distribution table.

Table 3 Overall sample demographics by menu-labeling use status, two-state BRFSS sample, 2016

Variable	Total Number	Users	Non-Users
BMI			
Underweight	135	39 (28.89%)	96 (71.11%)
Normal Weight	2420	1157 (47.81%)	1263 (52.19%)
Overweight	3295	1588 (48.19%)	1707 (51.81%)
Obese	3757	1949 (51.88%)	1808 (48.12%)
Diabetes	1732	822 (47.46%)	810 (46.77%)
Heart Attack	716	311 (43.44%)	405 (56.56%)
Heart Disease	830	383 (46.14%)	447 (53.86%)
Stroke	515	252 (48.93%)	263 (51.07%)
Age			
18-34 years	1636	839 (51.28%)	797 (48.72%)
35 - 54 years	3071	1575 (51.29%)	1496 (48.71%)
55 and older	5477	2631 (48.04%)	2846 (51.96%)
Education			
Less than high school diploma	1078	465 (43.14%)	613 (56.86%)
High School diploma	3505	1471 (41.97%)	2034 (58.03%)

More than a high school diploma	5586	3103 (55.55%)	2483 (44.45%)
Gender			
Female	5952	3354 (56.35%)	2598 (43.65%)
Male	4232	1691 (39.96%)	2541 (60.04%)
Annual Household Income			
< \$34,999	3919	1778 (45.37%)	2141 (54.63%)
\$35,000 - \$49,999	1250	640 (51.20%)	610 (48.8%)
\$50,000 - \$74,999	1243	652 (52.45%)	591 (47.55%)
> \$75,000	1995	1180 (59.15%)	815 (40.85%)
Race			
Non-Hispanic White	8184	3992 (48.78%)	4192 (51.22%)
Non-Hispanic Black	1629	865 (53.10%)	764 (46.9%)
Hispanic	83	54 (65.06%)	29 (34.94%)
Others	212	104 (49.06%)	108 (50.94%)

Chi-Square Test

Chi-square tests were conducted to determine if menu-labeling use differed by BMI, number of diseases and disease diagnosis. Table 4, highlights all of the chi-square tests that were conducted as part of the analysis. In reviewing the chi-square of BMI categories those that are in the underweight category have a significantly smaller proportion of menu-labeling users than those in other BMI categories. The chi-square test on the number of chronic disease reveals that as the number of chronic disease increase so does the proportion of users of menu-labeling when eating FAFH. In reviewing the chi-square results among respondents that had not had heart attack there were significantly more menu-labeling users than those who had experienced a heart attack ($\chi^2(1, N= 4709, p = < 0.0008$).

Table 4. Chi-Square Tests

BMI Categories	User	Non-User	Chi-Square	P-Value
< 18.50	39 (28.89%)	96 (71.11%)	36.27 (df = 4)	< 0.0001
18.50 - 24.90	1157 (47.81%)	1263 (52.19%)		
24.91 - 29.90	1588 (48.19%)	1707 (51.81%)		
29.91 - 39.90	1591 (51.87%)	1476 (48.13%)		
> 39.90	358 (51.88%)	332 (48.12%)		
Number of Diseases (Includes Obesity as a Disease)	User	Non-User		P-Value
0	2441 (48.34%)	2609 (51.66%)	12.51 (df = 5)	0.0283
1	1724 (51.14%)	1647 (48.86%)		
2	639 (50.31%)	631 (49.69%)		
3	158 (45.66%)	188 (54.34%)	-	
4	74 (55.22%)	60 (44.78%)		
5	9 (69.23%)	4 (30.77%)		
Disease Diagnosis	User	Non-User		P-Value
Heart Attack				
Yes	311 (43.44%)	405 (56.56%)	11.21 (df = 1)	0.0008
No	4709 (50.00%)	4709 (50.00%)	-	
Heart Disease				
Yes	383 (46.14%)	447 (53.86%)	4.12 (df = 1)	0.0424
No	4617 (49.89%)	4638 (50.11%)	-	
Diabetes				
Yes	992 (55.05%)	810 (44.95%)	11.75 (df = 1)	0.0006
No	4076 (48.67%)	4298 (51.33%)	-	

Stroke				
Yes	252 (48.93%)	263 (51.07%)	0.06 (df = 1)	0.7988
No	4779 (49.61%)	4854 (50.39%)	-	

Regression Analysis

The results from logistic regression are presented in Table 7. The table shows results based on complete case analysis and analysis after multiple imputation. The complete case sample for this study is 7,813 whereas the multiple imputation sample includes 12,286 respondents from Mississippi and West Virginia who participated in the BRFSS in 2016. Similar to the results found in the chi-square tests, the results from the logistic regression show an association between the independent variable - menu-labeling use and the dependent variables of interest, chronic disease diagnosis, and BMI. In addition, both models highlight an association between demographics and socioeconomic variables of interests and the independent variables.

Among the chronic disease diagnoses under investigation only findings among those diagnosed with diabetes were significant. The adjusted complete case model and the multiple imputation model identified diabetes as significant however at different levels of significance. In the complete case model individuals had an estimated odds of 1.35 (95% CI: 1.17, 1.56) whereas in the multiple imputation model individuals had an estimated odds of 1.16 (95% CI: .98, 1.36) of using menu labeling compared to those without a diagnosis of diabetes.

BMI was found to be a significant predictor of menu-labeling use in both models however the level of the strength of the association is higher in the logistic regression model with multiple imputation. Among the demographic and socioeconomic variables, there were four significant findings. Based on the findings, females use menu labeling information significantly

more than males. The odds of a male using menu labeling information is less than females (AOR 0.51, 95% CI: 0.47, .56 Complete case, AOR .98 CI: .90, .0662 Multiple Imputation). Second, as a person's income increases, they also tend to use menu labeling more (AOR 1.50, 95% CI: 1.31, 1.71 Complete case, AOR 1.20, 95% CI: 1.07, 1.36 multiple imputation). Third, college graduates were found to use menu-labeling at greater rates than those without a high school diploma. Specifically, the estimated odds of someone with a college degree using menu labeling is estimated to be 1.32 (95% CI: 1.14, 1.53, complete case) or .99 (95% CI: .88, 1.10 multiple imputation) times that of those without a high school diploma or equivalent. Fourth, a person's race/ethnicity was also found to be a significant indicator of whether they use menu-labeling when eating away from home. Hispanics (AOR = 3.42; 95% CI: 2.39, 4.90) used menu-labeling more than non-Hispanic whites in the complete case logistic regression model whereas in the multiple imputation logistic regression model other races/ethnic groups (AOR = 1.92; CI: 1.48, 2.48) used menu-labeling more compared to non-Hispanic whites. In review of the results from the complete case and the multiple imputation logistic regressions the adjusted odds ratios and confidence intervals are significantly different for some variables. This sensitivity analysis implies that the observations are not missing completely at random and results from the complete case logistic regression are just as reliable as the multiple imputation logistic regression due to the large sample size.

Table 5. Logistic regression of menu label use by disease condition and weight status in the states of Mississippi and West Virginia, Complete Case and Multiple Imputations (BRFSS, 2016).

	<i>Complete Case</i>		<i>Multiple Imputations</i>	
	<i>AOR</i>	<i>95% CI</i>	<i>AOR</i>	<i>95% CI</i>
<i>State (WV Reference Group)</i>	0.96	(0.87, 1.07)	0.91	(0.80, 1.04)
<i>Gender (Female Reference Group)</i>	0.51	(0.47, 0.56)	0.98	(0.90, 1.06)

<i>Marital Status (Unmarried Reference)</i>	0.95	(0.86, 1.05)	0.57	(0.53, 0.61)
<i>Income \$35,000 - \$49,999 (< \$34,999 Reference Group)</i>	1.16	(1.01, 1.33)	0.98	(0.91, 1.07)
<i>Income \$50,000 - \$74,999</i>	1.33	(1.15, 1.54)	1.15	(1.03, 1.28)
<i>Income > \$75,000</i>	1.50	(1.31, 1.71)	1.20	(1.07, 1.36)
<i>High School Grad (Less than HS Reference Group)</i>	0.97	(0.83, 1.12)	1.42	(1.27, 1.59)
<i>College Grad</i>	1.32	(1.14, 1.53)	0.99	(0.88, 1.10)
<i>Stroke</i>	1.28	(1.01, 1.63)	1.25	(1.12, 1.40)
<i>Heart Attack</i>	1.02	(0.81, 1.28)	1.15	(0.97, 1.38)
<i>Heart Disease</i>	1.01	(0.82, 1.24)	0.91	(0.77, 1.08)
<i>Diabetes</i>	1.35	(1.17, 1.56)	1.16	(0.98, 1.36)
<i>BMI > 29.99 (Reference Group < 29.99)</i>	1.11	(1.011, 1.22)	1.27	(1.14, 1.42)
<i>Black (White Reference Group)</i>	1.19	(1.05, 1.34)	1.09	(1.00, 1.17)
<i>Latinx</i>	3.42	(2.39, 4.90)	1.10	(1.00, 1.21)
<i>Other Race</i>	1.50	(1.09, 2.07)	1.92	(1.48, 2.48)
<i>34 - 55 Age Group (18-34 Reference Group)</i>	0.95	(0.84, 1.07)	1.14	(0.90, 1.44)
<i>55+ Age Group</i>	0.85	(0.75, 0.97)	0.94	(0.86, 1.04)

Hypotheses Testing

Hypothesis A: The menu-labeling policy is associated with increased use by those with a chronic disease diagnosis. In an examination of the relationship between menu labeling use and chronic disease diagnosis indicated that individuals with diabetes had odds of using menu-labeling 1.35 (complete case) times that of those without diabetes (AOR & 95% CI = 1.17, 1.56). No significant difference was found in the odds of use or non-use of menu-labeling between those who had been diagnosed with heart disease, a heart attack, or a stroke and those who had not been diagnosed with one of these disease conditions.

Hypothesis B: The menu-labeling policy is associated with increased use by those with obesity. The results indicate that for an increase in weight status, the odds of using menu-

labeling also increases. The odds of using menu-labeling were 13% higher for individuals with obesity compared to individuals without obesity 1.13 (AOR & 95% CI = 1.01, 1.22). The null hypothesis is rejected indicating there is evidence indicating an association between an individuals' weight status as measured by BMI and menu-labeling use.

The results provided in Table 8 is a 2x2 contingency table. The findings identify a relationship between the number of chronic disease diagnoses and weight status on the use of menu-labeling. As the number of chronic diseases diagnoses and BMI increase the greater the odds of using menu-labeling when eating away from home. Persons with four chronic diseases are 1.31(95%, CI .93 – 1.86) times more likely to use menu-labeling compared to individuals with no disease or obesity. Those with diabetes, heart disease, have had a heart attack, had a stroke, and have obesity are 2.40 (95% CI 0.73 – 7.81) times more likely to use menu-labeling compared to those who do not have any chronic diseases or obesity.

Table 6. 2 x2 Contingency Table of Number of Chronic Disease Diagnoses and/or Obesity Status

Number of Diagnosed Diseases/Obesity (No Diseases or obesity is the Reference Group)	OR	95% CI
One Chronic Disease or Obesity	1.11	(1.02, 1.22)
Two Chronic Diseases and/or Obesity	1.08	(0.95, 1.22)
Three Chronic Diseases and/or Obesity	0.89	(0.72, 1.11)
Four Chronic Diseases and/or Obesity	1.31	(0.93, 1.86)
Five Chronic Diseases and Obesity	2.40	(0.73, 7.81)

Chapter Summary

The purpose of this study was to evaluate the use of menu-labeling by chronic disease diagnosis and obesity. The results of the logistic regression analysis demonstrate a strong association between diabetes diagnoses, obesity, and menu-labeling usage. A more in-depth interpretation of results is presented in the following chapter, including limitations and recommendations for future research.

CHAPTER 5 DISCUSSION

The purpose of this quantitative research study was to evaluate the use of the Federal menu-labeling policy by adults diagnosed with a chronic disease or having obesity among the adult population in Mississippi and West Virginia. The chronic disease and obesity epidemic have become a mainstay in American society. As a result, researching interventions to the problem are vital. Food policies are one type of intervention. Obesity has long been perceived to be the result of an individual's lack of self-control, while the deteriorating food environment that is saturated with energy-dense, high sodium, high sugar, and poor nutritional value foods is not held accountable. Obesity is a risk factor for chronic diseases such as diabetes, heart disease, heart attack, and stroke, as such, chronic disease and obesity should be investigated in tandem. The research presented herein is such an investigation.

Key Findings

The premise behind the federal menu-labeling policy is to inform consumers of the calorie and nutritional content of food when eating FAFH. The Federal government's investment in the food environment by requiring menu labeling provides an opportunity to evaluate the use of menu-labeling among the U.S. population. Understanding the role of choice architecture and nudging to improve health outcomes has the potential to assist in the development of future population-wide public health policies.

This study uses libertarian paternalism as the theoretical framework to evaluate use of menu-labeling by consumers when eating FAFH. This study was an evaluation of the usefulness of the U.S. Federal policy of menu-labeling in fast-food and chain restaurants based on chronic disease diagnosis and obesity. It was hypothesized that menu-labeling usage would be associated

with increased use by those with a chronic disease diagnosis. In addition, it was hypothesized that menu-labeling usage would be associated with increased use by those with a BMI greater than or equal to 30, which is considered obese. There were three significant findings related to the study hypotheses.

Diabetes and Menu-labeling Use

The first finding revealed that individuals with diagnosed diabetes were twice as likely to use menu-labeling than those without diagnosed diabetes and more likely to use menu-labeling than respondents with other chronic diseases. Menu-labeling use among this subset of the study population is attributed to the high emphasis on the diet-disease relationship. The findings further highlight that Mississippi and West Virginia are higher in diabetes than the national average of thirteen percent (CDC, National Diabetes Statistics Report, 2020). This insight emphasizes the important role of research that evaluates public health prevention strategies such as menu-labeling. In research evaluating the role of diabetes diagnosis, as an opportunity to educate patients on diet-disease relationship, found individuals diagnosed with diabetes or prediabetes were substantially more likely to use to nutritional fact labels when shopping in the grocery store after receiving education on the importance of nutritional facts label usage than those with undiagnosed diabetes/prediabetes (An, 2016). The study by An (2016) highlights the critical role healthcare provider interactions are to patient lifestyle changes. Additional researchers found when healthcare advice such as nutrition education is provided in emergency or outpatient settings by a healthcare provider, results in a significant increase in patients making lifestyle changes to improve their health (Brobeck, Bergh, Odenchrants, & Hildingh, 2015). Recognizing the essential role providers play in changing behavior provides an opportunity for the healthcare system to revise how they educate those recently diagnosed with a chronic disease of the diet-

disease relationship to improve health and decrease the incidence of diagnosis of multiple chronic diseases.

Chronic Disease and Menu-labeling Use

The second significant finding discovered that as the number of chronic disease diagnoses increased the use of menu-labeling increased as well. This could be the result of multiple encounters with the healthcare system and the emphasis on the diet-disease relationship as noted by Rooks, Kapral, & Mathis (2019). Additionally, multiple chronic disease diagnoses may spark a patient's interest in taking a more active role in managing their health. Research findings have concluded when menu-labeling information is used fewer calories are purchased (Roberto, et al, 2010). A systematic review of menu-labeling research found that consumers consumed, ordered, or selected significantly less energy-dense content foods when menu-labeling was present compared to consumers who were not provided menu-labeling (Littlewood, 2015). Hence use among consumers at risk of diet-related disease conditions benefit from encouragement by the food environment and healthcare providers.

Obesity and Menu-labeling Use

The third findings of this study reflected the existing literature on those with obesity and menu-labeling usage. For example, in an examination of characteristics that predict the likelihood of seeing menu-labels and using them that found certain groups such as those with obesity, higher income, and frequently eat away from home are more likely to use menu-labeling information (Breck et al., 2014). In the current study weight status was found to be a significant predictor of menu-labeling usage. This aligns with similar research that concluded as consumers are more likely to use menu-labeling in purchase decisions if they find the information relevant (Roseman et al., 2013). Such insights highlight the need to educate the population that menu-

labeling is not just relevant due to current health status but is beneficial for continued good health.

Analysis of demographic and socioeconomic data disclosed additional findings on menu-labeling usage. Findings identified subgroups of menu-labeling uses when eating FAFH based on age, education, gender, income, and race/ethnicity. This association has been seen in previous studies (Bleich & Pollack, 2010, Bowers & Suzuki, 2014 & Breck, Cantor, Martinez & Elbel, 2014). Disparate uses based on socio-demographics are important given the inequities experienced by some of these groups. A systematic review of fast food access identifies a pattern that shows low income and ethnically diverse neighborhoods have higher concentrations of fast-food restaurants compared to higher-income neighborhoods, creating an obesogenic food environment (Fleischhacker, Evenson, Rodriguez, & Ammerman, 2010). Similar to previous research (Harnack & et al., 2008) the present study found that more educated consumers and consumers with higher income were more likely to use menu-labeling information than their counterparts. Research has been mixed on the association between age and menu-labeling. One study found younger consumers, less than twenty-five years old, were more likely to use menu-labeling while an alternate study found consumers over forty-five more likely to use and another found there was no association between age and menu-labeling use (Harnack et al, 2008, Pulos & Leng, 2010 & Green et al., 2015). The current study found as a person ages, they are less likely to use menu-labeling to inform their consumption behavior.

Future research is needed to identify why some groups utilize menu-labeling information more than others furthering health inequalities. Interventions need to be designed to bridge the divide. Findings from this study suggest that menu-labeling can be an effective policy in altering

consumer purchase behavior when utilized, resulting in a significant population-level influence on consumption behavior.

Limitations

There is widespread interest in addressing the obesity epidemic and the chronic disease burden among the US population. This interest can be harnessed by supporting population-level policy interventions that improve the food environment such as menu-labeling. In an exploration of ways to address obesity and chronic disease, four limitations are presented based on findings from the current study.

Due to the self-report of height and weight, there is the potential of over and underestimation of BMI, resulting in misclassification (Gosse, 2014). This is the first limitation of the current study. This limitation is linked with to social desirability bias. This type of bias relates to the tendency to present information that is thought to be socially acceptable (Bergen & Labonte, 2019). Weight is a sensitive topic, as such respondents may respond in a way that makes them look good.

A second limitation of the study is the number of states administering the module makes generalizability to the entire US population not possible. This study examined data from Mississippi and West Virginia, two states that administered the menu-labeling module of the BRFSS. Access to national-level data on menu-labeling usage is limited. As a consequence, this study did not have access to data sets that represented the majority of states in the US.

Another limitation of this study is it did not investigate what foods were purchased as a result of using the menu-labeling information to identify a link with healthy eating practices which limits identifying how usage resulted in improved consumption behaviors. It is possible taste preferences drive consumption behavior in addition to the obesogenic food environment.

Menu labeling did not assist consumers in choosing a healthier option but just made them aware of the calorie information of their taste preference.

Lastly, an important limitation to highlight in this study is that it did not identify differences in total calories purchased by those who used menu-labeling and those that did not. This would have provided insight into differences in calories to identify the tangible usefulness of the menu-labeling information. When studies have conducted a calorie comparison, researchers have found consumers that utilize menu-labeling purchase fewer calories than those who did not (Vadiveloo et al., 2011).

As a profession public health has used policy in its effort to control and prevent disease however has only recently begun to incorporate policy change tools (Freiden, 2010). This study contributes to research on menu-labeling by being the first, based on current knowledge, to evaluate the use of menu-labeling among those diagnosed with a chronic disease or have obesity. Findings make the case for continued use of choice architecture and nudge strategies in policy development and implementation. Insights on how nutrition information is presented to individuals with diabetes who use menu-labeling more than those who do not have diabetes might provide insight on how to properly inform others of the diet-disease relationship in hopes of curbing the incidence of other chronic diseases and obesity.

Recommendations

There are numerous views on how to address obesity and chronic disease rates in the US. Traditional policies focused on individual effort have had little to no impact on population-level trends. This recognition has led state and local governments to use regulatory measures to address the chronic disease burden and obesity epidemic that plagues many areas of the US. As policymakers and stakeholders continue to explore ways to address obesity and chronic disease,

five recommendations are presented based on findings from the current study that can act as the foundation for future research on menu-labeling.

The first recommendation encourages policymakers and other stakeholders to review how agricultural policies such as the Farm Bill impact the food environment. Commodity pricing and subsidies to farmers impact what farmers grow and the price of those crops and consequently influence the purchase behavior of consumers. Federal policies need to be complimentary for significant gains to be made in combating chronic disease and obesity population-wide. Currently, agricultural policies favor unhealthy food environments and the overproduction of commodities that are the foundation of processed foods (Franck, Grandi & Eisenberg, 2013). USDA/HHS Dietary Guidelines for Americans stress the importance of consuming a diet high in fruits, vegetables, and whole grains while limiting saturated fats, sugars, salt, and refined grains while at the same time highly subsidizing commodities such as corn, soybeans, and sorghum the primary ingredients of processed foods. Forty-percent of the corn and half of the soybeans grown in the US are used to feed cattle and livestock, and the other half is converted into oils (Siegel et al., 2016). Another five percent of corn is converted into high fructose corn syrup. Consumption of high fructose corn syrup increased a thousand percent in the last thirty years and today accounts for forty percent of caloric sweeteners added to food and beverages (Franck, Grandi, & Eisenberg, 2016). As discussed, high consumption of sugar is a risk factor for type 2 diabetes creating domino effects for other chronic diseases and obesity. The engagement of multiple policy sectors, that influence the food environment, would benefit consumers when eating FAFH and create alignment across the government. Menu-labeling usefulness to the consumer is stifled when policies are not in alignment from farm to table.

Menu-labeling is a step in the right direction for improving the obesogenic food environment that plagues the US. Public health advocates and proponents of menu-labeling are doing the population a disservice if requiring calorie content, the guidance on 2000 calories a day, and ensuring nutrition information is available upon request is enough to improve the consumption behavior of consumers when eating FAFH. Knowing the calorie content of food upon looking at the menu is not enough. Consumers need to readily know what the sodium and sugar content of the food item is as well if they aim to maintain their blood sugar level, heart health and truly select the healthiest option based on their dietary needs.

A second recommendation is a complementary approach to the menu-labeling policy to include a traffic light labeling system. In this system, food items would be given a red, yellow, or green label, where red is high in sugar and/or sodium, yellow is moderate, and green is low in sodium and sugar. Traffic light labeling has been used with success in packaged food labeling and research on menu-labeling (Borgmeier & Westenhoefer, 2009 & Yepes, 2015). In an evaluation study using traffic light signals, menu items were categorized based on whether it was a positive food items (fruits and vegetables, whole grain and lean protein, low-fat dairy) or negative food item (saturated fat and high caloric content). Items were labeled based on USDA/My Pyramid recommendations. Food items with more positive attributes were designated green, equally positive and negative were designated yellow, and more negative food items were designated as red. Upon analysis, researchers found consumers will make healthier choices consistently over time after repeated exposure to traffic light labels (Thorndike, Riis, Sonnernberg, & Douglas, 2014). Menu labeling that only provides calorie information does not provide the consumer with the full extent of the nutritional quality of the food and how it relates to their individual dietary needs. As previously mentioned, sodium and sugar content in food

have a role in diabetes, heart disease, stroke, and weight status. Knowing the sodium and sugar content of food with the recommended daily allowance that is communicated on a menu, will improve the choice architecture by structuring the sometimes complex choices to allow the consumer to make the most informed choice for their health. Figure 4 illustrates how a restaurant menu could be modified to include calorie information along with traffic light labels to identify sodium and sugar content at or above the daily recommended levels. This modification of the current federal menu-labeling policy allows the consumers to identify whether the selected food item meets or exceeds the daily allowance of sodium and sugar. This choice architecture gives the consumer feedback on whether the food item aligns with their individual nutritional needs, nudging them in the direction of their best interest.







Sandwiches			
¼ lb Patty with Cheese	\$3.49	560 calories	
¾ lb Patty with Cheese	\$5.59	1070 calories	
Salads			
Hummus and Chicken	\$5.89	470 calories	
Chicken Caesar	\$5.89	710 calories	
Fries			
Small	\$1.59	310 calories	
Large	\$2.39	520 calories	

Figure 4 Traffic Light Menu Modification Example

In an expansion of his theory on nudging, Thaler & Shefrin (2001) suggest behavior is not the result of a lack of information but a lack of self-control. Suggesting adverse health

behaviors are most likely not the result of lack of information, such as menu-labeling, but self-control. It is reasonable to suggest that a person with obesity is aware of the health problems that could arise and want to lose weight; however, are unable. Thaler and Sunstein (2008) suggest in the choice environment a test of self-control arises when the choice a person makes is separated in time by the consequences of that choice and further complicated when one is uncertain how the choice will impact you in the long run. This highlights the importance of more than providing calorie and nutritional information but reviewing how menu-labels are organized and how the information is interpreted by the consumer. In a review of Figure 5, one can see that the calorie information is listed next to the food item; however, the context of what those calories mean in terms of sodium, sugar, and weight status is unknown. This design is acceptable by the federal menu-labeling policy. Additionally, the mathematical and nutritional calculations that must be employed can be a deterrent for consumers if they elect to purchase more than one menu item (Cohn, Larson, Araujo, Sawyer & Williams, 2012). For example, when a consumer reviews a menu board at a fast-food restaurant or a menu in a sit-down restaurant they would need request the nutrition information (which is allowable under the policy to gain insight on fat, sodium, and sugar) and conduct calculations to find out how many calories are in the total meal they are considering ordering. This additional step in the consumer's desire just to enjoy a meal away from home can be a deterrent to the utility of the menu-labeling policy.

Sandwiches or Wrap			
	1/4 lb Patty with Cheese	\$3.49	560 Cal.
	1/2 lb Patty with Cheese	\$4.29	820 Cal.
	3/4 lb Patty with Cheese	\$5.59	1070 Cal.
	1/2 lb Patty with Bacon	\$5.39	930 Cal.
	Mini-Bacon Cheeseburger	\$1.39	370 Cal.
	Chicken Wrap	\$1.69	260 Cal.
Salads			
	Hummus & Chicken Salad	Full Size \$5.89	470 Cal.
		1/2 Size \$3.89	240 Cal.
	Bacon & Chicken Salad	Full Size \$5.89	580 Cal.
		1/2 Size \$3.89	300 Cal.
	Chicken Caesar	Full Size \$5.89	710 Cal.
		1/2 Size \$3.89	400 Cal.
Chocolate Milkshakes			
	Small	\$0.99	350 Cal.
	Medium	\$2.19	470 Cal.
	Large	\$2.49	590 Cal.
Fries			
	Small	\$1.59	310 Cal.
	Medium	\$1.99	410 Cal.
	Large	\$2.39	520 Cal.
Chili			
	Small	\$0.99	160 Cal.
	Large	\$1.99	260 Cal.
Sides			
	Sour Cream & Chive Baked Potato	\$0.99	300 Cal.
	Bacon & Cheddar Baked Potato	\$2.49	470 Cal.
Or Pair Two			
	Choose any 1/2 Size salad and ADD 1 of these options		\$5.59
	Chicken Wrap	Small Milkshake	
	Mini-Bacon cheese burger	Small Chili	
	Small Fries	Sour Cream & Chive Baked Potato	
	2,000 calories a day is used for general nutrition advice, but calorie needs vary.		
	Additional nutrition information available upon request.		

Figure 5. Federal Menu-Labeling Policy Example. Image source – FDA Menu Labeling Supplement <https://www.fda.gov/files/food/published/Menu-Labeling-Supplemental-Guidance-for-Industry-PDF.pdf>



Barriers to usefulness influences whether the consumer will benefit from the information provided by menu labeling and nutritional information. As noted earlier good choice architecture relies on nudges that provide incentives, understanding mapping, defaults, gives feedback, has an expected error, and structures complex choices. Depending on the location of the FAFH the consumer will experience different elements of nudges. For example, Panera can offer an apple as the default option for a meal instead of chips while McDonalds could map combo meals from lowest to highest calories on the menu, enabling the consumer to internalize what the increase means to them.

Consumer utilization of menu-labeling information is multifaceted. This is not surprising due to the influences that prompt a person to eat FAFH are complex. The role of the food environment, sensory perceptions, monetary considerations, and health and nutritional beliefs must be considered in developing food policies and how those roles impact food consumption

behaviors. The USDA's 2014 Report on Menu Labeling which reviewed how consumers rank different characteristics of food when eating FAFH concluded that taste was most important followed by nutrition, convenience, and weight control. It further suggests menu-labeling assist those consumers who are weighing these options to meet their needs and wants. According to the USDA study, the average fast food and sit-down restaurant meals have between 728 – 1,437 calories (USDA Menu Labeling). The trade-offs consumers must make between electing the healthier option and the delayed benefit of not acquiring a chronic disease or obesity is hard. This is why it is important for calorie and nutritional information placed on menus to be easily understood and relatable to consumers. One way to accomplish this is to present calorie information along with exercise equivalents on menu labeling (Blumenthal & Volpp, 2010).

Menu-labeling with exercise equivalents acts as the third recommendation based on the study findings. It is believed such a presentation would allow the consumers to count the cost of the higher calorie items. In a study investigating whether physical activity based menu labels added to calorie information would influence consumer behavior compared to consumers presented with no nutritional information or menus with calorie information alone found consumers presented with calorie information and exercise equivalents selected the lowest calorie options (Dowray, Swartz, Braxton, & Viera, 2013). This aligns with libertarian paternalism that suggests consumers will be more apt to change consumption behavior when they understand the mapping of their decision to an outcome i.e. what I eat today will impact my weight status tomorrow. Contextual cues are important for decision making. Figure 6 is an example by the Royal Society of Public Health of how activity equivalent labels can be used to educate consumers of the exercise equivalent for their selected food item or items.

ENJOY THAT SNACK OR DRINK!
What it takes to burn it off*

	CALORIES APPROX.	WALK OFF CAL MEDIUM PACE / 3-5 MPH	RUN OFF CAL SLOW PACE / 5 MPH
 soft drink (16oz can)	138	26 min	13 min
 standard chocolate bar	229	42 min	22 min
 sandwich (chicken & bacon)	445	1 hr, 22 min	42 min
 large Pizza (1/4 pizza)	449	1 hr, 23 min	43 min
 medium mocha coffee	290	53 min	28 min
 small bag of chips	171	31 min	16 min
 roasted peanuts (50g)	296	54 min	28 min
 iced cinnamon roll	420	1 hr, 17 min	40 min
 bowl of cereal	172	31 min	16 min
 blueberry muffin	265	48 min	25 min

Source Royal Society for Public Health *Estimated for adult of average size, age

Figure 6. Exercise Equivalent by the Royal Society of Public Health.
Source www.rspj.org.uk

The fourth recommendation that has been found to compliment menu labeling and decrease calorie consumption of consumers is changing the default, as suggested as one of the principles of food choice architecture (Thaler & Sunstein, 2008). For example, at McDonald's

the default could be sliced apples (95 calories) and not small fries (365 calories) for the side item with a meal (USDA/ARS/ Food Data <https://fdc.nal.usda.gov/fdc-app.html#/>). The consumer would need to request fries for a substitution to be made. This default option would result in a 270-calorie decrease. Choice architecture and nudging on menu labels are important for consumers to use and for the public health benefits to be achieved. Continued research needs to be conducted on how consumers internalize the calorie and nutrition information presented for their benefit.

The fifth and last recommendation suggests the use of strategies employed to combat tobacco be employed to combat obesity (Engelhard, 2009). Such strategies have yielded significant decreases in tobacco use. Those strategies have included labeling, taxation, and limiting marketing. Menu-labeling has been addressed; however, the role taxation and limiting marketing can be employed to complement the menu-labeling policy. Value-added tax (VAT) has been employed by the United Kingdom (17.5%), France (19.6), and Canada (5%) on energy-dense foods such as sugar-sweetened beverages and snack foods (Engelhard, 2009). It is suggested if a conservative 10% tax was applied to processed foods, it would result in \$522 billion in revenue over ten years, rightly applied could offset the healthcare costs associated with the treatment of chronic disease and obesity (Engelhard, 2009).

For the policy recommendations suggested to be successful Hawkes et al. (2015) proposes four mechanisms that need to be leveraged. First an enabling food environment for healthy food preference learning needs to be provided. Food preferences are learned through exposure to eating patterns of parents, caregivers, peers, etc., foods that are available inside and outside of the home and from cultural and social norms around food. As these preferences are learned they can change with repetitive new information and marketing. Menu-labeling provides

insights to consumers that previously they were unaware of, enabling them to make decisions based on new information.

Secondly, barriers to the desire to eat healthily need to be overcome (Hawkes et al., 2015). These barriers are reinforced by the structure of food systems where some communities are overly saturated with unhealthy food options while others are not. Additional barriers include the availability, cost and information provided about nutritious foods. Barriers must be lifted for people to fulfil their desire to eat healthily.

The third mechanism to ensure the implementation of good food policies is encouraging people to reassess existing unhealthy preferences. It is well established that people who already have developed unhealthy food preferences struggle to make healthier options (Hawkes et al., 2015). These preferences, according to Thaler and Sunstein (2008), can be nudged in the way food environments present healthy and unhealthy food to encourage consumers to make choices that satisfy their long-term health goals rather than following their short-term gratification.

Lastly, food policies need to stimulate a positive food system response (Hawkes et al., 2015). Policies that affect consumer responses such as menu-labeling nudge the food system to review what information the consumer will have and how it will make them look. For example, if consumers are made aware that the average meal at their favorite restaurant is 2000 calories and based on the daily recommended calories a day for the average person is 2000 calories, the consumer will internalize that information and think ‘oh I cannot eat anything else for the rest of the day if I go to my favorite restaurant,’ and opt not to go to their favorite restaurant as often. The restaurant will recognize this, and instead of losing a customer will reformulate its menu to include healthier lower-calorie options. The food system will respond to consumer demand. Demand is created when consumers are made aware of the calorie and nutritional content of the

food selections available to them. Research on menu items additions since the passage of the ACA found that the average calorie content of added menu items has decreased in comparison to before the ACA (Bleich, et al., 2016). Continued expansion and implementation of the menu-labeling policy has the potential to continue to decrease the total number of calories offered to consumers when eating FAFH.

When employing choice architecture and nudge strategies three assumptions are made according to research. First, consumers who will select the option with the least amount of physical effort. Secondly, they will align their behavior to social norms and lastly, consumer's identity with peer groups that reinforce specific lifestyle behaviors (Mols, Haslam, Jetten & Steffens, 2015). Further research should investigate what formats of menu-labeling inspire consumers to value calorie and nutrition information and why. Knowing this will assist policymakers and public health advocates in their efforts to more than inform consumers of calorie and nutritional content information but to change consumer consumption behavior.

The increase in away from home food compared to at-home food as graphed in Figure 7 illustrate the impact of away from home food on the US food environment. The largest segments of away from home food are fast food and full-service restaurants (USDA/ERS, <https://www.ers.usda.gov/topics/food-markets-prices/food-service-industry/market-segments/>). Together, they account for seventy-three percent of away from home food sales. It is not surprising with this level of saturation of the food market, that FAFH has transformed the dietary patterns of US consumers. It has been established that foods purchased away from home are more energy-dense than foods eaten at home (Mancino et al., 2009). Research has shown, for example, that a cheeseburger meal, which includes a burger, french fries, and a soda can account for up to 65%-85% of a person's 2000 calorie/day diet (Urban, Roberts, Fierstein, Gary, &

Lichtenstein, 2014). Research has identified a trend in lower calories of newly introduced menu items in restaurants since the introduction of menu-labeling as part of the ACA (Bleich, et al., 2017). It is believed this trend is in response to menu-labeling and consumer demand for healthier options. The potential long-term effect could include decreasing population obesity and chronic disease. A decrease of just sixty calories a day could greatly impact the 220 excess calories a day adults consume when eating FAFH (Hall, et al., 2019). Menu-labeling has been the catalyst for consumers to demand healthier options when eating away from home and the food industry has responded. Findings suggest that food industry-regulated changes in calories content of foods eaten away from home may act as an added tool in improving consumption behavior more than menu-labeling alone. Research has further demonstrated time and time again that policy-based interventions that are population-wide are more effective than interventions aimed at individual behavior as seen in some of the top ten public health achievements of the 20th century, among them are seat belt laws, fluoridation of drinking water and safer and healthier foods (CDC, Ten Great Public Health Achievements -- United States, 1900-1999, 1999).

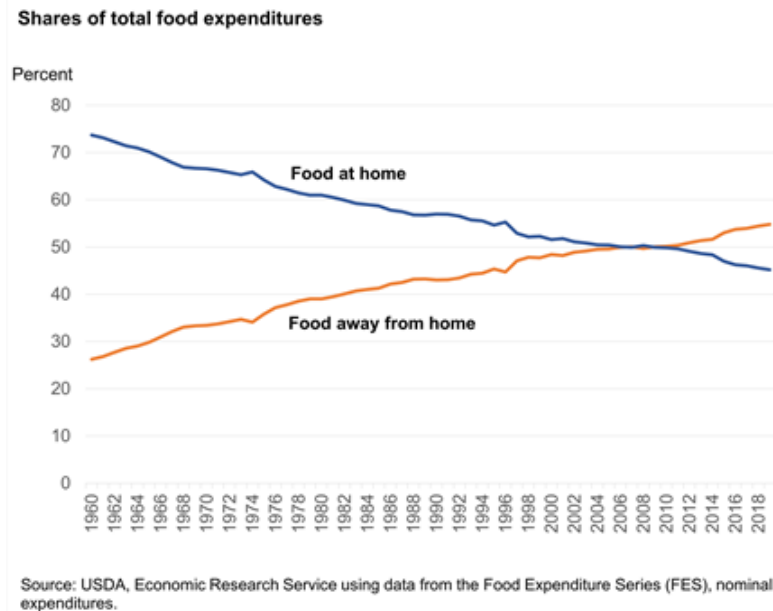


Figure 7. Share of Total Food Expenditure. Source USDA ERS
https://www.ers.usda.gov/webdocs/publications/90228/eib-196_ch3.pdf?v=8116.5

Public Health Implications

As menu-labeling becomes a mainstay in the food environment when eating FAFH exposure will increase the usefulness of the policy. The presence of menu-labeling enables consumers who want to consume healthier options the tools to do so. In formulating sound food policies to address obesity and chronic disease, policymakers and public health advocates must examine the health impacts, costs, and feasibility. In an investigation of drivers and moderators to the obesity epidemic found increased total energy intake that has been in response to obesogenic food environments as a driver and reduced physical activity a moderator (Swinburn, Sacks & Ravussin, 2009). The increase in obesity would have occurred in the absence of reduced physical activity in the U.S. population; however, the reduction of physical activity resulted in a steeper trajectory of weight gain. As a consequence, the US is experiencing continued growth in obesity and chronic disease.

This study highlights a number of public health implications. First, the incidence of obesity and chronic disease can be reduced through the identification and prevention of factors that contribute to the consumption of high-calorie foods when eating FAFH. Secondly, the study brings attention to how consumers internalize calorie and nutrition information in relation to their individual dietary needs. Lastly, identifying policy improvements that led to population level health improvement has implications for positively changing dietary behavior, obesity and chronic disease rates. It is important for future investigations of policy benefits, occur over time due to the progression of obesity and chronic disease, to detect health improvements.

Implications for menu-labeling use as a result of the federal policy instituted within the ACA were at the forefront of this study. The theoretical framework of libertarian paternalism has proven to be a great asset in the examination of public health policy. Future research on food policy intervention efforts would benefit from the findings presented herein on menu-labeling use. Findings could provide policymakers clarity on not just the use of menu-labeling and who uses them but how the framing of the information could be enhanced to increase menu-labeling utilization. Given that increasing menu-labeling use enables consumers to make an informed decision when eating FAFH, including the decision to eat healthier, can improve outcomes related to obesity and chronic disease long term public health implications are profound. Furthermore, this study provides the basis for continued use of population-level intervention efforts to ensure consumers are informed of the calorie and nutritional content of food when eating FAFH and the associated health risk.

Transitions in the Food Environment

The use of menu-labeling among those with a chronic disease or obesity provides insight on what improvements can be made to the food environment and how policies can be enacted for

population-wide impact. In the 2017/18 congressional session, the House of Representatives passed the Common Sense Nutrition Act. The Act allows retail food establishments such as pizza restaurants, where most orders are placed off-site to disclose nutritional content information on the internet only. It also eliminates criminal penalties and allows food establishments to take corrective action and preempts civil litigation for violations of the federal menu labeling law and any state laws that may exist (HR772 , 2017). The Act has moved on the Senate. While awaiting review by the Senate, a global pandemic has emerged that has altered how Americans eat FAFH. COVID-19, a highly contagious disease that caused the closure of in-service dining, has caused retail food establishments to transition to take out and delivery only. As a result, the FDA issued a temporary policy easing menu-labeling requirements due to rapid transition required for food establishments to remain operational and due to changes in the food supply chain that has resulted in changes in menu item content (Temporary Policy Regarding Nutrition Labeling of Standard Menu Items in Chain Restaurants and Similar Retail Food Establishments During the COVID-19 Public Health Emergency, 2020). The leniency provided to food establishments has benefited consumers in the interim by maintaining access to FAFH while simultaneously strengthening retail food establishments argument that nutrition and calorie information only needs to be provided in one location, preferably online and not in store. This relief, if prolonged, could diminish the steps made to improve the food environment.

Conclusion

This study identified differences in menu-labeling use among a subgroup with and without a chronic disease or obesity in Mississippi and West Virginia. The effect of the federal menu-labeling policy on helping consumers decide what to order when eating away from home is significant; however, use was higher for those with diabetes, multiple chronic diseases and obesity. Implementation of the policy has increased access to calorie and nutritional information for consumers; however, not all consumers are equally benefiting. The menu-labeling policy must continually evolve to expand reach to the entire population to remain effective in educating consumers of the calorie and nutritional content of food when eating FAFH. It is reasonable to assert that menu labeling alone will not reverse the obesity and chronic disease trend however in tandem with other population-wide public health interventions and policies will assist consumers in changing their consumption behaviors when eating FAFH.

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