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Socioeconomic Differences In Body Mass Index, Neighborhood Satisfaction, Stress, And Perceived Racism Among African Americans In Metropolitan Detroit

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SOCIOECONOMIC DIFFERENCES IN BODY MASS INDEX, NEIGHBORHOOD SATISFACTION, STRESS, AND PERCEIVED RACISM AMONG AFRICAN AMERICANS IN METROPOLITAN DETROIT

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CHAPTER 1

INTRODUCTION

In 2004, Detroit made headlines when it was named the "Fattest City in America" by *Men's Fitness Magazine* (Associated Press 2004). Using criteria such as fast food restaurants per capita, number of health clubs, availability of health care, and other measures, Detroit gained a reputation as a place where it was difficult to maintain a healthy lifestyle. In 2012, *Men's Fitness Magazine* ranked Detroit the second fattest city in America, meaning that the region still has not shaken it's "fat" reputation (Millado 2012). In general, Metro Detroit is regarded as a region with high rates of physical inactivity and poor eating habits (Colletti and Masters 2010). In 1995, Michigan had an adult obesity rate (body mass index ≥30) of 17.2% and a combined overweight/obesity prevalence (body mass index ≥25) of 53.6% (Levi, et al. 2011). Body mass index is a measure of weight status calculated from weight and height (kg/m^2). By 2010, Michigan's obesity rate rose to 30.5% and the combined overweight/obesity prevalence was 65.7% (Levi, et al. 2011). With such a sharp rise, many segments of society experienced this increase, including both the poor and wealthy. However, obesity rates are particularly high in African American communities. In 2010, the Michigan obesity rate for African Americans was 41.1%, much higher than in the state population as a whole (Levi, et al. 2011).

In 2010, there were 1,400,362 African Americans (14.2% of the State population) living in Michigan (U.S. Census Bureau 2011). Of these, 70% or 980,451 African Americans lived in the Detroit Metropolitan Statistical Area comprised of Lapeer, Livingston, Macomb, Oakland, St. Clair and Wayne counties (U.S. Census Bureau

2011). Since Metro Detroit has a large African American population and a reputation for obesity prevalence, it is an ideal location for studying variables that are associated with BMI.

The rise in obesity has led researchers in various fields to seek the causes of this increase. Researchers have examined everything from increased reliance on fast food (Judge, et al. 2006; Kumanyika 2008) to genetic factors (Bell, et al. 2005; Cummings and Schwartz 2003; Fischer 2009; Hinney 2007; Rohner-Jeanrenaud and Jeanrenaud 1996). The rise in obesity seems to affect numerous populations and virtually every age group. Physicians fear that as obesity rates rise, so will the rate of chronic diseases tied to obesity.

Across socioeconomic status (SES) groups, African Americans have a high rate of obesity compared to the population in general, particularly among women (Bindon, et al. 2007; Freedman 2011; Kumanyika and Grier 2006; Robert and Reither 2004; Scharoun-Lee, et al. 2009; Wang and Beydoun 2007). Within anthropology, "race" is a cultural construct. In popular thinking (and for some scientists), racial groups are assumed to be biologically distinct and easily defined (Brace 2005; Dressler, et al. 2005). However, racial divisions created within societies, such as in the United States, are not biologically distinct when using phenotypic traits or genetic analysis (Brace 2005; Dressler, et al. 2005). Races are culturally meaningful categories, but in reality, they have limited biological applications because variation of human traits overlaps racial groups (Brace 2005; Dressler, et al. 2005). This study will examine African Americans as an "ethnic group." Ethnicity is often considered interchangeable with race. However, "ethnicity" lacks the biological connotations that race has. Instead, ethnicity is based on shared cultural traits and cultural affiliation (Barth 1969; Dressler and Bindon 2000; Smedley and Smedley 2005; Utsey, et al. 2002). Ethnic groups are often fluid and may be different based on an individual's perspective (Barth 1969; Dressler and Bindon 2000; Smedley and Smedley 2005; Utsey, et al. 2002).

Ethnicity does have a role in health, since many ethnic disparities in health status have been identified. A prevalent hypothesis in obesity research is that ethnic disparities in obesity are due to SES differences between African Americans and Americans in general (Bleich, et al. 2010; Wang and Chen 2011). If true, then the expectation is that SES will have some association with the distribution of variables that affect obesity.

The present study analyzes the associations of multiple variables with income for African Americans in Metro Detroit. The study variables include measures of neighborhood satisfaction, stress, and perception of racism. Neighborhood attributes influence exposure to stressors that may lead to obesity. Neighborhood satisfaction is an assessment of services, physical attributes, and social features that influences a person's feelings about where he or she lives (Herting and Guest 1985). Stress has been shown to be associated with obesity (Bjorntorp 2001; Dragan and Akhtar-Danesh 2007; Moradi and Subich 2004; Stunkard, et al. 2003; Utsey, et al. 2002). Racism, or at least the perception of racism, induces a stress response (Harrell 2000; Paradies 2006; Vines, et al. 2006). Therefore, an assumption is that a stressful response to racism may also affect the development of obesity. In addition to stress responses, perceived racism may also affect health through lack of preventive care and treatment for conditions such as obesity (Gamble 1997; LaVeist 2000; Randall 1996; Smedley 2012;

White, et al. 2012). Avoidance of health care may occur because perception of racism among African Americans has been linked to mistrust of biomedicine and health care systems (Gamble 1997; LaVeist 2000; Randall 1996; Smedley 2012; White, et al. 2012). While it appears that all of these variables potentially influence obesity, it is uncertain whether they influence obesity in the same way for members of different SES groups.

The traditional view of how SES relates to obesity is that in developed societies, such as the United States, individuals of higher SES will have better access to healthy foods, opportunities for exercise, and less stress (Brown and Konner 1987; Ezeamama, et al. 2006; Wang and Beydoun 2007). Therefore, under this model, people with a high SES will tend to have lower BMIs than their low SES counterparts in society. However, if persons in both higher and lower SES categories are becoming more obese at a relatively rapid rate, it suggests two possibilities: 1) That obesity-influencing aspects (i.e. stress) are becoming uniform across SES categories. Or 2) that obesity is caused by exposure to different obesity-influencing aspects based on SES.

Hypothesis and Aims

The research hypothesis for this study is that among African Americans in Metropolitan Detroit, neighborhood satisfaction, stress, and perception of racism are associated with obesity differently based on income. Data for Metropolitan Detroit African Americans were obtained from the Center for Urban and African American Health (CUAAH) at Wayne State University. CUAAH was developed as part of The Centers for Population Health and Health Disparities (CPHHD) initiative and engages in research that addresses African American health disparities. CUAAH seeks to understand the role of individual, environmental, biological and genetic mechanisms that affect chronic conditions (breast cancer, oxidative stress/salt sensitivity, and cardiovascular disease) in Metropolitan Detroit (Paskett, et al. 2008). Data used in this dissertation were collected by CUAAH between 2004 and 2008. Each of the CUAAH projects involved clinical interventions to assess outcomes for chronic conditions, and include BMI and ordinal scale measures of neighborhood satisfaction, stress, and perception of racism.

This is an exploratory study whose goal is to reveal how SES (using income as a proxy) exposes African Americans to different levels of obesity-influencing variables. For example, stress may have a significant association for high SES obesity whereas dissatisfaction with neighborhood traits may be significant for low SES obesity. In other words, demonstrating that there may be equifinality (multiple paths) to obesity as it relates to SES.

The expectation is that there is no link between income and BMI within the study population, since obesity rates are very high among all SES groups for African Americans. If this idea is true, income alone likely does not correlate with BMI for African Americans. Income differences in neighborhood satisfaction, stress, and perceived racism potentially mean that individuals in different income categories are overweight or obese due to the differences in the influences of these variables. To demonstrate this idea, it must be shown that the way BMI is related to neighborhood satisfaction, stress, and perceived racism differs based on income. There are three aims in this study that address the hypothesis:

1. Determine if income correlates with BMI for the study population.
2. Evaluate correlations between BMI, stress, neighborhood satisfaction, and perceived racism for income categories.
3. Evaluate if stress, neighborhood satisfaction, and perceived racism are related to BMI using multivariate statistics.

This study examines whether variables that affect obesity differ based on income. In other words, do people in different income groups become obese for different reasons? In order to address this question, some variables need to be controlled. Focusing on African Americans in Metropolitan Detroit reduces the influences of ethnic and regional differences in the data because it limits analysis to a more specific population. Focusing on African Americans reduces the impact of cultural differences that may affect behaviors or conditions that lead to obesity. In addition, focusing on a single race/ethnic group in a single region allows for the examination of the role of perceived racism within this population. A potential benefit of a local study is that it can identify conditions that may be unique to a specific locale, and would not be detected if examining a more general population.

The expectation is that study variables related to neighborhood satisfaction, stress, and perceived racism will differ because belonging to different SES groups exposes persons to different types of environmental stressors and different ways to buffer the stressors that typically lead to obesity. If the data support the research hypothesis, this may indicate that attaining and maintaining an overweight or obese status varies based on SES. The null hypothesis is that BMI is not correlated with neighborhood satisfaction, stress and perceived racism based on income. Accepting the null hypothesis would give support to the idea that aspects of life related to stress, perceived racism, and neighborhood attributes that may influence weight status are relatively uniform among SES groups.

There is a long established correlation between SES and weight status (Averett and Korenman 1996; Bjerregaard 2009; Braveman, et al. 2005; Cawley, et al. 2005; Conley and Glauber 2007; Garn, et al. 1977; Ogden, et al. 2010a; Ogden, et al. 2010b; Sobal and Stunkard 1989; Zhang and Wang 2004). In the United States, the association between SES and BMI virtually disappeared over the past decade. The proportion of overweight/obese individuals is rising in *all* SES categories. However, there is little understanding of why there are now large numbers of overweight/obese individuals in high SES categories, especially since higher SES usually correlates with better access to healthy foods, exercise opportunities, and reduced stress.

Many studies have looked at the relationship between SES and obesity (Averett and Korenman 1996; Bjerregaard 2009; Braveman, et al. 2005; Cawley, et al. 2005; Conley and Glauber 2007; Garn, et al. 1977; Ogden, et al. 2010a; Ogden, et al. 2010b; Sobal and Stunkard 1989; Zhang and Wang 2004). However, few anthropological studies examine whether the variables that lead to obesity can be different based on SES. In a time where SES seems to matter less when it comes to weight status (especially for African Americans), understanding the types of obesity-favoring stressors to which members of different SES categories are exposed becomes more important.

A central tenet of physical anthropology is that biology interacts with culture. For obesity, aspects of the human cultural environment likely influence obesity patterns. In 2008, Stanley Ulijaszek, a biocultural anthropologist at the University of Oxford, wrote the article “Seven Models of Population Obesity” in which he discussed the ways that obesity is studied, and how combining approaches can be beneficial in understanding obesity. The seven models that are used includes: obesogenic environments, thrifty genotype, nutrition transition, obesogenic behavior, culture, political economy, and biocultural approaches (Ulijaszek 2008). The “obesogenic environment” model includes the idea that obesity is the result of environments that encourage caloric intake while discouraging caloric expenditure (Ulijaszek 2008). The “thrifty genotype” model includes genetic hypotheses related to genes that lead to fat retention, and ultimately to obesity (Ulijaszek 2008). The “nutrition transition” model sees obesity as the result of a shift away from healthier foods and towards high calorie/high fat foods (Ulijaszek 2008). The “obesogenic behavior” model includes the concept that mammalian species, including humans, respond to certain conditions (i.e. abundance of food, palatability of food) through overeating (Ulijaszek 2008). It has also been shown that stress-induced eating has a biological basis in non-human species (Dallman 2010; Mathes 2009), therefore, stress response is considered obesogenic behavior. The “culture” model frames obesity as the result of norms, behaviors, or experiences shared by a cultural group that promote or lead to obesity (Ulijaszek 2008). The “political economy” model sees obesity as the result of socioeconomic conditions that make certain segments of society more vulnerable to obesity (Ulijaszek 2008). Finally, “biocultural approaches” are hypotheses that fit within a model where obesity is viewed as the result of multiple interacting factors within the context of evolutionary or cultural change (Ulijaszek 2008).

Physical anthropologists can make contributions to biocultural approaches. This dissertation follows Ulijaszek’s recommendation of utilizing a biocultural approach to address the rise of obesity among African Americans. This research gives consideration to the other six models in order to follow a biocultural approach.

The models directly addressed through data analysis include the following: political economy, obesogenic behavior, obesogenic environments, and culture. This study is primarily centered on a "political economy" model, in that it assesses whether socioeconomic status (using income as a proxy measurement) influences the way in which African Americans are exposed to obesity-inducing conditions. The "obesogenic behavior" model is addressed by the incorporation of stress as a variable, since stress is shown to induce over-eating behavior in mammals. The "obesogenic environments" model is considered through the assessment of neighborhood traits and how these environmental aspects influence obesity. The "culture" model is also incorporated, in that the study design examines an aspect of the African American shared experience that can potentially affect obesity rates: racism. Measures of perceived racism can reflect racism-induced stress, but also can be linked to mistrust of the biomedical community, which can affect utilization of health care services (LaVeist 2000; Shavers, et al. 2012; Smedley 2012; White, et al. 2012).

This study cannot directly address two models of obesity: nutrition transition and thrifty genotype. The "nutrition transition" model cannot be addressed since it deals directly with measuring changes over time, and this is not a longitudinal study. Although the design of this study lacks a direct observation of current conditions versus those in the past, and cannot speak towards cultural change on its own, it is widespread and well-understood that obesity is on the rise in the United States and that conditions have likely changed from the past. Therefore, the exclusion of this model in data analysis is appropriate. The “thrifty genotype” model also is not tested, mainly because genetic tests were not part of the analysis. However, the literature review will consider some genetic explanations of obesity and explain why those factors are not considered necessary for this study.

By following Ulijaszek’s biocultural approach, instead of looking at increased obesity rates simply as a disease process in need of a cure, obesity is seen as the biological consequence of shifting cultural conditions within a population undergoing change. By overturning long established epidemiological assumptions about the nature of SES and obesity, scientists can move away from looking at SES as a “risk factor” for obesity, and understand that as human conditions change the way SES is associated with health conditions will also change.

Expectations Prior to Analysis

There are three expected results for the data, which if met would support the research hypothesis. First, that income does not have a link to obesity. Second, that links between BMI and the study variables (neighborhood satisfaction, stress, and perceived racism) differ according to income category. Third, that the study variables (neighborhood satisfaction, stress, and perceived racism) influence BMI distribution differently according to income category.

Since the 1970s, the United States population in general has become more obese (Bell, et al. 2005; Gordon-Larsen, et al. 1997). High rates of obesity plague many ethnic minority groups, including African Americans, Hispanics, Pacific Islanders, and Native Americans (Bruss, et al. 2003; Paeratakul, et al. 2002; Robert and Reither

2004; Tremblay, et al. 2005; Wang and Beydoun 2007). African American obesity is of particular interest because since the first large scale obesity studies have been performed, adult African Americans consistently have higher rates of obesity compared to Americans in general (Baskin, et al. 2005; Paeratakul, et al. 2002; Robert and Reither 2004; Wang and Beydoun 2007). This disparity is especially high among women (Baskin, et al. 2005; Paeratakul, et al. 2002; Robert and Reither 2004; Wang and Beydoun 2007). African American children have also been shown to be more obese than their white counterparts (Scharoun-Lee, et al. 2009). In the 1970s, there was an inverse relationship between SES and obesity among African Americans, where lower SES groups had greater obesity rates than higher SES groups (Zhang and Wang 2004). Since the 1990s, this relationship started to disappear, and recent studies show relatively high rates of obesity within all SES segments studied (using income-based or education-based SES categories) (Kumanyika 1993; Wang and Beydoun 2007; Zhang and Wang 2004).

Despite the high rates of obesity for African Americans in all SES groups, the sociocultural and environmental conditions that promote obesity are likely different between SES groups. The expectation is that SES will not have a link with BMI for the study population. Since high BMI is present within all social classes for African Americans, there will likely be few differences.

It is expected that correlations between BMI and the study variables (neighborhood satisfaction, stress, perceived racism) will differ based on income category (low, middle, high). Since lower income groups are typically from environments with poorer access to recreational facilities, a lack of healthier foods, and higher rates of crime (which can deter a person from many outdoor activities), the expectation is for relatively low neighborhood satisfaction scores associated with high BMI.

Many studies report a positive correlation between stress and obesity (Bjorntorp 2001; Dragan and Akhtar-Danesh 2007; Moradi and Subich 2004; Stunkard, et al. 2003; Utsey, et al. 2002); therefore, the expectation is that lower and higher income groups would each experience stressful events. However, the ability to control or cope with stress may differ, as persons with a higher income has better access to resources that may alleviate stress (stress relieving activity, health care, psychological care, etc.) (Evans and Kim 2012). Higher income individuals likely experience less stress and have the ability to cope more effectively with it, meaning BMI is not likely associated with higher stress levels.

Another expectation is that the impact of racism differs slightly between income categories. Since perceived racism leads to stress (Paradies 2006) and may reflect underlying mistrust of the medical community (Gamble 1997; LaVeist 2000; Randall 1996), it potentially affects health, including prevalence of obesity. However, there is evidence that African Americans of different SES statuses (looking at income, education, and childhood SES) all experience similar levels of perceived racism (Vines, et al. 2006). African Americans in different SES groups likely experience racism differently (Clark, et al. 1999). Lower SES individuals probably have higher rates of group racism, since poorer African American neighborhoods tend to have ethnic segregation and a tie between racism and low SES is more prevalent. The belief is that incidences of personal racism will probably be higher for high SES individuals because they are more likely to navigate environments in which African Americans encounter members of other ethnic groups more frequently and are in roles where they are equal or higher in status to non-African Americans.

If all expected results are consistent with the actual analysis, it will support the idea that there is equifinality in becoming obese based on SES. In other words, SES in part dictates the types of environmental and sociocultural experiences that lead to high BMI. Historical clinical studies of Americans in general, and African Americans specifically, suggest that SES inversely correlates with obesity. If this is not the case, this study potentially reveals factors that uniquely contribute to weight gain among high SES African Americans.

Overview of Chapters

Following the introduction are five chapters, each addressing different aspects related to the research hypothesis. Chapter 2 "*Literature Review*" is a look at previous studies conducted that relate to obesity, neighborhood attributes, stress, and racism. It first defines what it means to be overweight or obese from a biomedical perspective, and proceeds to show a link between health and weight status. Since obesity is becoming more prevalent in America, this chapter includes a review of possible explanations for the rise in obesity rates, both biological and sociocultural. There is discussion about how socioeconomic status and ethnicity relates to obesity. Then there is a review of the reported links between obesity and the variables analyzed in this study (neighborhood attributes, stress, and perceived racism).

Chapter 3 "*Methods*" presents the sources of data, lists the variables, and explains the analyses performed in this study. The chapter provides details of the study population, such as number of participants included in the analyses and demographic information. It also provides descriptions of the variables analyzed in this study and the statistical methods used to address each study aim.

Chapter 4 "*Results*" provides the results of this study. It reports the results of the data analyses regarding each of the three major areas under consideration (neighborhood satisfaction, stress, and perceived racism), and how they address each aim of the study.

Chapter 5 "*Discussion*" looks at the data related to the three aims of the study and provides an interpretation of the results. It explains why persons in different socioeconomic classes may have different paths to becoming overweight or obese. It reveals whether there are indeed income differences in neighborhood satisfaction, stress and perceived racism that influence BMI.

Chapter 6 "*Conclusion*" is a last look at the results of this study, and examines how the results address the study aims and the research hypothesis presented in Chapter 1. It also discusses whether the results support the expectations established prior to analysis. Chapter 6 will end with some of the limitations of this study and suggestions for future directions in anthropological research related to obesity and SES.

CHAPTER 2

LITERATURE REVIEW

Due to a dramatic rise in obesity prevalence in the United States, obesity and obesity-related illnesses have become popular areas of research over the past two decades. These areas include clinical research seeking to find ways to effectively address obesity; medical research that assesses the effects of obesity on health; and social science research that seeks to find the cultural, social, and behavioral influences on obesity. Physical anthropology is the study of human biology within human cultural systems and seeks to identify ways in which biology and culture interact. Within physical anthropology, there is an interest in examining the biological impact of obesity and understanding how the cultural environment in which individuals live influences obesity prevalence. Instead of understanding obesity as a purely biological condition with established risk factors and medical solutions, obesity needs to be understood as a biological state often mediated by cultural traditions that affect energy intake and expenditure (Flynn and Fitzgibbon 1998; Moffat 2010).

One problem when examining widespread epidemiological phenomena such as the rise in obesity rates is that complex interactions are reduced to a few variables with very little local context. Generalizability is a central aspect of scientific research, but it is also important to realize that local conditions will alter the ways in which certain variables operate. This issue quickly becomes apparent when reviewing research on obesity, ethnicity and social class. Obesity is sometimes quantified differently, ethnic designations vary based on region (e.g., Europe vs. United States), and standards for social class assignment vary.

Defining Obesity

In American society, there is both biomedical and popular discourse about why it is problematic and detrimental to well-being to be obese. Obesity is associated with everything from social stigmatization to an increased likelihood of developing chronic illnesses. From a biological perspective, obesity potentially exposes an individual to strong negative evolutionary stressors. Early in the course of human history, being overweight or obese was relatively uncommon. It was not because people did not want to over-eat or preferred rigorous physical activity, but because early humans had high-energy lifestyles and were more prone to experience food shortages. The propensity for humans to become obese is an adaptation to surviving seasonal periods of food scarcity in our evolutionary past (Brown and Konner 1987). Humans stored fat in order to have an energy reserve for lean seasons. Since periods of hardship were common, no one had the time to accumulate fat, and an individual's fat stores would become depleted. However, as reliance on agriculture became commonplace, the need to build fat stores became less important because food was readily available (Brown and Konner 1987). Individuals who consumed more calories than needed, and accumulated fat stores, had the potential to preserve fat for long periods of time. Instead of a lean season leading to a decrease in fat stores, depletion of fat only occurred with increased activity or reduced food consumption. If physical activity is low or food consumption is high, then the result is increased body fat.

From the start of human existence, people have had the potential to become obese. Non-human animals have this same ability. For example, even though obese wolves are not common, their evolutionary relatives, the domesticated dog, commonly become obese when living with humans. In order to see obesity in any species, a specific combination of factors must occur: caloric intake must consistently exceed caloric expenditure. An energy imbalance due to ingesting more calories than is expended leads to an increase in fat storage (Bindon, et al. 2007; Brown and Konner 1987; NIH 2002). Obesity occurs when there is an excessive accumulation of body fat. Since wild mammalian species typically lack the ability to alter their environment for food production, there is a reduced chance of seeing obesity among wild or feral species of mammals. However, once humans provide food and discourage physical activity, humans and domesticated animals can quickly become obese.

To say that obesity is an excessive accumulation of body fat is a very general statement. Establishing standards for defining obesity among humans allows for the scientific study of obesity. Body mass index (BMI) is perhaps the most easily measured and most commonly used standard for designating a person as overweight or obese.
BMI is a calculation of weight and height: kg/m^2 (WHO 2006); and is used to minimize height as a factor when comparing weights between individuals. According to National Institutes of Health and World Health Organization standards, "obese" is defined as having a BMI greater than or equal to 30 (NIH 2002; WHO 2006). "Overweight" is defined as a BMI between 25 and 29.9 (NIH 2002). "Normal" BMI is between 18.5 and 24.9 (NIH 2002; WHO 2006). "Underweight" is a BMI below 18.5 (NIH 2002; WHO 2006).

BMI was selected to assess obesity in the present study for two reasons: calculating BMI is straightforward, and widespread use of BMI in the literature suggests it is a reliable way to assess weight status (Ulijaszek and Lofink 2006). In addition, obesity as determined by BMI is associated with increased morbidity and mortality for numerous conditions and represents a good measure for assessing susceptibility to obesity-related conditions (Ulijaszek and Lofink 2006). Other methods exist to assess obesity, such as skin fold thickness in certain regions of the body (Dietz and Bellizzi 1999; Sturm 2007). However, inconsistency of measures, varying body types between populations, and a general lack of public understanding of skin fold thickness measures make it difficult to use it as the main measure of overweight or obesity (Dietz and Bellizzi 1999; Sturm 2007).

The usefulness of BMI may be limited according to some researchers. First, there is no guarantee that all individuals will have the same ratio of fat mass to total mass. Fat mass is most commonly calculated using water weighing that measures displacement of water (Siri 1961) or through the use of dual energy X-ray absorptiometry (DEXA) (Levine, et al. 2000). For individuals with the same BMI, there is 30 – 40% variation in actual fat mass (Gallagher, et al. 1996). As a result, persons with a large muscle mass may have a high BMI and categorized with people who have high fat content. Application of this idea extends to ethnic groups as well. Ethnic groups may have different average ratios of fat mass to total mass, making direct multiethnic comparisons inaccurate when using BMI (Deurenberg and Deurenberg-Yap 2003; Kleerekoper, et al. 1994; Lee, et al. 1981). For example, Kleerekoper et al. (1994) found that African American women had a lower percentage of body fat compared to white women with the same BMI. When examining data that showed African American women had higher average BMI, the research team demonstrated that the differences in BMI between African American women and white women disappear when considering ethnic differences in fat composition at specific BMI levels (Kleerekoper, et al. 1994). However, this finding does not go unchallenged. Other studies have shown that BMI indicates similar fat levels between ethnic groups. Gallagher et al. (1996) determined that BMI predicted similar fat content for both African Americans and whites. Recent studies indicate visceral fat content differs for individuals of different ethnicities with similar BMI (Camhi, et al. 2011; Carroll, et al. 2008). However, BMI is more reliable when predicting subcutaneous fat and total fat mass across ethnic groups (Camhi, et al. 2011). It is possible that local conditions affecting the study populations affect the results. Also, the significance of racial and ethnic categories in scientific research has some flaws, which a subsequent section of this dissertation will cover. In addition to possible ethnic differences, the percentage of fat mass expected when someone has a specific BMI differs based on age, since older adults have a higher percentage of fat than younger adults with the same BMI (Gallagher, et al. 1996). All of this background tells us that from one individual to another, the relationship of BMI to fat content may vary.

The relationship between BMI and health status across ethnicities also needs consideration. There is evidence that for several diseases influenced by obesity (hypertension, diabetes, coronary heart disease, asthma, arthritis) that risk levels vary by ethnicity (non-Hispanic whites, African Americans, East Asians, Hispanics) (Stommel and Schoenborn 2010). However, it is consistent that being considered obese increases the risk of poor health among all ethnic groups (Stommel and Schoenborn 2010). Since African Americans are the target population, this study avoids some of the debate regarding ethnic differences in BMI and its relationship to health status.

Regardless of the way in which obesity is measured, it is clear that obesity is more common today than in the past. It is interesting to note that not only are Americans becoming more overweight, but the prevalence of very high BMI (so-called super-obesity) is staggering. From 2000 to 2005, the prevalence of individuals with a BMI over 30 increased by 24% (Sturm 2007). Over the same period of time, the prevalence of BMI over 40 increased by 50%, and BMI over 50 increased by 75% (Sturm 2007). The increase in extreme obesity rises at a disproportionately high rate compared to moderate obesity and overweight status (Sturm 2007). Overall, there is a clear statistical shift in the average weight of Americans, and this shift has made being large the norm.

Obesity and Health

The health implications of increased obesity rates are an important topic to investigate. One of the significant consequences of excess fat storage is an increased likelihood of chronic illnesses. Those categorized as overweight or obese according to their BMI have an increased likelihood of having cardiovascular diseases, diabetes, hypertension, and depression (Bindon, et al. 2007; Brown and Konner 1987; Cummings and Schwartz 2003; Dragan and Akhtar-Danesh 2007; Gallagher, et al. 1996; Paeratakul, et al. 2002). Obesity is sometimes understood as being caused by a chronic condition (such as diabetes or depression); however, controlling obesity typically assists in the treatment of these chronic conditions (Paeratakul, et al. 2002). If the trend continues, and extreme obesity (BMI >40) continues to rise, this pattern could become even more of an issue. Health complications are a greater concern for extremely obese individuals and add to the problem of chronic health conditions in the United States (Sturm 2007). The association of obesity and an increased chronic illness burden is a significant reason that obesity research is important.

The rise in obesity has been loosely termed an “epidemic,” which highlights the severe impact that this rise is expected to have on the medical community. There has been some resistance to consider the rise in obesity a true epidemic, which commonly is infectious in nature or can be traced to a common cause (Moffat 2010; U.S. Department of Health and Human Services 2006). Instead, the belief is that framing the rise in obesity as an epidemic allows for medical researchers and pharmaceutical companies to profit on efforts to cure the “epidemic” (Moffat 2010). However, this viewpoint is cynical, since any relatively rapid change from an expected baseline for a health condition can be considered an epidemic (U.S. Department of Health and Human Services 2006).

There is also the idea that the rise in obesity is feared by the public, not only for its health consequences, but also because of the cultural consequences as it relates to standards of attractiveness (Garcia-Arnaiz 2010). According to Garcia-Arnaiz (2010), when examinations of obesity in the United States show increasing obesity rates, health concerns becomes the most publicized problem, but there is also a desire to maintain a cultural standard that portrays obese as unattractive. This portrayal highlights the possible stigmatization of obesity that can potentially affect economic opportunities. Brewis et al. (2011) reports that fat stigma and the social undesirability of fatness is more prevalent globally than it was in the past, even in traditionally “fat-positive” societies (according to previous ethnographic accounts) like American Samoa, Puerto

Rico, and Tanzania. This shift in fatness desirability means that the negative connotations of obesity will potentially create hurdles for populations worldwide if obesity prevalence continues to increase on a global scale (Brewis, et al. 2011). The potential role of body size norms for African American communities will be examined later in this chapter.

Possible Causes of the Rise in Obesity

The root cause(s) of the rise in obesity is currently a matter of heated scientific debate. There are two broad viewpoints on why obesity rates are rising. One is that sociocultural changes make obesity more common in the United States and globally. The second view is that changes in population genetics have made obesity-influencing genes more common in regions experiencing increases in obesity, such as the United States. Within these two broad viewpoints are numerous hypotheses, some of which are not necessarily mutually exclusive. The most likely explanation involves a complex interaction of genes and the environment.

Genetic Causes

A number of biological and genetic factors that may contribute to obesity have been identified. One area of focus is ‘leptin resistant’ obesity, in which individuals are resistant to leptin, a protein that signals the brain that an individual is satiated (Bell, et al. 2005; Cummings and Schwartz 2003; Rohner-Jeanrenaud and Jeanrenaud 1996). Without the ability to signal the brain that a person is satiated, they will continue to feel hungry, overindulge in food, and become obese. There are numerous polymorphisms of the leptin receptor gene, with several leading to reduced receptivity of leptin (Paracchini, et al. 2005). The frequencies of leptin polymorphisms vary by ethnicity (with some variants particularly high among East Asians and Native Australians), however, there is no evidence that increased frequency of particular variants of the leptin receptor gene actually lead to obesity (Paracchini, et al. 2005). Additionally, in a study of African American and white children in the United States, it is found that serum leptin concentrations (which would be affected by leptin resistance) is not influenced by ethnicity (Nagy, et al. 1997). Therefore, there is little evidence that leptin resistance is the main cause of African American obesity.

Another gene that may lead to obesity is the FTO gene. The FTO gene codes for the protein alpha-ketoglutarate-dependent dioxygenase FTO. It has several functions, including stimulation of energy regulation by the hypothalamus. There is a possibility that certain variations of the FTO gene may lead to increased desire to consume calories without a corresponding mechanism to trigger a person to cease consuming calories (Fischer 2009; Hinney 2007). A genome-wide association study showed that different variations of the FTO gene correspond to early onset obesity (Hinney 2007). A study done in mice even demonstrated that loss of the FTO gene leads to a reduction in fat tissue and increases lean body mass, signifying that an active FTO contributes to fat accumulation (Fischer 2009). The reduction in fat mass is attributed to elevated levels of systemic sympathetic activation and increased energy expenditure, even though the mice were less active than mice with FTO genes and displayed relatively normal hunger and eating behavior (Fischer 2009). FTO genes have been identified that affect obesity for people of European, Asian, and African descents (Bollepalli, et al. 2010; Liu, et al. 2010). The FTO gene rs8057044 is identified as potentially influencing obesity among African Americans (Bollepalli, et al. 2010), however, numerous other variants that potentially influence obesity are prevalent in non-African American populations, such as SNP rs9939609 (Bollepalli, et al. 2010; Liu, et al. 2010). Overall, even though it appears that FTO gene variables influence susceptibility to obesity, there is no evidence that African American populations have a higher prevalence of obesity-influencing FTO genes than other populations. Furthermore, current genetic studies only examine contemporary populations, and it is not evident whether these FTO variants are more prevalent now than they were in the past.

In addition to leptin resistance and FTO genes, researchers have uncovered other genetic mechanisms in numerous regions and populations that make individuals susceptible to obesity (Bell, et al. 2005; Cummings and Schwartz 2003; Paracchini, et al. 2005; Rohner-Jeanrenaud and Jeanrenaud 1996). Even if genetic factors lead to obesity, it is acknowledged that recent increases in obesity worldwide indicate that environment plays a significant (if not primary) role in the expression of "obesity genes" (Bell, et al. 2005; Paracchini, et al. 2005).

If genetic factors play a role in the ever-increasing prevalence of obesity, there is still uncertainty around how to treat genetically triggered obesity. There are several medications used to treat obesity in cases where attempts to change lifestyle are unsuccessful, most notably orlistat (Padwal and Majumdar 2007). Vrecko (2010) argues that medication that decreases obesity may not actually directly lead to weight loss. Instead, the medications allow individuals to cope with a modern consumer environment that leads to a desire to over-consume (Vrecko 2010). However, this viewpoint discounts many of the pharmacological effects that medications have, such as inhibition of enzymes that lead to fat absorption. Other pharmacological effects of obesity medication are unpleasant side effects like oily rectal discharge, fecal incontinence, and inability to absorb fat-soluble vitamins (Padwal and Majumdar 2007). However, obesity medications are not considered completely effective, since there is no supportive evidence that medication actually improves obesity-related morbidity and mortality (Padwal and Majumdar 2007). Even if pharmaceutical interventions are deemed successful in addressing obesity in the short-term, they are not designed to address genetics-based ethnic disparities in obesity. In other words, current interventions were not developed to target African Americans obesity any differently than for other populations.

In general, even if there are genetics-based explanations for why certain people are more susceptible to obesity than others are, this does not mean that the rise in obesity is due to population-level increases in the frequency of obesity genes. There is no evidence that the frequency of obesity-influencing genes has changed over the past three decades. It would perhaps be interesting to conduct a study that compares the frequency of obesity-influencing genes in past biological samples to gene frequencies in contemporary samples. However, an assumption in this study is that a very rapid increase in obesity-influencing genes has not occurred. This assumption is made because evolutionary explanations of obesity typically operate under the idea that obesity genes evolved in the past and have become maladaptive (Ulijaszek and Lofink 2006). Therefore, obesity-influencing genes developed early in modern human evolutionary history and should become less common over time, if indeed they are maladaptive.

Sociocultural Causes

When examining ethnic disparities, solely focusing on genetic links discounts the role of social and cultural variables (Krieger 2005). Increased genetic knowledge, such as human genome mapping, gives the appearance that every aspect of humanity is established at the genetic level and that environments cannot change these aspects (Brodwin 2002). When social and cultural variables are discounted, disparities are more difficult to address and can lead to inaccurate depictions that imply that each person belongs in a distinct genetic population (i.e. race) within the human species. If taken to an extreme, this way of thinking can lead to the commodification of race in biomedicine through the funding of research to find genetically-based race-specific treatments for illnesses (Abu El-Haj 2007). Even if genetics plays a role in obesity, environmental factors still influence the expression of these genes. There are researchers who primarily view the recent rise in obesity as the result of environmental conditions, with very few (or no) genetic factors contributing to this rise. Garn (1986) observed decades ago that obesity tended to run in families, which on the surface suggests that obesity is a heritable condition. Family members who live together or live apart had similar obesity levels (Garn 1986). As a heritable condition, the rise in obesity could simply be due to the increased prevalence of obesity genes. However, the same study found that adopted children tended to have the same weight status as their adopted parents (Garn

1986). In addition, spouses tended to have a similar weight status (Garn 1986). This pattern suggests that something external to genetics is at play.

No one has yet definitively identified a selective force leading to an increased prevalence of obesity-causing genes. Instead, it is believed that overconsumption of calories in conjunction with less activity is the more likely cause (Gordon-Larsen, et al. 1997; Hill, et al. 2003). Considering the widespread nature of the increase in obesity prevalence, conditions that lead to decreased activity and increased eating must not be exclusive to a single population, although these conditions may disproportionately affect some communities.

A significant non-genetic factor in health for any human group is culture. Specific cultural aspects that impact obesity include dietary choices, activity (including occupational roles), ideal body type standards, negative connotations of thinness (i.e. drug use, poverty), the role of food in social gatherings, and the symbolic meaning of fatness (Bindon, et al. 2007; Burke, et al. 1992; Davis, et al. 2005; Flynn and Fitzgibbon 1998; Judge, et al. 2006; Kumanyika and Grier 2006; Kumanyika 2008; Scharoun-Lee, et al. 2009; Ulijaszek 2008; Whitaker, et al. 1997). Even though obesity is typically dependent upon dietary intake and activity levels, one should examine these two variables within the context of culture. In addition, when analyzing health within socially and culturally identified populations, such as African Americans, one should consider the unique impact of belonging to one of these groups (Dressler, et al. 2005). This approach includes taking into account past and present social inequalities that may contribute to health disparities (Dressler, et al. 2005; Krieger 2001). Also, patterns of segregation influence where a person lives and works, which may lead to different local environmental conditions (Schell 1997). Therefore, environmental inequalities need consideration, such as availability of healthy foods, neighborhood safety (i.e. poor safety conditions can inhibit physical activity), and access to high calorie foods (i.e. fast food restaurants) (Judge, et al. 2006; Kumanyika 2008; Ulijaszek 2008).

Other significant factors contributing to obesity expression are economic. Economic explanations of obesity examine the relative cost of food for individuals. Prior to the 1990s, in societies where high-calorie and fatty foods are expensive, those with more resources tended to be more obese (Brown and Konner 1987; Ezeamama, et al. 2006). In societies where high calorie, low quality foods are cheap (as in the United States), and obesity was prevalent in the poorest communities (Brown and Konner 1987; Ezeamama, et al. 2006). However, these trends have changed. Trade and global increases in urbanization have made relatively unhealthy foods more common in more regions of the world (Greenberg, et al. 2010). Aguirre (2010) argues that the agricultural industry has changed, and it has made imported foods rich in saturated fats and carbohydrates cheaper and more widespread across the globe. Since this change has proven profitable to the food production industry, its continued use and proliferation are likely (Aguirre 2010).

Selection of food and physical activities are not only health choices, but also choices based on price and time considerations (Smith 2009). Often, unhealthy foods are cheaper, as well as easier to prepare (if there is any preparation). Unfortunately, global economic interactions are difficult to quantify at an individual level and will not be directly included in this study. However, it is important to note that changes in the food industry will have direct impacts on food choices.

There is an idea that a rise in obesity may relate to evolutionary history. As stated previously, the propensity to become obese is due to the adaptation to create fat stores to survive in times of food shortage. A hypothesis based on this evolutionary adaptation claims that financial insecurity triggers the primitive biological mechanisms that encouraged over-eating prior to times of scarcity (Smith 2009). So just as an approaching lean season made early humans consume more when food was available, modern humans may consume more if they fear a future economic downturn. For example, a person may consume a lot directly after receiving a paycheck or financial assistance in preparation for when money is scarce (Smith 2009). There is some evidence that economic security is negatively related to obesity levels when comparing global societies, with the United States having high rates of obesity and low economic security whereas Western European nations, Canada, and Australia has lower rates of obesity and high economic security (Offer, et al. 2010).

Socioeconomic Status and Obesity

Based on previous studies on obesity, socioeconomic status (SES) should be a factor in the distribution of obesity in a community. SES should lead to differential access to food resources and opportunities to exercise. This concept is one of the reasons that in the current study an analysis of income is important. Income does not fully represent a person's SES, because features such as wealth, education level, and occupation also are significant. Wealth represents assets accumulated over time, and considered a more reliable form of support. Wealth may also explain some ethnic disparities. For example, in the United States, when looking at individuals with equivalent incomes, African Americans and Hispanics have less accumulated wealth compared to whites (Braveman, et al. 2005). Education may also be significant when examining obesity. As far back as 1977, reports linked obesity to education. At the time, it was discovered that men with 12 or more years of education were more obese than those with 8 or fewer years of education (Garn, et al. 1977). The opposite was found for women, with more educated women being thinner than their less educated counterparts (Garn, et al. 1977). Outside of the United States, other socioeconomic variables may be important. In a study of obesity and socioeconomic status among Greenland Inuit (a community where income and wealth differences are not very different from one individual to another), several factors like parental places of birth and parental alcohol problems were considered parts of SES in the analysis (Bjerregaard 2009). Interestingly, male obesity was correlated with mother's place of birth while female obesity was correlated with parental alcohol problems (Bjerregaard 2009).

In this study, it is determined that income serves as the best measure of SES. This decision was made because of the role that income plays on the ability to acquire food and other resources on a regular basis, the ease of measurement, and the common usage of income in epidemiological studies. It is certainly not a comprehensive measure, but for a United States population it gives a relatively good sense of a person's social class.

Historically, there is an established link between SES and obesity prevalence. Obesity studies in developed countries (like the United States) have shown an inverse relationship between SES and obesity (Sobal and Stunkard 1989; Zhang and Wang 2004). In other words, low SES correlates with higher obesity prevalence. In developing countries, the opposite occurs and there is generally a direct relationship between SES and obesity (Sobal and Stunkard 1989). One argument is that level of economic development is a driving force (Brown and Konner 1987; Ezeamama, et al. 2006). Highly ranked individuals in a poorer society will be the only ones able to over-consume calories (Brown and Konner 1987; Ezeamama, et al. 2006). In contrast, low-SES individuals are typically exposed to obesity-inducing conditions in wealthier societies (Brown and Konner 1987; Ezeamama, et al. 2006). A link between SES and obesity is logical because SES influences many behaviors that affect dietary choices and activity patterns, which ultimately influences energy expenditure and consumption (Sobal 1991; Stunkard and Sorensen 1993). Additionally, one can argue that the relationship between obesity and SES is not one-way. Obesity influences SES via stigmatization and discrimination, which limits an obese person's sociocultural and economic opportunities (Sobal 1991; Stunkard and Sorensen 1993; Wang and Beydoun 2007). One long-term obesity study concluded that obese girls are less likely to enter college after high school than non-obese girls (controlling for factors that co-vary with obesity and predict college enrollment, such as ethnicity, family structure, and parental education) (Crosnoe 2007). Other studies indicate that obesity has a negative impact on occupational attainment and income (Averett and Korenman 1996; Cawley, et al. 2005; Conley and Glauber 2007). The root cause of these hardships may be tied to stigmas attached to obesity, such as perceptions about the inability to control oneself, greediness, and immorality (Moffat 2010; Sobal 1991).

The straightforward historic relationship between SES and obesity has changed in the United States, with overweight and obese individuals becoming more prevalent in all social classes. As a result, studies on the links between SES and obesity have had sometimes-contradictory results.

Ogden, et al. (2010b) found that from 2005-2008 that children in lower income and education brackets had higher obesity prevalence. However, these results were not consistent for all ethnic groups, because even though this trend held true for non-Hispanic white children, it was not the case for African American and Mexican American children. Instead, African American and Mexican American children in higher income households had obesity rates just as high as those in lower income households (Ogden, et al. 2010a). Additionally, between 1988-1994 and 2005-2008, the prevalence of childhood obesity increased for all income levels and most education levels (girls in households where the head had at least a college degree were the only exception) (Ogden, et al. 2010a).

Ogden, et al. (2010a) also examined data for adults and found that the link between SES and obesity was not straightforward. For all men analyzed, there were no links between education and obesity or income and obesity. However, for African American and Mexican American men, there was a correlation between higher income and higher obesity rates (Ogden, et al. 2010b). For women, lower income and less educated women were more likely to be obese (Ogden, et al. 2010b). It was also found that obesity prevalence increased from 1988-1994 to 2005-2008 among adults of all income and education levels (Ogden, et al. 2010b). Therefore, even though obesity disproportionately affects certain SES groups, the increase in overall obesity is throughout all SES segments of society.

As already alluded to, factors that influence SES and their significances can vary based on the population or community studied. Understanding economic, cultural, social, and political environments that shape a population is thus important when studying conditions influenced by SES. For some researchers, obesity is framed as a lifestyle choice, but every choice a person makes is undertaken within a larger cultural framework (Garcia-Arnaiz 2010). For certain groups, such as African Americans, historic marginalization and discrimination (covert and overt) need consideration in order to get an accurate portrayal of the environmental conditions that influence health (Davis 2001). The current study examines the perception of racism to assess whether marginalizing conditions contribute to obesity in African American communities.

African Americans and Obesity

Historically there are different conditions (social, cultural, environmental) that SES groups face. These different conditions expose people to environments with various resources that influence caloric intake and expenditure, and to different levels of stress that may drive obesity-influencing behavior (i.e. inactivity and eating). The expectation is that different variables influence the appearance of obesity in each income group. The proposed study seeks to identify different influences on obesity among African American SES groups. The onset of obesity can be influenced by many contributing factors, including genetics, diet, physical activities, and sociocultural variables. In the absence of direct evidence for genetic causes of the African American increase in obesity prevalence, it is more likely that sociocultural variables are involved.

In order to understand the interactions involved in the appearance of obesity, a framework that considers multiple variables is important (Dufour 2005; Sobal 1991).

A difficulty when examining human variability is the assignment of ethnicity or race to the populations of interest. Some believe that racial groups are biologically distinct and roughly approximate genetic haplogroups (Lind, et al. 2007; Rowe 2005). The use of Ancestry Information Markers (AIMs), mitochondrial DNA, and Y chromosomes to determine geographic origins strengthen the idea that race corresponds with genetics (Abu El-Haj 2007). Those who support the idea of genetically distinct ethnic groups believe that population-level genetic differences develop when ethnic identification affects marriage patterns and reproduction (Fiorini, et al. 2007). For example, if social standards dictate that someone that is Japanese should marry another person who is Japanese, then Japanese AIMs will inherently become more common within this population over time. However, the use of AIMs is misleading because identified AIMs appear to be non-coding DNA sequences and therefore do not influence biological processes or physical traits (Gravlee 2009). AIMs reflect degree of relatedness, not similarity in adaptive traits. Some researchers go even further and argue that ethnic differences in athletic ability, disease rates, and intelligence have their bases in genotype (Rowe 2005). This view is extremely problematic, since it disregards cultural traditions or discrimination that likely influences these aspects (Littlefield, et al. 1982; Ossorio and Duster 2005). Overall, many complex genetic-environmental interactions occur when looking at specific traits or disease states.

Given the complexity of gene-environment interactions, researchers should not assume that higher prevalence of a disease or condition among African Americans is evidence that there is genetic similarity among all African Americans. In fact, there is little evidence supporting the idea that African Americans belong to a distinct genetic population. Even researchers using genetic haplogroups that roughly correspond with geographical racial categories acknowledge that African Americans have a high degree of genetic admixture (Lind, et al. 2007; Parra, et al. 1998). It is estimated that ~20% of the average African American's genome is of European origin (Lind, et al. 2007). The average level of admixture varies according to geographic location in the United States (Lind, et al. 2007; Parra, et al. 1998; Tishkoff, et al. 2009). In addition, African genomes are not homogenous and encompass a wide range of variation (Tishkoff, et al. 2009). This lack of homogeneity illustrates the difficulty in assuming that African Americans are a neatly defined biological population. In general, migration and immigration makes it erroneous to assume that a specific set of genes will be present in individuals assigned to any racial or ethnic category (Billinger 2007; Duster 2005; Kaplan and Bennett 2003; Littlefield, et al. 1982; Ossorio and Duster 2005; Smedley and Smedley 2005). Since racial and ethnic categories are not genetically discrete, they cannot be studied as biological populations (Keita and Kittles 1997).

Overall, racial and ethnic groups vary among societies, and are fluid within societies. Every decade, the United States Census Bureau redefines racial and ethnic designations in an effort to reflect popular notions of racial and ethnic identification. At a given moment, ethnicity refers to groups that share cultural attributes (i.e. traditions, values, beliefs, sense of history) and become distinguished as a social cluster (Dressler and Bindon 2000; Smedley and Smedley 2005; Utsey, et al. 2002).

Within the United States, 'Black' or 'African American' is a culturally relevant ethnic group that has social and biological implications. The data used in the proposed study ascertained ethnicity using self-report. Self-reporting of ethnicity typically involves a person using a mix of phenotype, cultural affiliation, family history, or other factors to determine their own ethnicity (Smedley and Smedley 2005; Wang 2005). Genetic variability and various degrees of admixture within African Americans makes identifying a biologically meaningful and genetically distinct African American group based solely on self-report impossible (Smedley and Smedley 2005; Wang 2005). Instead, identifying oneself as African American is a marker of ethnic group affiliation, which has real world implications. This study seeks to go beyond genetically based racial explanations for the increased prevalence of overweight/obesity among African Americans. Even though there is a high prevalence of obesity among African Americans, since there are no biologically-defined races, being of African descent should not be considered a biological risk factor (Kaplan and Bennett 2003). Racial and ethnic categories are understood as sociocultural constructs, and they still hold significance when examining the influence of sociocultural variables on health (Smedley and Smedley 2005; Wang 2005). There is significance because group identity often influences level of stress encountered and access to resources (Hogue 2002; Jones 2001; Smedley and Smedley 2005). Focusing on a single ethnic group in this study may reveal environmental aspects that affect members of SES groups differently.

There is evidence that the sociocultural stressors of belonging to a specific ethnic group have an impact on health. Racial segregation is considered an influential factor in accessing resources and attaining a high social status (Williams 2001). Because of differences in social attainment, racially segregated communities have a high propensity of developing health problems related to access to cheap, unhealthy foods and other negative environmental aspects of segregated regions (Williams 2001). In addition, a study conducted in Detroit found that percentage of residents that are African American for a neighborhood was positively correlated with living in self-reported stressful environments (i.e. gang activity, prostitution, theft, vandalism, vacant lots, air pollution) (Schulz, et al. 2008). There is also evidence that living in highly segregated, mostly African American neighborhoods has a positive correlation with hypertension, which may reflect increased amounts of stress experienced by residents in these areas (Kershaw, et al. 2011). Therefore, even though there is no biological validity in the racial categories used in society, racial designations can certainly have an effect on health. In other words, biological races do not exist, but the social construction of race can affect biology.

When considering factors that lead to increases in the number of overweight and obese people, one cannot discount one broad area: satisfaction with being overweight or obese. Not all who eat high calorie or generally unhealthy foods do so because they are cheaper or are the only options in their neighborhood. Many people enjoy these foods and actively seek them out, even when exposed to healthier alternatives. Some economic arguments acknowledge that high calorie foods are marketable, and readily available. However, there is a prevalent idea that certain segments of the population have limited dietary choices outside of high-calorie fast food, especially in environments with high concentrations of fast food restaurants (Li, et al. 2009). Nevertheless, one cannot discount that some people just may not see being overweight as a problem. According to previous studies across disciplines, many African Americans have body image standards that categorize overweight figures as acceptable, and sometimes encouraged (Bindon, et al. 2007; Burke, et al. 1992; Davis, et al. 2005; Flynn and Fitzgibbon 1998; Judge, et al. 2006; Kumanyika and Grier 2006; Kumanyika 2008; Scharoun-Lee, et al. 2009; Whitaker, et al. 1997). Being obese is not seen as a problem, and sometimes being thin has negative connotations, like being considered sick or poor (Bindon, et al. 2007; Burke, et al. 1992; Davis, et al. 2005; Flynn and Fitzgibbon 1998; Judge, et al. 2006; Kumanyika and Grier 2006; Kumanyika 2008; Scharoun-Lee, et al. 2009; Whitaker, et al. 1997). Liburd (2010) found that obese African American women do not view themselves as unhealthy. These same women on average acknowledge that they are larger than the weight expectations for women, but many do not feel it necessary to conform to these expectations (Liburd 2010). Liburd also mentions another important contributing factor to obesity: children. The presence of children, especially in a single parent household, makes it much more difficult for a woman to seek recreational opportunities or to afford the healthiest food options (Liburd 2010). Considering high rates of single parent households in African American communities, being a single-parent could be a factor for obesity among women.

Variables Influencing Obesity

Three groups of factors that influence obesity appear to be caloric intake/expenditure, resources related to food access and physical activity, and stress. This study examines two areas with strong correlations with obesity: neighborhood resources and stress. The population examined is African American, and also included is an assessment of the particular impact of perceived racism.

Obesity is associated with energy consumption and expenditure. Unfortunately, this study lacks the sufficient data to compare differences in diet and physical activity. Therefore, this comparison is not part of the analyses.

Neighborhood satisfaction likely influences the prevalence of obesity. Neighborhoods carry both sociocultural and economic aspects, which affects individuals in terms of access to resources and psychological well-being (Dufour 2005; Narayan 2000). Neighborhoods with diminished access to healthier foods and fewer places for recreational activities tend to have higher rates of obesity (Robert and Reither 2004; Ross 2000). These neighborhoods also tend to have a lower average income and education level (Robert and Reither 2004; Ross 2000).

Disadvantaged neighborhoods may expose community members to aspects that encourage obesity, such as fear of leaving home to exercise, as well as increased exposure to chronic stressors (the relationship between obesity and stress is discussed later) (Ross 2000). Measuring an individual's neighborhood satisfaction allows for the assessment of access to, or lack of, resources that affect diet and physical activity. Individual neighborhood satisfaction also gives an indication of stress that may exist due to safety concerns. Neighborhood characteristics may be more influential on health than individual socioeconomic traits (Cutts, et al. 2009). Cutts, et al. (2009) found that even in neighborhoods with attributes that should counter obesity, such as proximity to walkable parks, crime could overshadow the benefits of the neighborhood. This situation was the case with Hispanic neighborhoods analyzed in Phoenix, Arizona, where safety concerns discouraged utilization of parks (Braveman, et al. 2005). Racial segregation may also play a role; for example, Braveman, et al. (2005) found that at a given income level, African Americans and Hispanics live in more disadvantaged neighborhoods (fewer resources) than whites do.

In Metro Detroit, racial segregation, differential access to resources based on location, neighborhood attributes, and neighborhood satisfaction likely play significant roles in whether obesity is encouraged or discouraged. For example, predominantly African American neighborhoods are more than a mile further from supermarkets than predominantly white neighborhoods in Metro Detroit (Zenk 2009). In addition, low-income African American neighborhoods have lower quality food options when compared to middle-income African American neighborhoods or racially mixed neighborhoods (Zenk 2009).

It is perhaps obvious that neighborhood attributes may affect weight status. However, just as with the choices people make to determine what to eat, one cannot discount that there is personal choice involved in choosing where to shop and whether one wants to exercise. A study by Magoc, et al. (2010) of Hispanic college students at the University of Texas at El Paso supports this view. A finding was that despite an understanding that exercise has benefits, many students responded that they chose not to make exercise a priority even though they had access to recreational facilities and areas to walk (Magoc, et al. 2010).

There are many reasons that a person may choose not to exercise or to eat healthily, including aspects that an individual can and cannot control. One psychological aspect that is typically not under the control of an individual and promotes obesity-inducing activities is stress. Stress arises from a wide range of internal, social, or environmental stimuli. Stress includes conditions or situations that may create feelings of frustration, anxiety, anger, helplessness, resentment, or fear that can have significant physiological impacts (Bjorntorp 2001; Dragan and Akhtar-Danesh 2007; Stunkard, et al. 2003; Utsey, et al. 2002). This includes such things as dissatisfaction with one's neighborhood, job status, and personal experiences.

Previous studies have shown that stress is directly correlated with increased rates of obesity (Bjorntorp 2001; Dragan and Akhtar-Danesh 2007; Moradi and Subich 2004; Stunkard, et al. 2003; Utsey, et al. 2002). Chronic stress often leads to depression, which itself is associated with obesity (Cortese, et al. 2009; Dragan and Akhtar-Danesh 2007; Sachs-Ericsson, et al. 2007; Sujoldzic and De Lucia 2007). In particular, African American obesity has a strong positive correlation with higher rates of depression (Sachs-Ericsson, et al. 2007).

Stress can negatively impact homeostasis in the body in a way that affects weight loss or gain (Bjorntorp 2001; Dallman, et al. 2003). Perception of stressful events activates the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system, which leads to the release of glucocorticoids (hormonesthat are associated with obesity) (Bjorntorp 2001; Dallman, et al. 2003). Chronic exposure to increased levels of glucocorticoids is associated with an increase in compulsive activities, including consumption of ‘comfort foods’ (Dallman, et al. 2003).

Since previous studies link obesity to economic circumstances, it makes sense that there is evidence that economic circumstances play a role in the appearance of stress. A belief is that SES influences stress because of differential access to resources and stigmatization related to belonging to a lower social class (Blanchard 2009; Offer, et al. 2010). In addition to these factors, belonging to a lower SES may expose someone to a more stressful lifestyle with resource uncertainty and a less desirable neighborhood environment (i.e. high crime, fewer local resources) (Blanchard 2009; Offer, et al. 2010). This scenario falls in line with the traditional view of obesity in developed societies, where there is an inverse relationship between obesity and SES. However, it does not explain the role of stress since all SES segments of society are becoming more obese. One possible explanation is the expansion of free market principles and their increased significance in individual lives. Offer, et al. (2010) found that societies with more free market policies tend to have higher rates of obesity than societies with more socialized economies, and hypothesize that it is because of the stress caused by the economic system. Under this hypothesis, the cause of stress is competition, uncertainty, and inequality, which as a result lead more people to over-eat (Offer, et al. 2010). While this idea is plausible, it discounts the possibility that in free market societies, unhealthy foods are very marketable and readily available for consumption.

Stress and depression correlate with obesity among African Americans, especially among women. Blanchard (2009) found that for African American women in

Omaha, Nebraska a significant correlation between obesity and depression exists for the convenience sample under study. This correlation is especially troublesome since 87% of the women surveyed were overweight or obese (Blanchard 2009).

An important stress factor for African Americans is racism or perceived racism. Racism has its roots in a system of privilege and dominance based on racial designation, in which races are understood as discrete and fundamentally different biological categories (Brace 2005; Jones 1997; Wolf, et al. 1994). Historically, the powerful have used biology to justify social differences (Brace 2005; Cartmill 1998). In countries with a history of privilege and power determined partly because of race, such as the United States, racism can have a long-standing impact even after officially sanctioned racist policies cease to exist (Cartmill 1998; Jones 1997; Utsey, et al. 2002). One can argue about the degree of racism that still exists in the United States; however, it is inarguable that many African Americans perceive racism. Perceived racism represents the subjective experience of discrimination regardless of whether an objectively determined, or independently verified act of racism actually occurred (Clark, et al. 1999). In order to see the potential impact of racism on obesity, an analysis of perceived racism occurs in this study.

Depending on the dimension of racism studied, previous studies have variously shown direct as well as inverse relationships between SES and perceived racism among African Americans (Clark, et al. 1999; Clark, et al. 2006). There is evidence that African American women of different SES statuses (based on income, education, and childhood SES) all experience similar levels of perceived racism (Vines, et al. 2006). Clark (1999) believes that higher SES African Americans perceive subtler discrimination since their environments have less overt forms of racism. In contrast, lower SES African Americans perceive more overt and institutionalized racism (Clark, et al. 1999). A definitive link between perceived racism and obesity has not been established, and this study can potentially shed light on this area.

Racism occurs at three levels: individual, institutional, and cultural (Harrell 2000; Jones 1997; Utsey, et al. 2002). All three of these levels of racism include both personal experiences and collective experiences. Individual racism is face-to-face expression of racist beliefs done by individuals (Harrell 2000; Jones 1997). Institutional and cultural racism, in contrast, occur when race impacts access to resources and exposure to race-specific stressors (Schell 1997). Institutional racism is systemic oppression embedded within social institutions and which is reflected in social policies and practices (Harrell 2000; Jones 1997; Smedley 2012; White, et al. 2012). Cultural racism is an ethnocentric worldview that perpetuates the superiority of the dominant racial or ethnic group (Harrell 2000; Jones 1997; Smedley 2012; White, et al. 2012). Each of these three forms of racism can be overt or covert, intentional or unintentional (Harrell 2000; Jones 1997; White, et al. 2012). When assessing stress among African Americans, it is important to consider stress that stems from experiences of racism or perceived racism.

In the same way that cultural practices within a group have an impact on health, discrimination or stigmatization based upon racial or ethnic affiliation can also have impacts on health. These impacts can derive from altered resource availability relative to the population in general, or derive from the physiological impact of exposure to racism-induced stress (Clark, et al. 1999; Dressler, et al. 2005; Harris-Britt, et al. 2007; Hogue 2002).

Harrell (2000) contends that racism can potentially affect quality of life in five domains: physical, psychological, social, functional, and spiritual. The physical domain refers to physiological changes in the body, such as cardiovascular reactivity, hypertension, and increased risk behavior (i.e. smoking and over-eating). The psychological domain is the mental well-being of an individual, and includes such things as depression, anxiety, and feelings of hostility. The social domain refers to the social connectedness members feel within a group and with society in general. The functional domain is the ability to function within roles and includes job performance, academic achievement, and parental functioning. The spiritual domain encompasses spiritual soundness, and racism can lead to loss of faith or feelings of meaninglessness. When considering the impact of racism on obesity, each of these domains can be directly or indirectly influential. It is possible that African Americans have a genetic predisposition towards obesity, but this does not discount the gene-environment interaction where racism-induced stress leads to the expression of these genes (Hogue 2002).

If a positive correlation between stress and obesity exists, there is possibly a similar connection between racism-induced stress and obesity (Paradies 2006; Vines, et al. 2006). Evidence supports the idea that racism-induced stress has a specific impact on other health conditions. Several studies have shown that when presented with racially insensitive imagery or situations, African Americans typically have cardiovascular reactivity, such as an increase in arterial blood pressure (Blascovich, et al. 2001; Fang and Myers 2001; Guyll, et al. 2001). Utsey et al. (2002) found that

African Americans reported more cases of race-related stress than Hispanic and Asian Americans; this finding corresponded to lower psychological quality of life scores. In addition to personal experiences of racism, stress may occur when perceived racism occurs towards a person's children (Nuru-Jeter 2009). Racism-induced stress potentially contributes to the high prevalence of heart disease, hypertension, low birth weight, and diabetes among African Americans (Clark, et al. 1999; Jones 2001; Jones 1997; Paeratakul, et al. 2002; Winkleby, et al. 1998). So even if racial categories are not genetic, systemic racism potentially become embodied in the physiological functioning of those affected (Gravlee 2009).

In addition to direct physiological responses to racism, perceived racism could also influence utilization of the healthcare system. For many African Americans, there is a mistrust of medical communities (Gamble 1997; LaVeist 2000; Randall 1996). Accounts of poor treatment (i.e. disrespectful clinicians), differential diagnoses/medical procedures (i.e. increased rates of hysterectomies for African Americans), and immoral practices (i.e. Tuskegee syphilis study subjects going untreated despite a cure being in existence) have made many African Americans avoid health care (Gamble 1997; LaVeist 2000; Randall 1996; Roberts 1998; Shavers, et al. 2012; White, et al. 2012). Increased perception of racism (especially group-level, institutional racism) may lead to less preventive care, in which conditions like obesity would be addressed by physicians (Gamble 1997; LaVeist 2000; Shavers, et al. 2012; White, et al. 2012).

Racism does have a biological impact, but that does not mean every African American will perceive or cope with racism in the same way. These differences are why it is most useful to collect subjective data regarding perception of racism as well as more objective measures of racism. For example, if one analyzes a single African American community, one expects that each community member experiences approximately the same degree of racism. However, personality traits, coping strategies, discrimination preparation, self-esteem, and/or ‘ethnic pride’ change the way an individual perceives and handles racism (Clark, et al. 1999; Harris-Britt, et al. 2007; Hogue 2002). Therefore, this variability creates a range of health outcomes seen in a community with the same level of racism.

There are possibly other factors contributing to the rise in obesity other than those mentioned in this chapter. Such factors might include higher birthrates among the obese, increased utilization of drugs that cause weight gain, or epigenetics that involves suppression of genes without altering DNA sequences (McAllister, et al. 2009). However, there is little evidence to support these as significant factors in the present study.

CHAPTER 3

METHODS

This study examines socioeconomic differences in obesity-influencing variables among African Americans in Metropolitan Detroit. There is an analysis of income, body mass index (BMI), and environmental stressors (including neighborhood satisfaction, stress, and perceived racism). Multiple regression and bivariate correlation statistical analyses of these variables are used. These statistical analyses cannot reveal causation; however, they can potentially reveal links between variables that are associated, in order to suggest interactive relationships. Previous research on obesity, as well as aspects of the collected data allows for an understanding of how the data relates to cultural and social circumstances experienced by the population under examination.

Study Population

The Center for Urban and African American Health (CUAAH) at Wayne State University provided local Metropolitan Detroit study data. CUAAH has several projects that seek ways to address health issues experienced by African Americans in the Detroit area, and to expand this knowledge to gain an understanding of how to address medical problems that disproportionately affect African Americans. These projects include: Obesity, Nitric Oxide, Oxidative Stress, and Salt Sensitivity; Weight Loss in Breast Cancer Survivors; and A Dyadic Intervention for Cardiac Rehabilitation Patients. CUAAH collected clinical and survey data used for this dissertation. Ordinal scale measures of neighborhood satisfaction, stress and perception of racism collected between 2004 and 2008 are used.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	518	18.3	104.5	53.3	1.2
BMI	536	20.1	83.2	32.7	7.1
Valid N (listwise)	505				

Table 1. Descriptive Statistics, Total

All participants resided in metropolitan Detroit at the time of data collection, and therefore are more likely to live in urbanized communities and subjected to specific local environmental and social factors that do not affect all African American populations in the United States. CUAAH recruited individuals aged 18 years and older, and from normal to obese BMI ranges. However, very few individuals under the age of 30 participated. The mean age is 53.3 +/- 1.2 for the sample (Table 1).

BMI Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<25	41	7.6	7.6	7.6
	25-30	163	30.4	30.4	38.1
	30-35	173	32.3	32.3	70.3
	35-40	94	17.5	17.5	87.9
	40+	65	12.1	12.1	100.0
	Total	536	100.0	100.0	

Table 2. BMI Distribution, Total

A large range of BMI was included in the study, with a minimum BMI of 20.1 (68”, 135 lbs.) and a maximum BMI of 83.2 (72”, 616 lbs.) (Table 1). The mean BMI is 32.7 for the sample (Table 1). Only 7.6% of participants included in the present study are in the “normal” BMI category (20 – 25 BMI) (Table 2). 30.4% is in the “overweight” category (25 – 30 BMI) (Table 2). The majority of participants, 62.0%, are considered “obese” (30+ BMI) (Table 2).

This study looks at both men and women, although 386 out of the 536 CUAAH participants analyzed (72.0%) were women. From a statistical standpoint, higher sample numbers allow for easier identification of significant associations and correlations for women than for men. The greater number of women is likely due to the studies being of greater interest to women and recruitment strategies that favored the enrollment of women (i.e. recruiting in areas commonly frequented by women). In 2008, the National Center of Health Statistics national survey reported that 49.6% of non-Hispanic Black women in the United States were overweight or obese, and 37.3% of non-Hispanic Black men were overweight or obese (Ogden, et al. 2010a). This pattern indicates that obesity is more prevalent among African American women than men, and it is appropriate that the data analyzed in this study has more women.

Variables

CUAAH obtained weight and height data for the participants during study visits. Weight (in pounds) was measured using a digital scale and height (in inches) obtained with a stadiometer. A conversion of these two measurements into metric units allowed for the calculation of body mass index (BMI) using the following formula:

$BMI = kg/m^2$

It is misleading to assume that all overweight and obese African Americans live in similar environments or have similar influences on their fat content. Traditionally, there is a correlation between obesity and SES. However, with a trend showing that African Americans of all social classes are becoming more obese, understanding the specific influences underlying obesity is important. This understanding includes discovering if members of different SES categories have different levels of exposure to obesity-favoring influences, or if there is exposure to similar obesity-favoring influences. By analyzing associations between income and several obesity-related variables, it is possible to hypothesize why African American obesity is on the rise for people of various SES backgrounds.

SES is quantified using household income. Chapter 2 discussed the advantages and disadvantages of using income to classify SES. CUAAH participants self-reported information on household income by selecting the income range to which they belong. Participants could select one of 16 income brackets:

1: $0 – 4,999 (38 participants)

2: $5,000 – 9,999 (41 participants)

3: $10,000 – 14,999 (19 participants)

4: $15,000 – 19,999 (26 participants)

5: $20,000 – 24,999 (28 participants)

6: $25,000 – 29,999 (31 participants)

7: $30,000 – 34,999 (26 participants)

8: $35,000 – 39,999 (27 participants)

9: $40,000 – 44,999 (23 participants)

10: $45,000 – 49,999 (36 participants)

11: $50,000 – 99,999 (152 participants)

12: $100,000 – 149,999 (48 participants)

13: $150,000 – 199,999 (22 participants)

14: $200,000 – 249,999 (5 participants)

15: $250,000 – 299,999 (0 participants)

16: $300,000+ (1 participant)

According to the 2006-2010 American Community Survey, mean earnings of African American households in the Detroit Metropolitan Statistical Area was $44,707 +/-484, and the median was $32,438 +/-347 (U.S. Census Bureau 2011). The CUAAH study population had a median income range of $45,000 – 49,999, which is higher than the Metro Detroit median. Income brackets were collapsed into three categories. The low income category included everyone with an income below $25,000. The middle income category included those with income between $25,000 and $49,999. The high income category included participants with income at $50,000 or higher. The cutoffs for the three income categories were selected due to three factors: the income cutoffs are relatively uniform at $25,000 intervals; the number of participants in each category is relatively equal; and the middle income category contained the Metro Detroit mean income, Metro Detroit median income, and study population median income.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	147	18.7	83.2	53.1	1.3
BMI	152	20.4	63.1	32.6	7.2
Valid N (listwise)	147				

Table 3. Descriptive Statistics, Low Income

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	141	18.37	104.5	54.6	1.2
BMI	143	20.2	76.7	33.0	6.8
Valid N (listwise)	141				

Table 4. Descriptive Statistics, Middle Income

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	217	19.7	81.0	52.2	9.8
BMI	228	20.1	83.2	32.8	7.4
Valid N (listwise)	217				

Table 5. Descriptive Statistics, High Income

After dividing into three income categories, each income category was compared to ensure that they maintained similar demographic statistics. Mean age, mean BMI, and sex distribution were relatively equal between the three income categories (Table 3, Table 4, Table 5).

BMI Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<25	14	9.2	9.2	9.2
	25-30	48	31.6	31.6	40.8
	30-35	45	29.6	29.6	70.4
	35-40	21	13.8	13.8	84.2
	40+	24	15.8	15.8	100.0
	Total	152	100.0	100.0	

Table 6. BMI Distribution, Low Income

BMI Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<25	9	6.3	6.3	6.3
	25-30	40	28.0	28.0	34.3
	30-35	48	33.6	33.6	67.8
	35-40	29	20.3	20.3	88.1
	40+	17	11.9	11.9	100.0
	Total	143	100.0	100.0	

Table 7. BMI Distribution, Middle Income

BMI Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<25	18	7.9	7.9	7.9
	25-30	69	30.3	30.3	38.2
	30-35	75	32.9	32.9	71.1
	35-40	42	18.4	18.4	89.5
	40+	24	10.5	10.5	100.0
	Total	228	100.0	100.0	

Table 8. BMI Distribution, High Income

In addition, the distribution of BMI within each income category was similar (Table 6, Table 7, Table 8).

CUAAH collected questionnaire data pertaining to satisfaction with neighborhood attributes, stress, and perception of racism. Assessment of neighborhood satisfaction occurred in two steps. First, participants answered 2 questions about their overall feelings about their neighborhood, and then answered several questions about specific neighborhood attributes. The first question related to overall neighborhood satisfaction is “All things considered, how satisfied are you with this neighborhood as a place to live?” The response is on a 4-value ordinal scale (0-3), with 0 meaning very dissatisfied, 1 meaning dissatisfied, 2 meaning satisfied, and 3 meaning very satisfied. The second question is “Do you feel that you are part of the neighborhood or is it just a place to live?” These questions were asked to see if satisfaction with neighborhood attributes correlate with overall satisfaction and feelings towards a neighborhood.

Participants then responded to the question “Are you satisfied or dissatisfied with these aspects of your neighborhood?” followed by a list of features. The responses are on a 4-value ordinal scale (0-3), with 0 meaning very dissatisfied, 1 meaning dissatisfied, 2 meaning satisfied, and 3 meaning very satisfied. Some of the specific neighborhood features analyzed relate to sustenance, including satisfaction with grocery stores and restaurants. Other questions relate to physical activities, such as satisfaction with recreation and parks. The question responses were collectively analyzed through factor analysis to create a scale measure of neighborhood satisfaction. There are also questions related to satisfaction with safety and neighborhood appearance, including neighborhood safety, overall appearance, streets, lighting, and sidewalks. Satisfaction is a relatively subjective measure since two different people can have different satisfaction levels with the same neighborhood. However, satisfaction tells more about a personal perspective of a neighborhood than does a list of neighborhood attributes (Amerigo and Aragones 1997).

A separate survey tool was used to evaluate stress experienced by participants. There are data that assesses the level of stress encountered by participants and the ability to cope with stress using 4-value ordinal scales. For all of the stress related questions, 1 indicates that the person never had to deal with the stress-related event, 2 means a few times, 3 means sometimes, and 4 indicates that they dealt with the event frequently. Analysis of the question responses through factor analysis created scale measures of stress. Listed below are the stress-related questions to which CUAAH participants replied:

- How often have you felt that you were unable to control the important things in life?
- How often have you felt nervous and "stressed?"
- How often have you dealt successfully with stress?
- How often have you effectively coped with stress?
- How often are you confident in controlling your personal problems?
- How often do you feel things are going your way?
- How often are you unable to cope with stress?
- How often are you able to control irritations in your life?
- How often do you feel on top of things?
- How often do you feel anger?

- How often do you find yourself able to control your time?
- How often do you find difficulties piling?

This study includes an analysis of data collected by CUAAH pertaining to perception of racism. Measurements of perceived racism occur in a very similar way to measurements of stress events. Participants answered questions related to personal experiences of racism, events of racism they heard about, and how they felt others regarded members of their race. Participants identified their perceptions of racism based on a 5-value ordinal scale (0-4), with 0 meaning either "never" or "very low" depending on the question, 1 meaning "rarely" or "below average," 2 meaning "sometimes" or "average," 3 meaning "often" or "above average," and 4 meaning "very often" or "very high." Analysis of the question responses through factor analysis created scale measures of perceived racism. This study includes an analysis of the following questions:

- During your lifetime, how much have you personally experienced unfair treatment because of your race or ethnicity?
- Over the past 12 months, how much have you personally experienced unfair treatment because of your race or ethnicity?
- Does racism affect the lives of people in the same race or ethnicity as you?
- For people close to you, how has racism/discrimination impacted their life experience?
- How are individuals from your race/ethnicity regarded in the United States?
- How frequently do you hear about incidents of racial prejudice, discrimination or racism from people you know?

- How much do you think about racism/discrimination?
- How much stress has racism caused in your lifetime?
- How much stress has racism caused in the last 12 months?

When looked at collectively, these questions reveal perceptions of personal, institutional, and cultural racism.

Statistical Analyses

This study utilized three statistical analyses to yield results that address the hypothesis and aims: bivariate correlation, multiple linear regression, and multiple analysis of covariance. However, before performing these analyses, a factor analysis reduces data obtained from numerous questions related to stress, perceived racism, and neighborhood satisfaction into a handful of underlying component factor variables that will become the "study variables" (variables from which information that address the study hypothesis is derived). Bivariate correlations are utilized twice: first, to see if income correlates with BMI for the study population and, second, to see if there are correlations between BMI, age, and the study variables derived from factor analysis for the three income categories (low, middle, high). Multiple regression is then used to evaluate whether the study variables predict the variability of BMI (controlling for age and sex) for the three income categories. Finally, multiple analysis of covariance is done to evaluate if BMI explains the variability of the study variables (controlling for age and sex) for the three income categories.

Factor Analysis

Factor analysis is a data reduction technique used to find a few unobserved variables that explains the variation observed in numerous survey question responses (Tabachnick and Fidell 2007). It is useful because it can identify unifying themes that otherwise are not detected when analyzing individual survey question responses (Tabachnick and Fidell 2007).

As mentioned previously, participants answered numerous questions regarding neighborhood satisfaction, stress, and perceived racism. Factor analysis is used to find the underlying factors in each of these areas.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.887
Bartlett's Test of Sphericity	Approx. Chi-Square	2013.333
	df	78
	Sig.	.000

Table 9. KMO and Bartlett's Test of Sphericity for Stress Survey Responses

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.847
Bartlett's Test of Sphericity	Approx. Chi-Square	1702.068
	df	36
	Sig.	.000

Table 10. KMO and Bartlett's Test of Sphericity for Perceived Racism Survey Responses

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.914
Bartlett's Test of Sphericity	Approx. Chi-Square	2172.125
	df	36
	Sig.	.000

Table 11. KMO and Bartlett's Test of Sphericity for Neighborhood Satisfaction Survey Responses

To determine whether a data set is reducible with factor analysis, a Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were performed. Together, these tests show if there is a sufficient link between questions to reveal component factors (Tabachnick and Fidell 2007). Data from the 12 questions used to assess stress for the study sample had a KMO score of 0.887 and a Bartlett's score of 2013.333, which has a significance of p<0.001 (Table 9), meaning that a factor analysis would reveal significant components for stress. Data for the 9 questions related to perceived racism had a KMO score of 0.847 and a Bartlett's score of 1702.068, which has a significance of p<0.001 (Table 10). Neighborhood satisfaction data had a KMO score of 0.914 and a Bartlett's score of 2172.125, which has a significance of p<0.001. Therefore, the reduction of data for stress, perceived racism and neighborhood satisfaction to factor components is appropriate.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.601	35.396	35.396	4.601	35.396	35.396	3.793	29.175	29.175
2	1.696	13.049	48.445	1.696	13.049	48.445	2.505	19.270	48.445
3	.975	7.497	55.942						
4	.830	6.383	62.325						
5	.724	5.571	67.896						
6	.680	5.231	73.127						
7	.610	4.694	77.822						
8	.600	4.614	82.435						
9	.530	4.077	86.512						
10	.502	3.860	90.372						
11	.442	3.401	93.773						
12	.419	3.225	96.998						
13	.390	3.002	100.000						

Extraction Method: Principal Component Analysis.

Table 12. Component Analysis for Stress Survey Responses, Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.179	46.432	46.432	4.179	46.432	46.432	3.161	35.127	35.127
2	1.053	11.702	58.134	1.053	11.702	58.134	2.071	23.008	58.134
3	.826	9.178	67.312						
4	.689	7.660	74.973						
5	.645	7.170	82.143						
6	.528	5.865	88.008						
7	.434	4.820	92.828						
8	.420	4.662	97.490						
9	.226	2.510	100.000						

Extraction Method: Principal Component Analysis.

Table 13. Component Analysis for Perceived Racism Survey Responses, Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.920	54.666	54.666	4.920	54.666	54.666
2	.900	9.997	64.663			
3	.631	7.010	71.673			
4	.547	6.073	77.746			
5	.482	5.359	83.104			
6	.444	4.938	88.042			
7	.411	4.564	92.607			
8	.375	4.170	96.777			
9	.290	3.223	100.000			

Extraction Method: Principal Component Analysis.

Table 14. Component Analysis for Neighborhood Satisfaction Survey Responses, Total Variance Explained

Principal component factor analysis helps to determine patterns among multiple question responses, and identifies clusters of questions that are potentially linked (Tabachnick and Fidell 2007). Identification of these clusters is based on the percentage of variance explained by a component. A component is significant if it has an eigenvalue ≥1 (Tabachnick and Fidell 2007). Stress data (Table 12) and perceived racism data (Table 13) each have two components with eigenvalues ≥1. Neighborhood satisfaction only has one eigenvalue ≥1 (Table 14). However, at this stage, it is not clear what each component means, and further analysis must be done.

A component matrix shows the percentage of each variable explained by a component (Tabachnick and Fidell 2007). For example, the component matrix for stress data (Table 15) indicates that 75.4% of variation in the responses to the question *How often have you felt nervous and "stressed?"* is explained by component 1. By analyzing the questions with the highest percentage explained by a particular component, the components can be interpreted (Tabachnick and Fidell 2007). Using varimax rotation on the component matrix maximizes the amount of variation explained by each component for the survey questions. The meaning of each component is determined by the researcher by using knowledge of the area of study (Tabachnick and Fidell 2007).

Rotated Component Matrix[a]

	Component	
	1	2
STRESS_UNABLE_TO_CONTROL	.721	-.136
STRESS_NERVOUS	.754	-.046
STRESS_DEALT_SUCCESSFULLY	.035	.695
STRESS_EFFECTIVELY_COPING	-.182	.746
STRESS_PERSONAL_PROBS	-.387	.614
STRESS_THINGS_YOUR_WAY	-.578	.284
STRESS_NOT_COPE	.630	-.232
STRESS_CONTROL_IRRITATIONS	-.373	.608
STRESS_ON_TOP_OF_THINGS	-.540	.492
STRESS_ANGER	.698	.004
STRESS_FOUND_THINKING	.415	.465
STRESS_DIFFICULTIES_PILING	.736	-.133
STRESS_CONTROL_TIME	-.396	.295

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 15. Rotated Component Matrix for Stress Survey Responses

Stress data is reduced into two categories. Component 1 in Table 15 was interpreted as "uncontrollable stress," or stress that a participant is unable to cope with and handle. In general, questions with 60% or more of their variation explained by a component are considered most important when interpreting a component's meaning. Component 1 explained 74.5% of variation in the responses to "How often have you felt nervous and stressed," 73.6% of variation for "How often do you find difficulties piling," 72.1% of variation for "How often have you felt that you were unable to control the important things in life," 69.8% of variation for "How often do you feel anger," and 63.0% of variation for the question "How often are you unable to cope with stress?" Each of these questions refers to instances where a person is unable to control emotions or aspects of their life. Component 2 in Table 15 represents "controllable stress," or stress that a participant can cope with successfully. Component 2 explained 74.6% of variation in the responses to "How often have you effectively coped with stress," 69.5% of variation for "How often have you dealt successfully with stress," 61.4% of variation for "How often are you confident in controlling your personal problems," and 60.8% of variation for the question "How often are you able to control irritations in your life?" Each of the questions related to Component 2 refer to the ability to control or cope with stress.

The thirteen questions used to measure stress have a Cronbach's alpha of 0.338. A Cronbach's alpha under 0.700 generally indicates that the questions would not combine to form a scale that accurately measures a single variable. The low Cronbach's alpha for stress questions is expected because the factor analysis revealed two fairly distinct underlying components.

Rotated Component Matrix[a]

	Component	
	1	2
RACISM_RACE_UNFAIR_LIFE	.667	.369
RACISM_RACE_UNFAIR_12M	.832	.075
RACISM_RACISM_AFFECTS	.242	.715
RACISM_RACISM_IMPACT	.455	.614
RACISM_INDIVIDUALS_REGARDED	.047	-.706
RACISM_RACIAL_INCIDENTS	.445	.476
RACISM_THINK_ABOUT_RACE	.515	.451
RACISM_STRESS_DUE_RACISM_LIFE	.736	.332
RACISM_STRESS_DUE_RACISM_12M	.867	.057

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 16. Rotated Component Matrix for Perceived Racism Survey Responses

Perceived racism data has two categories. Component 1 in Table 16 was interpreted as “personal racism,” which is racism that an individual feels is directed towards them. Component 1 explained 86.7% of variation in the responses to “How much stress has racism caused in the last 12 months,” 83.2% of variation for “Over the past 12 months, how much have you personally experienced unfair treatment because of your race or ethnicity,” 73.6% of variation for “How much stress has racism caused in your lifetime,” and 66.7% of variation for responses to the question “During your lifetime, how much have you personally experienced unfair treatment because of your race or ethnicity?” The questions related to component 1 each refers to personal experiences of racism, without necessarily identifying the type of racism experienced (i.e. institutional, cultural, etc.). Component 2 was interpreted as “group racism,” or racism that is experienced collectively by members of an ethnic group. Component 2 explained 71.5% of variation in the responses to “Does racism affect the lives of people in the same race or ethnicity as you,” 70.6% of variation for “How are individuals from your race/ethnicity regarded in the United States," and 61.4% of variation in responses to "For people close to you, how has racism/discrimination impacted their life experience?" None of the questions refers to personal experiences of racism, instead they address how racism affects others (or people of the same race, in general).

The nine questions used to measure perceived racism have a Cronbach's alpha of 0.788. The high Cronbach's alpha indicates that all of the questions collectively address perceived racism as a scale measure. The factor analysis revealed two distinct components, or types of perceived racism, within the question responses. However, a single scale measure would have adequately measured perceived racism in general.

Component Matrix[a]

	Component
	1
SP_SAFETY	.760
SP_GROCERY	.701
SP_APPEARANCE	.783
SP_RECREATIONAL	.730
SP_STREETS	.811
SP_LIGHTING	.709
SP_SIDEWALKS	.703
SP_PARKS	.763
SP_RESTAURANTS	.685

Extraction Method: Principal Component Analysis.

a. Only one component was extracted. The solution cannot be rotated.

Table 17. Component Matrix for Neighborhood Satisfaction Survey Responses

Correlations

		How satisfied are you with this neighborhood as a place to live	Do you feel that you are part of the neighborhood or is it just a place to live	Neighborhood Satisfaction
How satisfied are you with this neighborhood as a place to live	Pearson Correlation	1	.327**	.605**
	Sig. (2-tailed)		.000	.000
	N	533	530	519
Do you feel that you are part of the neighborhood or is it just a place to live	Pearson Correlation	.327**	1	.191**
	Sig. (2-tailed)	.000		.000
	N	530	530	516
Neighborhood Satisfaction	Pearson Correlation	.605**	.191**	1
	Sig. (2-tailed)	.000	.000	
	N	519	516	519

**. Correlation is significant at the 0.05 level (2-tailed).

Table 18. Correlation of Neighborhood Satisfaction Component Variable to Overall Neighborhood Satisfaction Question Responses

Neighborhood satisfaction data only has one category, and therefore the interpretation of component 1 in Table 17 was simply "neighborhood satisfaction." There was a correlation analysis performed to ensure that this category indeed reflects neighborhood satisfaction. Table 18 is a bivariate correlation table showing if there were significant links between responses to the questions "How satisfied are you with this neighborhood as a place to live?" and "Do you feel like part of the neighborhood?" with the neighborhood satisfaction data obtained through the factor analysis. There were significant positive correlations ($p<0.001$) between neighborhood satisfaction and the two questions. This result means that a higher neighborhood satisfaction score corresponds to feeling satisfied with a neighborhood as a place to live and feeling like part of the neighborhood.

The nine questions used to measure neighborhood satisfaction have a Cronbach's alpha of 0.895. The high Cronbach's alpha indicates that all of the questions collectively address neighborhood satisfaction as a scale measure. Since factor analysis only revealed a single component, Cronbach's alpha supports the reliability of that component.

Bivariate Correlations

Bivariate correlation analyses were used in this study to assess direct variable-to-variable trends in the data set (Tabachnick and Fidell 2007). The variables included BMI, age, income, and the study variables derived from factor analysis (uncontrollable stress, controllable stress, personal racism, group racism, and neighborhood satisfaction). Results are displayed in bivariate correlation tables, although not all of the correlations are relevant to this study and are therefore not considered in the final analysis. For example, even though the table displays the correlation between neighborhood satisfaction and personal racism, this correlation does not directly address the goal or aims of the study (even though a link may be interesting), so no further discussion is warranted.

Multiple Regression

Multiple regression analysis assesses whether several independent variables are able to predict the variation seen for a single dependent variable (Tabachnick and Fidell 2007). In this study, the dependent variable tested was BMI. The independent variables were controllable stress, uncontrollable stress, neighborhood satisfaction, personal racism, and group racism. Hierarchical multiple regression was used to control for age and sex, which influence the distribution of BMI. First, the control variables (age and sex) were entered into a regression with the dependent variable of

BMI. Then the study variables (controllable stress, uncontrollable stress neighborhood satisfaction, personal racism, and group racism) were entered into the regression in a second step. This two-step entry process examined the study variables after accounting for the influence of the control variables.

An analysis of variance (ANOVA) for regression is a test that results in an F-statistic that shows whether a group of independent variables predicts a dependent variable (Tabachnick and Fidell 2007). The F-statistic is compared to the F-distribution (expected distribution of variation if there is no link between variables). If the ANOVA test is significant, the interpretation is that the independent variables can predict the dependent variable.

Regression coefficients show how well each independent variable predicts the dependent variable (Tabachnick and Fidell 2007). Regression coefficients are expressed as t-scores. It is possible to have a collection of independent variables that is predictive, yet the regression coefficients can reveal that no single variable is strongly predictive. If there is a significant regression coefficient for a variable, it means the variable likely has an individual influence on the dependent variable.

Regression analyses were performed for three income categories: $0 – 24,999 (low), $25,000 – 49,999 (middle), and $50,000+ (high). The resulting data was compared with one another to determine if the independent variables influence BMI differently based on income.

Multiple Analysis of Covariance

Multiple analysis of covariance (MANCOVA) tests the effects of a single independent variable on several dependent variables (Tabachnick and Fidell 2007). This analysis evaluates the level of influence BMI has on the study variables (stress, neighborhood satisfaction, and perceived racism). A correlation analysis identifies statistical relationships between BMI and the study variables. Multiple regression shows if the study variables predict the variation of obesity. MANCOVA was done to examine whether there is evidence of BMI predicting the distributions of the study variables. This examination potentially reveals more about the nature of relationships the study variables have with obesity.

In the MANCOVA, the independent (or fixed) variable was BMI. Age and sex were entered as covariates, this controlled for their effect on the amount of variability that BMI explains. The dependent variables were uncontrollable stress, controllable stress, neighborhood satisfaction, personal racism, and group racism. The results revealed information about the predictive value of BMI on the dependent variables collectively and individually.

CHAPTER 4

RESULTS

Obesity may have connections with neighborhood satisfaction and stress (including stress due to racism) based on the literature review; however, for the study population of African Americans from Metropolitan Detroit, this connection has yet to be established. The research includes analyses that address the study aims in order to support or reject the research hypothesis that among African Americans in Metropolitan Detroit, neighborhood satisfaction, stress, and perception of racism influence obesity differently based on income. This chapter is organized to address each aim of the study. A discussion of the results is provided in Chapter 5.

Aim 1: Determine if income correlates with BMI for the study population

An analysis of whether income correlates with obesity allows for assessment of whether social status has a relationship with the distribution of obesity. Income serves as a proxy measure for socioeconomic status in this study, and can reveal whether there is a relationship in the study population.

Correlations

		BMI	Income
BMI	Pearson Correlation	1	.039
	Sig. (2-tailed)		.370
	N	536	523
Income	Pearson Correlation	.039	1
	Sig. (2-tailed)	.370	
	N	523	523

Table 19. Correlation between Income and BMI, Total

Correlations

		BMI	Income
BMI	Pearson Correlation	1	.218*
	Sig. (2-tailed)		.011
	N	136	136
Income	Pearson Correlation	.218*	1
	Sig. (2-tailed)	.011	
	N	136	136

Table 20. Correlation between Income and BMI, Men

Correlations

		BMI	Income
BMI	Pearson Correlation	1	-.038
	Sig. (2-tailed)		.460
	N	386	373
Income	Pearson Correlation	-.038	1
	Sig. (2-tailed)	.460	
	N	373	373

Table 21. Correlation between Income and BMI, Women

Using bivariate correlation analysis, there is no link between income and BMI when looking at the total study sample (Table 19). However, when only considering men, there is a significant correlation between income and BMI (Table 20). This direct correlation indicates that as household income increases, BMI increases for men. No link exists between income and BMI for women.

Aim 2: Evaluate correlations between BMI, stress, neighborhood satisfaction and perceived racism for income categories

The study population is divided into three income categories: Low ($0 – 24,999), Medium ($25,000 – 50,000), and High ($50,000+). Bivariate correlations are conducted within each income category. For this study, the most important correlations are those that are related to BMI. If a variable has a significant correlation with BMI, it suggests a relationship. However, it will require the later multivariate analyses to determine if the variable predicts BMI, or if BMI predicts the variable.

Correlations

		BMI	Age	Sex (Male=1, Female=2)	Controllable Stress	Uncontrollable Stress	Personal Racism	Group Racism	Neighborhood Satisfaction
BMI	Pearson Correlation	1	-.049	.303**	.134	.035	-.052	-.038	.016
	Sig. (2-tailed)		.559	.000	.103	.674	.531	.652	.851
	N	152	147	148	150	150	147	147	148
Age	Pearson Correlation	-.049	1	-.049	-.122	-.133	.047	.021	-.032
	Sig. (2-tailed)	.559		.552	.143	.111	.582	.806	.705
	N	147	147	147	145	145	142	142	145
Sex (Male=1, Female=2)	Pearson Correlation	.303**	-.049	1	.273**	-.042	-.103	-.099	-.117
	Sig. (2-tailed)	.000	.552		.001	.614	.221	.239	.160
	N	148	147	148	146	146	143	143	146
Controllable Stress	Pearson Correlation	.134	-.122	.273**	1	.075	.094	.144	-.202*
	Sig. (2-tailed)	.103	.143	.001		.362	.260	.085	.014
	N	150	145	146	150	150	145	145	146
Uncontrollable Stress	Pearson Correlation	.035	-.133	-.042	.075	1	.062	.046	-.039
	Sig. (2-tailed)	.674	.111	.614	.362		.460	.584	.637
	N	150	145	146	150	150	145	145	146
Personal Racism	Pearson Correlation	-.052	.047	-.103	.094	.062	1	.048	-.198*
	Sig. (2-tailed)	.531	.582	.221	.260	.460		.567	.017
	N	147	142	143	145	145	147	147	144
Group Racism	Pearson Correlation	-.038	.021	-.099	.144	.046	.048	1	-.122
	Sig. (2-tailed)	.652	.806	.239	.085	.584	.567		.145
	N	147	142	143	145	145	147	147	144
Neighborhood Satisfaction	Pearson Correlation	.016	-.032	-.117	-.202*	-.039	-.198*	-.122	1
	Sig. (2-tailed)	.851	.705	.160	.014	.637	.017	.145	
	N	148	145	146	146	146	144	144	148

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 22. Low Income: Bivariate Correlations between BMI, Age, Sex, Controllable Stress, Uncontrollable Stress, Personal Racism, Group Racism, and Neighborhood Satisfaction

Within the low income category, there is only one significant correlation between BMI and another variable (Table 22). The correlation indicates that being female is directly correlated with being obese, with $p \leq 0.001$. Since BMI does not have a significant correlation with any of the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction), this preliminarily suggests that none of these variables likely have an influence on obesity among low income individuals in the study population. Sex has a significant direct correlation with controllable stress (p=0.001), which suggests that sex may have an influence on the relationship between BMI and the study variables, and therefore it is justified to control for this variable in the multivariate analyses.

Correlations

		BMI	Age	Sex (Male=1, Female=2)	Controllable Stress	Uncontrollable Stress	Personal Racism	Group Racism	Neighborhood Satisfaction
BMI	Pearson Correlation	1	-.031	.193*	-.052	-.025	-.051	.135	.074
	Sig. (2-tailed)		.718	.021	.540	.771	.558	.117	.395
	N	143	141	142	142	142	135	135	135
Age	Pearson Correlation	-.031	1	-.085	-.259**	-.049	-.010	-.112	-.022
	Sig. (2-tailed)	.718		.319	.002	.569	.910	.196	.803
	N	141	141	141	140	140	135	135	133
Sex (Male=1, Female=2)	Pearson Correlation	.193*	-.085	1	.225**	.163	.053	.004	.115
	Sig. (2-tailed)	.021	.319		.007	.053	.538	.961	.184
	N	142	141	142	141	141	135	135	134
Controllable Stress	Pearson Correlation	-.052	-.259**	.225**	1	-.077	.182*	.069	-.057
	Sig. (2-tailed)	.540	.002	.007		.364	.036	.426	.516
	N	142	140	141	142	142	134	134	134
Uncontrollable Stress	Pearson Correlation	-.025	-.049	.163	-.077	1	.091	-.006	.131
	Sig. (2-tailed)	.771	.569	.053	.364		.294	.947	.131
	N	142	140	141	142	142	134	134	134
Personal Racism	Pearson Correlation	-.051	-.010	.053	.182*	.091	1	.012	-.004
	Sig. (2-tailed)	.558	.910	.538	.036	.294		.887	.967
	N	135	135	135	134	134	135	135	127
Group Racism	Pearson Correlation	.135	-.112	.004	.069	-.006	.012	1	-.135
	Sig. (2-tailed)	.117	.196	.961	.426	.947	.887		.131
	N	135	135	135	134	134	135	135	127
Neighborhood Satisfaction	Pearson Correlation	.074	-.022	.115	-.057	.131	-.004	-.135	1
	Sig. (2-tailed)	.395	.803	.184	.516	.131	.967	.131	
	N	135	133	134	134	134	127	127	135

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 23. Middle Income: Bivariate Correlations between BMI, Age, Sex, Controllable Stress, Uncontrollable Stress, Personal Racism, Group Racism, and Neighborhood Satisfaction

As seen in the low income category, the middle income category shows a significant direct correlation between sex and BMI (Table 23), with being female being associated with higher BMI. The strength of the correlation is not as strong for the middle income as it is for the low income, but with p=0.021, it is still statistically significant. BMI does not exhibit any significant correlations with the study variables. However, age has a significant inverse correlation with controllable stress (p=0.002) and sex has a significant direct correlation with controllable stress (p=0.007). This result means that analyses that control for their influence should be conducted before concluding that the study variables have no relationships with BMI.

Correlations

		BMI	Age	Sex (Male=1, Female=2)	Controllable Stress	Uncontrollable Stress	Personal Racism	Group Racism	Neighborhood Satisfaction
BMI	Pearson Correlation	1	-.061	-.067	-.010	-.102	-.027	.039	-.063
	Sig. (2-tailed)		.374	.322	.879	.125	.689	.562	.347
	N	228	217	219	228	228	219	219	224
Age	Pearson Correlation	-.061	1	-.160*	.002	-.006	.045	.118	-.003
	Sig. (2-tailed)	.374		.019	.975	.927	.515	.088	.962
	N	217	217	217	217	217	208	208	213
Sex (Male=1, Female=2)	Pearson Correlation	-.067	-.160*	1	.137*	.119	-.107	-.111	.072
	Sig. (2-tailed)	.322	.019		.043	.078	.124	.110	.295
	N	219	217	219	219	219	210	210	215
Controllable Stress	Pearson Correlation	-.010	.002	.137*	1	-.029	.239**	.032	-.194**
	Sig. (2-tailed)	.879	.975	.043		.663	.000	.638	.004
	N	228	217	219	228	228	219	219	224
Uncontrollable Stress	Pearson Correlation	-.102	-.006	.119	-.029	1	.005	-.027	.051
	Sig. (2-tailed)	.125	.927	.078	.663		.937	.689	.451
	N	228	217	219	228	228	219	219	224
Personal Racism	Pearson Correlation	-.027	.045	-.107	.239**	.005	1	-.060	-.032
	Sig. (2-tailed)	.689	.515	.124	.000	.937		.376	.642
	N	219	208	210	219	219	219	219	216
Group Racism	Pearson Correlation	.039	.118	-.111	.032	-.027	-.060	1	-.019
	Sig. (2-tailed)	.562	.088	.110	.638	.689	.376		.777
	N	219	208	210	219	219	219	219	216
Neighborhood Satisfaction	Pearson Correlation	-.063	-.003	.072	-.194**	.051	-.032	-.019	1
	Sig. (2-tailed)	.347	.962	.295	.004	.451	.642	.777	
	N	224	213	215	224	224	216	216	224

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 24. High Income: Bivariate Correlations between BMI, Age, Sex, Controllable Stress, Uncontrollable Stress, Personal Racism, Group Racism, and Neighborhood Satisfaction

The high income category differs from the low and middle categories because there are no significant correlations between BMI and any of the variables examined (Table 24). Since sex does not correlate with BMI, it means that men have a similar distribution of BMI as women. Once again, there is a significant correlation between sex and controllable stress (p=0.043).

The results of bivariate correlations show no direct interactions between BMI and the five study variables. However, within all three income categories, sex has a significant direct correlation with controllable stress. In the middle income category, age has an inverse correlation with controllable stress. This result highlights the importance of controlling for age and sex in the multivariate analyses before making a conclusion that the study variables do not have a relationship with BMI.

Aim 3: Evaluate if stress, neighborhood satisfaction, and perceived racism are related to BMI using multivariate statistics

There are two multivariate analyses conducted in this study: multiple regression and multiple analysis of covariance (MANCOVA). Multiple regression examines BMI as a dependent variable and the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction) are independent variables. This design directly addresses the study hypothesis because it looks at whether neighborhood satisfaction, stress, and perception of racism can predict the variability of BMI within each income category. However, the relationships between the study variables and BMI may be such that BMI has influence on the variability seen in the study variables. The MANCOVA examines the same data, but uses BMI as the independent variable, and the study variables are viewed as dependent. This analysis is performed to help in interpreting the causation of any relationships seen between BMI and the study variables. For both the multiple regression and MANCOVA, age and sex are controlled for in the analyses.

Multiple Regression

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	828.553	2	414.276	8.761	.000[a]
	Residual	6430.701	136	47.285		
	Total	7259.254	138			
2	Regression	876.200	7	125.171	2.569	.016[b]
	Residual	6383.054	131	48.726		
	Total	7259.254	138			

a. Predictors: (Constant), Sex, Age

b. Predictors: (Constant), Sex, Age, Group Racism, Uncontrollable Stress, Personal Racism, Neighborhood Satisfaction, Controllable Stress

c. Dependent Variable: BMI

Table 25. Low Income: Analysis of Variance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.338[a]	.114	.101	6.876377406	.114	8.761	2	136	.000
2	.347[b]	.121	.074	6.980372580	.007	.196	5	131	.964

a. Predictors: (Constant), Sex, Age

b. Predictors: (Constant), Sex, Age, Group Racism, Uncontrollable Stress, Personal Racism, Neighborhood Satisfaction, Controllable Stress

Table 26. Low Income: Multiple Regression Model Summary

In the low income category, the regression models predict the variation seen in BMI. In Table 25, model 1 is the analysis of variance results for the control variables, and model 2 are analysis of variance results with the addition of the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction). Since model 2 yielded significant results, it means that the study variables along with the control variables are able to predict the variation of BMI within the low income category (p=0.016). Table 26 is able to provide more information about the predictive strength of the study variables. R=0.347 for model 2, meaning that the strength is relatively weak since an R value under 0.400 is generally considered weak (Tabachnick and Fidell 2007). In addition, the change in R square from model 1 to model 2 was slightly negative, indicating that the addition of the study variables after controlling for age and sex had no impact on the predictive power of the model.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	23.404	3.594		6.511	.000		
	Age	-.020	.045	-.036	-.445	.657	.996	1.004
	Sex (Male=1, Female=2)	5.795	1.404	.334	4.128	.000	.996	1.004
2	(Constant)	23.465	3.691		6.358	.000		
	Age	-.014	.046	-.025	-.296	.767	.965	1.036
	Sex (Male=1, Female=2)	5.555	1.516	.320	3.665	.000	.881	1.136
	Controllable Stress	.355	.562	.056	.631	.529	.846	1.183
	Uncontrollable Stress	.299	.559	.044	.535	.593	.973	1.028
	Personal Racism	.115	.584	.017	.197	.844	.937	1.067
	Group Racism	-.256	.537	-.040	-.478	.634	.943	1.061
	Neighborhood Satisfaction	-.030	.727	-.004	-.041	.967	.918	1.089

a. Dependent Variable: BMI

Table 27. Low Income: Regression Coefficients

A look at the regression coefficients for the low income category (Table 27), gives a better idea of the impact of each individual variable on the regression model. Looking at model 2, only sex had a statistically significant coefficient for predicting BMI. This result indicates that even though the model shows that the study variables predict the variability of BMI when controlling for age and sex, none of the study variables have a particularly strong influence on BMI.

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	182.843	2	91.421	1.935	.149[a]
	Residual	5812.298	123	47.254		
	Total	5995.140	125			
2	Regression	527.239	7	75.320	1.625	.135[b]
	Residual	5467.901	118	46.338		
	Total	5995.140	125			

a. Predictors: (Constant), Sex, Age

b. Predictors: (Constant), Sex, Age, Personal Racism, Group Racism, Neighborhood Satisfaction, Uncontrollable Stress, Controllable Stress

c. Dependent Variable: BMI

Table 28. Middle Income: Analysis of Variance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.175[a]	.030	.015	6.874187380	.030	1.935	2	123	.149
2	.297[b]	.088	.034	6.807212934	.057	1.486	5	118	.199

a. Predictors: (Constant), Sex, Age

b. Predictors: (Constant), Sex, Age, Personal Racism, Group Racism, Neighborhood Satisfaction, Uncontrollable Stress, Controllable Stress

Table 29. Middle Income: Multiple Regression Model Summary

Table 28 shows that the study variables do not predict BMI for the middle income participants, even when controlling for age and sex. The R-value of the regression increases from model 1 to model 2 (Table 29), suggesting that the addition of the study variables adds predictive power to the regression after age and sex are controlled. However, this increase in predictive power is not statistically significant.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	30.739	3.755		8.186	.000		
	Age	-.030	.050	-.052	-.589	.557	.996	1.004
	Sex (Male=1, Female=2)	2.453	1.337	.163	1.835	.069	.996	1.004
2	(Constant)	30.581	3.747		8.160	.000		
	Age	-.041	.052	-.072	-.786	.433	.916	1.092
	Sex (Male=1, Female=2)	2.853	1.386	.190	2.059	.042	.909	1.100
	Controllable Stress	-.958	.734	-.124	-1.305	.194	.861	1.161
	Uncontrollable Stress	-.858	.653	-.121	-1.315	.191	.914	1.094
	Personal Racism	-.358	.707	-.046	-.506	.614	.953	1.050
	Group Racism	1.048	.617	.152	1.699	.092	.963	1.038
	Neighborhood Satisfaction	.757	.630	.110	1.201	.232	.915	1.092

a. Dependent Variable: BMI

Table 30. Middle Income: Regression Coefficients

Table 30 shows that sex had a statistically significant coefficient in model 2, suggesting it has an influence on the variance seen in BMI for the middle income category. Compared to the low income category, study variable coefficients for middle income participants were generally higher. However, none is statistically significant.

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	66.607	2	33.303	.639	.529[a]
	Residual	10524.206	202	52.100		
	Total	10590.813	204			
2	Regression	301.564	7	43.081	.825	.568[b]
	Residual	10289.248	197	52.230		
	Total	10590.813	204			

a. Predictors: (Constant), Sex, Age

b. Predictors: (Constant), Sex, Age, Neighborhood Satisfaction, Personal Racism, Uncontrollable Stress, Group Racism, Controllable Stress

c. Dependent Variable: BMI

Table 31. High Income: Analysis of Variance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.079[a]	.006	-.004	7.218035033	.006	.639	2	202	.529
2	.169[b]	.028	-.006	7.227010911	.022	.900	5	197	.482

a. Predictors: (Constant), Sex, Age

b. Predictors: (Constant), Sex, Age, Neighborhood Satisfaction, Personal Racism, Uncontrollable Stress, Group Racism, Controllable Stress

Table 32. High Income: Multiple Regression Model Summary

The high income category multiple regression results had no statistical significance (Table 31). Of the three income categories, this regression had the least explanatory strength with an F statistic of 0.825, compared to 2.569 for low income (Table 25) and 1.625 for middle income (Table 28). Addition of the study variables after controlling for age and sex increased the predictive power of the model (Table 32), but the model does not significantly predict BMI.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	36.774	3.587		10.251	.000		
	Age	-.051	.052	-.069	-.974	.331	.982	1.018
	Sex (Male=1, Female=2)	-.794	1.135	-.050	-.700	.485	.982	1.018
2	(Constant)	36.502	3.634		10.046	.000		
	Age	-.046	.053	-.063	-.881	.379	.964	1.038
	Sex (Male=1, Female=2)	-.641	1.172	-.040	-.547	.585	.924	1.082
	Controllable Stress	.206	.586	.026	.352	.725	.888	1.126
	Uncontrollable Stress	-.959	.581	-.117	-1.650	.101	.983	1.018
	Personal Racism	-.249	.526	-.034	-.473	.637	.936	1.068
	Group Racism	.145	.551	.019	.264	.792	.967	1.034
	Neighborhood Satisfaction	-.479	.495	-.070	-.968	.334	.956	1.047

a. Dependent Variable: BMI

Table 33. High Income: Regression Coefficients

None of the individual variables (either from the study variables or control variables) has a significant coefficient in the regression model for the high income category (Table 33). This result indicates that none of the variables is able to predict the variability seen in BMI in the sample.

Overall, only the low income regression model could predict the variability seen in BMI. However, sex is the most significant aspect in predicting the distribution of BMI. When looking at the middle income category, sex still has an influence on variation of BMI (though not as significant as for low income), but the model of the study variables predicting BMI is not significant. Within the high income category, the study variables do not predict BMI, and sex does not have a strong influence on the model. This result suggests that as income increases, the ability to predict BMI using sex decreases within the study population.

Multiple Analysis of Covariance

MANCOVA allows for examination of BMI as the independent variable that predicts the variability seen in the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction), while controlling for age and sex (covariates in this test). In the tables in this section, the data that addresses the role of BMI on the study variables are highlighted.

Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[b]
Intercept	Pillai's Trace	.011	.282[a]	5.000	128.000	.922	1.410	.118
	Wilks' Lambda	.989	.282[a]	5.000	128.000	.922	1.410	.118
	Hotelling's Trace	.011	.282[a]	5.000	128.000	.922	1.410	.118
	Roy's Largest Root	.011	.282[a]	5.000	128.000	.922	1.410	.118
Age	Pillai's Trace	.034	.906[a]	5.000	128.000	.479	4.532	.316
	Wilks' Lambda	.966	.906[a]	5.000	128.000	.479	4.532	.316
	Hotelling's Trace	.035	.906[a]	5.000	128.000	.479	4.532	.316
	Roy's Largest Root	.035	.906[a]	5.000	128.000	.479	4.532	.316
Sex (Male=1, Female=2)	Pillai's Trace	.085	2.374[a]	5.000	128.000	.043	11.869	.742
	Wilks' Lambda	.915	2.374[a]	5.000	128.000	.043	11.869	.742
	Hotelling's Trace	.093	2.374[a]	5.000	128.000	.043	11.869	.742
	Roy's Largest Root	.093	2.374[a]	5.000	128.000	.043	11.869	.742
BMI Category	Pillai's Trace	.164	1.118	20.000	524.000	.326	22.369	.818
	Wilks' Lambda	.841	1.138	20.000	425.478	.306	18.795	.720
	Hotelling's Trace	.183	1.157	20.000	506.000	.288	23.133	.834
	Roy's Largest Root	.145	3.788[c]	5.000	131.000	.003	18.938	.929

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + Age + Sex + BMI Category

Table 34. Low Income: Multiple Analysis of Covariance Tests

For the low income category, the only significant result is for Roy's Largest Root test, which only looks at the upper bound of the F statistic and cannot confirm the relationship of the independent variable to the dependent variables by itself (Table 34). Instead, the most significant tests are Pillai's Trace, Wilk's Lambda, and Hotelling's Trace, since they examine all of the variation that the independent variable predicts. Since none of these has significance, the entire model (that BMI predicts the variation seen in the study variables) is rejected.

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[b]
Corrected Model	Controllable Stress	22.615[a]	6	3.769	3.115	.007	18.691	.908
	Uncontrollable Stress	8.650[c]	6	1.442	1.254	.283	7.523	.479
	Personal Racism	8.253[d]	6	1.376	1.257	.282	7.542	.481
	Group Racism	3.010[e]	6	.502	.376	.893	2.255	.155
	Neighborhood Satisfaction	3.621[f]	6	.604	.822	.555	4.932	.316
Intercept	Controllable Stress	.331	1	.331	.274	.602	.274	.081
	Uncontrollable Stress	.417	1	.417	.363	.548	.363	.092
	Personal Racism	.155	1	.155	.141	.707	.141	.066
	Group Racism	1.619E-5	1	1.619E-5	.000	.997	.000	.050
	Neighborhood Satisfaction	.423	1	.423	.576	.449	.576	.117
Age	Controllable Stress	2.311	1	2.311	1.910	.169	1.910	.279
	Uncontrollable Stress	1.104	1	1.104	.960	.329	.960	.163
	Personal Racism	.700	1	.700	.640	.425	.640	.125
	Group Racism	.081	1	.081	.061	.806	.061	.057
	Neighborhood Satisfaction	.380	1	.380	.517	.473	.517	.110
Sex (Male=1, Female=2)	Controllable Stress	7.697	1	7.697	6.361	.013	6.361	.707
	Uncontrollable Stress	.550	1	.550	.478	.490	.478	.106
	Personal Racism	2.678	1	2.678	2.447	.120	2.447	.342
	Group Racism	.261	1	.261	.195	.659	.195	.072
	Neighborhood Satisfaction	.400	1	.400	.545	.462	.545	.113
BMI Category	Controllable Stress	6.502	4	1.625	1.343	.257	5.374	.410
	Uncontrollable Stress	6.302	4	1.576	1.370	.248	5.481	.418
	Personal Racism	5.775	4	1.444	1.319	.266	5.277	.403
	Group Racism	1.820	4	.455	.341	.850	1.363	.125
	Neighborhood Satisfaction	2.712	4	.678	.924	.452	3.694	.287
Error	Controllable Stress	159.709	132	1.210				
	Uncontrollable Stress	151.773	132	1.150				
	Personal Racism	144.449	132	1.094				
	Group Racism	176.202	132	1.335				
	Neighborhood Satisfaction	96.916	132	.734				
Total	Controllable Stress	187.682	139					
	Uncontrollable Stress	167.290	139					
	Personal Racism	153.121	139					
	Group Racism	181.340	139					
	Neighborhood Satisfaction	103.831	139					
Corrected Total	Controllable Stress	182.324	138					
	Uncontrollable Stress	160.423	138					
	Personal Racism	152.703	138					
	Group Racism	179.212	138					
	Neighborhood Satisfaction	100.537	138					

a. R Squared = .124 (Adjusted R Squared = .084)

b. Computed using alpha = .05

c. R Squared = .054 (Adjusted R Squared = .011)

d. R Squared = .054 (Adjusted R Squared = .011)

e. R Squared = .017 (Adjusted R Squared = -.028)

f. R Squared = .036 (Adjusted R Squared = -.008)

Table 35. Low Income: Test of Between-Subjects Effects for Multiple Analysis of Covariance

Despite the model being rejected, the effect of BMI on each study variable can be determined by looking at data for between-subjects effects. In the low income category, BMI has no effect on controllable stress, uncontrollable stress, personal racism, group racism, or neighborhood satisfaction (Table 35). Therefore, the results suggest that BMI does not alter the study variables either collectively or individually.

Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[b]
Intercept	Pillai's Trace	.017	.408[a]	5.000	115.000	.842	2.040	.154
	Wilks' Lambda	.983	.408[a]	5.000	115.000	.842	2.040	.154
	Hotelling's Trace	.018	.408[a]	5.000	115.000	.842	2.040	.154
	Roy's Largest Root	.018	.408[a]	5.000	115.000	.842	2.040	.154
Age	Pillai's Trace	.078	1.950[a]	5.000	115.000	.091	9.750	.640
	Wilks' Lambda	.922	1.950[a]	5.000	115.000	.091	9.750	.640
	Hotelling's Trace	.085	1.950[a]	5.000	115.000	.091	9.750	.640
	Roy's Largest Root	.085	1.950[a]	5.000	115.000	.091	9.750	.640
Sex (Male=1, Female=2)	Pillai's Trace	.102	2.621[a]	5.000	115.000	.028	13.106	.788
	Wilks' Lambda	.898	2.621[a]	5.000	115.000	.028	13.106	.788
	Hotelling's Trace	.114	2.621[a]	5.000	115.000	.028	13.106	.788
	Roy's Largest Root	.114	2.621[a]	5.000	115.000	.028	13.106	.788
BMI Category	Pillai's Trace	.152	.930	20.000	472.000	.549	18.593	.716
	Wilks' Lambda	.854	.929	20.000	382.362	.550	15.348	.601
	Hotelling's Trace	.164	.928	20.000	454.000	.551	18.570	.715
	Roy's Largest Root	.106	2.502[c]	5.000	118.000	.034	12.510	.766

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + Age + Sex +

Table 36. Middle Income: Multiple Analysis of Covariance Tests

The results of MANCOVA for the middle income category are similar to low income, in that Roy's Largest Root test was significant while Pillai's Trace, Wilk's Lambda, and Hotelling's Trace are not significant (Table 36). This lack of significance means that BMI does not predict the variation seen among the study variables.

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[b]
Corrected Model	Controllable Stress	9.964[a]	6	1.661	2.196	.048	13.176	.759
	Uncontrollable Stress	7.696[c]	6	1.283	1.372	.231	8.233	.519
	Personal Racism	3.262[d]	6	.544	.688	.660	4.125	.264
	Group Racism	6.847[e]	6	1.141	1.136	.346	6.818	.434
	Neighborhood Satisfaction	7.747[f]	6	1.291	1.284	.270	7.705	.488
Intercept	Controllable Stress	.086	1	.086	.113	.737	.113	.063
	Uncontrollable Stress	.432	1	.432	.462	.498	.462	.104
	Personal Racism	.150	1	.150	.190	.664	.190	.072
	Group Racism	.522	1	.522	.520	.472	.520	.110
	Neighborhood Satisfaction	1.375	1	1.375	1.367	.245	1.367	.213
Age	Controllable Stress	5.194	1	5.194	6.868	.010	6.868	.739
	Uncontrollable Stress	.714	1	.714	.764	.384	.764	.140
	Personal Racism	.032	1	.032	.041	.841	.041	.055
	Group Racism	1.861	1	1.861	1.853	.176	1.853	.272
	Neighborhood Satisfaction	.044	1	.044	.044	.834	.044	.055
Sex (Male=1, Female=2)	Controllable Stress	3.240	1	3.240	4.285	.041	4.285	.537
	Uncontrollable Stress	3.892	1	3.892	4.164	.044	4.164	.526
	Personal Racism	.832	1	.832	1.052	.307	1.052	.174
	Group Racism	.017	1	.017	.017	.897	.017	.052
	Neighborhood Satisfaction	4.215	1	4.215	4.192	.043	4.192	.528
	Controllable Stress	.774	4	.194	.256	.906	1.024	.105
	Uncontrollable Stress	3.355	4	.839	.897	.468	3.589	.278
	Personal Racism	2.728	4	.682	.862	.489	3.450	.268
	Group Racism	4.893	4	1.223	1.218	.307	4.873	.372
	Neighborhood Satisfaction	4.501	4	1.125	1.119	.351	4.477	.343
Error	Controllable Stress	89.993	119	.756				
	Uncontrollable Stress	111.231	119	.935				
	Personal Racism	94.109	119	.791				
	Group Racism	119.496	119	1.004				
	Neighborhood Satisfaction	119.642	119	1.005				
Total	Controllable Stress	102.163	126					
	Uncontrollable Stress	118.971	126					
	Personal Racism	97.442	126					
	Group Racism	126.501	126					
	Neighborhood Satisfaction	127.390	126					
Corrected Total	Controllable Stress	99.957	125					
	Uncontrollable Stress	118.927	125					
	Personal Racism	97.372	125					
	Group Racism	126.343	125					
	Neighborhood Satisfaction	127.389	125					

a. R Squared = .100 (Adjusted R Squared = .054)

b. Computed using alpha = .05

c. R Squared = .065 (Adjusted R Squared = .018)

d. R Squared = .034 (Adjusted R Squared = -.015)

e. R Squared = .054 (Adjusted R Squared = .007)

f. R Squared = .061 (Adjusted R Squared = .013)

Table 37. Middle Income: Test of Between-Subjects Effects for Multiple Analysis of Covariance

Looking at the between-subjects effects for the middle income category, BMI does not explain the variation seen in any of the study variables (Table 37). Therefore, BMI is not a statistically significant factor in the variability of controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction.

Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[b]
Intercept	Pillai's Trace	.022	.878[a]	5.000	194.000	.497	4.391	.311
	Wilks' Lambda	.978	.878[a]	5.000	194.000	.497	4.391	.311
	Hotelling's Trace	.023	.878[a]	5.000	194.000	.497	4.391	.311
	Roy's Largest Root	.023	.878[a]	5.000	194.000	.497	4.391	.311
Age	Pillai's Trace	.018	.709[a]	5.000	194.000	.617	3.545	.253
	Wilks' Lambda	.982	.709[a]	5.000	194.000	.617	3.545	.253
	Hotelling's Trace	.018	.709[a]	5.000	194.000	.617	3.545	.253
	Roy's Largest Root	.018	.709[a]	5.000	194.000	.617	3.545	.253
Sex (Male=1, Female=2)	Pillai's Trace	.058	2.392[a]	5.000	194.000	.039	11.962	.753
	Wilks' Lambda	.942	2.392[a]	5.000	194.000	.039	11.962	.753
	Hotelling's Trace	.062	2.392[a]	5.000	194.000	.039	11.962	.753
	Roy's Largest Root	.062	2.392[a]	5.000	194.000	.039	11.962	.753
BMI Category	Pillai's Trace	.067	.666	20.000	788.000	.861	13.328	.534
	Wilks' Lambda	.935	.663	20.000	644.375	.863	10.982	.433
	Hotelling's Trace	.069	.661	20.000	770.000	.866	13.223	.529
	Roy's Largest Root	.044	1.736[c]	5.000	197.000	.128	8.679	.591

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + Age + Sex +

Table 38. High Income: Multiple Analysis of Covariance Tests

The high income category has no statistically significant MANCOVA tests (Table 38). It is interesting to note that the F statistic decreases with income. For example, Pillai's Trace is 1.118 for low income (Table 34), 0.930 for middle income (Table 36), and 0.666 for the high income category (Table 38). Even though these tests are not statistically significant, it does indicate a general trend that BMI's strength in explaining the variation in the study variables decreases as income increases.

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[b]
Corrected Model	Controllable Stress	6.053[a]	6	1.009	1.208	.304	7.249	.470
	Uncontrollable Stress	2.759[c]	6	.460	.589	.739	3.536	.233
	Personal Racism	4.383[d]	6	.730	.733	.624	4.396	.287
	Group Racism	5.489[e]	6	.915	1.051	.394	6.305	.410
	Neighborhood Satisfaction	3.638[f]	6	.606	.547	.772	3.281	.217
Intercept	Controllable Stress	1.951	1	1.951	2.336	.128	2.336	.331
	Uncontrollable Stress	.522	1	.522	.669	.415	.669	.129
	Personal Racism	.058	1	.058	.058	.809	.058	.057
	Group Racism	.037	1	.037	.042	.837	.042	.055
	Neighborhood Satisfaction	.337	1	.337	.304	.582	.304	.085
Age	Controllable Stress	.372	1	.372	.445	.505	.445	.102
	Uncontrollable Stress	.316	1	.316	.405	.525	.405	.097
	Personal Racism	.190	1	.190	.191	.663	.191	.072
	Group Racism	1.905	1	1.905	2.188	.141	2.188	.313
	Neighborhood Satisfaction	.219	1	.219	.197	.657	.197	.073
Sex (Male=1, Female=2)	Controllable Stress	3.173	1	3.173	3.800	.053	3.800	.492
	Uncontrollable Stress	1.296	1	1.296	1.662	.199	1.662	.250
	Personal Racism	1.255	1	1.255	1.259	.263	1.259	.201
	Group Racism	1.336	1	1.336	1.534	.217	1.534	.234
	Neighborhood Satisfaction	.669	1	.669	.603	.438	.603	.121
	Controllable Stress	2.451	4	.613	.734	.570	2.935	.234
	Uncontrollable Stress	1.349	4	.337	.432	.785	1.729	.150
	Personal Racism	2.952	4	.738	.740	.566	2.961	.236
	Group Racism	1.378	4	.345	.396	.812	1.583	.140
	Neighborhood Satisfaction	2.764	4	.691	.623	.647	2.492	.202
Error	Controllable Stress	165.338	198	.835				
	Uncontrollable Stress	154.483	198	.780				
	Personal Racism	197.404	198	.997				
	Group Racism	172.402	198	.871				
	Neighborhood Satisfaction	219.566	198	1.109				
Total	Controllable Stress	171.394	205					
	Uncontrollable Stress	163.562	205					
	Personal Racism	201.932	205					
	Group Racism	178.970	205					
	Neighborhood Satisfaction	225.966	205					
Corrected Total	Controllable Stress	171.391	204					
	Uncontrollable Stress	157.242	204					
	Personal Racism	201.787	204					
	Group Racism	177.891	204					
	Neighborhood Satisfaction	223.203	204					

a. R Squared = .035 (Adjusted R Squared = .006)

b. Computed using alpha = .05

c. R Squared = .018 (Adjusted R Squared = -.012)

d. R Squared = .022 (Adjusted R Squared = -.008)

e. R Squared = .031 (Adjusted R Squared = .001)

f. R Squared = .016 (Adjusted R Squared = -.014)

Table 39. High Income: Test of Between-Subjects Effects for Multiple Analysis of Covariance

The test of between-subjects effects for the high income category yielded no significant results (Table 39). Across all of the MANCOVA tests, BMI is not related to the study variables for any of the income categories.

Overview of Results

Bivariate correlation analysis, showed no link between income and BMI for the total study sample. However, there is a direct correlation between income and BMI for men. Bivariate correlation analysis shows no direct interactions between BMI and the five study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction). However, within all three income categories, being female is significantly correlated with controllable stress. In the middle income category there is an inverse correlation between age and controllable stress. The low income multiple regression model showed that the study variables predict the variability seen in BMI when controlling for age and sex. However, sex is the most significant aspect in predicting the distribution of BMI. In the middle income category, sex has an influence on variation of BMI (though not as significant as for low income), but the model of the study variables predicting BMI is not significant. Within the high income category, the study variables do not predict BMI, and sex does not have a strong influence on the model. MANOVA tests were not significant enough to support the idea that BMI can predict the variation seen in the study variables. MANCOVA between-subjects effects tests do not indicate that BMI can sufficiently predict variation seen among the five study variables.

CHAPTER 5

DISCUSSION

Race/ethnicity is often treated as a single variable in epidemiology, which reduces the complexity inherent in human variability to a single and often poorly defined geographic or racial designation. However, members associated with the same racial or ethnic designations are not a homogenous group on a number of variables related to lifestyle, experiences, surroundings, and socioeconomic status (SES). Additionally, increased obesity rates among members of all social classes in recent decades indicates that belonging to a specific social class is not a "risk factor" for obesity among African Americans, specifically in Metropolitan Detroit. I propose that variables that affect obesity differ depending on income. It is important to understand any differences that exist because there may need to be different obesity interventions based on the circumstances through which someone becomes obese.

In this study, the research hypothesis is that for African Americans in Metropolitan Detroit, neighborhood satisfaction, stress, and perception of racism influence obesity differently based on income. The discussion below evaluates whether the data support each of the study aims in order to evaluate the research hypothesis.

Aim 1: Determine if income correlates with BMI for the study population

If following the traditional view on obesity in developed societies, one would expect a significant relationship between income and obesity. In addition, there should be an inverse relationship that shows lower income categories have higher rates of obesity than higher income categories. The literature review indicates that at least since the 1990s, this traditional view has become irrelevant and often not seen in many contemporary populations, and there is not always a link between income and weight status. The findings in this dissertation are that there is not a significant relationship between income and BMI for the total study population (Table 19). This findingmeets expectations, since the trend in recent decades has been towards a reduction in the significance of SES in influencing obesity rates. The existence of this trend reinforces the idea laid out in the literature review that there is no longer a link between SES and obesity for African Americans.

It is interesting, however, that when looking at gender, there is a relationship between income and BMI for men (Table 20). The direct correlation between the two variables shows that as income increases, BMI also increases. This correlation may indicate that for men, access to resources is more dependent on income, whereas this is not necessarily true for women. It is also possible that the disproportionately large ratio of women to men in the analysis has affected the results (523 women to 136 men). Despite this trend seen among men, the analysis shows that for neither African American men nor women is there a negative association between income and BMI. This outcome implies that African Americans do not conform to historical trends that have an inverse association between SES and BMI in American society.

The data supports the notion that for African Americans, obesity is no longer a health issue that is more likely to predominately affect people in a lower income bracket. It is therefore a worthwhile endeavor to see if there are any differences in what may be influencing obesity in different income categories.

Over the last two decades, obesity has been rising for African Americans of all social classes (Bell, et al. 2005; Gordon-Larsen, et al. 1997). However, it would be misguided to assume that all African Americans are experiencing an increase for the same reasons. Studies that identify being African American as a “risk factor” for obesity ignore the variability among individuals of the same ethnic designation. The design of this study cannot reveal individual circumstances for why specific persons are overweight or obese, but it does reveal associations between income and the experiences and environmental influences African Americans encounter. Among overweight and obese individuals, there may be equifinality, or multiple trajectories, which can lead to a high BMI. Not all African Americans live in the same environments, have access to the same foods, encounter the same amounts of stress, or experience racism in the same way. The same is true for any individual, no matter their ethnic designation, but it is important to point out potential differences when some believe identifying as African American is a “risk factor” for certain conditions. When identifying as African American is considered a risk factor, instead of examining the many sociocultural and environmental influences that affects weight status, a condition like obesity is portrayed as a purely biological condition with primarily biological causation. However, obesity is certainly not just a biologically determined condition.

This study examines some underlying factors that may be contributing to African American obesity, other than simply identifying with an ethnic group. As stated in the literature review, obesity has links to neighborhood resources and stress. Statistical analyses used to address aims 2 and 3 examine whether variation of neighborhood traits, stress, and perceived racism differ between income groups. These analyses help in assessing whether income plays a role in the types obesity influencing variables that African Americans of different social classes are exposed.

Aim 2: Evaluate correlations between BMI, stress, neighborhood satisfaction and perceived racism for income categories

The results of bivariate correlation analysis indicate no statistically significant interactions between BMI and the study variables (controllable stress, uncontrollable stress, neighborhood satisfaction, personal racism, and group racism) for any of the income categories (low, middle, high). The strongest correlation, while not statistically significant, was between BMI and controllable stress in the low income category (Pearson correlation=0.134, p=0.103) (Table 22). This result was surprising, since the literature review revealed that stress and neighborhood attributes are associated with obesity rates. This result could be explained as revealing that stress, perceived racism, or neighborhood satisfaction does not influence BMI for the population. A second explanation is that the survey questions do not adequately assess aspects of stress, racism, or neighborhood that would influence BMI. A final explanation is that subtle differences between income groups are not differentiated in this study, and that there could be very different motivations for selecting the same answers on the surveys used in this study.

The correlation analysis did reveal one BMI-related difference between income categories: high BMI has a correlation with being female for the low and middle income categories, but this correlation is not present in the high income category. This association complements the results in aim 1, which found that BMI was directly correlated with income for men. Further, for all income categories, being female is associated with controllable stress. Controllable stress is stress that can be handled or coped with. Having a high controllable stress score indicates that a person frequently handles or copes with stress. A low controllable stress score means that a person encounters stress they cannot control. Therefore, being male correlates with having few instances of controlling stress. This correlation highlights why it was appropriate to control for sex in the multivariate analysis, but it also indicates that the role of sex in determining the types of obesity-influencing conditions a person encounters may be different. Unfortunately, given the vast difference between the number of men participants versus the number of women participants, analyses that divide each income category based on sex was not appropriate. The power of analysis would be weak for mean, and it would not be meaningful to make comparisons based on sex. Therefore, multivariate analyses controlled for the effect of sex to determine any trends within the study population as a whole.

Aim 3: Evaluate if stress, neighborhood satisfaction, and perceived racism are related to BMI using multivariate statistics

Two multivariate tests are performed: multiple regression and multiple analysis of covariance (MANCOVA). In each test, sex and age are controlled. Multiple regression directly addresses the study question of whether stress, perceived racism, and neighborhood satisfaction influence BMI. The multiple regression analysis found that the low income model could predict the variability seen in BMI when age and sex are included in the analysis (Table 25). Unfortunately, the addition of the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction) had little to do with the association that is observed. The regression model summary indicates that the addition of the study variables had virtually no effect on the predictive power when added to the regression (p=0.964) (Table 26). In fact, the percentage of variation accounted for by adding the study variables actually decreased from 10.1% to 7.4% when looking at adjusted R square. A look at the regression coefficients (Table 27) confirms that any significant association with BMI is due to sex. This outcome is not surprising since the influence of sex has already been mentioned. However, since this effect is only seen among low income, it becomes important to consider why income matters for men when it comes to obesity, but it does not matter for women. Four possibilities are as follows: different sex-based body standards, the role of child birth for women, the role of child caretaking, and sex-based differential access to food and other resources for those with low-income. The literature review noted that studies have found that African Americans have body image standards where being obese is acceptable. Some studies, such as the one conducted by Liburd (2010) focus on body image among women. It is quite possible that among African Americans, body image standards are such where larger women are more acceptable than larger men. However, this premise does not explain why higher income would correspond with higher BMI for men. One reason could be that higher income eliminates the need to conform to image standards, but data from this study cannot confirm this. The role of sexual dimorphism related to pregnancy can also make a difference for why sex matters. On average, women have a higher percentage of body fat, which is an evolutionary adaptation to storing energy for pregnancy (Brown and Konner 1987). This adaptation may lead to women having similar obesity rates across income levels, whereas other mechanisms will dictate obesity among men. Child caretaking can also make a difference. As discussed previously, single-parent households are prevalent in African American communities. If women of different incomes have similar single-parent household rates (which could not be determined in this study), that could explain similarities in BMI among women across income categories. Finally, there could also be sex-based differences in food and other resources among those with low income. If single parent rates are high, and most single parents are mothers, then various forms of public assistance is available to low-income women. However, low-income men will not have this same level of support, and theoretically, it would be more difficult to live a lifestyle where obesity could be maintained.

The MANCOVA analysis in this study examines the same data as multiple regression, but instead uses BMI as the independent variable and the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction) are dependent. This test is conducted to determine if the relationships between the study variables and BMI may be such that BMI has influence on the collective variability seen within the study variables.

The MANCOVA results had no statistically significant findings, meaning that BMI likely does not influence the collective variability of controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction. Even though there are no statistically significant differences between income categories, it is noted that the F statistics for the MANCOVA tests decrease with income. For example, Pillai's

Trace is 1.118 for low income (Table 34), 0.930 for middle income (Table 36), and 0.666 for the high income category (Table 38). The trend shows that as income increases BMI's strength in predicting the variation in the study variables decreases. Since this test controls for age and sex, this difference cannot be completely explained away by differences related to sex. This outcome could point to the possibility that for lower income African Americans, BMI partially predicts exposure to stress. BMI also may partially predict whether someone is satisfied with a neighborhood. However, since there are no significant statistics, this supposition cannot be supported. When examining the between-subjects effects tests for each income category, there are no BMI-related associations. Therefore, BMI does not predict the variation seen for any of the individual study variables.

Overview of Findings

When looking at all variables examined in the present study, there is no evidence that income matters when looking at the relationship between BMI and the study variables (controllable stress, uncontrollable stress, personal racism, group racism, and neighborhood satisfaction). Therefore, the hypothesis that among African Americans in Metropolitan Detroit, neighborhood satisfaction, stress, and perception of racism influence obesity differently based on income must be rejected. In fact, there are no relationships between BMI and any of the study variables present in the analyses. Therefore, these data do not support the idea that people in different SES categories become obese due to differences in stress, neighborhood satisfaction or perceived racism. In addition, the idea that ethnic disparities in obesity are due to SES differences between African Americans and the general population (Bleich, et al. 2010; Wang and Chen 2011) is not supported. The study results suggest that ethnic disparities in obesity are not due to SES, which is consistent with the findings of another recent study that concluded that for African American women in Washington, DC there are no SES differences in obesity prevalence (Gaston, et al. 2011).

However, this study does reveal an important observation: traditional models of the role of stress and neighborhood resources on obesity likely do not apply to African Americans in Metro Detroit. However, it cannot be discounted that the CUAAH study population may not be sufficiently representative of Metro Detroit to make this a definitive statement.

Income is not a stand-alone variable and risk factor, but it influences many other factors. The increase in obesity rates is a contemporary example of biocultural evolution. Changing conditions are likely making overweight and obese individuals more common among African Americans of all social classes. These new conditions challenge long held beliefs and require rethinking the ways in which culture (and environment in general) influence obesity and one's lifestyle.

When referring to the “biocultural approach” suggested by Ulijaszek, this study was able to address several models of obesity for African Americans. The “political economy” model was assessed by analyzing if SES (using income as a proxy measurement) influenced the way in which African Americans are exposed to obesity-inducing conditions. The “political economy” model is not supported by the results for the study population. SES is not related to study variables in this population. Among men, income is correlated with BMI, so this model may be reflected among men. The "obesogenic behavior" model was addressed by analyzing stress survey responses as variables, since stress is shown to induce over-eating behavior in mammals. Nowhere in this study was it shown that stress is linked to obesity. Therefore, there is no evidence supporting the "obesogenic behavior" model of obesity within the study population. The "obesogenic environments" model was considered through the assessment of neighborhood traits and how these environmental aspects influence obesity. Neighborhood satisfaction and BMI were not linked in this study. For this population, the "obesogenic environments" model could not explain prevalence of obesity within the study population. The "culture" model was incorporated, in that the role of perceived racism was analyzed. Perceived racism was not associated with obesity. Therefore, at least for the role of racism, the "culture" model does not explain the nature of obesity for African Americans in Metropolitan Detroit.

Overall, the hypothesis of this research study is rejected, and there is not an adequate explanation of obesity within the study population using Ulijaszek's biocultural approach. However, the study supports the idea that income (and perhaps SES) does not have an association with obesity, as it did in the past. This study is certainly not the first to have this result, but it lends further support to the long list of literature in many fields that show that the relationship between SES and obesity does not follow traditional models that could explain BMI distribution prior to the 1990s.

Cultural anthropology has approached rising obesity rates in the context of the spread of cultural ideals related to thinness and fatness, changing economies, and body norms within societies (Brewis 2010; Brewis, et al. 2011; Cassell 1995). These concepts can certainly exhibit variability within SES groups. There was a lack of significant results that show relationships between BMI and stress, as well as BMI and neighborhood satisfaction. These are two areas where there were expected to be relationships to some degree. A lack of any relationship suggests that other areas may be more significant in explaining recent obesity increases. A study that examines whether cultural ideas related to obesity, changing economies, and body norms within SES groups could potentially explain why SES is not associated with BMI for African Americans.

CHAPTER 6

CONCLUSION

This exploratory study tested the research hypothesis that among African Americans in Metropolitan Detroit, neighborhood satisfaction, stress and perception of racism influence obesity differently based on income. The dissertation begins with a literature review. Included is an assessment of the biological perspectives on the rise in obesity rates. This assessment established that a recent rise in obesity prevalence among African Americans is likely not due to evolutionary selection, changes in population genetics, or other biological processes. The literature review then examined possible sociocultural influences that may influence the prevalence of obesity, both for the general population and African Americans. It was determined that changes in sociocultural variables most likely altered patterns of caloric intake and expenditure in the United States. Further, the most significant sociocultural aspects were determined to be closely related to socioeconomic status (SES). Three factors (neighborhood satisfaction, stress, and perceived racism) were identified as influenced by income and associated with obesity, and were established as the focus of this study. The dissertation then described the statistical analyses (bivariate correlations, multiple regression, and multiple analysis of covariance) that tested if there were any statistically significant associations between income (a proxy for SES), body mass index (a variable that is linked to fat content), neighborhood satisfaction, stress, and perceived racism.

The results indicated that there were no income differences in how the study variables influence obesity. Therefore, the hypothesis was rejected. It was also concluded that for the study population, there is no support for the idea that there is equifinality in becoming obese based on income. However, this study supported previous observations that SES no longer has an influence on the distribution of obesity. In addition, it revealed that a combination of a person's sex and income level may expose a person to different types or levels of obesity-influencing factors.

Despite the rejection of the study hypothesis, this project has added to the research on the relationship between ethnicity, socioeconomic status, and obesity. This increased knowledge allows for further refinement of ideas about how ethnicity, socioeconomic status, and obesity are interconnected. Using a specific ethnic designation (i.e. African American) or a specific SES designation (i.e. low income) as a "risk factor" for a condition is not adequate. Disparities are created by complex interactions that may not easily be measured or understood. Scientifically, the exact reasons behind an increase in obesity cannot be answered with this study alone, however, it further reveals that factors that lead to ethnic disparities or the rise of obesity cannot be oversimplified.

Expected Results versus Actual Results

The three expected results for the data were as follows: income does not have a link to obesity; links between BMI and the study variables (neighborhood satisfaction, stress, and perceived racism) vary according to income category; and the study variables (neighborhood satisfaction, stress, and perceived racism) influence the variability of BMI differently according to income category.

The expectation that BMI does not correlate with income was supported by the findings for the total population and for women. Considering that BMI has increased for persons in all income categories, and that SES differences in BMI among African Americans have been disappearing, this study provides further evidence that this trend exists for women. However, among men, there was a link between BMI and income. This outcome is an indication that the role of income in determining BMI persists for some segments of society. The pattern seen among men was similar to what is traditionally ascribed to developing societies, where those in high social classes tend to be more obese. So even this result is different than what should be seen in a developed society like the United States.

The expectation that links between BMI and the study variables (neighborhood satisfaction, stress and perceived racism) vary according to income category was not met. There are no links between BMI and the individual study variables for any of the income categories analyzed (low, middle, high); this includes bivariate correlations, coefficients for multiple regression, and between-subjects effects for multiple analysis of covariance. Not meeting this expectation suggests that income does not influence the way that BMI interacts with stress, perceived racism, and neighborhood satisfaction for the study population.

The final expectation that the study variables (neighborhood satisfaction, stress, and perceived racism) influence the variability of BMI differently according to income category was not supported by the data analyses. None of the multiple regression models could support the idea that the study variables could collectively predict the variability of BMI. Within the low income category, the initial regression model could predict the variation of BMI; however, it was only due to the effect of sex, and not neighborhood satisfaction, stress, or perceived racism.

Overall, none of the findings supported the expectations related to BMI and the study variables. Since none of the study variables were associated with BMI, then perhaps other variables would be more appropriate to focus on for the study population. Changes in physical activity, shifts in what is considered an acceptable body image, and/or dietary habits may reflect income differences in developing obesity among African Americans.

Limitations

There are several limitations to this study. One limitation is that the CUAAH study population is not a random representation of the target population (African Americans in Metro Detroit). Center for Urban and African American Health (CUAAH) recruitment was for clinical research, and did not represent a random sample of African Americans. The study sample analyzed included very few participants with a BMI under 25, so it is difficult to know if the results would be different if there were more low-BMI participants.

Another limitation is that BMI is the only measure of weight status used in this study. As mentioned in the literature review, BMI is a widely used and accepted measure; however, other measures of obesity may provide information that is more relevant. For example, tests that can differentiate between visceral and subcutaneous fat (which affect health differently) would be useful.

The use of income as a proxy measurement for SES is a limitation. SES can only be fully encompassed if other aspects that determine social status (education, occupation, wealth) are considered in conjunction with income. Using a different scale of measure for SES may have different results than those seen in this study.

There are limitations related to the variables examined. Variables related to stress and neighborhood traits were selected because they were associated with obesity in previous studies. In addition, it was reasonable to suspect that racism may have an influence on obesity because of stress-induced racism and mistrust of clinical care tied to perceived racism. Unfortunately, BMI associations were not found in any income category within the study population. Therefore, it cannot be verified that any of the study variables actually influence obesity. However, important variables like diet, physical activity, and body image standards may be associated with obesity, and may vary according to income. In addition, variables yet to be studied may be associated and actually reveal an even more complete picture of the equifinality of obesity, as influenced by SES, with more detail and precision.

Increasingly, the role of genetically influenced outcomes is being studied in epidemiology. In this study, there is no direct examination of the potential role of genetics and gene/environment interactions. Great strides in genetics are occurring, and there is a better understanding of the biology of obesity. Cultural or behavioral changes in our ancestors shaped much of human evolution, so current cultural changes may affect humans at the genetic level.

Future directions

A good model for future physical anthropology research related to SES and obesity should link cultural and biological variables. Specifically, considering each model described by Ulijaszek will provide a multifaceted examination of obesity (evolutionary, sociocultural, political, environmental, genetic). Being mindful of the multitude of factors that contribute to obesity will allow for the development of comprehensive intervention plans.

There are numerous cultural and biological variables that are associated with BMI, so it is impractical to include all aspects into a single study. Examining the distribution of obesity-inducing aspects within environments, identifying subsistence changes that have occurred, or finding if beliefs within societies encourage obesity are ways to address how culture influences obesity. However, it is just as important for a physical anthropologist to consider how these cultural aspects interact with biological aspects. Biological aspects relating to dietary intake, caloric expenditure (via physical activity), and genetic predisposition can all reveal how cultural factors can have a physiological manifestation in the form of obesity. The current study utilized some assumptions related to stress-induced eating that can lead to obesity, and differential satisfaction with dietary choices. However, future studies can more clearly measure and discuss the importance of biological processes that lead to obesity within populations. For example, collecting information on diet, hormone levels, genetic testing, response to physical activity, and measures of biological homeostasis.

Future studies should use more complete measures of SES. SES includes more than income, including education, occupational prestige, job status, neighborhood characteristics, and more. It is difficult to make any solid conclusions about the nature of SES without considering that SES includes many elements that will vary over time.

Therefore, it is important to know if a person's SES has remained stable or changed over their life course.

This type of research could also benefit from use of qualitative approaches. Survey questions provide some insight into the sociocultural factors that influence health, and they allow for statistical analyses. However, qualitative data provides information about actual experiences and reflects personal understandings of health, personal behavior, stigmatization, and body image. Quantitative statistical analyses cannot capture these aspects. Programs that promote healthy eating and exercise are more likely to have success if there is a clearer understanding of how communities comprehend issues related to obesity. In addition, qualitative methods can reveal more about any potential direct connections between racism and obesity. Even though this study found no direct evidence that obesity is influenced by perceived racism, that does not mean there are not potential links. A study design that specifically addresses whether physical activity and food consumption are related to perceptions of racism may yield results.

For physical anthropologists, collaboration with cultural anthropologists would be especially helpful in capturing the qualitative information mentioned. Cultural anthropology can provide relevant information related to specific communities (i.e. African Americans in Detroit). Incorporating ethnographic data related to social organization, kinship relationships, shared experiences, socialization commonalities, and accepted/desired body norms would better reveal the complex cultural processes that influence the prevalence of obesity. In addition, understanding what determines a person's social class within a local context will allow for a better assessment of the relationship between socioeconomic status and obesity.

This study demonstrates that straightforward representations of problems are often more complex than they may seem. For decades, the assumption was that differential access to resources makes some people more susceptible to obesity. However, as more segments of society are becoming overweight and obese, support for this assumption disappears. Instead, exposure to obesity-influencing stressors is what is important. These stressors can potentially vary from one social class to another, but they are increasingly becoming more common throughout all social classes.

Anthropologists uniquely contribute to obesity research, specifically as it relates to ethnic disparities. Anthropology examines the phenomena within a local context because conditions are often unique for specific communities. Cultural variables are understood to be important in influencing health. This idea contrasts with many biomedical approaches, which often favor genetic or healthcare-related explanations for ethnic disparities. That is not to say genetics and healthcare options do not influence obesity, but culturally-mediated factors are just as important to consider. Physiologically, obesity does have a detrimental effect on health. If obesity is to be addressed as a social concern, culturally-mediated influences on obesity will need to be recognized. If obesity prevalence is to be decreased, that will mean changing cultural norms, experiences, and other sociocultural variables. In order to decrease obesity, strategies will need to include community outreach and collaboration; and not just biomedical intervention.

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ABSTRACT

SOCIOECONOMIC DIFFERENCES IN BODY MASS INDEX, NEIGHBORHOOD SATISFACTION, STRESS, AND PERCEIVED RACISM AMONG AFRICAN AMERICANS IN METROPOLITAN DETROIT

by

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This exploratory study tested the research hypothesis that among African Americans in Metropolitan Detroit, neighborhood satisfaction, stress and perception of racism influence obesity differently based on income. The three expected results for the data were as follows: income does not have a link to obesity; links between BMI and the study variables (neighborhood satisfaction, stress, and perceived racism) vary according to income category; and the study variables (neighborhood satisfaction, stress, and perceived racism) influence the variability of BMI differently according to income category. The results indicate that there are no income differences in how the study variables influence obesity. Therefore, the hypothesis is rejected. It must also be concluded that for the study population, there is no support for the idea that there is equifinality in becoming obese based on income. However, this study supports previous observations that SES no longer has an influence on the distribution of obesity. In addition, it reveals that a combination of a person's sex and income level may expose a person to different types or levels of obesity-influencing factors. For decades, the

assumption was that differential access to resources makes some people more susceptible to obesity. However, as more segments of society are becoming overweight and obese, support for this assumption disappears. Instead, exposure to obesity-influencing stressors is what is important. Since none of the study variables is associated with BMI, then perhaps other variables would be more appropriate to focus on for the study population. Changes in physical activity, shifts in what is considered an acceptable body image, and/or dietary habits may reflect income differences in developing obesity among African Americans.

AUTOBIOGRAPHICAL STATEMENT

Corey S. Zolondek was born in Detroit, Michigan to Michael and Barbara Zolondek. He attended the University of Michigan in Ann Arbor where he received a Bachelor of Science majoring in Anthropology-Zoology. While at the University of Michigan, he received Class Honors during his senior year. Following his undergraduate education, Zolondek attended Wayne State University where he earned a Master of Arts majoring in Anthropology. The Masters Essay topic was "*Intensified Maize Agriculture and a Comparison of Skeletal Changes in the Illinois River Valley and on the Georgia Coast*." Upon completion of the Masters degree, he entered into the Doctor of Philosophy program in Anthropology, specializing in physical anthropology. As a doctoral student at Wayne State University, Zolondek received the Thomas C. Rumble Graduate Fellowship and served as a Graduate Teaching Assistant in Anthropology, Graduate Student Assistant at the Museum of Anthropology, Anthropology Part-Time Faculty, and Research Subject Advocate in the Division of Research. He also earned a Certificate of Teaching Development. Current interests include the role of social status on health, the interaction of cultural practices with health, and research ethics.