THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF BIOBEHAVIORAL HEALTH

Sociocultural Factors and Regional Variations on Obesity among African Americans

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SPRING 2023

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Science
with honors in Biobehavioral Health

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ABSTRACT

Background: The history of food culture among African Americans spans different spaces from the cultural influences of African cuisine, to cooking survival practices during the time of enslavement, to the distinct styles, ingredients, and popular flavors of Soul food today. Food culture contributes to Black adult obesity prevalence. Understanding the role of cultural, environmental, and sociodemographic factors on obesity by the geographic residence of Black adults is important as obesity rises to epidemic levels in the U.S.

Objective: The objective of this study is to examine the roles of cultural, geographical, and social variables on current Black adult obesity prevalence in different geographic regions of the country.

Methods: A weighted sample from the 2020 Behavioral Risk Factor Surveillance System consisting of 401,958 Black respondents was employed to conduct an analysis. Descriptive and inferential statistics, including measures of central tendency and correlations, and multiple linear regression (MLR) were conducted.

Results: The findings revealed that 20% Black or Greater Southern states (β=-0.04), metropolitan status (β=0.03), Stroke Belt states (β=-0.02), and Census region ((β=-0.01) contributed significantly to the variance in BMI for Black adults. However, the MLR model with the greatest explanatory power included only Southern states with a 20% or greater proportion of residents that were Black in 2020. General health, sex, and diabetes were the variables most highly associated with BMI among Black adults. Geography variables provided minimal explanation for the variance in BMI.

Conclusions: The variables with the strongest associations with BMI in Black adults related more to sociocultural factors. Black women, when compared to Black men, were more likely to be obese, but their perception of body weight was correlated with self-reported comorbidities.

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ACKNOWLEDGEMENTS

I would like to thank Dr. Gary King for serving as my thesis supervisor throughout this process. He has been a continued supporter of my development for many years. I would also like to thank Dr. Lori Francis, my thesis advisor, who has supported my progress continuously throughout class and after. Additionally, I am thankful for the assistance from my honors advisor, Dr. Carolyn Jensen.

Chapter 1

Introduction

1.1. The History of Obesity

Though obesity has reached epidemic levels in the United States, it has not always been considered a disease, or even much of a health concern, until the modern era. The earliest concerns about the effect of body weight on health can be traced to Hippocrates who noted that poor diets and obesity led to illnesses, death, and infertility. The discussion regarding obesity continued throughout the 1500's and 1600's as early doctors recognized the associations between obesity, diet, and exercise (Haslam, 2007). The early parts of the 1920's marked the beginning of weight-loss drugs being marketed and prescribed to patients. Yet, it was not until 2013 when the American Medical Association (AMA) officially labeled obesity a disease that needed to be treated clinically (Brown, 2015; Rosen, 2014).

Exactly when the distinction was drawn between obesity as a sign of eating well and a pathological condition is unclear. Historically, socioeconomic status (SES) was attributed to weight. Those who were wealthy could afford more and higher caloric foods indicating their status and prosperity (Komaroff, 2016). Early humans were hunter-gatherers and foraged off the land to survive. However, when the world transitioned to be an agricultural society, food became readily available for consumption (Bellisari, 2008; Huebbe & Rimbach, 2020). Canned and dried foods allowed for the storage of perishable items throughout the winter months. Then, with the advent of commercial food preservation technology in the 19th century, such as refrigeration, food lasted longer. However, it also became more processed, and centered around meats, grains, and dairy (Bellisari, 2008; Huebbe & Rimbach, 2020). These changes in eating behaviors combined with the increase in sedentary lifestyles of modern-day Americans, led to the average weight of all Americans rising steadily (Bellisari, 2008; Centers for Disease Control and Prevention [CDC], 2006). Figures 1 and 2 illustrate this change by showing the dramatic increase in obesity prevalence from 2011 to 2021.

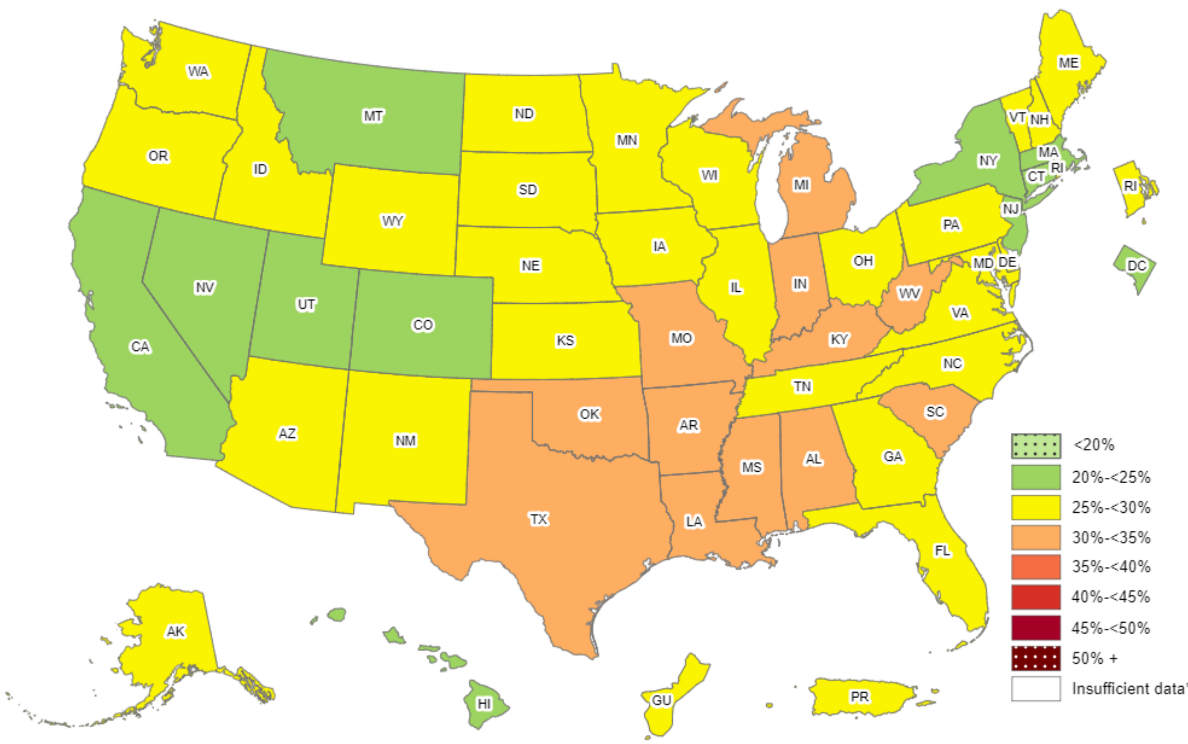

Figure 1. Prevalence of self-reported obesity in the U.S. in 2011 (Source: CDC, 2022f)

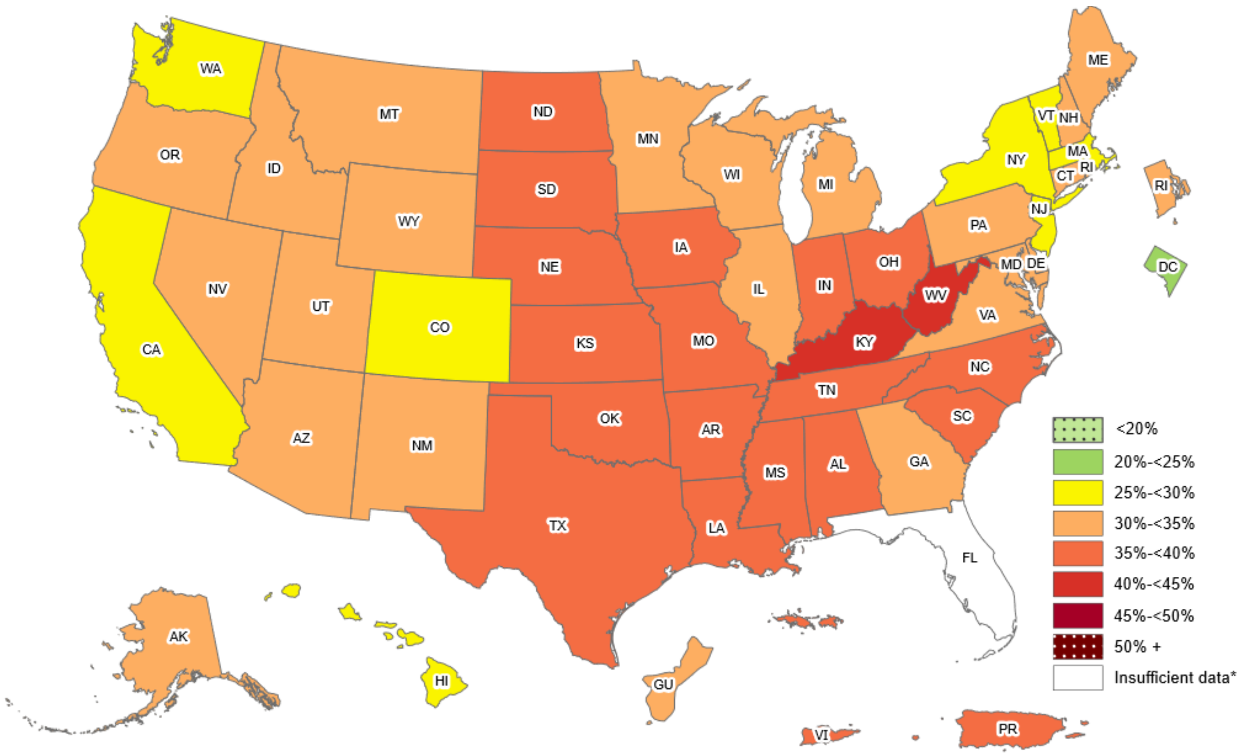

Figure 2. Prevalence of self-reported obesity in the U.S. in 2021 (Source: CDC, 2022f)

The dichotomy of food and eating behaviors among the rich and poor was especially pronounced during the time of enslavement in the United States. Food was a commodity: enslaved individuals were expected to produce and sell food for someone else while they endured on the scraps. It was, for Blacks at that time, about survival and subsistence, not indulgence. However, in the 20th century, a shift in eating behaviors and food perceptions occurred parallel to the shift in geography within the Black population. As more African Americans moved North during the Great Migration periods (1910-1930, 1940-1970), urban lifestyles became more common, with large urban areas such as New York City, Detroit, Baltimore, St. Louis, Los Angeles, and Chicago being likely destinations (Poe, 1999; Trotter, 2002). By the 1940's, African Americans had shifted from primarily residing in rural areas to living mostly in urban ones. The shift was representative of the rejection of "sharecropping and disenfranchisement" in the South for a booming industrial labor force in the North and West (Trotter, 2002).

With the massive influx of African Americans, racial tensions in the North grew. Race riots and discrimination separated Black residents from White communities. This led to the creation of Black churches, clubs, newspapers, businesses, and other institutions that established Black culture in the new environment (Trotter, 2002; Tolnay, 2003). The Great Migration led to the upward mobility of many Northern Black Americans as they made more money and were more likely to be employed than their compatriots in the South. With upward mobility came a transition in the availability and perceptions about food (Poe, 1999).

Despite the slow decline in the Great Migration during the 1960's and 1970's, the overall increase in the SES of African Americans was one of the lasting impacts of the demographic transition. By the 1980's, 4 million Southern-born Black Americans lived outside of the South indicating the culture, institutions, and practices of Black Americans were firmly established throughout the country (Tolnay, 2003). Though eating behaviors were adapted in the Northern environment, much of the cultural cuisine popularized in the South followed African Americans North. Meals consisting of fat pork, sap (made from molasses), corn bread, and vegetables, such as turnips or collards cooked in pork fat were integral to Southern Black diets while also influencing Northern Black cuisine (Dirks & Duran, 2001; Poe, 1999). These foods took on the name "Soul" food during the 1960's. Poet and activist Amiri Baraka published a work titled "Soul Food" connecting the term soul, commonly used to described African American culture at the time, with distinctly African American foods (Henderson, 2007; Peartree, 2023). The term proliferated throughout the rest of the century and beyond.

A major part of Black culture, both then and now, is food. A 2021 Netflix documentary entitled *High on the Hog* highlights the influences of enslaved people on not just common Soul dishes, but popular American cuisine. Macaroni and cheese, for example, was created by James Hemings, chef to the enslaver and U.S. President, Thomas Jefferson (*High on the Hog*, 2021, ep. 3, 35:31). “Quintessentially African” foods like okra, rice, and yams serve as the basis for popular Soul food dishes (*High on the Hog*, 2021, ep. 2, 40:34). And now hose same dishes, created during times of scarcity, are deeply woven into Southern Black diets today.

The flavors and ingredients of traditional African dishes in Southern-style cuisine are not lost on modern-day Black Americans. The continuation of Black foodways throughout generations leads to a clear distinction between the dietary patterns of Black Americans and other racial groups (Airhihenbuwa & Kumanyika, 1996). These foodways do not end at personal diet choices. Sharing food with guests and family is deeply rooted in Black culture and is expressed through church and community gatherings where food plays a central role. Some African Americans have expressed that soul and cultural foods are connected to memories and emotions. To them, diet culture and healthy eating risks losing their ties to the Black foods with which they are comfortable (James, 2004). Thus, food may also be a way of exerting agency through autonomy of food choices during times of segregation and discrimination. Unsurprisingly, with the flavors, ingredients, and cultural significance of food consumption behavior is strongly correlated to the high rates of obesity among Black Americans (Centers for Disease Control and Prevention [CDC], 2022a).

1.2. Obesity as an Epidemic

Obesity is defined by the Centers for Disease Control and Prevention (CDC) as having a body mass index (BMI) of greater than 30 (CDC, 2022d). Obesity prevalence for adults in the United States between 2017 and 2018 was 42.4%, and Black Americans had the highest rate of obesity (49.6%) among all racially or ethnically classified social groups (Hales et al., 2020; National Health and Nutrition Examination Survey [NHANES], 2021; CDC, 2022b). As the prevalence of obesity continues to rise in the U.S., concerns about chronic comorbidities such as type 2 diabetes and heart disease, affecting 60% of Americans, becomes an increasingly large problem (CDC, 2022b; CDC, 2022c). Obesity also has national economic consequences as it cost the U.S. $173 billion in 2019 in excess medical care spending (Ward et al., 2021). Addressing obesity and the factors that influence it is crucial to promoting better health and well-being.

The issue of obesity amongst many Black Americans seems to have roots much deeper than the usual risk factors, such as unhealthy foods, age, physical inactivity, or even SES. Black Americans throughout the United States experience higher rates of stress, food insecurity, and lower SES (Williams, 2018; Coleman-Jensen et al., 2022). These issues are not under the control of the individuals experiencing them; rather they are systemic and reflect long-term social inequities that affect health. There are also physical and social barriers that make living a healthy lifestyle a difficult task for many Black Americans, such as crime, accessibility of recreational facilities or supermarkets, and costs (Casagrande et al., 2009; Cooksey-Stowers et al., 2017; Jilcott-Pitts et al., 2013; Joseph et al., 2015; Stolzenberg et al., 2019). Cultural barriers exist as well that illuminate the differences in lifestyle, mindset, and beliefs that are highly influential on food behaviors and physical activity, which, in turn, influence obesity. These various factors could explain why, despite no biological differences existing between so-called races, African

Americans are more likely than any other group to be obese (Goodman, 2020; American Anthropological Association [AAA], 1998; CDC, 2022a). Thus, this study will investigate the factors that influence obesity among African Americans

1.3. Sociodemographic Factors

Among all Americans, characteristics, such as sex and age, contribute to differences in adult obesity prevalence. Generally, women are more likely to be obese. Among women, those who face food insecurity are also more likely to be obese, yet this difference is not seen amongst men (Koller et al., 2022). Age is another factor in obesity: adults aged 40 to 59 years old have the highest prevalence of adult obesity (Hales et al., 2020; CDC, 2022b). Education also plays a role. Studies have shown that both men and women with college degrees are less likely to be obese than those with a lower educational attainment. Education is also associated with employment and higher income. Consequently, employed individuals with higher incomes have a lower prevalence of obesity than do populations with higher rates of unemployment and lower income (Kim & von dem Knesebeck, 2018).

Additionally, financial security is important in determining related factors of obesity. Over a quarter (25.4%) of African American households receive Supplemental Nutrition Assistance Program (SNAP) benefits, which provides financial support to low-income families, adults over 60 years old, and people with disabilities for grocery items through a debit card (Center on Budget and Policy Priorities, 2022). Over 21% of Black households lived in poverty in 2021, and 48% lived in neighborhoods without chain supermarkets (U.S. Census Data, 2021; Powell et al., 2007). In a study of four southern U.S. states and Colorado, obesity was correlated with lower levels of income, higher levels of unemployment, greater receipt of SNAP benefits, and higher levels of poverty (Akhil & Ahmad, 2011).

Other findings suggest a significant relationship between family SES and obesity for all Black Americans regardless of their ethnicity. However, ethnicity is related to neighborhood characteristics: Caribbean Black American men have lower odds of obesity when they reside in neighborhoods with at least one supermarket but the odds of obesity for African American men does not change irrespective of the number of supermarkets in the neighborhood (Barrington et al., 2021). The role of biogeographic ancestry may offer another perspective to understand the effects of ethnicity on obesity, especially if some ancestries have a different experience with obesity than others. For example, researchers found that West African ancestry was positively correlated to BMI, especially among women, in the Boston area. However, European ancestry did not exhibit the same association with respect to BMI (Gooneskera et al., 2015).

The aforementioned studies suggest a generalized effect of sociodemographic factors on obesity prevalence among Black Americans. Yet, cultural heterogeneity or within group differences is another important factor to consider because these variables are not necessarily similar between different geographic regions of the U.S. As shown in Figure 3, different regions of the U.S. have different percentages of African American residents (Tamir et al., 2021). Additionally, the rates of poverty, unemployment, median income, and food prices also vary between regions (Kneebone, 2017; Robert, 2021). Moreover, in U.S. counties with higher rates of physical inactivity, unemployment, lack of education, and a greater proportion of Black residents, local obesity prevalence for all groups are elevated (Slack et al., 2014). Accordingly, examining the geographical differences in these factors will further explain the basis of greater obesity prevalence among Black Americans.

1.4. Environmental Factors and Geographic Differences

The U.S Census divides the country into four geographic regions: South, North, Midwest, and West. The four regions are further classified into nine divisions. The differences between those divisions and regions, including cultural, sociodemographic, and geographical factors, could uncover underlying influences on obesity, especially for Black Americans. For example, obesity prevalence changes based on region. The southern U.S. has the highest concentration of Black Americans as shown in Figure 3 and the highest obesity prevalence (Tamir et al., 2021; Jackson et al., 2005). Specifically, within the states with the highest rates, rural Black Americans saw the highest prevalence of obesity (Jackson et al., 2005). More recently, researchers have found greater rates of obesity in the South Central division of the Southern U.S. which includes the states of Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas (Gurka et al., 2018).

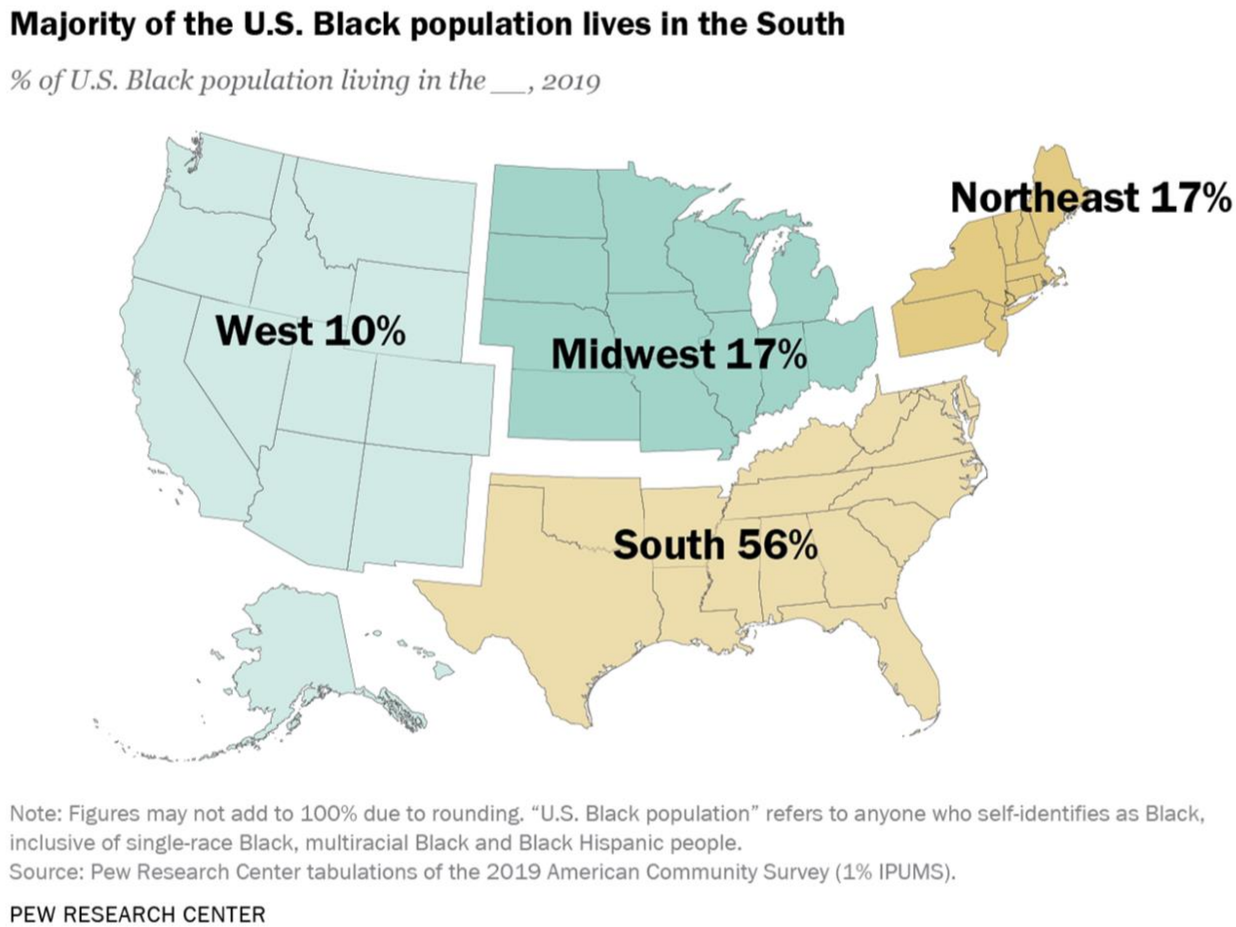

Figure 3. The geographic distribution of Black Americans (Source: Tamir et al., 2021)

Geographic variations in obesity prevalence offer additional insights into the role of environmental factors on the development of obesity. Food environment plays a significant role in determining the accessibility and affordability of nutritious foods and balanced meals. Areas that lack stores with healthy food options qualify as food deserts, while areas with a high density of stores with unhealthy food options are considered food swamps (Ver Ploeg et al., 2011). Residents of food deserts are more likely to be obese than those who do not live in food deserts (McCullough et al., 2022). However, food swamps are more likely to contain a higher proportion of minority residents. They are also a stronger predictor of obesity than food deserts (Cooksey-

Stowers et al., 2017). Bell, Kerr, & Young (2019) found that counties with greater racial disparities in SES were more likely to have higher rates of obesity, fewer grocery stores, and a higher concentration of unhealthy food options. These findings suggest that both the density and quality of food choices affect obesity. Moreover, food environment affects access to healthy, nutritious foods. One study found that counties with a small proportion of African American residents experienced lesser obesity prevalence (29.63%) than counties with a large proportion of African American residents (32.98%). The type and availability of food in these counties accounted for nearly 14% of the difference in obesity prevalence between low and high African American counties (Singleton et al., 2016). Thus, food access likely plays an important role in obesity prevalence.

Green space is defined as any open space partially or completely covered by trees and is another geographical factor that has been shown to affect rates of obesity (Environmental Protections Agency [EPA], 2022). Green space offers free and safe options for physical activity. Areas where there is a greater density of green space are negatively correlated with BMI by likely encouraging more movement and mobility (Ghimire et al., 2017). A different study utilized the natural amenities scale to measure the association between environment and BMI. The natural amenities scale was developed by the U.S. Department of Agriculture (USDA) to include topography, climate, and the total water area (U.S. Department of Agriculture [USDA], 2019). That study found that areas with a lower natural amenities scale score and fewer recreational facilities saw higher rates of obesity. Concurrently, areas with a larger proportion of Black residents were less likely to have recreational facilities and residents more likely to have obesity (Jilcott Pitts et al., 2013). Thus, African Americans are more likely to live in communities that lack facilities for physical activity thereby minimizing the opportunities to exercise.

Physical activity can also be influenced by crime. In an analysis of neighborhoods in New York City, the incidence of obesity amongst Black residents rose as violent crime rates increased (Stolzenberg et al., 2019). These results corroborate a previous study completed in Chicago that also found violent crime was associated with higher rates of obesity. However, nonviolent crimes also have an association. One study found that repeated exposure to nonviolent crimes was positively correlated with obesity (Tung et al., 2018). Thus, crime can create unsafe environments that reduce mobility, thereby hindering physical activity. These environments also discourage businesses from operating there which decreases the opportunity for work, lowers the SES, and makes affording healthy food, healthcare, and recreational facilities difficult. Within urban environments, supermarkets are less likely to operate in areas with high rates of crime. Furthermore, the density of fast-food restaurants was positively associated with violent crime (Singleton et al., 2022). Therefore, crime can directly affect residents' access to nutritious foods.

1.5. Culture

Culture is the symbols that represent the "beliefs, art forms, and ceremonies, as well as… language, gossip, stories, and rituals of daily life" (Swidler, 1986). These "beliefs, institutions, customs, [and] habits… [are] built up by humans and passed on from generation to generation." The intergenerational transmission of culture makes it a learned behavior that is given meaning by the "sphere" in which it exists in (Sewell, 2004). Hence, Black culture includes the beliefs, customs, language and more that is shared between generations of Black Americans and is assigned meaning within the Black community. In the context of obesity, culture illustrates the potential barriers and influences unique to Black Americans that affect behavior, mentality, and beliefs that are related to obesity.

Black women's perceptions of food, physical activity, weight, and general health are notably different than other racially or ethnically classified social groups. Perceptions of weight by Black women do not necessarily align with the White view or popular culture. In a qualitative study, some obese and overweight Black women expressed feeling "just [the] right" size in the social networks. They described themselves as "curvy, slim sexy, and perfect" and that media promotes "an unrealistic or undesirable BMI." Another participant stated that within the Black community, "having a little meat on your bones" is a positive attribute. Others noted family as another strong influence on weight perception (Spinner, 2022). The acceptance and even celebration of larger body types within Black social networks could be due to the popularization and glorification of those body types among celebrities. An example of this phenomenon could be considered the 'Lizzo Effect.' Lizzo, a celebrated singer and musician, who is known for her attention-grabbing and revealing outfits, is lauded for her body confidence and beauty. She encourages self-love at all sizes and normalizes her body type. However, she neglects to advertise the negative health effects of excessive weight and severe obesity. As she may receive stellar health care, other young and impressionable girls may learn to normalize obesity in their own lives without understanding the long-term health consequences. This type of influence can perpetuate the concerning levels of obesity among Black women.

Food itself is an important part of Black culture. In the same qualitative study, Black women shared about learning how to make Soul and Caribbean food at young ages and felt the influence of those traditions in their eating behaviors as an adult. Some noted that food was a quintessential part of Black gatherings and there was an expectation for food to be eaten if offered (Spinner, 2022). Cultural diets and foods may be amplified by the clustering of individuals of certain ethnicities in the same neighborhoods or communities throughout the nation. Figure 4 illustrates this clustering by highlighting counties where minorities make up a greater proportion of the county population than the national average.

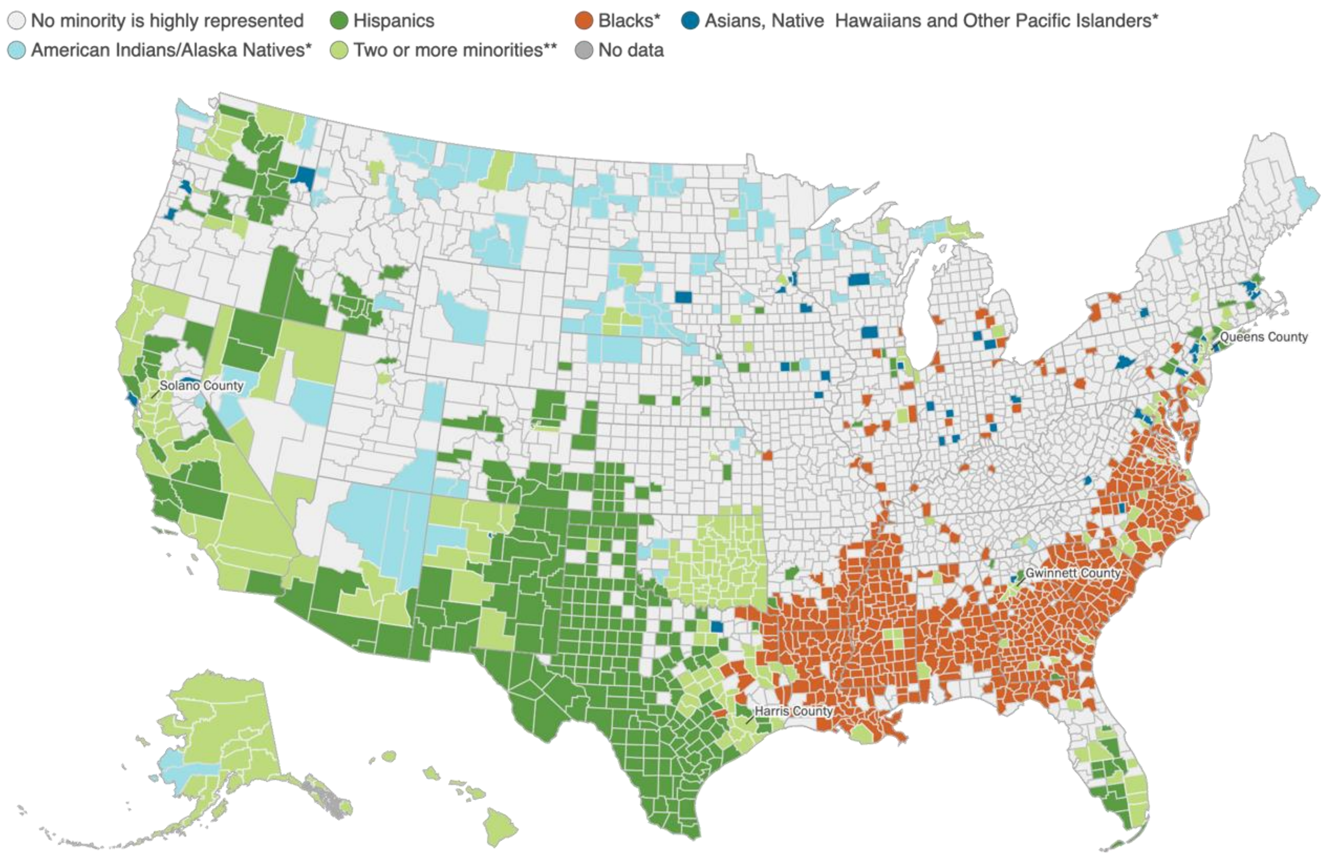

Figure 4. Counties where minorities are highly represented (Source: Frey, 2019)

While Black culture influences eating patterns and perceptions of weight, it also includes some customs and practices that discourage physical activity. A systematic review found that African American women tended to report lack of motivation, hair care, and a preference for a curvaceous body as reasons not to participate in physical activity (Joseph et al., 2015; Johnson &

Niles, 2005). Hair maintenance is an issue most apparent in Black culture that could become a barrier to physical activity. African American women in another study reported washing their hair once every one or two weeks, which deterred them from physical activity because of sweating (Hall et al., 2013). The issue of hair is a unique barrier for Black women as they find their self-worth and self-identity in their hair and spend more time taking care of and thinking about their hair than do women of other races (Mbilishaka, 2018).

The interplay of culture in the decision-making, perceptions, and behaviors of Black individuals suggests that there exist unique Black experiences that are related to obesity. Thus, the learned behavior of the multidimensional aspects of Black culture dismantles the notion that simply sociodemographic and geographical factors can explain the higher prevalence of obesity in the Black community.

1.6. Biological Factors

Obesity is not only related to geographical factors; potential genetic links to common obesity (obesity not caused by pathologic conditions) have been found in multiple gene loci that are associated with obesity across multiple studies (El-Sayed Moustafa & Froguel, 2013). The heritability of body weight is also supported by twin studies that show similar weight patterns regardless of shared environments. The physiological mechanism of energy balance, which is tied to weight gain or loss, is also known. The hypothalamus regulates hunger and satiety in partnership with hormones, such as leptin, ghrelin, and insulin (Bell et al., 2005). Exercise can contribute to these metabolic processes and increase their efficiency, thereby supporting weight loss. Studies that combined a decrease in energy intake (i.e. change in diet) with an increase in physical activity showed evidence of steeper declines in weight than studies that did not prescribe a decrease in energy intake (Jakicic & Davis, 2011). Diet content also plays a role in weight with one study showing that individuals with hyperinsulinemia and hyperglycemia had greater average urinary norepinephrine excretions which were positively correlated with BMI (Troisi et al., 1991).

It is important to note that while this thesis recognizes the biological mechanism of weight gain and obesity development, it also acknowledges that race is not itself biological. There are no inherent or genetic differences between groups identified by modifiable racial categories (Goodman, 2020; AAA, 1998). There may, however, be biological links and associations between obesity and other conditions that are expressed differently between so-called races. For example, one study found that breast cancer was positively associated with obesity for all women in the study, but the association was only significant for African American women. Moreover, the association was most significant among postmenopausal African American women (Sarkissyan & Vadgama, 2011). Insulin resistant syndrome (or metabolic syndrome) is another condition related to excess adiposity and type II diabetes. It is also believed to be the heritable component of obesity. For example, parents with diabetes were more likely to have children with excess body fat (Crossrow & Falkner, 2004). Another study offered more evidence for the genetic component of insulin resistant syndrome through the difference in glucose tolerance between groups classified as racial. Researchers suggested that an evolutionary pathway could explain the racial and ethnic variance in insulin resistant syndrome (Dickinson et al., 2002).

1.7. Research Question and Hypothesis

This thesis aims to explore the associations among sociodemographic and geographical factors on Black adult obesity prevalence. As the aforementioned literature has suggested, there is evidence of a relationship between sociodemographic and geographical factors and obesity. However, only a small number of these studies have focused on the role of Black culture, especially its differences in the various regions of the U.S. Therefore, the purpose of this study is to expand on the current body of knowledge that describes the factors that influence obesity among Black Americans. Specifically, this paper will examine the regional differences in the influence of sociocultural and geographical factors on obesity. I hypothesize that there will be a strong positive relationship between obesity and Black Americans of lower socioeconomic status, less education, and living in rural areas. Moreover, the relationship between obesity and Black Americans will be strongest in the Southern United States.

Chapter 2

Methods

2.1. Behavioral Risk Factor Surveillance System Sampling

To understand the influence of geography on sociocultural and geographical factors that affect obesity prevalence in Black Americans, the Behavioral Risk Factor Surveillance System (BRFSS) will be used to conduct a cross-sectional analysis. BRFSS is a telephone survey conducted in all 50 states annually. Data in this thesis was obtained from the 2020 version of the BRFSS dataset. The sample size consisted of 401,958 Black respondents from a nationally representative sample. Statistical weights were provided by the BRFSS dataset and were applied to better reflect the national percent distribution of Black Americans.

The sample was recruited using telephone numbers categorized into high-density and medium-density strata. Then, probability sampling was employed to have a random sample with equal representation from the two strata. A service that provided a random sample of cellular telephone numbers was used for cellular contacts. States individually conducted telephone-based interviews daily during each calendar month. Participants were considered eligible if they were 18 or older and non-institutionalized. Of the households contacted, one adult respondent was randomly selected.

2.2. Sample

There was a total of 401,958 Black Americans included in the 2020 BRFSS sample. Respondents from Guam and the Virgin Islands were excluded in this analysis and descriptive statistics. The proportion of the weighted sample in each region of the U.S. aligned with the known proportion of Black Americans by region in 2019 (Tamir et al., 2021). The sample was also cross-referenced with the known percentage of overweight and obese Black Americans (75.7%) (Office of Minority Health, 2023).

2.3. Dependent Variable

The dependent variable is obesity, which was a calculated variable in the BRFSS dataset. Interviewers asked respondents to self-report their height and weight from which BMI was calculated. The primary variable of interest in this thesis was a continuous BMI variable. Other BMI variables reported four computed BMI categories (underweight, normal, overweight, obese). A binary variable indicating if a subject was overweight/obese or not.

2.4. Sociodemographic Covariates

The sociocultural covariates in this model included home ownership as own or rent home. Other demographic variables were included, such as age, sex, and number of adults in the household. These variables were included to provide more insight into the lifestyle factors that could affect eating and exercising behaviors or patterns, as well as access to food, recreational resources, and health care. These lifestyle factors could affect diet, exercise, and health, which all impact obesity as noted earlier in this thesis.

All demographic and socioeconomic variables were self-reported. Other socioeconomic and demographic variables (e.g. income, employment, education, and marital status) were considered but excluded from the final model after assessing the strength of their association using bivariate correlation analysis and stepwise regression. A sociodemographic characteristic used as an alternative to SES was home ownership, a categorical variable with the options of own, rent, or other arrangement. Sex was reported as the biologically assigned sex. Age was a continuous variable ranging from 18 to 80+ years. The variable number of adults living in the household was classified as the number of individuals living in the residence, including the respondent, that were over the age of 18. This was also reported continuously; however, an ordinal variable was created and employed in analysis. Education was reported as low, medium, high, and very high indicating less than high school, high school graduate, some college, and greater than a bachelor's degree, respectively.

2.5. Geographical Covariates

The primary geographical covariates are the region and states variables. Regions were given by the U.S. Census Bureau as North, South, West, and Midwest. Divisions within those regions were New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific. Two other geographical variables were created from the state variable including the Stroke Belt States and Greater than 20% Black States. The Stroke Belt States included Alabama, Arkansas, Indiana, Kentucky, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. Those 11 states were established as part of the Stroke Belt in the 1980's by the American Heart Association because they all had an age-adjusted stroke mortality rate that was more than 10% greater than the national average (Howard & Howard, 2020). The Greater than 20% Black States included Mississippi, Alabama, Louisiana, Georgia, Maryland, and South Carolina. These states were selected as having a Black population that exceeded more than 20% Black within the BRFSS sample for that state.

Other geographical covariates that were considered include metropolitan status and urban/rural status. Both variables were based on the county of residence for the participants. Respondents either live in metropolitan or non-metropolitan counties. Urban/rural status was based on the county of residence as well. Respondents were coded into living in an urban county or a rural county.

Four different geographic variables were included in four multiple linear regression models. Model 1 was 20% or greater Black Southern states; Model 2, metropolitan counties; Model 3 included Stroke Belt states; and Model 4 included all Census-defined regions. Each variable offered a different perspective on the cultural and physical environment that could influence obesity prevalence. Creating four separate models was essential to understand how the sociodemographic and health covariates differed between geographic regions and if rurality or the percent African American affected results.

2.6. Health Covariates

Various health variables were included in the model to understand the health of obese individuals to ensure they were not extraneous variables affecting the data unknowingly. The final model health covariates included general health, diabetes, exercise, and hours of sleep. Other variables that were considered but excluded were length since last check-up, number of health professionals, heart attack, cardiovascular disease, and kidney disease.

General Health status was self-reported by respondents as their interpretation of their health overall. Exercise was self-reported as a "yes" or "no" response indicating whether the respondents participated in exercise within the past 30 days. Sleep was reported as a continuous number of nightly hours from 1-24. Diabetes was self-reported and recoded to only include those who did not have diabetes, had diabetes, or were pre-diabetic.

Length since last check-up was self-reported as having a check-up within the last 12 months, two years, five years, or more than five years. Respondents were asked "About how long has it been since you last visited a doctor for a routine checkup?" Routine checkup was defined as a visit for a "general physical exam, [or any exam not for] a specific injury, illness, or condition." Heart attack, cardiovascular disease, and kidney disease were also self-reported by asking respondents if they had ever been diagnosed with any of those conditions.

2.7. Statistical Analysis

Chi-square and Pearson product moment were conducted to calculate the strength and direction of the relationships between variables. Additionally, the analysis of variance, or ANOVA, was used to assess the differences in BMI values related to demographics. Multiple linear regression analysis was used to investigate the role of specific variables in the model and the coefficient of determination was used to compare each model. To build a parsimonious model, stepwise regression was utilized. Four models were constructed using four different geographic variables and collinearity diagnostics were run on each model.

Chapter 3

Results

3.1. Descriptive Statistics

Table 1 presents the descriptive statistics for the sample of Black respondents. Most respondents were women (58.8%). Additionally, 20.0% all Black respondents were in the 55 to 64 years age category.

With respect to income, 21.0% of survey participants had an annual household income greater than $75,000, however 19.7% earned an income less than $20,000 annually. Half of respondents were employed (50.7%) and about an equal proportion owned (45.5%) or rented (46.3%) their homes. About a third of respondents (33.8%) had earned a bachelor's degree or higher.

Most Black respondents were not married (65.5%). A small proportion of respondents labeled their health as poor (4.1%), and most rated their health as good (35.0%). Of all Black respondents, 17.4% reported being diagnosed with diabetes and 2.8% stated they were pre-diabetic. Over a quarter (28.8%) of survey participants reported not exercising at least once in the last 30 days.

Table 1. Descriptive statistics

	N	%		N	%
Age[a]			**Employment**		
18-24 y	29653	7.4%	Employed	203738	50.7%
25-34 y	57825	14.4%	Unemployed	188415	46.9%
35-44 y	67955	16.9%	**Marital Status**		
45-54 y	73222	18.2%	Married	134852	33.5%
55-64 y	80433	20.0%	Not married	263377	65.5%

65+ y	92871	23.1%	**Regions**		
Sex			South	235407	58.6%
Male	165500	41.2%	Midwest	68999	17.2%
Female	236458	58.8%	West	39085	9.7%
Income			North	58438	14.5%
< $20,000	79066	19.7%	**General Health**		
$20,000 to $35,000	68810	17.1%	Poor	16490	4.1%
$35,000 to $50,000	44060	11.0%	Fair	60247	15.0%
$50,000 to $75,000	46635	11.6%	Good	140610	35.0%
> $75,000	84381	21.0%	Very Good	112187	27.9%
Own or Rent Home			Excellent	71103	17.7%
Own	182856	45.5%	**Diabetes**		
Rent	185936	46.3%	Not diabetic	320102	79.6%
Education			Pre-diabetic	11109	2.8%
Low	34096	8.5%	Diabetic	70007	17.4%
Medium	112353	28.0%	**Exercise**		
High	117870	29.3%	Yes	285532	71.0%
Very high	135771	33.8%	No	115788	28.8%

[a]Imputed age in six categories

3.2. Correlations

Table 2 shows the Pearson product moment correlation matrix and the correlation coefficients of BMI and the various health covariates that were considered in developing a parsimonious multivariate model. The strongest correlation with BMI was self-reported general health (r=-0.21, p-value=<0.001). Thus, general health was included in the final multiple linear regression (MLR) models.

Health behaviors, such as exercise, number of hours of sleep, and length of time since last check-up showed variable strengths of association with BMI. However, these associations were stronger than the associations for the health outcome variables. For example, the strongest health risk behavior association was between exercise and BMI (r=0.12, p-value=<0.001). Length of time since last check-up was not strongly correlated with BMI (r=-0.06, p-value=<0.001) and neither was the number of hours of sleep per night (r=-0.05, p-value=<0.001). Length of time since last check-up was excluded from the MLR models because it was not highly correlated with BMI, but sleep remained, despite its low correlation, because its conceptual importance was substantial.

The health outcome variables were diabetes, cardiovascular disease (CVD), and kidney disease. Diabetes showed the strongest association with BMI out of the health outcome variables. Diabetes showed the strongest association with BMI among the health outcome variables (r=0.16, p-value=<0.001). CVD and kidney disease both showed similarly weak associations (r_{CVD}=-0.02, p-value=<0.001; r_{KD}=-0.02, p-value=<0.001). The health outcome variables showed stronger associations with general health ($r_{Diabetes}$=-0.30, p-value=<0.001; r_{CVD}=-.157, p-value=<0.001; r_{KD}=0.187, p-value=<0.001). Because of the weak associations with BMI, CVD and kidney disease were excluded from the MLR models.

Table 2. Correlations between BMI and health covariates

		BMI	Gen Health	Diabetes	CVD	Kidney Disease	Exercise	Sleep	Last Check-Up
BMI	R	1							
	Sig. (2-tailed)								
Gen Health[a]	R	-.209**							
	Sig. (2-tailed)	<.001							
Diabetes	R	.164**	-.298**						
	Sig. (2-tailed)	<.001	<.001						
CVD[b]	R	-.024**	.157**	-.144**					
	Sig. (2-tailed)	<.001	<.001	<.001					
Kidney Disease	R	-.023**	.187**	-.179**	.094**				
	Sig. (2-tailed)	<.001	<.001	<.001	<.001				
Exercise	R	.115**	-.229**	.117**	-.086**	-.083**			
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001			
Sleep[c]	R	-.051**	.070**	.027**	-.019**	.015**	.005**		
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	.001		
Last Check-Up[d]	R	-.061**	.065**	-.133**	.053**	.049**	.004**	-.051**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	.010	<.001	

[a]General health
[b]Cardiovascular disease
[c]Hours of sleep
[d]Length since last check-up
*R is the Pearson correlation statistic
***Statistically significant at α=0.05

Table 3 shows the Pearson product moment correlation matrix and correlation coefficients for the sociodemographic covariates that were considered for the MLR models. The strongest association with BMI was sex (r=0.14, p-value=<0.001). Marital status, education, employment, and income were excluded from the final MLR models due in part to their stronger correlations with each other (multicollinearity) and because they had nominal effects on the results. Moreover, income and education were included in initial models, but were removed after stepwise regression. Own or rent home was included despite its small association with BMI because it was correlated to income (r=-0.33) and education (r=-0.21) and increased the coefficient of determination in the MLR models.

Table 3. Correlations between BMI and sociodemographic covariates

		BMI	Sex	Age	Income	Own or Rent	Educ.	Employment	Marital Status
BMI	R	1							
	Sig. (2-tailed)								
Sex	R	.140**							
	Sig. (2-tailed)	<.001							
Age	R	.017**	.009**						
	Sig. (2-tailed)	<.001	<.001						
Income	R	-.020**	-.063**	-.060**					
	Sig. (2-tailed)	<.001	<.001	<.001					
Own or Rent	R	-.011**	-.006**	-.324**	-.331**				
	Sig. (2-tailed)	<.001	<.001	<.001	<.001				
Educ.[a]	R	-.043**	.053**	-.100**	.481**	-.211**			
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001			
Employment	R	-.030**	.032**	.357**	-.413**	.048**	-.241**		

	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001		
Marital Status	R	-.006**	.099**	-.158**	-.324**	.336**	-.167**	.080**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001	

[a]Education
*R is the Pearson correlation statistic
***Statistically significant α=0.05

3.3. Multiple Linear Regression

Based on the bivariate correlations, the health covariates selected for the MLR model were general health, diabetes, exercise, and sleep. The socioeconomic variable selected was own or rent home. Other demographic variables included sex, age, and number of adults in the household.

Four MLR models were constructed to understand the role of geographic region and cultural environment on obesity prevalence among Black adults. The r^2 results of each model are displayed in Table 4 and organized from the model with the greatest explanatory power to the least. Model 1 used 20% or greater Black Southern states as the geographic variable. Model 2 used Metropolitan status. Model 3 used Stroke Belt states and Model 4 used the U.S. Census regions.

Model 1 had the largest r^2 (9.6%). Model 2 had a slightly greater r^2 (9.3%) than Model 3 (9.2%) and Model 4 (9.2%). All four models are shown to be statistically significant by the large F-statistic (F_1=1934.9; F_2=3219.0; F_3=3209.4; F_4=3193.1) and p-value less than 0.001 in Table 5.

Table 4. Coefficient of determination for multiple linear regression models

Model	R	R^2	Std. Error of the Estimate
1[a]	.310[a]	.096	6.71552
2[b]	.304[a]	.093	6.91858
3[c]	.304[a]	.092	6.91953

4[d]	.303[a]	.092	6.92115

a. Geographic variable: 20% or Greater Black Southern States
b. Geographic variable: Metropolitan Status
c. Geographic variable: Stroke Belt States
d. Geographic variable: Region

Table 5. F-statistic for multiple linear regression models

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	785333.117	9	87259.235	1934.874	<.001[b]
	Residual	7361231.000	163227	45.098		
	Total	8146564.117	163236			
2	Regression	1386732.864	9	154081.429	3218.968	<.001[b]
	Residual	13593296.088	283982	47.867		
	Total	14980028.952	283991			
3	Regression	1382979.885	9	153664.432	3209.370	<.001[b]
	Residual	13597049.067	283982	47.880		
	Total	14980028.952	283991			
4	Regression	1376630.802	9	152958.978	3193.145	<.001[b]
	Residual	13603398.150	283982	47.902		
	Total	14980028.952	283991			

As Table 6 indicates, the variables with the largest statistically significant standardized beta coefficients in Model 1, examining Black population density in Southern states, were general health (β=-0.17, p-value=<0.001), diabetes (β=0.14, p-value=<0.001), and sex (β=-0.14, p-value=<0.001). The beta coefficients for general health increased slightly in Models 2, examining metropolitan status; 3, examining states within the Stroke Belt area; and 4, examining states by their Census region (β_2=-0.18, β_3=-0.18, β_4=-0.18); however, the beta coefficient for diabetes decreased (β_2=0.13, p-value=<0.001; β_3=0.13, p-value=<0.001; β_4=0.13, p-value=<0.001). The standardized beta coefficient for sex was similar across the other three models (β_2=0.14, p-value=<0.001; β_3=0.14, p-value=<0.001; β_4=0.14, p-value=<0.001).

The geographic variables and number of adults in the household had the lowest beta coefficients across all models except for Model 1. The standardized beta coefficients for age (β_1=-0.06, p-value=<0.001) and number of adults in the household (β_1=0.02; p-value=<0.001) were larger in Model 1 than in the other models (β_{2age}=-0.04, p-value=<0.001; β_{3age}=-0.04, p-value=<0.001; β_{4age}=-0.04, p-value=<0.001; $\beta_{2adults}$=0.01, p-value=<0.001; $\beta_{3adults}$=0.01, p-value=<0.001; $\beta_{4adults}$=0.01, p-value=<0.001). The beta coefficient for the self-reported average number of hours of nightly sleep in Model 1 (β_1=-0.03, p-value=<0.001) was less than the coefficients in other models (β_2=-0.05, p-value=<0.001; β_3=-0.04, p-value=<0.001; β_4=-0.04, p-value=<0.001).

Table 6. Multiple linear regression models

		Standardized Coefficients	
Model		Beta	Sig.
1	(Constant)		<.001
	20% Black or Greater Southern States	-.040	<.001
	Sex	.136	<.001
	Age	-.056	<.001
	Own or Rent Home	-.043	<.001
	Number of Adults	.015	<.001
	General Health	-.174	<.001
	Diabetes	.139	<.001
	Exercise	.070	<.001
	Hours of Sleep	-.029	<.001
2	(Constant)		<.001
	Metropolitan Status	.029	<.001
	Sex	.138	<.001
	Age	-.043	<.001
	Own or Rent Home	-.041	<.001
	Number of Adults	.007	<.001
	General Health	-.176	<.001
	Diabetes	.127	<.001
	Exercise	.062	<.001
	Hours of Sleep	-.045	<.001

3	(Constant)		<.001
	Stroke Belt States	-.024	<.001
	Sex	.138	<.001
	Age	-.043	<.001
	Own or Rent Home	-.040	<.001
	Number of Adults	.007	<.001
	General Health	-.176	<.001
	Diabetes	.127	<.001
	Exercise	.062	<.001
	Hours of Sleep	-.044	<.001
4	(Constant)		<.001
	Regions	-.012	<.001
	Sex	.138	<.001
	Age	-.043	<.001
	Own or Rent Home	-.041	<.001
	Number of Adults	.007	<.001
	General Health	-.177	<.001
	Diabetes	.127	<.001
	Exercise	.062	<.001
	Hours of Sleep	-.044	<.001

*Dependent variable: BMI

Chapter 4

Discussion

4.1. Main Findings

Model 1 had the largest r^2 (9.6%) and consisted of the geographic variable 20% or greater Black Southern states. Model 2 used metropolitan status as the geographic variable and the r^2 was slightly less than that of Model 1 (9.3%). Models 3 and 4 included the Stroke Belt states and the states by region variables, respectively, and the r^2 coefficients were the same (9.2%). The variables that explained most of the variance in BMI in all four models were general health (β_1=-0.17; β_2=-0.18; β_3=-0.18; β_4=-0.18) followed by sex (β_1=0.14; β_2=0.14; β_3=0.14; β_4=0.14) and diabetes (β_1=0.14; β_2=0.13; β_3=0.13; β_4=0.13).

The variables with the least explanatory power varied across models. The geographic variables in Models 3 and 4 had nominal explanatory power (β_3=-0.02; β_4=-0.01). Sleep and exercise (β_{Sleep}=0.06; $\beta_{Exercise}$=-0.03; $\beta_{Exercise}$=-0.05; $\beta_{Exercise}$=-0.04) did not explain as much of the variance in BMI as would be predicted based on evidence suggesting they both play vital roles in metabolic processes that influence obesity (Beccuti & Pannain, 2011; Church, 2011). Age and own or rent home, the socioeconomic status indicator, accounted for a similar amount of explanation for the variance in BMI (β_{Age}=-0.04; β_{OR}=-0.04).

The results of the present analysis suggest that geography plays an important role in obesity prevalence, which aligns with previous studies that the food environment explained some of the variance in BMI (Singleton et al., 2016; McCollough et al., 2022). While food environment was not directly measured in this analysis, it does vary based on geographic residence and could contribute to the explanatory power of the geographic variables in the models of this thesis study. Furthermore, Model 2 highlights that rurality interacts with BMI as well and is similar to the findings in other studies that demonstrated living in rural areas increased the likelihood of obesity among Black Americans (McCullough et al., 2022; Jackson et al., 2005). However, this study was dissimilar to other research that found that obesity prevalence was associated with income, unemployment, and physical inactivity. While some studies found that areas with greater amounts of unemployment and lower income were more likely to have a greater prevalence of obesity, those variables were both excluded from the final models because of their minimal contributions to the coefficient of determination (Slack et al., 2014; Martin et al., 2008).

Although the results of the present research deviated from some previous studies, many of the findings corroborated other empirical investigations. For example, BMI was most explained by isolating Southern states. This could be because these states have some of the highest average temperatures: five out of six of the Southern states with greater than 20% Black residents are within the top 10 hottest states ("Statewide Average Weather for all 50 States," n.d.). Greater average temperatures are generally indicative of high temperatures throughout the summer, which would make physical activity less inviting or more difficult (von Hippel & Benson, 2014).

Beyond physical activity, food access can also affect obesity. There are many rural counties in these Southern states, and rurality decreases food accessibility and can contribute to county-level obesity prevalence (Jackson et al., 2005). Counties with a higher density of fast-food restaurants can also contribute to the problem of obesity (Singleton et al., 2016). This trend persists even after a transition to urban areas: food shopping at low-cost locations increases the likelihood of obesity (Ghosh-Dastidar et al., 2014).

Our findings also indicate that several health covariates interacted strongly with BMI variance. General health had the strongest association with BMI and had a larger beta coefficient than health risk behaviors such as sleep or exercise. This implies that the perception of health and weight influences obesity prevalence among Black adults more than how much they sleep or participate in physical activity.

Diabetes was more strongly correlated to general health than to BMI for Black adults. Initially, because of the strong association between diabetes and general health, diabetes was removed from the model. However, the explanatory power of the model decreased after the removal of diabetes suggesting that the interaction between health perception and diabetes was what influenced the variance in BMI. In the Black community, this could be explained by the perception of weight and beauty standards. Being obese may often be conflated with being "big boned" or "curvaceous" (Harris et al., 1991). Thus, Black adults may be more likely to rate their health more favorably when they are obese but and have diabetes because the perception of weight in their network differs from the popular cultural understanding of weight and standard of beauty (Smalley et al., 2017).

The other health outcome variables, CVD and kidney disease, were not strongly correlated to BMI and were removed from the MLR models because they decreased the explanatory power of the model. This was likely because of their strong associations with general health. Medically, CVD and kidney disease are very tangible signs of poor health. They are treated clinically and known as a health condition. Additionally, obesity is a risk factor for both CVD and kidney disease (CDC, 2022e; Kovedsky et al., 2017). However, obesity is not discussed as a health concern socially, despite the AMA labeling it as such in 2013 (Brown, 2015; Rosen, 2014). Nevertheless, Black adults could be more likely to report their health as being poorer when they have a comorbidity in addition to obesity than when they are obese with no other conditions.

Interestingly, our regression models explained more of the variance in BMI for Black women than for Black men. The r^2, or explanatory power, of the model decreased to 6.3% when limiting the Census regions variable to Black men, whereas the explanatory power of the model increased to 8.3% for Black women. While BMI is explained to a larger degree by our model for Black females, and Black women are more likely than Black men to be obese, there may be other unmeasured variables that can better explain the variance in BMI for Black men (Robinson et al., 2009). This could be because Black women experience cultural barriers that Black men do not. For instance, hair maintenance is frequently cited by Black women as a barrier to physical activity (Hall et al., 2013). Additionally, women discussed feeling a sense of comfort in traditional Soul foods and may feel discouraged from eating more healthy meals (James, 2004).

Furthermore, romantic validation and partnership could influence how Black women perceive their weight and their desire to lose it. One study found that White individuals in relationships tended to be thinner than those who were not; and dating status was inversely correlated to BMI. Yet, for African Americans in the study, this finding was not validated. Those in relationships were heavier than those not in relationships. Additionally, Black males reported finding heavier women more attractive, than White males did (Harris et al., 1991). Another more recent study found that ethnicity was the main point of association between BMI and perceived attractiveness. African American women were more likely to rate their attractiveness higher at larger BMI values when compared to White women (Chithambo & Huey, 2013). These findings suggest that culturally, heavier weights are less stigmatized or viewed negatively. This cultural significance of weight and appearance can make Black women feel more empowered and accepted in their networks at heavier sizes, which would encourage them to remain at a higher, and potentially unhealthy, body weights.

Considering the various social influences on weight and weight perception in the Black community, a potential theory through which to interpret this data could be the Health Lifestyles Theory (Cockerham, 2022). This theory posits that there are certain health behaviors that influence health, or in this case, obesity. Those health behaviors are learned through and determined by social class and social networks. The theory also has four main tenets, which include race/ethnicity, social class, collectivities (which is akin to the definition of culture used in this thesis) and living conditions. The theory puts forward that life choices and life chances interact to determine how individuals behave. Life choices can refer to the exercise and sleep variables whereas life chances can include sex, own or renting a home, age, and geographic residence. Those life choices, or health behaviors, such as cooking or eating practices, and physical activity, affect health. Though behavior is highly influential on health, it does not act alone: life chances, such as geographic region, interact with life choices to shape health outcomes (Cockerham, 2022). As the aim of this thesis was to investigate the associations among sociocultural and geographic factors on obesity prevalence among Black adults based on geographic location, the Health Lifestyles Theory can serve as a valuable conceptual framework.

4.2. Biological Factors

There are also biological factors specific to the female sex that could influence obesity, especially among Black women. For example, Black women in the 45 to 54 years age category in the BRFSS sample had the greatest average BMI of all age groups. This could be explained by menopause, which marks the final menstrual cycle that a female experiences and begins the slow decline in the amount of estrogen and progesterone that a female produces (Office on Women's Health, 2021). Typical age of onset of menopause is in the mid- to late 40's, and menopause has been associated with midlife weight gain in females (Office on Women's Health, 2021; Al-Safi & Polotsky, 2015). Other theories regarding midlife weight gain have attributed lower energy expenditure during this age range, but menopausal women had a larger decrease in energy expenditure than premenopausal women. Further, the loss of energy expenditure could be explained by the loss of the luteal phase in the menstrual cycle which accounts for some of a female's energy expenditure each month (Al-Safi & Polotsky, 2015). Generally, women hold more body fat than men, but blanket measurements like BMI cannot differentiate between weight due to fat and weight to due to muscle (Blaak, 2001). Thus, BMI may appear higher for females without indicating poorer health.

There may be genetic phenotypes that predispose, by way of ancestry, not race, African Americans to obesity development. For example, researchers found that African American women had a greater increase in their peripheral insulin concentration than European American women after being given the same oral glucose dose. Moreover, the fat gain experienced by African American women was greater than that of the European American women; and the fat gain was highly associated with insulin sensitivity. The authors concluded that obesity predisposition was the combination of insulin sensitivity and acute insulin response to glucose, both of which were seen more frequently and to a greater extent among African American women when compared to European women (Gower & Fowler, 2020). Another study found four potential gene loci that were associated with BMI among African Americans, but not European Americans thereby supporting a potentially heritable link to obesity for Blacks (Ng et al., 2012).

Genetic predispositions may explain the larger prevalence of obesity among Black adults than any other group. However, despite the high prevalence, African Americans are less likely to experience negative health effects at an overweight and obese BMI level. That would suggest BMI may not be the most accurate measurement of health. What might be normal, or even healthy, for Blacks, may differ from the healthy BMI range for another racially or ethnically classified social group.

No consensus on the accuracy of BMI has been made yet, but evidence would suggest that BMI is not accurate for all groups, especially for African Americans. One study found that the obesity BMI cutoff at 30 was applicable for every racially classified group and sex except for African American women. Rather, the appropriate BMI value to be classified as obese, according to this study, was 33, or three points higher than the standard. Moreover, the optimal waist circumference for African American women was nearly nine centimeters higher than the published standard (Katzmarzyk et al., 2011). This would suggest that many African American females are misclassified as obese when a more accurate measurement would be greater than the current standard cutoff.

BMI also cannot account for the difference in fat versus muscle mass. In a study of African American men and Asian Indian men, African American men had, on average, higher BMI values than the Asian Indian men. Yet, African Americans had, on average, lower body fat composition (26.7%) and greater muscle volume (35.05 L) than the fat composition (33%) and muscle volume (28 L) of the Asian Indian participants (Banerji et al., 1999). Blacks are also less likely to have adverse comorbidities at higher BMI values than Whites suggesting that BMI is not the most valid or accurate indicator of health or wellness among Black Americans (Katzmarzyk et al., 2011). Additionally, the BMI for American football players and Olympic athletes would indicate that they were obese, when in fact, they are both healthy and lean (Prentice & Jebb, 2001). Thus, BMI is clearly not an accurate indicator of health for all and using it as a measure of the general health of the Black American population could be misleading.

4.3. Limitations

The BRFSS is a nationally representative sample of the U.S. population, which suggests that these results are indicative of the experiences of Black Americans nationwide. However, it is important to note that because the sample size is quite large, statistical significance is easily attained in most of the analyses. As such, the statistically significant findings may not necessarily indicate clinically or practically significant results. Additional limitations of this thesis include the usage of categorical variables rather than continuous ones. As a result, there was limited control over the variables when conducting statistical analyses. Data are based on responses to a telephone survey, which means the responses, especially concerning weight and income, may not be the most accurate. Volunteer fatigue may affect answers, as well, with the average length of interview lasting for 17 minutes with a maximum of nearly 30 minutes when including additional state-requested questions. Interviewers were asked to follow scripts and could give limited follow-up to questions, so volunteers may not have understood every question, and performance or interviewer bias may have occurred (Pannucci & Wilkins, 2010).

Another important consideration is that BRFSS data is collected throughout the year. The dataset utilized in this thesis was from 2020: the year the COVID-19 pandemic began. As such, data on income level, employment status, and health care coverage received at the beginning of the year may not reflect one's status at the end. The COVID-19 pandemic had a very strong negative impact on the Black community: Black Americans were more likely to contract the COVID-19 virus during the first wave of the pandemic and faced a higher mortality rate than other groups (Cyrus et al., 2020). Black households were more likely to report food insecurity, joblessness, housing insecurity, and taking out loans to afford expenses in January of 2021 (Monte & Perez-Lopez, 2021). The clear social impact of the pandemic on the Black community shows the potential for long-term effects on their health. Thus, future work should consider the changes in BMI post-pandemic and the social factors that are at work.

While BRFSS was a useful data source, it did not provide much information on food security. Future work should combine the BRFSS data with other sources, such as the U.S. Department of Agriculture (USDA) Food Research Atlas or the National Health and Nutrition Examination Survey (NHANES) which do offer food security variables. The USDA Food Research Atlas provides county-level data for each state and includes food and vehicle access. Future work could utilize the USDA Food Research Atlas in conjunction with the BRFSS to investigate more closely the relationship between food accessibility and obesity. Moreover, a county-level perspective would offer a deeper understanding into "pockets" or high-density regions of Black Americans within each state, which could help explain the elevated prevalence of obesity in certain states.

An additional limitation is that the BRFSS uses self-reported height and weight to calculate BMI. A study analyzing the accuracy of the self-report BMI data from NHANES compared to measured BMI found that 43% of self-reported underweight participants were actually normal and 16% of self-reported overweight individuals were normal weight. However, self-reported data is still useful because half of all the individuals whose BMI category was misclassified when using self-reported data were within one unit of their measured BMI category and 81.6% were within two units. Moreover, all extremely obese individuals had a correctly classified self-reported BMI and only 19% were misclassified as overweight. However, of those 19% self-reported BMI values, all were within one unit of their measured BMI values (Stommel & Schoenborn, 2009). Thus, while the self-reported data may have some inaccuracies that limit its applicability to the general population, it is still useful information.

Finally, this study was cross-sectional and limited in its ability to infer any causation. Our analysis was limited to exploring the associations among variables. As such, no conclusions on the causal nature of these variables on BMI can be made using the results of this study.

4.4. Conclusions

In conclusion, geographic residence plays some role in obesity prevalence among Black Americans. However, the variance in BMI among Black adults is more strongly explained by the perceptions of weight, sex, and comorbidities. While BMI is significantly associated with these health covariates, the large sample size likely contributed to the statistical significance thereby limiting the clinical or practical usage of these results. The models in this thesis only explained about 10% of the variance in BMI, and key food environment variables were not included in the dataset. Despite these limitations, the findings of this thesis suggest that Black adult obesity is not localized in any one area of the United States indicating a large and pressing obesity crisis in the Black community. Though the influence of culture is directly immeasurable, the influence of weight perception suggests that Black culture and foodways do affect obesity prevalence. Ultimately, more research into the geographic variations in the influence of food environment on

Black adult obesity is necessary to better understand strategies and interventions to lower the obesity prevalence for Black adults, especially women.

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ACADEMIC VITA

Alexandria Koehl

Education

BS, Science & Honors in Biobehavioral Health
Penn State University – Expected Graduation: May 2023
Integrated Undergraduate Graduate Degree Program | Schreyer Honors College
MPH, Public Health
Penn State College of Medicine – Expected Graduation: 2024
Community & Behavioral Health Track

Awards & Distinctions

Dean's List *(7 semesters)*
Eberly College of Science Black History Month Honoree *(2023)*
Provost Award *(2019)*

Skills & Interests

Skills include communication and teamwork, vitals measurements, Microsoft Office, SPSS, SAS, & Google products.

Interests include Mountain biking, gravel cycling, & songwriting.

Certificates & Programs

Presidential Leadership Academy *(2020)*
Pennsylvania Area Health Education Center Rural Health Scholar *(2022)*

Research

Undergraduate Research Assistant – College of Health and Human Development – 2021 to 2023

- Visualized and analyzed data for a COVID-19 research project presented to the PA Department of Health
- Advanced my statistical analysis skills during collaboration with the Black Researchers Consortium.
- Acknowledged for work on the *More Rivers to Cross* reports and the College of Health and Human Development's statement on racism as a public health crisis.

Experience & Service

Undergraduate Teaching Assistant – College of Science – 2020 to 2023

- Taught students of various levels during lab and office hours and established relationships
- Authored course materials & assisted the review of the new edition of the lab manual
- Collaborated with co-TAs and lab coordinators to facilitate weekly labs, grade assignments, and create activities

Clinic Intern – University Health Services – 2022

- 80+ hours of direct patient contact by measuring vitals and establishing rapport with patients.
- Assisted providers with procedures, such as suture removals, cryotherapy, and incision & drainage.
- Shadowed internal medicine physicians, as well as x-ray and ultrasound technicians.

Prep Team – College of Science – 2022 to 2023

- Collaborated with a team to organize lab materials for 100 thru 400-level anatomy & physiology lab courses.
- Facilitated the care of frogs and survival surgery rats, and prepared animal organ dissections.
- Undertook weekly maintenance of the cadaver lab, including intimate work the care of the cadaver bodies.

LION Mobile Clinic Volunteer – 2022 to present

- Assisted with the distribution of consent forms and initiated the vaccination process for all patients
- Collaborated with medical students and doctors to provide information regarding vaccines to patients