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Associations of Stress, Health Behaviors, and Obesity Among African American Immigrants

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Walden University
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Abstract

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MD, Avalon University School of Medicine, 2018

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MSc, University of Lagos, Nigeria, 1987

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Obesity has been identified as a predisposing factor that poses a serious threat for the development of chronic diseases and contributes to health disparities affecting both minority and vulnerable populations. Though previous studies reported the association of stress with health status and behavior, there is little or no research on the heterogeneity of obesity predictors in specific minority populations in the United States. The purpose of this study was to examine the predictors of obesity among adult African American immigrant populations in the United States. Studying obesity in this population may help policy makers tailor interventions that could reduce obesity prevalence. Guided by the social ecological model and acculturation theory, this study utilized a quantitative cross-sectional design using a secondary data set from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120). Pearson's chi-square test and logistic regressions were used to analyze data. The findings indicated that, although some categories of age, duration of residence, education, gender, and marital status significantly predict odds of being obese, stress and health behaviors (tobacco use, marijuana use, alcohol use, physical activity) remained insignificant predictors after the inclusion of these variables in this sample of African American adults. The social change implications from these findings may include their use by public health workers and policy makers to target interventions toward reducing obesity among this population. There is a need for further investigation into other causes of obesity in this minority population.

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Dedication

First and foremost, I would like to dedicate this work to the Almighty God who made a way for me where there seemed to be no way by providing me with the resources and the strength to achieve this great milestone in my doctoral journey. I also dedicate this project to my beautiful wife, Dr. Itohan Stephanie Akinsola, and our wonderful children, for their unwavering support and demonstrating such love and understanding during this journey. This work is also in honor of my childhood friends, Julius Akinwusi of blessed memory, and Biodun Adeyemi, as well as my brother Tayo Akinsola, who made positive impacts in my life.

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Chapter 1: Introduction to the Study

Introduction

This was a quantitative cross-sectional study to determine the associations of stress, health behaviors, and obesity among African American immigrants. Obesity is a predisposing factor that, though is reversible, poses a serious threat for the development of chronic diseases such as cardiovascular disease, cancer, Type 2 diabetes, hypertension, and coronary heart disease (World Health Organization [WHO], 2018). Higher mortality and higher risk of mental health problems, musculoskeletal problems, and a generally lower quality of life have also been linked to obesity (WHO, 2018). Despite obesity being one of the leading causes of death, approximately 2 billion individuals are affected by obesity worldwide (WHO, 2017). In today's largely obesogenic environment, the number of overweight/obese individuals continues to grow, with many finding it difficult to maintain a normal weight.

There has been an enormous increase in the prevalence of obesity in both high-income countries (HICs) as well as low- and middle-income countries (LMICs; Ng et al., 2014). From 2000 to 2015, global international migration increased by 41%, with over 244 million people now living in a country other than where they were born (United Nations Department of Economic and Social Affairs Population Division, 2015). It was reported in previous studies that immigrants from LMICs have much healthier body weights and diet upon arrival to HICs than the local community (Murphy et al., 2017). However, some immigrant groups are at a higher risk of becoming overweight/obese (da Costa et al., 2017). Migration from LMICs to HICs profoundly affects lifestyle, in

particular dietary habits, nutrient intake, and physical activity as a result of both westernization and urbanization (Argys, 2015). The adaptation of immigrants to the more refined high-energy-density diet of a HIC, combined with physical inactivity, the interaction between genetic susceptibility and environmental factors (i.e., diet, smoking, and exercise), psychological stress, immune-inflammatory changes, inequalities in access to and lower quality of health care, inappropriate management, and underdetection of morbidities (Qureshi et al., 2020) all contribute to increasing in weight. In addition to lifestyle factors, sociodemographic factors such as sex, age, education, income level, marital status, and physical activity affect body composition (Ohlsson & Manjer, 2020). Increasing age, low income, low education, and sedentary lifestyle are related to high body mass index (BMI; Ahmed et al., 2018; Ohlsson & Manjer, 2020). Furthermore, it has been identified that the global migration phenomenon is a social determinant of health (Rechel et al., 2013).

In this chapter, I provide an overview of the associations of stress, health behaviors, and obesity among African American immigrants residing in Milwaukee County, Wisconsin, United States. The following sections include the study's background, problem statement, purpose, research questions, conceptual framework, nature, definitions, assumptions, scope and delimitations, limitations, significance, and social change implications, concluding with a summary.

Background

Obesity continues to be a major health issue whose nature keeps challenging scientists and policymakers around the world (Amarasinghe & D'Souza, 2012). In 2016,

the WHO estimated that 1.9 billion adults, or 25% of the world's population, are overweight; among which a third is obese (WHO, 2018). In 2015, high BMI contributed to 4 million deaths worldwide, 60% of which occurred in individuals with obesity and mostly due to cardiovascular diseases (Afshin et al., 2017). Between 1990 and 2015, the rate of early mortality due to high BMI increased from 41.9 to 53.7 per 100,000 individuals (Afshin et al., 2017). Correspondingly, disability-adjusted life years due to high BMI increased from 1,200 to 1,630 per 100,000 individuals (Afshin et al., 2017).

Overweight and subsequently obesity result from a chronic surplus in energy intake compared to energy expenditure, likely driven by an imbalance towards calorie consumption, sedentary behaviors, and lack of physical activity (Romieu et al., 2017; Ross et al., 2016). In the last two decades, there has been a paradigm shift in researching causes of obesity, in particular by moving the focus towards the drivers of such "obesogenic" behaviors (Lakerveld & Mackenbach, 2017). While earlier research generally focused on individual-level factors such as knowledge, psychological constructs such as motivation, and genetics, more recent epidemiological research places obesity into the larger socioecological context where the environment also plays a role in shaping individual behaviors (Lakerveld & Mackenbach, 2017; Roberto et al., 2015). It has been reported that weight gain by immigrants in the United States after migration could be attributed to many factors, such as physical inactivity, socioeconomic factors, tradition, religion, self-perception, body image, psychosocial factors, as well as nutrition transition, among others (Misra et al., 2018).

An increase in the risk of obesity-related chronic diseases amongst immigrants of different ethnic groups has also been reported, and the vulnerability to obesity by these immigrant populations such as Pacific Islanders, Latinos, Asians, and African Americans may be due to different predictors (Krueger et al., 2015; Murphy et al., 2017). Although alcohol consumption has been linked to obesity among Nigerian immigrants in the United States (Obisesan et al., 2017), the researchers were unable to show an association between the more traditional predictors of obesity such as socioeconomic status, level of physical activity, education, acculturation, diet choices, perceived stress, and obesity in this population, therefore creating a knowledge gap (Obisesan et al., 2017).

In other immigrant populations, potential risk factors for obesity such as diet, socioeconomic status, physical activity, acculturation, and perceived stress have been identified as predictors of obesity (Krueger et al., 2015). However, no study has specifically focused on the associations of stress and identified health behaviors such as tobacco use, alcohol use, marijuana use, and physical inactivity with obesity among African immigrant adults residing in Milwaukee County, Wisconsin. Given the striking worldwide prevalence of overweight and obesity and the resulting burden on individuals and societies, it is important to elucidate its determinants and find approaches for sustainable reduction and prevention.

Problem Statement

Obesity is a chronic condition classified by a BMI ≥ 30 kg/m^2 whose prevalence has constantly increased in previous years. In the United States, the prevalence of obesity among adults significantly increased from 25.3% in 1976–1980 to 33.2% in 2003–2004

(Flegal et al., 2016; Williams et al., 2015). Obesity is a risk factor for many chronic diseases including cardiovascular illnesses, Type 2 diabetes, metabolic syndrome, some cancers, kidney malfunction, renal failure, chronic system inflammation, and nonalcoholic fatty liver disease (Isasi et al., 2015; Stenholm et al., 2016). It has been reported that obesity does not impact all groups equally, and racial/ethnic differences, defined as phenotypic characteristics such as skin color and cultural factors such as nationality, tribal affiliation, religion, language, and traditions of a particular group, must be taken into consideration when determining obesity prevalence and treatment strategies (Winkler et al., 2017). Extensive research on obesity among minority populations in the United States has indicated that multiple factors contribute to its prevalence. These risk factors, which are multifactorial, involve an interplay of environmental, lifestyle, and social determinants (Murphy et al., 2017; Petersen et al., 2019).

Stress, both physical and psychological, can be viewed as a part of life that every individual will experience to some extent. Goldstein (2010) described stress as a condition in which expectations, whether genetically programmed, established by prior learning, or deduced from circumstances, do not match current or anticipated perceptions of the internal or external environment. This mismatch between what is observed or sensed and what is expected or programmed evokes patterned, compensatory responses. Previous studies reported the association of stress with health status and behavior (McCaul et al., 2017; Siegrist et al., 2016). However, no study has specifically focused on the associations of stress and identified health behaviors with obesity among African

immigrant adults residing in Milwaukee County, Wisconsin. Consequently, this gap was addressed by this study.

Purpose of the Study

The purpose of this quantitative study was to examine the associations of stress, health behaviors, and obesity among African American immigrant adults residing in Milwaukee County, Wisconsin. I classified sociodemographic factors as age, gender, marital status, duration of residence in the United States, education, employment, and income, while health behaviors were classified as tobacco use, alcohol use, marijuana use, and physical activity. I utilized a quantitative cross-sectional study to examine these variables. Quantitative methodology is appropriate in developing an understanding of how these variables are related to obesity outcomes in African American immigrant adults.

Research Questions and Hypotheses

RQ1: Is there a statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States?

H_o1: There is no statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)

and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States.

Ha1: There is a statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States.

RQ2: Is there a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, controlling for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o2: There is no statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha2: There is a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

RQ3: Is there a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, controlling for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o3: There is no statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha3: There is a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Theoretical Framework

Social-Ecological Model

The social-ecological model (SEM) provides a framework that captures the influencing factors of specified health behaviors at various levels (Saquib, 2018).

According to the SEM, there are multiple levels of influence on behavior, and these influences interact across different levels. The levels include intrapersonal, interpersonal, organizational, community, and public policy (Sallis et al., 2008). Theoretically, each level independently acts on the outcome, and the effect is accentuated further when the influencing factors interact across levels. The SEM provided a context to examine the relationship between obesity and its possible risk factors in African American immigrants. In this research, I used the SEM to identify behavior changes among these populations and categorized the predictors of obesity into different levels (individual level, interpersonal level, community level, societal level, and policy/enabling environment level).

The SEM was used to describe the etiology of obesity and to develop a framework for its prevention. The layers of the model representing individual, interpersonal, organizational, and community were applied in this research to predict obesity in African American immigrants. The SEM was appropriate in this study because it particularly addressed the relationship between behaviors at societal levels. The model addressed how environmental and individual factors interact to determine behaviors and to target such behaviors with health promotion.

Acculturation Theory

Acculturation, as a multifaceted concept, reflects the overall adaptation to a new society when in contact with individuals and groups from another culture, including the complex and dynamic nature of cultural identity, social connection, and preferences in the residence culture (e.g., language, history, foods, and holidays; Barry & Garner, 2000).

Particularly, during migration, the change of environment and adaptation process may influence individuals' diet, physical activity, and other life behaviors, which may further be bidirectionally associated with health status. On the one hand, it may contribute to overweight and obesity among migrant populations when they form bonds with natives and adapt to the obesogenic diet, behaviors, and environment in a receiving society (Liu et al., 2012). On the other hand, migration into a healthy environment may reduce the risk of being overweight or obese. The use of acculturation theory as a theoretical framework in this research was appropriate because it helped to identify possible social and environmental risk factors that increase the vulnerability of the African American immigrant population in Milwaukee County, Wisconsin to obesity. In this study, acculturation was used to show observed changes in immigrant behaviors and how these behaviors are affected by income, level of education, physical activity, and length of stay.

Nature of the Study

This study utilized a quantitative cross-sectional design using a secondary data set from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120) to examine the associations between stress, health behaviors (tobacco use, alcohol use, marijuana use, physical activity), and obesity among African immigrant adults residing in Milwaukee County, Wisconsin. The dependent variable was obesity, and the independent variables were stress and health behaviors (defined as tobacco use, alcohol use, marijuana use, and physical activity). The control variables were the sociodemographic factors (defined as age, gender, marital status, duration of residence in the United States, education, employment, income). The criteria for

eligibility were that participants were African Americans 44 years of age and older who had lived for more than 12 consecutive months in Milwaukee County, Wisconsin and had completed the baseline MIDUS survey of Milwaukee African Americans in 2005 (ICPSR Study 22840).

Statistical analysis consisted of logistic regression models to predict the odds of being obese by stress and health behaviors while controlling for the sociodemographic factors.

Definitions of Terms

Acculturation: A phenomenon which results when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original cultural patterns of either or both groups (Erten et al., 2018).

Body mass index (BMI): A measurement universally used to classify overweight and obesity in adults. BMI is calculated as a person's weight in kilograms divided by the square of height in meters (Centers for Disease Control and Prevention [CDC], n.d.).

Demographic factors: Factors including age, gender, ethnicity, and marital status that influence the acculturation process (Shipp et al., 2014).

Dietary acculturation: A process of assimilation to a different culture's dietary patterns by immigrants, usually the dominant one in their host environment. The process through which members of a foreign culture adopt dietary patterns of the host culture (Wandell, 2013).

Health disparity: A specific difference, variation, or inequality in some measure of health status, health care, or population health in which socially, economically, or

geographically disadvantaged people who, based on race, gender, age, literacy, and/or socioeconomic status, experience worse health than their counterparts (Kaye, 2021).

Immigrant: A person who is allowed to enter the United States lawfully and intends to permanently reside in the country.

Obesity: Classified as a BMI greater than 30 kg/m^2 (WHO, 2018).

Overweight and obesity: Abnormal fat accumulation that may be associated with some chronic diseases (WHO, 2018).

Socioeconomic factors: Factors including household income, occupation, place of residence, and level of education that influence the acculturation process (Allen et al., 2014).

Socioeconomic status: A complex and multidimensional construct, encompassing both independent objective characteristics (e.g., income, education, or occupation) and people's subjective ratings of their placement in the socioeconomic spectrum (Navarro-Carrillo et al., 2020). It is the social class to which an individual or group belongs.

Stress: A condition in which expectations, whether genetically programed, established by prior learning, or deduced from circumstances, do not match current or anticipated perceptions of the internal or external environment (Goldstein, 2010). This mismatch between what is observed or sensed and what is expected or programmed evokes patterned, compensatory responses that have harmful effects.

Assumptions

The following assumptions were made in this study:

1. The data set from the MIDUS 3: Milwaukee African American Sample, 2016–2017 (ICPSR 37120) was obtained from a cross-sectional study carried out using a probability sampling technique.
2. Length of stay was an accurate measure of acculturation among African American immigrants. Length of stay was not actual but a proxy measure for acculturation. The use of this measure was necessary because the study included secondary data that were not derived from acculturation scales. Although the validity of this measure among African American immigrants was not tested, it has been confirmed among other groups of immigrants (Goulao et al., 2015).
3. The information that was collected through the MIDUS 3: Milwaukee African American Sample, 2016–2017 (ICPSR 37120) data set was accurate. This assumption was founded on the rationale that each year, the MIDUS surveys aim to uncover different aspects of the stress/health connection via focusing on a particular topic and/or subgroup of the population and mitigated the limitation associated with the use of self-reported measures in collected data.
4. Participants were competent to understand and provide information.
5. Participants in this study told the interviewers the truth and were accurate about the various variables used for the study (i.e., their statistics, lifestyle, and demographics—age, height and weight, sex, physical activity level, socioeconomic status, stress levels, and health behaviors).

6. The data set had enough cases and variables for unbiased study of the variables of interest.
7. Missing data occurred in a completely random manner, and their absence did not bias the study even if a listwise or casewise data deletion technique was used in data management (Langkamp et al., 2010).
8. The assumptions ensured normality, independence, linearity, and homoscedasticity of the data collected.

Scope and Delimitations

This study was based on a data set from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120). I evaluated the associations between stress, health behaviors, and obesity among African American immigrant adults who reside in Milwaukee County, Wisconsin. There was no primary data collection or contact with the participants in the original study. In addition, there was a gap between the time when the study was conducted and the time when this secondary analysis took place. The delimitations of this study included the following:

1. This study was delimited to a quantitative cross-sectional study. There were neither control groups for comparison nor interventions for temporal analysis.
2. The study was a secondary data analysis without any opportunity for primary data collection. Therefore, only variables available in the data set were analyzed.
3. The study was delimited to the variables present in the data set selected for this study.

4. The study was delimited by the number of questions in the data collection tools as well as the sample size used for the national study.
5. The study was also delimited to the information collected by the data collectors when the study took place.
6. The study was delimited by the time of data collection and by the findings in the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120) data set when the study was done.

Study Limitations

A significant limitation of the cross-sectional design was that it is time-constrained to a specific period when the investigation is being done. Therefore, researchers may be unable to identify the order of events to that point. This means that causality cannot be established (Setia, 2016; Szklo & Nieto, 2014). In secondary data analysis, there is the likelihood of an inadvertent exclusion of some variables in the data set that may have added value to the study. Missing data may have affected the inferences drawn from this study.

Information bias resulting from varying levels of recall capacities of the respondents (who may have had different levels of health literacy) may have negatively impacted the findings of the study (Obisesan et al., 2017). In addition, the use of a convenience sample during the initial primary data collection phase posed a significant limitation to this study. The convenience sampling method does not enable representation of the entire population of African Americans in the United States. It only involves collecting data from some parts of the country. Consequently, the results of this study

may not be generalized to the entire population of African Americans. The quality of the data set may have been affected by the various manipulations of the data set over past years. Apart from the age of the data set, the quality also depends on the researchers and field workers who collected the primary data, the statisticians and data clerks who uploaded the data into the system, as well as the capacity of the staff who watched over the data set.

The use of self-reported data regarding the weight and height of participants may also have been a limiting factor. As established in a study by Elgar and Stewart (2008), self-reports are not very good measures of weight and height, as participants tend to exaggerate their measurements.

Another factor that may have constrained the study was the use of BMI as the only measure of obesity. Although BMI is accepted as a standard measure for obesity, it is not a perfect measure. The main feature that defines obesity as a medical condition is the presence of an excess amount of fats in the body (Ashwell & Gibson, 2015; Haijan-Tilaki & Heidari, 2015).

Significance of the Study

This study is significant because obesity is at epidemic levels in most of the populations of the United States, where it is a risk factor for many chronic diseases. As obesity is linked to adverse health outcomes, including hypertension, diabetes, heart disease, stroke, and cancer (Flegal et al., 2016), monitoring obesity is critical in shaping national and local prevention strategies (Pratt et al., 2017). This study will help inform

public health and health care providers of risk factors that African Americans, especially those who have resided in the United States for at least 1 year, may be subjected to.

Social Change Implications

This research may promote better health outcomes by contributing to reduced risks of chronic diseases and related healthcare-associated costs. The intervention efforts towards a decrease in disparities related to obesity in African American immigrants may be improved when the physical environment and the societal norms are identified (Noonan et al., 2016). This study has potential social change implications, in that it may help public health officials and providers understand the predictors of obesity among this population and may help in tailoring interventions around them at different levels. To prevent overweight and obesity in young people, this study may prompt people to know the importance of addressing the experience of stress among socioeconomically disadvantaged families (Poulsen et al., 2019). It may also raise awareness of the need to address the importance of young people's educational attainment, given the potentially important mitigating role of own education in the relationship between parental low education and later overweight and obesity.

Researchers and public health professionals may use the findings of this study to integrate a social change activity, such as developing health education materials and programs. Additionally, policymakers may use the findings to advance health policies in the fight against obesity and its risk factors/behaviors in the African American population.

Summary

Obesity is a major global problem that involves biological, physiological, behavioral, social, environmental, economic, and political factors (WHO, 2018). Epidemic proportions of obesity were reached by the end of the 20th century, when the disease became one of the leading causes of death and disability worldwide, creating a significant financial burden (Rhea et al., 2017). Obesity is a global health problem with a broad set of comorbidities, such as malnutrition, metabolic syndrome, diabetes, systemic hypertension, heart failure, and kidney failure (Gomez-Apo et al., 2021).

In this section, I presented the background, problem statement, purpose, research questions and hypotheses, conceptual framework, and nature of the study. This section also included definitions, assumptions, scope and delimitations, limitations, significance, and social change implications of the study.

In the next chapter, I will review existing abundant literature on obesity predictors and ground the dissertation research in a theoretical/conceptual framework related to obesity among African American immigrants.

Chapter 2: Literature Review

Introduction

In the previous chapter, I presented the background, problem statement, purpose, research questions and hypotheses, conceptual framework, and nature of the study. I also included in the section definitions, assumptions, scope and delimitations, limitations, significance, and social change implications of the study. Obesity is a major contributor to preventable disease and death across the globe and poses a nearly unprecedented challenge not just to those tasked with addressing it at the public health level, or at the healthcare provider level, but to all people as individuals. Increasing ease of life, owing to reduced physical labor and automated transportation, an increasingly sedentary lifestyle, and liberal access to calorie-dense food, driven by dramatic economic growth in many parts of the world in the last century, has turned a once-rare disease of the affluent into one of the most common diseases—increasingly of the poor. That barely one in three people in the United States today is normal weight portends, quite simply, an astounding and frightening future.

In this chapter, I reviewed existing abundant literature on obesity predictors and ground the dissertation research in a theoretical/conceptual framework related to obesity among African American immigrants. This literature review identifies articles that addressed the subject of stress; sociodemographic factors, which are classified as age, gender, marital status, length of stay, education, and income; and health behaviors, which are classified as tobacco use, alcohol use, marijuana use, and physical activity, and their impact on obesity to synthesize knowledge and to identify gaps. The search was

conducted in several databases simultaneously: Walden University Library and Walden Library Books, PubMed, CINAHL Plus with Full Text, MEDLINE with Full Text, Cochrane Database of Systematic Reviews, Dissertations & Theses, Dissertations & Theses at Walden University, ProQuest Central, SAGE Knowledge (formerly Encyclopedias), SAGE Research Methods Online, SAGE Stats, Science Journals, Science Direct, ProQuest, ERIC, and Health Source: Nursing Edition. Google Scholar and Google search engines and the WHO and UNICEF websites were also used.

The following key terms were used for the literature search: *African Americans*, *obesity, acculturation and health behavior*, *African Americans' health status*, *African Americans & dietary practices, smoking and obesity, alcohol use and obesity*, *marijuana use and obesity, stress and obesity*, *acculturation and immigrants, ethnicity and obesity, racial differences in obesity in the US, physical inactivity and obesity*, and *obesity prevalence and African Americans.*

Although an open-ended search was conducted for this literature review, the emphasis was placed on peer-reviewed articles published between 2015 and 2021, available in full text, and written in English. Different types of articles were considered, including primary research, systematic reviews, opinion papers, editorials, and dissertations. Articles were scrutinized for their purpose, theoretical foundation, method, design, population, sample, and findings.

Theoretical Framework

Social-Ecological Model

The Social-Ecological Model (SEM) provides a framework that captures the influencing factors of specified health behaviors at various levels (Saquib, 2018). According to the SEM, there are multiple levels of influence on behavior, and these influences interact across different levels. The levels include intrapersonal, interpersonal, organizational, community, and public policy (Kilanowski, 2017). Theoretically, each level independently acts on the outcome, and the effect is accentuated further when the influencing factors interact across levels. The SEM provided a context to examine the relationship between obesity and its possible risk factors in African American immigrants. It identified behavior changes among these populations and categorized the predictors of obesity into different levels (individual level, interpersonal level, community, societal level, and policy/enabling environment level).

The socio-ecological framework has been reported to elucidate how interactions across multiple contexts may affect an individual's perception of stress (Junne et al., 2017). Obesity is a complex, multifactorial, and largely preventable condition with major consequences for public health. In the past years, evidence has mounted that stress, and particularly an increase of the glucocorticoid stress hormone cortisol, plays a role in the development of obesity (van der Valk et al., 2018). It may be beneficial to investigate their work in chronic hypothalamic-pituitary-adrenal (HPA) axis activation and obesity. Stressful conditions are associated with irregular eating behaviors and food choices, which may lead to overweight and obesity (van der Valk et al., 2018). The perception of

stress by an individual is an evaluation of stressful experiences being dealt with, cognitive appraisal, and strategies for coping with the stressors. Obesity-associated behaviors such as consumption of highly caloric foods and drinks; dietary limitation, which tends to reduce obesity (e.g., vegan or keto diet); and eating disorders can be predicted by stress (van der Valk et al., 2018).

At the interpersonal level of the SEM, factors that characterize an individual (i.e., level of physical activity, food preferences, and overall social life) have been linked to obesity (Kilanowski, 2017; Lee & Park, 2021). To control obesity and its related conditions, changes need to occur in the interpersonal, cultural, physical, and organizational environments. Physical inactivity is associated with the rapid increase in the prevalence of obesity in the United States because of decreased energy expenditure. Normal-weight individuals tend to engage in physical activity, in contrast to overweight and obese individuals. Sedentary lifestyles and unhealthy dietary choices and behaviors such as smoking and drinking cause an increase in body weight, resulting in obesity and other related diseases such as Type 2 diabetes mellitus, some types of cancers, and heart diseases. While earlier research generally focused on individual-level factors such as knowledge, psychological constructs such as motivation, and genetics, more recent epidemiological research places obesity into the larger socioecological context where the environment, which can easily be influenced by psychological trauma from childhood, domestic abuse, war, and natural disasters, also plays a role in shaping individual response behaviors (Lakerveld & Mackenbach, 2017). The built environment has been hypothesized to be a potential driver of obesogenic behaviors and ultimately obesity

(Lam et al., 2021). Social environment, social support, and social relationships strongly influence the adoption of a healthier lifestyle, physical activity, and dietary changes, all of which result in a decrease in body weight (Kelly & Barker, 2016).

At the organizational level of the SEM, the consumption of high-calorie foods and changes in dietary pattern have been reported to influence individuals' weight towards the development of obesity (Smethers & Rolls, 2018). Faith-based and community-based organizations as part of the social environment have played a role in the health maintenance of their members. In research on churches across Los Angeles County, Robles et al. (2019) found that faith-based organizations whose members adopted some physical activity exercises experienced a high level of physical fitness and increased social support from other members, families, and friends, which had a positive effect on the overall health of the individuals and reduced obesity prevalence.

In the absence of evidence linking factors on a certain level of the SEM and the double burden of malnutrition, Mahmudiono et al. (2019) employed correlates of overweight status and obesity to complete this narrative. Potential intervention strategies were proposed in alignment with the targets and settings identified, based on the socioecological approach. They concluded that the double burden of malnutrition is a public health phenomenon associated with a variety of socioecological determinants and that an integrated approach is needed to address the root causes of malnutrition in all its forms, and at all life stages. Why this was important for this study was because it was the socioecological model that I was most interested in, as it examined how environmental

and individual factors interact to determine behavior and to target such behaviors with health promotion in adults with obesity.

The SEM was used to describe the etiology of obesity and to develop a framework for its prevention. The layers of the SEM representing individual, interpersonal, organizational, and community were applied in this research to predict obesity in African American immigrants. The SEM was appropriate in this study because it particularly examined the relationship between behaviors at societal levels. The model also examined how environmental and individual factors interact to determine behaviors and to target such behaviors with health promotion.

Acculturation Theory

Acculturation, as a multifaceted concept, reflects the overall adaptation to a new society when in contact with individuals and groups from another culture, including the complex and dynamic nature of cultural identity, social connection, and preferences in the residence culture (e.g., language, history, and foods; Huang et al., 2018; Maehler et al., 2019). Particularly, during migration, the change of environment and adaptation process may influence individuals' diet, physical activity, and other life behaviors, which may further be bidirectionally associated with health status. While migration may contribute to overweight and obesity among members of migrant populations when they form bonds with natives and adapt to the obesogenic diet, behaviors, and environment in a receiving society, it has also been reported that migration into a healthy environment may reduce the risk of being overweight or obese (Huang et al., 2018). The relationship between acculturation and outcomes, according to Zhang et al. (2019), varied between

the host countries and origin countries for children of immigrants. This study suggests that children of immigrants with different cultural backgrounds may interact with host countries to varying degrees, ultimately influencing their diet behaviors and body weight status.

Isasi et al. (2015) found that there was no significant relationship between acculturation and obesity among adult Hispanic immigrants living in the United States. The study established that prolonged exposure to the environment in the host communities, rather than acculturation, increases the risk for obesity among Hispanic immigrants.

There is extensive evidence for weight gain among people migrating from low/middle-income to high-income countries, which may be due, in part, to acculturation factors. Alidu and Grunfeld (2018) conducted a review with the aim of identifying associations between acculturation and body weight among immigrants to high-income countries and identifying whether studies accounted for the role played by health behaviors. Evidence from the review suggests that health interventions should target first-generation migrants to promote retention of their original healthy behaviors. Recent migrant groups report healthier behaviors than comparative host country populations, and therefore interventions should be promoted at the initial stages following migration to avoid uptake of unhealthy behaviors (Alidu & Grunfeld, 2018).

Literature Review

Jia et al. (2018) examined associations between four health behaviors (smoking, physical inactivity, heavy alcohol drinking, and obesity) and three health indices (health-

related quality of life, life expectancy, and quality-adjusted life expectancy [QALE]) among U.S. adults with depression. Among depressed adults, physical inactivity and smoking were strongly associated with lower EuroQol five-dimensional questionnaire (EQ-5D) scores, life expectancy, and QALE, as against a weak association with obesity and heavy drinking. These results suggest that reducing physical inactivity and smoking would improve health more among depressed adults. These results increased my knowledge of how physical inactivity and smoking may be detrimental to human health and wellness.

Obisesan et al. (2017) examined the predictors of obesity among Nigerian immigrants in the United States using a cross-sectional study. Data were obtained through a web-based survey. The authors identified a significant association between weekly consumption of alcohol and all obesity (*OR* 1.78, 95% CI 1.091, 2.919), and moderate/morbid obesity (*OR* 2.46, 95% CI 1.213, 4.999), and between gender and moderate/morbid obesity—men were less likely (*OR* .030, 95% CI .001, .733) to be obese. These findings provided evidence to inform targeted screening for excessive alcohol consumption along with other primary prevention strategies that may reduce the prevalence of obesity among the Nigerian immigrant population. This was important because knowing how excessive alcohol consumption related to obesity informed my research study.

Stenholm et al. (2016) examined the extent to which the co-occurrence of behavior-related risk factors such as smoking, physical inactivity, and obesity predict healthy life expectancy and chronic-disease-free life expectancy in four European cohort

studies. Data from four European countries show that persons with individual and co-occurring behavior-related risk factors have a shorter healthy life expectancy and shorter chronic disease-free life expectancy. I acquired the knowledge in this article that population-level reductions in smoking, physical inactivity, and obesity could increase life-years lived in good health.

In their study, Ohlsson and Majer (2020) explored the associations between sociodemographic factors and smoking and alcohol habits and lower versus higher BMI (≥ 25 kg/m^2) and examined whether categorization into lean, normal-weight obesity (NWO), and overweight leads to further information about sociodemographic and lifestyle associations, compared with the common categorization defined by BMI. A cohort of 17,724 participants (9,936 females, 56.1%) from the EpiHealth study, with a median age of 61 (53–67) years, was examined. EpiHealth is a collaboration between Lund University and Uppsala University aiming to build a Swedish resource of a multicenter longitudinal cohort of 300,000 individuals. The EpiHealth study includes three parts: a web-based baseline questionnaire completed by the participants, physical tests and biological sampling performed at a test center, and possibilities to follow up later concerning future diseases and medications through official Swedish registers. According to Ohlsson and Majer, sociodemographic and lifestyle habits showed similar associations with lower versus higher BMI as with lean and NWO versus overweight, whereas lean versus NWO showed different directions of associations regarding sex, marital status, occupation, smoking, and frequency of alcohol consumption. The

knowledge of the associations of sociodemographic factors and alcohol habits with lower and higher BMI gave more insights into my research study.

Dietary Acculturation and Obesity

Several studies have examined the relationship between acculturation and obesity, but results from these studies have not been consistent. Vargas and Jurado (2016) found that greater acculturation was associated with increased BMI and waist circumference among Filipino American immigrants by increasing caloric intake, percentage fat intake, and percentage carbohydrate intake. Similarly, Griffith et al. (2014) reported that the BMI of African adolescent immigrants living in Melbourne, Australia was associated with parents' acculturation patterns. Adolescents whose parents adopted the integration acculturation strategy had lower BMI than those whose parents used other strategies. In their systematic review, Goulao et al. (2015) found that BMI was positively associated with the length of stay of immigrants. Underlying causes for the increase in BMI after immigration include a change in physical activity and nutrition, genetic susceptibility, and social factors.

Increasing rates of obesity among successive generations occur among Chinese Americans. A cross-sectional survey by Liou et al. (2018) measured obesity-risk-reduction behaviors and degree of acculturation among a convenience sample of 203 Chinese Americans living in Los Angeles, California. Asian-identified participants were most likely to follow traditional healthful Chinese food patterns, and Western-identified individuals were more apt to engage in leisure physical activity. Individuals categorized as bicultural were prone to use limited amounts of fats or oils when preparing foods. The

study called for health professionals and educators working with Chinese Americans to consider the impact of acculturation affecting the adoption of obesity prevention behaviors.

Paxton et al. (2016) used the qualitative approach to examine changes in dietary habits among recent immigrants from West Africa. The immigrants' diet before entry to the United States was characterized by the high amount of root tubers, fruits, vegetables, and vegetable oil, a moderate quantity of fish and meat, and low sugar. Despite efforts to keep this traditional diet, there were signs that these immigrants were adopting the Western dietary patterns (Paxton et al., 2016). The children of the immigrants were more likely to adopt Western eating habits. Participants also reported a drastic increase in weight after living for a few years in the United States. The study offers some evidence on the association between change in dietary habits and increases in weight.

The Interplay Between the Stress System and Obesity

Stress is recognized as an important issue in basic and clinical neuroscience research, based upon the founding historical studies by Walter Canon and Hans Selye in the past century, when the concept of stress emerged in a biological and adaptive perspective (Godoy et al., 2018). A lot of research after that period has expanded the knowledge in the stress field. Since then, it was discovered that the response to stressful stimuli is elaborated and triggered by the, now known, *stress system*, which integrates a wide diversity of brain structures that, collectively, are able to detect events and interpret them as real or potential threats. However, different types of stressors engage different brain networks, requiring a fine-tuned functional neuroanatomical processing. This

integration of information from the stressor itself may result in a rapid activation of the Sympathetic-Adreno-Medullar (SAM) axis and the Hypothalamus-Pituitary-Adrenal (HPA) axis, the two major components involved in the stress response. The complexity of the stress response is not restricted to neuroanatomy or to SAM and HPA axes mediators, but also diverge according to timing and duration of stressor exposure, as well as its short- and/or long-term consequences (Godoy et al., 2018).

The end effects of stress with respect to weight gain can be accomplished in different ways due to the various properties of glucocorticoids. Glucocorticoids are a class of corticosteroids, which are a class of steroid hormones. Glucocorticoids are corticosteroids that bind to the glucocorticoid receptor that is present in almost every vertebrate animal cell. High levels of cortisol a glucocorticoid stress hormone can, for example, increase appetite with a preference for carbohydrate-dense food ("comfort food") and cause white adipose tissue to redistribute to the abdominal region, which may ultimately lead to abdominal obesity (van Rossum, 2017). Interestingly, it had been observed that glucocorticoids may decrease the sensitivity to adrenergic stimulation of brown fat (Barclay et al., 2015). Furthermore, exogenous glucocorticoid administration increases the intrahepatic conversion of cortisone to cortisol thereby potentially contributing to the repeating cycle (Dube et al., 2015). This relationship between (chronic) stress and obesity mediated by increased glucocorticoid action may in some persons be greater by exposure to factors enhancing the stress response. Biological factors, such as carrying glucocorticoid sensitive glucocorticoid receptor (GR) gene variants, or a disrupted diurnal cortisol rhythm by decreased sleep and/or shift work, can

potentially lead to higher glucocorticoid effects, and thus make certain persons more prone to weight gain, and obesity. Moreover, the same holds for other environmental and behavioral factors, such as intake of food with high glycemic index, excessive alcohol use, and chronic pain, all possibly leading to increased cortisol levels and higher body weight. (Tirabassi et al., 2014).

However, depending on certain individual characteristics, obesity by itself can also lead to increased chronic stress to varying degrees. Persons experiencing, for example, weight stigma are known not only to experience more stress (Tomiyama, 2014) but also to have higher long-term cortisol levels (Jackson et al., 2016). Additionally, persons with obesity are more likely to suffer from mental (e.g., depression) and physical disorders (e.g., obstructive sleep apnea, chronic pain due to weight load) which can in turn lead to chronic stress and/or higher cortisol levels. This can even be exaggerated by the use of certain medications indicated for obesity-related comorbidities, such as corticosteroids for arthrosis or asthma. Thus, in this and many other ways, a vicious circle may be formed that maintains chronic stress, obesity, and increased GC action, leading to even more weight gain and/or impeding weight loss.

In their study, Koski and Naukkarinen (2017), used psychiatric methods to examine the relationship between stress and obesity in individuals receiving a disability pension. Matched study and control groups were established, and the female and male control subjects were selected separately by random sampling. The control subjects were matched with the case subjects concerning the place of residence, sex, age, the date that a pension was granted, and occupation. Psychiatric and psychological methods were

assessed using a questionnaire and statistical analyses. Psychiatric interviews indicated that stress was more prevalent in the study group than in the control group. Separation from parents was nearly significantly more frequent in the study group than in the control group. The questionnaire on coping mechanisms revealed that case subjects tended to resolve their problems actively. The authors were able to identify stress factors that affect the development of obesity. This study is both necessary and important, as these findings provided valuable insight into the relationship between severe obesity and stress.

Junne et al. (2017) examined the relationship of the hypothesized potentially obesity-related factors with perceived stress in individuals with obesity. This study shows a substantial determination of perceived stress by potentially obesity-related cognitive and emotional stressors in females and males with obesity. The findings of this study contributed to an improved understanding of potentially specific stressors in obese individuals.

Yuan et al. (2020) examined the association among self-perceived stress, history of smoking and drinking, and weight status by using data from the China Health and Nutrition Survey in 2015. A total of 8028 adults were selected from this data. The self-reported data primarily included sociodemographic data, self-perceived stress scores, and a history of smoking and drinking. Multivariate and multinomial regression models were used to estimate the effects of the substance and perceived stress on weight status. The study suggested that a high perceived stress level may cover the risk of being overweight and obese. The knowledge that individuals with a history of smoking had a low risk to be

obese and that alcohol consumption was likely to increase abnormal weight informed my research study.

Stress has long been suspected to be related to (abdominal) obesity where high levels of cortisol increase appetite for energy-dense food thereby causing the distribution of white adipose tissue to the abdominal region, and ultimately leading to abdominal obesity (van Rossum, 2017). However, interindividual differences in this complex relationship exist. In their review, van der Valk et al. (2018), suggested that the extent of glucocorticoid action partly explains these interindividual differences. Van der Valk et al. (2018) provided latest insights with respect to multiple types of stressors. They reported that increased long-term cortisol levels, as measured in scalp hair, are strongly related to abdominal obesity and to specific mental disorders. However, not all obese patients have elevated cortisol levels. Possibly, the interindividual variation in glucocorticoid sensitivity, which is partly genetically determined, may lead to higher vulnerability to mental or physical stressors. The authors concluded that stress may play a major role in the development and maintenance of obesity in individuals who have an increased glucocorticoid exposure or sensitivity (van der Valk et al., 2018). These insights may lead to more effective and individualized obesity treatment strategies.

There is increasing evidence for weight-based discrimination against persons with obesity. In their study, Jackson et al. (2016) examined the physiological impact of perceived weight discrimination on cortisol in hair, an indicator of chronic stress exposure. The authors collected data from 563 nonsmoking individuals with obesity (BMI $\geq$30 kg/m^2) participating in the English Longitudinal Study of Ageing. Experiences

of discrimination were reported via questionnaire, and hair cortisol concentrations were determined from the scalp-nearest 2-cm hair segment. Height and weight were objectively measured. The association between weight discrimination and hair cortisol was particularly pronounced in individuals with severe (class II/III) obesity (1.402 vs. 0.972, F = 11.58, P = 0.001). It was concluded that weight discrimination is associated with the experience of stress at a biological level (Jackson et al., 2016). Chronic exposure to elevated levels of cortisol may play a role in generating a vicious circle of weight gain and discrimination and contribute to obesity-associated health conditions.

Stigmatization of individuals with obesity is pervasive and may act as a psychological stressor. Jackson and Steptoe (2018) examined whether perceived weight discrimination mediated the relationship between obesity and cortisol, an objective marker of chronic stress, in a population-based sample. Data were from the English Longitudinal Study of Ageing (n = 1872). Height and weight were objectively measured in 2008/2009. Experiences of weight-related discrimination were reported via questionnaire in 2010/2011. Hair cortisol concentrations were determined from the scalp-nearest 2 cm hair segment in 2012/2013. Mediation analyses tested the role of perceived weight discrimination in the associations between obesity and BMI and hair cortisol concentration, adjusting for age, sex, ethnicity, socio-economic status, smoking status, and depression. The results showed that obesity, BMI and perceived weight discrimination were positively related to hair cortisol. It was concluded that perceived weight discrimination is an important mediator of the association between obesity and cortisol. The authors suggested that interventions combating weight stigma and

discrimination or promoting strategies for coping with stress could help to lessen the psychological and physiological burden of obesity.

De Assis Pinheiro et al. (2021) conducted a study aimed to analyze associations involving stressors such as socioeconomic status, health conditions, and lifestyle in relation to NR3C1 methylation in adults. The NR3C1 glucocorticoid receptor (GR) gene is a component of the stress response system, which can be regulated by epigenetic mechanisms. NR3C1 methylation has been associated with trauma and mental issues, including depression (Efstathopoulos et al., 2018), post-traumatic stress (Palma-Gudiel et al., 2015), anxiety, and personality disorders (Charoensook, 2017). It has been reported that stressful events are involved in NR3C1 gene methylation, suggesting that its regulation under environmental effects is complex. In their study, de Assis Pinheiro et al. (2021), included 386 individual users of the Brazilian Public Unified Health System (SUS), and evaluated socioeconomic and health conditions, BMI, cortisol levels, and lifestyle. Data were correlated with NR3C1 methylation, determined using DNA pyrosequencing. The results showed that alcohol consumption, overweight, and high cortisol levels were related to NR3C1 demethylation, while depression was related to its methylation. It was concluded that habits, lifestyle, and health status may influence NR3C1 gene regulation via methylation, revealing the complexity of environmental impacts on NR3C1 methylation.

Lifestyle Behaviors and Body Dissatisfaction

Albawardi et al. (2021) examined body image perception and the associations of body dissatisfaction (BD) with socio-demographic and lifestyle factors among Saudi

women attending fitness centers in Riyadh. Saudi females aged 16 years and older were recruited from 12 randomly selected fitness centers in Riyadh, using a stratified clustered sampling technique (n = 460). Height and weight were measured to calculate the actual BMI. A previously validated instrument was used to collect socio-demographic and lifestyle variables including physical activity (PA), sedentary behaviors, sleep, and dietary habits. The Figure Rating Scale (FRS) by Stunkard et al. (1983), was used to assess perceived and desired body shape. The scale consists of nine schematic silhouettes ranging from very thin to very obese and has been used frequently as a measure of body dissatisfaction requiring participants to self-select a figure rating. Except for BMI and decreased dairy products and energy drinks consumption, many lifestyle behaviors including physical activity, sleep duration, screen time, food frequency intake (vegetables, fruits, fast foods, cake, and donuts) did not associate with BD among Saudi females attending fitness centers. The findings can inform healthcare providers when intervention strategy is implicated for females with BD. This is important because knowing how lifestyle behaviors relate to obesity may inform my research study.

Immigrants' Length of Stay and Obesity

Ro et al. (2015) found that although immigrants' length of stay in the United States was significantly associated with increased obesity, the inclusion of behavioral variables did not change the significance and magnitude of the relationship between the length of stay and obesity patterns. The findings led to the conclusion that the relationship between obesity and length of stay is not simply an issue of acculturation. However, the study only examined the effect of three health behavior variables: alcohol

use, smoking, and exercise; hence, does not provide a comprehensive conclusion on whether the acculturation process can explain the link between obesity and immigrants' length of stay. This finding enabled me to know that the relationship between obesity and length of stay may not simply be an issue of acculturation and that other factors may need to be considered.

Using a multivariable logistic regression to examine the association between length of United States residence and cardiometabolic risk (CMR) factors, the research of Mensah et al, (2016), detailed that the greater the length of residence in the United States the greater the predisposition to a higher prevalence of cardiometabolic risk (CMR) factors in Immigrants. CMR includes hypertension, overweight/obesity, diabetes mellitus, and hyperlipidemia all of which are linked to a sedentary lifestyle, unhealthy eating habits, low income, and other factors of acculturation (Ro, 2015). In a cross-sectional study of the association between length of residence and overweight among adult immigrants in Portugal, da Costa et al. (2017), reported that the length of residence (≥15 years) was positively associated with the prevalence of overweight, among the adult immigrant population. Oza-Frank and Narayan (2010), in their cross-sectional research using a multivariate-adjusted prevalence and odds ratio (OR) to estimate associations between the length of residence and overweight among United States immigrants by region of birth and age at arrival, found that there is a link between the length of residence and overweight, the odds of being overweight were three times higher in migrants from Mexico, South America, Europe, Russia, Africa and the Middle East

residing in the United States for >15 years than those who have been residing in the United States for less than 5 years.

Immigration from one cultural milieu to another has been associated with a greater risk for incident cardio-metabolic morbidity among adults. In this nationwide, population-based, cross-sectional study of data recorded from 1992 to 2016, Hamiel et al. (2019), assessed the association between BMI and blood pressure levels among adolescent immigrants, aged 16 to 19 years, of Ethiopian origin, and their secular trend of overweight and obesity. Adolescents of Ethiopian origin were classified as Israeli-born (n=16 153) or immigrants (N=23 487), with stratification by age at immigration. Adolescents whose fathers were at least 3 generations in Israel (n=277 789) served as a comparative group. Hypertensive-range blood pressure values adjusted for age, sex, and height served as an outcome. Among adolescents of Ethiopian origin, overweight and obesity (BMI ≥ 85th percentile), increased by 2.5 and 4-fold in males and females, respectively, during the study period, compared with a 1.5-fold increase among native Israeli-born males and females. The odds for hypertensive-range measurements increased with the length of residence in Israel: 7.3%, 10.6%, and 14.4% among males who immigrated at ages 12 to 19, 6 to 11.9, and 0 to 5.9 years, respectively; and 11.5%, 16.7%, and 19.3%, respectively, among females. Israeli-born Ethiopians had a significantly higher risk for hypertensive-range measurements at any BMI level compared with native Israeli-born examinees, after adjusting for sociodemographic factors and health status. Among Ethiopian Israeli adolescents, abnormal blood pressure correlates directly with the time-lapse since immigration. It was concluded that

immigrant populations require targeted surveillance and appropriate intervention (Hamiel et al., 2019).

Diet, Sociodemographic Factors, and Obesity

Rummo et al. (2018) examined the change in obesity prevalence among New York City (NYC) adults from 2004 to 2013–2014 and assessed variation across sociodemographic subgroups. They used objectively measured height and weight data from the NYC Health and Nutrition Examination Survey to calculate the relative percent change in obesity (≥ 30 kg/m2) between 2004 (n = 1987) and 2013–2014 (n = 1489) among all NYC adults and sociodemographic subgroups. They observed increases in eating out and screen time over time and no improvements in physical activity. Findings in this study show increase in obesity in NYC in the past decade, with important sociodemographic differences. This is important because the understanding of the research design informed my study.

Olivio et al. (2018), examined interactions between obesity and the candidate factors in 2043 African Americans without baseline kidney disease who enrolled in the Jackson Heart Study (JHS). JHS is a prospective cohort study designed to evaluate cardiovascular risk factors in African Americans. The results demonstrated that both the diet-obesity interaction and the stronger overall association between visceral adiposity and chronic kidney disease (CKD) suggest that metabolic factors promoted by dietary intake and greater visceral adipose volume are major pathways promoting CKD. These results added more insights into my initial knowledge about diet-obesity interaction and its involvement in the major pathways promoting chronic diseases.

Socioeconomic Status and Obesity in Immigrant Population

The economic burden of obesity in the United States runs into billions of dollars in expenditure. Current estimates show that the costs range from $147 billion to nearly $210 billion per year in the United States and the global impact of obesity economically as assessed in 2014 was estimated to be $2 trillion or 2.8% of the global gross domestic product (GDP) (Tremmel et al., 2017). The predisposing factors of obesity in Nigerian immigrants according to Obisesan et al. (2017) are acculturation, physical inactivity, income, gender, age, education, duration of residence, and socioeconomic status (SES). These factors were similarly noted in Hispanics, Asians, Europeans, and African immigrants to the United States (Murphy et al., 2017).

Socioeconomic status is the social standing or class of an individual or group often measured as a combination of education, income, and occupation and which in many populations, impacts physical activity (Stalsberg & Pedersen, 2018). Research into education and income shows that overweight and obesity are more prevalent in less educated and low-income earners, suggesting that individuals and immigrants or groups with low income and education are more susceptible to obesity (Marija et al., 2018). People on the lower scale of SES are more likely to be financially constrained to live in good neighborhoods where there are facilities for physical exercise, recreational parks, fresh food markets, unlike their socially well-to-do counterparts. People with high social-economic status have a higher probability for healthier habits in nutrition compared to the people with the worse socio-economic status, who are not able to follow complete nutritive recommendations and guidelines in nutrition, resulting in their worse health

state (Marija et al., 2018). The low-income earners who live in poor neighborhoods are more likely to eat in fast-food restaurants which have been linked to obesity and its associated diseases among the minorities (Müller et al., 2016). Obisesan (2015) researched educational level, age, gender, income, type of job, physical activity, SES, and dietary habits found that in combination with dietary choices, physical inactivity, and other factors, low SES is a predicting factor for weight gain and obesity in immigrant population and communities. It was also reported that a higher level of income increases the perception of health status and awareness in immigrants (Shi et al., 2015).

Research Design and Methodology

Overweight and obesity are major public health problems worldwide, with projections suggesting a proportional increase in the number of affected individuals in developing countries by the year 2030 (Simo et al., 2021). Evidence-based preventive strategies are needed to reduce the burden of overweight and obesity globally. Various studies on obesity and its prevalence in various populations have employed logistic regression as a preferred method of analysis for cross-sectional data involving lots of independent variables.

The prevalence of overweight and obesity among women of childbearing age is considered a public health concern. Few studies have been conducted in the Gaza Strip to determine the magnitude of overweight and obesity. This study by El Kishawi et al. (2020) aimed to determine the prevalence of overweight and obesity along with their associated factors among women in the Gaza Strip. A cross-sectional study was conducted to recruit a total of 357 mothers aged 18–50 years. Interviews were carried out

among mothers to collect sociodemographic information, nutritional information, and physical activity. Anthropometric measurements [height, weight, and waist circumference (WC)] were conducted with the mothers. BMI was computed to determine the prevalence of overweight and obesity. Analyses were performed with the statistical software package version (SPSS) 22.0. Descriptive statistics such as frequency and proportion were used to describe the sample and to determine the prevalence of overweight and obesity among women in the Gaza Strip. Cross tabulations and Pearson's Chi-square test were used to obtain the associations and strength of the relationship between the independent and the dependent variables. Multinomial logistic regression analysis was performed to control for confounding factors and to determine the Odds Ratios (ORs). The univariate analysis was carried out to evaluate each independent variable for its unadjusted association with overweight or obesity. In the second, bivariate association, they included all independent variables with $p < 0.25$ significantly associated with overweight or obesity, because they were considered important to evaluate factors associated with overweight or obesity. In the final model, the significance level was $p < 0.05$.

Nutrition knowledge was significantly associated with a high prevalence of obesity (OR = 1.20, 95% CI: (1.03,1.38)). This study showed a higher prevalence of overweight and obesity among Palestinian women than previous studies. Age, educational level, monthly income, and nutrition knowledge were associated with the prevalence of overweight and obesity, compared to other variables that were not

associated with overweight and obesity such as location, work status, physical activity, and sitting hours.

Some limitations were pointed out in this study. The study design was cross-sectional to identify associated factors with overweight and obesity, which could not determine the cause-and-effect relationship. The authors suggested that case-control studies should be conducted in the future to address the risk factors of weight gain. In this study, the authors assessed physical activity as a subjective tool (IPAQ), instead of a more objective tool such as an accelerometer or pedometer. It was concluded that urgent action is needed to tackle overweight and obesity among women and that an effective intervention is required to increase nutrition knowledge among women to improve their eating behaviors.

A cross-sectional study of data from the 2015 *Ontario Student Drug Use and Health Survey* (OSDUHS), a provincially representative survey of students in publicly funded schools in Ontario, Canada, was conducted by Menon et al. (2019). This study included self-reported data from students aged 11–17 years ($n = 9866$). The main outcome variable was overweight or obesity, classified using WHO BMI cut-points. Four independent variables for healthy weight behaviors were examined: (1) moderate-to-vigorous physical activity (MVPA) (≥ 60 mins vs. < 60 mins every day over the last seven days); (2) screen time (< 2 h daily vs. ≥ 2 h daily); (3) fruit and vegetable consumption (≥ 5 times/day vs. < 5 times/day); (4) sleep (adequate based on guidelines vs. inadequate). Covariates included sex, age, Subjective Social Status (SSS), parental education, and ethnicity. Binomial and multinomial logistic regression models were fitted

to determine whether not meeting the recommendations for healthy weight behaviors was associated with overweight or obesity status.

The results showed that only 2% of students in Ontario met the recommendations for all four healthy weight behaviors and 33% of students did not meet any of the four recommendations. In both the binomial and multinomial models, not meeting the recommendations for MVPA was the only significant healthy weight behavior associated with both overweight and obesity (AOR: 1.29, 95% CI: 1.03–1.62), and solely obesity (AOR: 1.45, 95% CI: 1.05–1.99). Males, students with lower SSS ratings, and students with parents with the education of 'High School' or less were also at significantly greater odds of being obese. Findings from this study show that inadequate levels of MVPA are a critical behavioral predictor of obesity status in adolescents between the ages of 11–17 years, after controlling for differences in screen time, fruit and vegetable consumption, sleep, and demographics. Findings from this study could have implications toward policies and programs targeted at reducing obesity and increasing the physical activity rates of adolescents.

Several limitations should be taken into consideration when interpreting the findings of this study. The cross-sectional nature of this study prevents the authors from making any causal or reverse-causal inferences from the study results, as the temporality of overweight or obese weight status cannot be established. All responses in OSDUHS are self-reported, leading to potential recall and social desirability bias. A study comparing the differences in self-reported vs. direct height and weight measurements in Canadians noted self-reported height to be typically greater than measured height, while

self-reported weight was lower than measured weight; consequently, self-reported rates of overweight and obesity were lower than rates provided by direct measures. This suggests that the rates provided in this study may underestimate the true magnitude of overweight and obesity in Ontario's adolescents.

Simo et al. (2021) assessed the prevalence of, and factors associated with overweight and obesity in selected health areas in West Cameroon. They collected data from a community-based cross-sectional study, involving the consecutive recruitment of participants aged 18 years or older. Overweight and obesity were defined according to the WHO classification. The statistical software R (version 3.5.1, The R Foundation for statistical computing, Vienna, Austria) was used for statistical analysis. Multivariable logistic regression analysis was used to assess independent factors associated with overweight and obesity. Records of 485 participants were included for analysis. The age and sex-standardized prevalence of overweight, obesity, and overweight and obesity were obtained. In multivariable analysis, being female, married, and having secondary or tertiary education were associated with higher odds of overweight and obesity, while current smokers had lower odds of overweight and obesity (aOR = 0.37, 95% CI = 0.16-0.82) when compared to their respective counterpart.

The authors observed a high prevalence of overweight and obesity in this study. The odds of overweight and obesity were higher in females, married participants, and those with higher levels of education. They recommended that community-based interventions to control overweight and obesity should consider targeting these groups.

This study is limited by the fact that it is a secondary analysis of previously collected data. The availability and quality of the variables used in the present study were dependent on the data collected in the primary study. The authors' findings are subjects to both measured and unmeasured confounding. The primary study used a non-probabilistic sampling technique to recruit participating health areas and participants into the study, thereby limiting the representativeness and generalizability of this study's findings. As a result, the authors caution against generalizing the prevalence of overweight or obesity herein.

The study of Jia et al. (2020) aimed to investigate the association between diet quality and obesity indicators applying Dietary Approaches to Stop Hypertension (DASH) and Mediterranean diets (aMed). Jia et al. (2020) did a cross-sectional study on adult nutrition and chronic disease in Inner Mongolia (n = 1320). Dietary data were collected using 24-h diet recall for 3 consecutive days and the weighing method. DASH and aMed were used to assess the dietary quality. waist circumference (WC), BMI, and WC-BMI were used as obesity indicators. Logistic regression models were used to examine the associations between diet quality and obesity indicators.

Their results showed that higher diet quality, assessed by DASH, was only associated with WC. The odds ratio (OR) for abdominal obesity in the highest group of DASH scores compared with the lowest was 0.71 (95% confidence interval (CI) 0.53, 0.96; $P_{trend} = 0.03$). Furthermore, aMed was inversely associated with obesity indicators. OR for abdominal obesity in the highest group of aMed score compared with the lowest were 0.63 (95% CI 0.47, 0.87; $P_{trend} = 0.005$) and 0.57 (95% CI 0.41, 0.77; $P_{trend} = 0.02$)

for overweight and obesity, respectively, and 0.60 (95% CI 0.44, 0.81; P_{trend} = 0.02) for high obesity risk. Their findings suggest that dietary quality assessed using aMed is more strongly associated with obesity than assessment using DASH in working-age adults in Inner Mongolia. They concluded that the Mediterranean diet can be recommended as a healthy diet to control weight.

There are several limitations to this study. First, the study design was cross-sectional, the associations are not proof of causality, and reverse causality bias could be present. Additional cohort studies with follow-up data are necessary to strengthen the understanding of the associations identified here. Secondly, the research was conducted in Inner Mongolia, which investigated the local diet and evaluated the relationship between dietary quality and obesity. Different from other parts of China, the diet in Inner Mongolia residents is characterized by less intake of vegetables, fruits, and fish, and more intake of meat. The authors' conclusion may apply to those regions whose diet characteristics are similar to diets in Inner Mongolia. At the same time, their research population was obtained by the multi-stage cluster random sampling method, and the samples are well represented. Thirdly, a 24-h recall and weighing method were used for the dietary investigation, which may cause recall bias.

Summary and Conclusion

Although in the past, research on obesity has been quite extensive, there is still an ongoing quest for further findings. The knowledge and abundance of literature on obesity are constantly growing and the addition of this literature review is in line with this trend. This wide-ranging literature review is a summary of peer-reviewed scholarly articles in

the study of obesity in a diverse range of cohorts. While it is known that the causes of obesity and its outcomes are unique and differ in diverse populations, there is also a complex interaction between obesity and its risk factors. Concerning obesity risk factors and their prevalence worldwide, they appear to be not much different from the similar studies synthesized above. This chapter identifies a gap in the literature by looking at the associations of stress and health behaviors with obesity among African Americans residing in Milwaukee County, Wisconsin so that prevention could be tailored to their unique risk factors. In the chapter, existing abundant literature on obesity predictors was reviewed and the dissertation research was also grounded in a theoretical/conceptual framework related to obesity among African American immigrants. In addition, articles that addressed the subject of stress, socio-demographic factors which are classified as age, gender, marital status, length of stay, education, income, and health behaviors which are classified as tobacco use, alcohol use, marijuana use, and physical activity and their impact on obesity were reviewed to synthesize knowledge and to identify gaps. The completeness of this chapter allowed this research to proceed into chapter 3 - the research method. Chapter 3 will describe in detail the research design and rationale, methodology, ethical procedures, and threats to validity. The chapter will conclude with a summary of the design and methodology of the study.

Chapter 3: Research Method

Introduction

The purpose of this study was to examine the association between stress, identified health behaviors (tobacco use, alcohol use, marijuana use, and physical activity), and obesity among African American immigrant adults residing in Milwaukee County, Wisconsin. In this section, I describe the research design and rationale; the methodology, including instrumentation and operationalization for each variable; the data analysis plan; threats to validity; and ethical procedures, concluding with a summary of the design and methodology of the method of inquiry.

Research Design and Rationale

A quantitative, cross-sectional research design utilizing a secondary data collection approach was used in this study. Quantitative methodology was appropriate in developing an understanding of how stress and health behaviors (defined as tobacco use, alcohol use, marijuana use, and physical activity) are related to obesity outcomes in African immigrants residing in Milwaukee County, Wisconsin.

Midlife in the United States (MIDUS) is a national longitudinal study that investigates how the health and well-being of Americans are affected by work, relationships, health, economic turmoil, and personal outlooks, through which researchers seek to understand the factors that best protect health from midlife into old age. The approach to this inquiry was to carry out a retrospective secondary data analysis using the data set from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016-2017 (ICPSR 37120). The MIDUS series is a data collection stemming

from the work of the John D. and Catherine T. MacArthur Foundation Research Network on Successful Midlife Development (MIDMAC). MIDMAC is an interdisciplinary research group consisting of numerous scholars from a wide range of disciplines and backgrounds. It was established in 1989 to study a period in the lifespan—middle age. The primary objective of MIDMAC is to identify the major biomedical, psychological, and social factors that permit some people to achieve good health, psychological well-being, and social responsibility during their adult years. To do this, MIDMAC collected a series of data to establish an empirical basis for documenting what happens in the middle years and to identify the factors that determine the course of midlife development.

A cross-sectional study design is used to measure outcomes and exposure in participants in a study at the same time. Participants in this study were selected based on inclusion and exclusion criteria, unlike case or cohort studies where participants are selected based on the outcome or exposure status. A population-based survey was used in this study to describe associations between independent and dependent variables. Some of the limitations of a cross-sectional study are that it is difficult to determine causal relationships because it is a one-time measurement of exposure and is therefore prone to certain biases. The choice of a cross-sectional design in this study was appropriate because my study was a population-based study that was a one-time measurement of an outcome, which was obesity among African American adults in Milwaukee County, Wisconsin. Moreover, the secondary data that were used in this study were generated using a cross-sectional design.

The use of a cross-sectional research design approach was the most appropriate to answer the research questions and address the associations/correlations between the independent variables and obesity (Obisesan et al., 2017). According to Setia (2016), a quantitative cross-sectional approach is quicker, less expensive, and efficient than the qualitative approach. Secondary data collection and analysis can be faster when compared to primary data collection and analysis, saving time and money and avoiding duplication of efforts. In addition, secondary data allow for analysis of large data sets that would not be possible with individually collected data. This study design also minimizes ethical issues associated with primary data collection and ensures the protection of the confidentiality of the participants.

Methodology

Target Population

The target population for this study included adult African American residents aged 44–94 years in Milwaukee County, Wisconsin who completed the baseline MIDUS survey of Milwaukee African Americans in 2005 (ICPSR Study 22840). This is the population from which the sample for the MIDUS 3 was drawn. My study included only data collected from the primary respondents on whom the MIDUS 3 interviews were conducted.

Sampling and Sampling Procedures

In 2005, 592 African Americans from Milwaukee were added to the MIDUS sample to examine health issues in minority populations. Respondents were interviewed in their homes using a computer-assisted personal interview (CAPI) survey protocol and

were asked to complete and return a self-administered questionnaire (SAQ). Afterward, these individuals were eligible for participation in the same research protocol as the national MIDUS 2 sample, including cognitive, daily stress, biomarker, and neuroscience projects.

With support from the National Institute on Aging, the second wave of survey data collection on the Milwaukee sample was begun in 2016. The sampling design was a stratified area probability sample of households in Milwaukee County, Wisconsin. The sampling frame included Census tracts in which at least 40% of the population was African American. The Census blocks were stratified by income, with roughly half coming from tracts in which the median household income was $40,000 or greater, and the rest coming from tracts in which the median household income was below $40,000. The survey consisted of a 2.5-hour CAPI interview followed by a 45-page mailed SAQ. CAPI survey data were collected for 389 individuals, realizing a 78% response rate, adjusted for mortality and other eligibility criteria. Data collection for this follow-up wave largely repeated baseline assessments, with additional questions in selected areas (e.g., economic recession experiences, childhood experience with race, etc.). Following successful completion of the CAPI and SAQ protocols, individuals were eligible for participation in cognitive, daily stress, biomarker, and neuroscience projects.

Procedure for Gaining Access to the Data Set

A request to access the data set MIDUS 3: Milwaukee African American Sample, 2016–2017 (ICPSR 37120) was put across by email to Walden's Institutional Review Board (IRB), whose members advised that I should contact the ICPSR support

department. The support department requested that I complete a Restricted Data Use Agreement with my original signature, which, upon approval, would grant me access to use the data. The data sets are free and can be accessed when a request is made by filing a request format on the ICPSR website. Approval was granted, and after completing other due process, I received the encrypted link from the specialist to access the data. The immediate provision of the restricted data enabled me to export the data to the Statistical Package for Social Sciences (SPSS 28) software, where the necessary coding and analysis were done. I sought guidance on data set analysis as secondary data for this study from Walden University through my committee chair and methodologist.

Sample Size Calculation

Calculation of the sample size was done using G*Power analysis with the G*power software Version 3.1.9.7 for Z tests—Logistic regression.

- *Analysis*: A priori: Compute required sample size, given α, power and effect size
- *Input parameters*: Tails = 2, Odds ratio = 2.3333333, Pr (Y = 1|X = 1) H0 = 0.3, α err prob = 0.05, Power (1-β err prob) = 0.80, R^2 other X = 0, X distribution = Binomial, X parm π = 0.50
- *Output parameters*: Critical Z = 1.9599640, Total sample size = 190, Actual power = 0.8017292

Using a G* power analysis from the above output, I reasoned that a minimum of 190 participants would be needed for this study. However, I used the sample size of 389 available from the MIDUS 3: Milwaukee African American Sample, 2016–2017 (ICPSR

37120), as it provided a higher power than the required 80%. The use of an adequate sample size ensures representativeness and generalizability to the wider population, reduces the probability of selection bias, and increases confidence and acceptability of study results (Andrade, 2020).

Instrumentation and Operationalization of Constructs

MIDUS is a national longitudinal study that investigates how the health and well-being of Americans are affected by work, relationships, health, economic turmoil, and personal outlooks and is used to understand the factors that best protect health from midlife into old age. The MIDUS Milwaukee 2 (referred to internally as MKE2) was a follow-up survey of Milwaukee African Americans who were first interviewed in 2005 (MKE1) as part of the MIDUS 2 national survey effort. Similarly, the MKE2 survey was conducted by the University of Wisconsin Survey Center (UWSC) as part of the MIDUS 3 national survey project.

Computer-Assisted Personal Interviewing Interview

The CAPI interview for the initial project was conducted using a CAPI system. The CAPI software employed by the UWSC was CASES 5.5 provided by the Computer-Assisted Survey Methods Program at the University of California—Berkeley. The CASES program provides a comprehensive range of computer-assisted interviewing tools. As a fully featured computer-assisted telephone interviewing (CATI) package, CASES has all the programs necessary to install a sample (including importing pre-existing data into the sample records), prepare a data collection instrument, monitor survey progress, automatically send into the field those cases that require calling at a

specific time or date (i.e., automatic call scheduling), code and clean data, produce reports, and output data into rectangular files for analysis. Using the CASES program, the text of the survey appears question by question on a computer screen for the interviewer to read to the respondent. The CAPI instrument consisted of questions about recession experience, health, education, occupation and industry, marriage, health insurance, finances, social networks, parents' health, children and household members, caregiving, living arrangements, community involvement, race and ethnicity, discrimination, life satisfaction, and contact information of family and friends to help contact the participant in the future. The CAPI instrument also included hip and waist measurements and a section for interviewer observations. According to Seary et al. (2014), the CAPI technique presents various advantages, such as minimizing item nonresponse and enhancing efficiency and accuracy of data entry by eliminating manual entry. This technique was particularly suitable for the MIDUS 3, as the elimination of manual entry of data led to significant cost reduction and timesaving. Because the questionnaire was also very detailed, the technique minimized cases of skipping items.

Self-Administered Questionnaire

A 44-page SAQ was fielded in the initial study using the 2005 MIDUS Milwaukee Refresher Oversample SAQ as a starting point. The only major change implemented was the replacement of Section D: Childhood with a new Section D: Childhood and Race. In addition, some minor wording changes were made in Section F: Social Networks to update the types of social media listed in a couple of questions.

Cognitive Telephone Interview

The Cognitive Telephone Interview or the Brief Test of Adult Cognition by Telephone (BTACT) interview for the initial project was conducted using a CATI system. The CATI software employed by the UWSC is CASES 5.5 provided by the Computer-Assisted Survey Methods Program at the University of California—Berkeley. To the extent possible, the instruments and protocols for MKE2 replicated those used during MIDUS MKE1. However, in response to the increasing prevalence of cellular telephones over the years, MKE2 added a method to measure latency due to technology. The Metronome Count, developed and used first during the MIDUS Refresher, was conducted before and after the Red/Green Task, to account for response variance due to technology, both between and within calls. By June 2016, the Cognitive Interview instrument was programmed, and both the instrument and the digital audio recording of the Cognitive Interview were tested. The Cognitive Interview was fielded in July 2016.

Operationalization of Each Variable

The dependent variable in this study was obesity, calculated as BMI of 30 kg/m^2 or greater ($BMI \geq 30\ kg/m^2$). This variable was computed from the self-reported height and weight of the participants. For purposes of descriptive analysis, BMI was treated as a categorical variable. Logistic regression was carried out to examine to what extent covariates predict the odds of being obese. To achieve a binomial distribution and test the hypotheses using logistic regression models, obesity was derived from the BMI values where 1 = obese (30 and higher) and 0 = all other observations.

The independent variables were stress and health behaviors (tobacco use, alcohol use, marijuana use, physical activity). The codes for the expression of emotional stress were 1 = *a lot*, 2 = *a medium amount*, 3 = *only a little*, 4 = *not at all*, -1 = *respondent does not have any SAQ data*, and 8 = *refused*. The code "-1" was treated as missing data.

The control variables were the sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, income, employment status). The control variables were added in the study to minimize their potential interference on the association between the independent variables and dependent variable, which might lead to error in interpretation.

Definition and Measurement of Study Variables

Table 1

Definition and Measurement of Study Dependent Variables

Variable name	Definition of variable	Value	Measure of variable
Obesity	Body mass index	0 = Not obese (< 30.00) 1 = Obese (≥ 30.00)	Binomial

Table 2

Definition and Measurement of Study Independent Variables

Variable name	Definition of variable	Value	Measure of variable
Physical activity	Exercise/movement therapy frequency (12 months)	1 = A lot 2 = Often 3 = Some 4 = A little 5 = Never	Nominal
Tobacco use	Regular smoking of cigarettes	1 = Yes 2 = No 9 = Other	Nominal
Alcohol use	Alcohol problem (12 months)	0 = No alcohol problem 1 = Alcohol problem	Nominal
Marijuana use	Used marijuana/hash on own ever (12 months)	1 = Yes 2 = No	Nominal
Stress	Expression of emotional distress (stressful event)	1 = A lot 2 = A medium amount 3 = Only a little 4 = Not at all -1 = Respondent does not have any SAQ data 8 = Refused	Nominal

Table 3

Definition and Measurement of Study Control Variables

Variable name	Definition of variable	Value	Measure of variable
Gender	Gender of participant	1= Male 2= Female	Nominal
Age	The calculated age in years that the respondent has lived or existed as at Project 1 CAPI interview	1 = 44 to < 55 2 = 55 to < 65 3 = 65 to < 75 4 = 75 to < 85 5 = 85 to < 95	Ordinal
Education	The highest level of formal schooling that a respondent has attended	1= Junior high school or less 2 = High school or less 3= Associate's degree or less 4= Master's degree or less 5= Doctoral/professional degree	Nominal
Income	Respondent's income from wages, pension, social security, and other sources	1= $0,000 to < $15,000 2 = $15,000 to < $30,000 3 = $30,000 to < $45,000 4 = $45,000 to < $60,000 5 = $60,000 to < $75,000 6 = $75,000 or higher	Nominal
Marital status	Marital status currently	1 = Married 2 = Separated 3 = Divorced 4 = Widowed 5 = Never married	Nominal
Duration of residence	Years lived in this state	1 = < 10 years 2 = 10 to < 20 years 3 = 20 to < 30 years 4 = 30 to < 40 years 5 = 40 to < 50 years 6 = ≥ 50 years	Nominal
Employment	Current employment	1 = Yes 2 = No 9 = Inapp	Nominal

Table 4

Description of Research Questions and Variables by Levels of Measurement and Statistical Analysis

Research questions	Independent variables and measurement	Dependent variables and measurement	Statistical analysis
RQ1	Age Gender Marital status Duration of residence Education Employment Income (All categorical)	Obesity—Categorical	• Descriptive (frequency distribution, cross-tabulation & chi-square tests) • Bivariate analysis (logistic regression)
RQ2	Stress—Categorical	Obesity—Categorical	• Descriptive (frequency distribution, cross-tabulation & chi-square tests) • Bivariate analysis (logistic regression)
RQ3	Physical activity—Categorical Tobacco use—Categorical Alcohol use—Categorical Marijuana use—Categorical	Obesity—Categorical	• Descriptive (frequency distribution, cross-tabulation & chi-square tests) • Bivariate analysis (logistic regression)

Note. The statistical significance level was set at $p < 0.05$.

Research Questions and Hypotheses

RQ1: Is there a statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States?

H_o1: There is no statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States

Ha1: There is a statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States.

RQ2: Is there a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, controlling for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o2: There is no statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha2: There is a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee

County, Wisconsin United States, after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

RQ3: Is there a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, controlling for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o3: There is no statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha3: There is a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

In both cases, logistic regression analysis was ideal. The null hypothesis was rejected if $p < 0.05$.

Data Analysis Plan

The statistical software that I used for analysis in this study was SPSS version 28. The SPSS was used to conduct descriptive and inferential statistics (Creswell & Creswell, 2018; Wagner, 2016). The data from the MIDUS 3: Milwaukee African American Sample, 2016-2017 (ICPSR 37120) which came in SPSS format was used as the secondary data source for this dissertation. As part of the preparation for the analysis of secondary data, the needed variables for this study were outlined, re-labeled for missing information, recoded where necessary, to be able to answer the dissertation questions. Data were analyzed using both descriptive and inferential techniques. Descriptive statistics such as percentages and means were used to characterize the sample by sociodemographic factors. Cross-tabulation and chi-squared analysis were used to examine the relationship between the independent variables and the control variables on one hand and obesity patterns on the other. A chi-squared test is a statistical hypothesis test that is valid to perform when the test statistic is chi-squared distributed under the null hypothesis, specifically Pearson's chi-squared test and variants thereof. Pearson's chi-squared test was used to determine whether there was a statistically significant difference between the expected frequencies and the observed frequencies in one or more categories of a contingency table. The hypotheses of the study were tested using the logistic regression technique.

Logistic regression is the most appropriate statistical method for this research as it can measure obesity as a dichotomous categorical variable and can be used to examine the association between the likely predictors of obesity. Logistic regression was carried out to examine to what extent covariates predict the odds of being obese. To achieve a binomial distribution and test the hypotheses using logistic regression models, obesity was derived from the BMI values where 1 = obese (30 and higher), 0 = all other observations. The odds ratio was represented in the logistic regression model tables by the column titled Exp(β) which is the exponentiation of the β coefficient. The odds ratio is easier to interpret than the β coefficient (in log-odds units). Significance of the predictor/ explanatory variables was tested using the Wald test. The Wald test is also called the Wald Chi-Squared Test and is used to test whether a binary or continuous variable adds significance to the model. The fit of each model was evaluated by the amount of variability in the dependent variable explained by the independent variables. In logistic regression, there is no true R^2 like in linear regression; therefore, the models' goodness of fit was tested using the Homer-Lemeshow Test (HLT). The HLT examines whether there is any evidence of poor fit within the model (Fagerland & Hosmer, 2016). If the test yields a significant p-value ($p < 0.05$), it indicates that there is evidence of poor fit within the model.

Threats to Validity

A valid study delivers conclusions that are well-founded and accurately represent the real situation within the study population. Threats to external validity occur when a researcher generalizes findings from a study: to groups in the experiment; to other racial

or social groups not under study; to settings not examined; or to past or future situations. The threats come due to the characteristics of individuals sampled, the uniqueness of the setting, and the timing of the experiment (Creswell & Creswell, 2018).

Threats to internal validity occur from experimental procedures, treatments, or experiences of the participants which threaten the ability of a researcher to draw correct inferences from data on the population being studied. A researcher needs to identify these threats and design approaches to stop or minimize them (Creswell & Creswell, 2018). Estimates from any survey could be affected by either non-sampling errors and or sampling errors. Non-sampling errors occur during data collection by interviewers' failure to locate and interview the right household, misunderstanding of the questions by interviewers or respondents, data entry errors, and data processing.

MIDUS 3: Milwaukee African American Sample, 2016-2017 data set has been validated several times in the past. However, there are a few threats to the validity of this study. There may be some level of content and construct validity threats. In addition, as secondary data analysis, there are limitations to construct validity, the limited number of variables available for analysis with the absence of some essential variables, inherent bias, missing data, and unaccounted errors in data collection. In addition, as MIDUS 3: Milwaukee African American Sample, 2016-2017 data set were collected between 2016 and 2017, there could be significant changes to the current situations in the study population of African American adults and their behavioral patterns.

Various threats could have affected the validity of MIDUS 3: Milwaukee African American Sample, 2016-2017 data set. The first threat is the lack of measurement

techniques that can secure consistent results (Sorrel et al., 2016). This threat is significant because of the characteristic of the subjects some of whom may not understand the questions being asked by the interviewers. To overcome this threat, the interviewers were trained as a measure for enhancing observer reliability. The second potential threat is failure to obtain a representative sample. Lack of a representative sample reduces the generalizability of findings obtained in each study; hence, affects the external validity of the study (Fortin & Smith, 2013). This threat was however minimized by utilizing a relatively large sample. The use of a sampling frame that included Census tracts in which at least 40 percent of the population was African American enhanced the representativeness of the sample. The Census blocks were stratified by income, with roughly half coming from tracts in which the median household income was $40,000 or greater, and the rest coming from tracts in which the median household income was below $40,000.

Another factor that can pose a threat to the validity of the study is the reliance on self-reported measures. The study utilized self-reported measures to assess all variables including BMI, and socioeconomic factors. According to Short et al. (2009), the use of self-reported measures exposes a study to the problems of exaggeration, poor introspection capability, nonresponse and self-selection, and poor memory. This study highlighted the dangers of using self-reports in measuring health variables that have a high level of stigma such as weight. The use of the CAPI technique may have compounded the problems of misrepresentation of facts and nonresponse as the presence of the interviewer may have threatened the respondents' privacy. Some respondents may

have been inclined not to answer sensitive questions or to provide less than accurate information on sensitive issues. These threats were minimized using multiple items to measure variables to control for a particular response style and guarantee privacy and confidentiality to participants. Random sampling also helped to reduce response bias. Survey reweighting was also used to address non-response bias. According to Kizilcec (2014), the survey reweighting technique eliminates non-response bias by weighing responses according to the respondents' likelihood to respond.

Ethical Considerations

This study involved indirect research with human subjects as it entails analysis of secondary data set looking at key variables collected in the MIDUS 3: Milwaukee African American Sample, 2016-2017 (ICPSR 37120). Ethical approvals were received from Walden University Institutional Review Board (Approval number 03-23-22-0525522) before proceeding to data retrieval, analysis and report. Protection of the privacy and confidentiality of the subject is one of the important ethical issues that was observed. I agreed to various terms aimed at protecting the privacy and confidentiality of participants before I could access data from MIDUS 3. This entailed not attempting to identify any person in the data and not handing over the data to a third party. Some variables that can lead to the identification of participants such as resident addresses were left out of the data as an additional measure for protecting the privacy and confidentiality of participants. Another ethical obligation that I fulfilled as a requirement for accessing the data was to appropriately acknowledge the source of the data in all my publications involving its use. The MIDUS 3 survey team was also expected to adhere to several

ethical requirements during the data collection process. One of the ethical requirements was respect for participants' autonomy. To fulfill this requirement, the MIDUS 3 team sought informed consent from potential respondents before proceeding with the data collection exercise. Participants who were not willing to proceed with the study were left out while those who wished to drop out before the interview was complete were also allowed. Respondents were also informed of the right not to respond to questions with which they were not comfortable. To protect the confidentiality and privacy of participants, the MIDUS 3 data set was stored in two versions: the public use data set and the restricted data set. Fields and variables that could lead to the identification of survey respondents were either removed or subjected to some sort of transformation such as categorization of continuous variables or top coding in the public-use data set. This public-use data set was then made easily accessible to users. The restricted data set comprises data with high disclosure risk; hence, access to this data set is limited. Users who want to access the restricted data set are subjected to a rigorous vetting process. The data was coded protected and I was the only one who had access to it. In addition, I will destroy the data 5 years after completion of the study.

Summary

This chapter provided guided information on the design and methodology of the research. The research is a quantitative cross-sectional study that examined the associations of stress, health behaviors, and obesity among the African American immigrant adults residing in Milwaukee County, Wisconsin United States. The dependent variable is obesity, while the independent variables are stress and health behaviors

(tobacco use, alcohol use, marijuana use, and physical activity). The control variables are the socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, income, employment status). The CAPI Interview, SAQ, and cognitive telephone were instruments used to collect data. Data analysis was carried out using descriptive statistics, cross-tabulation, Pearson's chi-square test, and multiple logistic regressions. The hypotheses, ethical considerations, and threats to the validity of this study have been explained in this chapter whose completeness allowed the research to proceed to the results of the analysis performed in the study.

Chapter 4: Results

Introduction

The purpose of this study was to determine the associations of stress, health behaviors, and obesity among African American immigrant adults residing in Milwaukee County, Wisconsin. This study involved analyzing a secondary data set from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120) to answer the study's research question and hypotheses using the SEM and acculturation theory. I ran analyses using IBM SPSS Version 28 to answer the following research questions and hypotheses:

RQ1: Is there a statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States?

H_o1: There is no statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States.

Ha1: There is a statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)

and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States.

RQ2: Is there a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, controlling for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o2: There is no statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha2: There is a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

RQ3: Is there a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, controlling for sociodemographic factors (age,

gender, marital status, duration of residence in the United States, education, employment, income)?

H_o3: There is no statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha3: There is a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States after adjusting for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

This chapter includes data collection procedures, time frames, and steps for data collection, cleaning, and preparation for analysis. This chapter also includes discrepancies in data collection, characteristics of study participants, and information about the representativeness of the sample in terms of the population of interest. The descriptive and inferential analytical findings using the research questions are also reported in this section.

Data Collection

This study involved the use of secondary data that were generated from adult African American residents aged 44–94 years in Milwaukee County, Wisconsin who completed the baseline MIDUS survey of Milwaukee African Americans in 2005 (ICPSR Study 22840). In the primary study in 2005, 592 African Americans from Milwaukee were added to the MIDUS sample to examine health issues in minority populations. Respondents were interviewed in their homes using a CAPI survey protocol and asked to complete and return a SAQ. Afterward, these individuals were eligible for participation in the same research protocol as the national MIDUS 2 sample, including cognitive, daily stress, biomarker, and neuroscience projects.

With support from the National Institute on Aging, the second wave of survey data collection on the Milwaukee sample was begun in 2016. The sampling design was a stratified area probability sample of households in Milwaukee County, Wisconsin. The sampling frame included Census tracts in which at least 40% of the population was African American. The Census blocks were stratified by income, with roughly half coming from tracts in which the median household income was $40,000 or greater, and the rest coming from tracts in which the median household income was below $40,000. The survey consisted of a 2.5-hour CAPI interview followed by a 45-page mailed SAQ. CAPI survey data were collected for 389 individuals, realizing a 78% response rate, adjusted for mortality and other eligibility criteria. Data collection for this follow-up wave largely repeated baseline assessments, with additional questions in selected areas (e.g., economic recession experiences, childhood experience with race, etc.). Following

successful completion of the CAPI and SAQ protocols, individuals were eligible for participation in cognitive, daily stress, biomarker, and neuroscience projects.

The data sets are free and can be accessed when a request is made by filing a request format on the ICPSR website and a completed Restricted Data Use Agreement is approved. I received approval from the Walden University IRB (Approval number 03-23-22-0525522) to commence data collection. Details of how the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120) data were collected are in Chapter 3. There were no discrepancies in the data collection from the plan presented in Chapter 3.

Results

Descriptive Statistics

Descriptive statistics were used to summarize the characteristics of this study population. SPSS Version 28 was used to analyze data and calculate percentage and frequency distributions. The independent variables were stress and health behaviors (tobacco use, alcohol use, marijuana use, physical activity). The control variables were the sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income). Participants' self-reported weight and height were used to calculate the dependent variable obesity measured by BMI according to WHO recommendation and classified in Table 5. The formula used was BMI = weight in kilograms/height in meters (squared).

Table 5

World Health Organization Classification of Weight Status Using Body Mass Index

Weight status	BMI
Normal weight	18.5 to 24.0 kg/m²
Overweight (not obese)	25.0 to 29.9 kg/m²
Class 1 (low-risk) obesity	30.0 to 34.9 kg/m²
Class 2 (moderate-risk) obesity	35.0 to 39.9 kg/m²
Class 3 (high-risk or extreme) obesity	≥ 40.0 kg/m²

For this research, normal weight and overweight (not obese) were combined as "not obese" with code "0." In the same vein, those individuals with BMI ≥ 30.0 kg/m² were defined as "obese" and coded "1."

As a dependent variable, obesity was measured as a binomial variable (not obese/obese). One hundred seventy-nine participants representing 46% of the study population were not obese, while 210 participants representing 54% of the study population were obese, as outlined in Table 6.

Table 6

Distribution of Body Mass Index Category of Study Participants

		Frequency	Percent	Valid percent	Cumulative percent
Valid	NOT OBESE (< 30.00 kg/m²)	179	46.0	46.0	46.0
	OBESE (≥ 30.00 kg/m²)	210	54.0	54.0	100.0
	Total	389	100.0	100.0	

Sociodemographic Characteristics of Study Participants

The sociodemographic characteristics of the 389 study participants were analyzed as outlined in Table 7. The target population for this study included African American adults aged 44–94 years, with those in the age categories 44 to < 55 years (34.4%), 55 to < 65 years (29.6%) and 65 to < 75 years (24.7%) being higher than their counterparts in the categories 75 to < 85 years (8.0%) and 85 to < 95 years (3.3%). Participants' personal characteristics indicated that members of the population were more likely to be female (65.3%) and never married (29.3%). According to their socioeconomic status, more were likely to be currently unemployed (61.4%), have high school or less education (44.2%), and earn $0,000 to < $15,000 income (35.2%). Participants were more likely to have resided in the state of Mississippi for 50 years or more (48.6%) than to have lived in the state for 40 to < 50 years (22.9%), 30 to < 40 years (9.0%), 20 to < 30 years (9.3%), 10 to < 20 years (3.3%), or < 10 years (6.9%).

Table 7

Sociodemographic Characteristics of Study Participants

Participant characteristics	Frequency (*N*)	Percentage (%)
Age		
44 to < 55 years	134	34.4
55 to < 65 years	115	29.6
65 to < 75 years	96	24.7
75 to < 85 years	31	8.0
85 to < 95 years	13	3.3
Gender		
Male	135	34.7
Female	254	65.3
Marital status		
Married	95	24.4
Separated	21	5.4
Divorced	99	25.4
Widowed	60	15.4
Never married	114	29.3
Duration of residence		
< 10 years	27	6.9
10 to < 20 years	13	3.3
20 to < 30 years	36	9.3
30 to < 40 years	35	9.0
40 to < 50 years	89	22.9
≥ 50 years	189	48.6
Income		
$0,000 to < $15,000	137	35.2
$15,000 to < $30,000	89	22.9
$30,000 to < $45,000	54	13.9
$45,000 to < $60,000	40	10.3
$60,000 to < $75,000	31	8.0
$75,000 or higher	38	9.8
Highest level of education		
Junior high school or less	10	2.6
High school or less	172	44.2
Associate's degree or less	152	39.1
Master's degree or less	47	12.1
Doctoral/professional degree	7	1.8
Missing	1	0.3
Current employment		
Yes	149	38.3
No	239	61.4
Inapp	1	0.3

Cross-Tabulations Between Sociodemographic Factors and Obesity

Obesity status varies by age, gender, marital status, education, employment, income, and duration of residence in the United States. Significant differences by gender ($p < 0.001$) included that females (60.2%) were 1.5 times more likely to be obese compared to their male counterparts (42.2%), as depicted in Table 8. Significant differences by age ($p < 0.001$) revealed that individuals aged 65 to < 75 years (64.6%) were about 8.5 times more likely to be obese compared to those 85 to < 95 years old (7.7%). Those who resided in the state < 10 years (66.7%) and 20 to < 30 years (63.9%) were twice as likely to be obese than those who resided in the state 30 to < 40 years (34.3%) and 10 to < 20 years (30.8%), respectively ($p = 0.037$). Since $p < 0.05$, the null hypothesis stating that there is no statistically significant association between the sociodemographic factors and obesity was rejected for the variables gender, age, and duration of residence. A p value of < 0.05 for the chi-square (χ^2) value for the control variables gender, age, and duration of residence and the dependent variable obesity is an indication that the control variables are independent of the dependent variable obesity as outlined in Table 8.

Those who were married (54.7%) were likely to be as obese as those who were divorced (55.6%) and widowed (56.7%), but rates were highest among those who were separated (61.9%) and smaller among those who were never married (49.1%).

Obesity status by income had a broader distribution where over half of those earning $15,000 to < $30,000 (60.7%), $60,000 to < $75,000 (61.3%), $45,000 to < $60,000 (57.5%), and $75,000 or higher (57.9%) were obese compared to the other

income groups. Individuals whose highest level of education was junior high school or less (60.0%) and master's degree or less (59.6%) were more likely to be obese than those whose highest level of education was high school or less (50.6%), associate's degree or less (56.6%), and doctoral/professional degree (28.6%). The results also indicated that individuals who were currently employed (55.0%) and those without employment (53.6%) were almost equally likely to be obese.

Table 8

Cross-Tabulations Between Sociodemographic Factors and Obesity

Sociodemographic factors	Not obese		Obese		Total		Chi-square	*df*	P
	N	%	*N*	%	*N*	%			
Gender							11.515	1	< 0.001
Male	78	57.8	57	42.2	135	34.7			
Female	101	39.8	153	60.2	254	65.3			
Age							19.246	4	< 0.001
44 to < 55 years	56	41.8	78	58.2	134	34.4			
55 to < 65 years	60	52.2	55	47.8	115	29.6			
65 to < 75 years	34	35.4	62	64.6	96	24.7			
75 to < 85 years	17	54.8	14	45.2	31	8.0			
85 to < 95 years	12	92.3	1	7.7	13	3.3			
Duration of residence							11.852	5	0.037
< 10 years	9	33.3	18	66.7	27	6.9			
10 to < 20 years	9	69.2	4	30.8	13	3.3			
20 to < 30 years	13	36.1	23	63.9	36	9.3			
30 to < 40 years	23	65.7	12	34.3	35	9.0			
40 to < 50 years	38	42.7	51	57.3	89	22.9			
≥ 50 years	87	46.0	102	54.0	189	48.6			
Income							5.410	5	0.368
$0.000 to < $15,000	70	51.1	67	48.9	137	35.2			
$15,000 to < $30,000	35	39.3	54	60.7	89	22.9			
$30,000 to < $45,000	29	53.7	25	46.3	54	13.9			
$45,000 to < $60,000	17	42.5	23	57.5	40	10.3			
$60,000 to < $75,000	12	38.7	19	61.3	31	8.0			
$75,000 or higher	16	42.1	22	57.9	38	9.8			
Highest level of education							3.767	4	0.438
Junior high school or less	4	40.0	6	60.0	10	2.6			
High school or less	85	49.4	87	50.6	172	44.3			
Associate's degree or less	66	43.4	86	56.6	152	39.2			
Master's degree or less	19	40.4	28	59.6	47	12.1			
Doctoral/professional degree	5	71.4	2	28.6	7	1.8			
Current employment							1.257	2	0.533
Yes	67	45.0	82	55.0	149	38.3			
No	111	46.4	128	53.6	239	61.4			
Inapp	1	100.0	0	0.0	1	0.3			
Marital status							1.909	4	0.753
Married	43	45.3	52	54.7	95	24.4			
Separated	8	38.1	13	61.9	21	5.4			
Divorced	44	44.4	55	55.6	99	25.4			
Widowed	26	43.3	34	56.7	60	15.4			
Never married	58	50.9	56	49.1	114	29.3			

Note. N = 389; P = Pearson chi-square (χ^2) 2-sided value; *df* = degree of freedom.

Cross-Tabulations Between Stress, Health Behaviors, and Obesity

Table 9 shows the *p*-values after the cross-tabulations between stress, health behaviors and obesity. The model indicated that tobacco use ($p = 0.023$) is significant with respect to predicting obesity in the study participants. Therefore, since $p < 0.05$, the null hypothesis stating there is no statistically significant association between health behaviors and obesity, was rejected for this variable. A *p* value of < 0.05 for the chi-square (χ^2) value for the independent variable tobacco use and the dependent variable obesity, is an indication that the independent variable is independent of the dependent variable obesity as outlined in Table 9. In the sample population, individuals who use tobacco regularly (48.0%) are less likely to be obese than those who do not use it regularly (56.0%). Participants who engage in elevated levels of physical activity (58.3%), often physically active (58.8%), some physical activity (55.6%), little physical activity (57.1%), and never physically active (53.3%) are equally likely to be obese. Similarly, those who use marijuana (50.0%) and those who do not (54.5%) are equally likely to become obese. The results also indicated that individuals in the sample population who use alcohol but do not have alcohol problem (55.4%) are more likely to be obese than their counterparts who have alcohol problem (41.0%).

Table 9

Cross-Tabulations Between Stress, Health Behaviors, and Obesity

Independent variables	Not obese		Obese		Total		Chi-square	*df*	P
	N	%	*N*	%	*N*	%			
Regular tobacco use							7.561	2	0.023
Yes	106	52.0	98	48.0	204	52.4			
No	40	44.0	51	56.0	91	23.4			
Inapp	33	35.1	61	64.9	94	24.2			
Physical activity							4.20	4	0.981
A lot	5	41.7	7	58.3	12	3.1			
Often	7	41.2	10	58.8	17	4.4			
Some	8	44.4	10	55.6	18	4.6			
A little	9	42.9	12	57.1	21	5.4			
Never	150	46.7	171	53.3	321	82.5			
Marijuana use							0.301	1	0.583
Yes	21	50.0	21	50.0	42	10.8			
No	158	45.5	189	54.5	347	89.2			
Alcohol use							2.930	1	0.087
No alcohol problem	156	44.6	194	55.4	350	90.0			
Alcohol problem	23	59.0	16	41.0	39	10.0			
Emotional distress							0.431	4	0.980
A lot	18	43.9	23	56.1	41	12.5			
A medium amount	31	46.3	36	53.7	67	20.5			
Only a little	59	46.5	68	53.5	127	38.8			
Not at all	39	45.9	46	54.1	85	26.0			
Refused	4	57.1	3	42.9	7	2.1			

Note. $N = 389$; P = Pearson chi-square ($\chi 2$) 2-sided value; *df* = degree of freedom.

Statistical Assumptions

The analysis for this study includes binary logistic regression for an outcome variable obesity and independent variables stress, health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and socio-demographic factors (age, gender, marital status, duration of residence, education, employment, and income). I reviewed key binary logistics regression analysis such as dichotomous dependent or outcome variable, Linearity, Multicollinearity, outliers, independent error, missing data and having minimum of 10 cases per variable category. To perform a binary regression analysis, I had to recode the dependent variable obesity to two outcomes as “Not Obese” and

"Obese". In the binary regression analysis, I created reference categories for all the independent variables and the control variables.

Linearity

I used the model fit statistics and pseudo-R^2 to test for linearity in binary logistic regression. The Cox & Snell R square and Nagelkerke R square carried out for all research questions showed that there was a correlation between the explanatory variables and the logit of the outcome variable obesity (Not obese or obese). The Hosmer & Lameshow test was carried out for all research questions and showed Chi- Square values that were not statistically significant ($p > 0.05$), meaning the model used in this study is a good fit for the data used.

Multicollinearity

A correlation matrix using the Pearson's test was carried out to test for multicollinearity. The assumption is that predictor variables should not be highly correlated with each other. The correlation matrix test for all the independent and control variables showed a Pearson r values < 1.0, meaning the predictor variables did not show any high correlation with each other and is therefore of no concern.

Missing Data

It was realized after running the descriptive analysis, that only two variables had some missing data. These variables were Highest level of education (0.3%) and Emotional distress (15.9%). The missing data were excluded from the cross-tabulation analysis and binary logistic regression analysis carried out in this study. Descriptive analysis of the outcome variable obesity did not show any outliers.

Inferential Statistical Analyses

A Pearson's chi-square test and Logistic regression was carried out to examine to what extent the independent variables and covariates predicted the odds of being obese. To achieve a binomial distribution and test the hypotheses using logistic regression models, obesity was derived from the BMI values where 0 = Not obese (< 30.00) kg/m², 1 = Obese (≥ 30.00) kg/m². The odds ratio is represented in the logistic regression model tables by the column titled Exp(β) which is the exponentiation of the β coefficient. Significance of the predictor/ explanatory variables was tested using the Wald test.

The fit of each model was evaluated by the amount of variability in the dependent variable explained by the independent variables. In logistic regression, there is no true R^2 like in linear regression; therefore, the models' goodness of fit was tested using the Homer-Lemeshow Test (HLT). The HLT examines whether there is any evidence of poor fit within the model (Fagerland & Hosmer, 2016). If the test yields a significant *p*-value ($p < 0.05$), it indicates that there is evidence of poor fit within the model.

Sociodemographic Factors as Predictors of Obesity

Research Question 1 and associated hypotheses were as follows:

RQ1: Is there a statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States?

H_o1: There is no statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States.

Ha1: There is a statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States.

As indicated in Table 8, the Pearson's chi-square test showed that there were significant differences between gender ($p < 0$ .001), age ($p < 0$ .001), duration of residence ($p < 0$ .037) and the odds of obesity, indicating that these variables were independent of the dependent variable obesity ($p < 0.05$). The model showed that these variables were significant with respect to predicting obesity. Since $p < 0.05$, the null hypothesis stating that there is no statistically significant association between socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States was therefore rejected for the variables gender, age and duration of residence.

Table 10 is the model summary of the binary logistic regression analysis of socio-demographic factors (age, gender, marital status, duration of residence, education,

employment, income) and obesity. The NagelKerke R Square of 0.249, means that 24.9% of the variance on the outcome variable obesity is explained by the model because of the influence of the explanatory variables as socio-demographic factors.

Table 10

Model Summary of the Binary Logistic Regression Analysis of Sociodemographic Factors and Obesity

Step	-2 log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	455.432 [a]	.187	.249

[a] Estimation terminated at Iteration 20 because maximum iterations had been reached. Final solution cannot be found.

The classifications presented in Table 11 for the binary logistic regression analysis of socio-demographic factors and obesity indicate that the predictive variables socio-demographic factors predicted correctly 56.4% obesity as not obese and 75.1% as obese. The overall correction prediction was 66.5%.

Table 11

Classification [a] Table of the Binary Logistic Regression Analysis of Sociodemographic Factors and Obesity

			Predicted Body mass index		
	Observed		Not obese (< 30.00 kg/m²)	Obese (≥ 30.00 kg/m²)	Percentage correct
Step 1	Body mass index	Not obese (< 30.00 kg/m²)	101	78	56.4
		Obese (≥ 30.00 kg/m²)	52	157	75.1
	Overall percentage				66.5

[a] The cut value is .500.

The binary logistic regression model shown in Table 12 indicates that some socio-demographic factors such as age, gender, duration of residence, education, and marital status could predict the odds of obesity. The age groups 44 to < 55 years ($p = 0.047$), 55 to < 65 years ($p = 0.014$), and 75 to < 85 years ($p = 0.012$) were statistically significant, showing there was an association between these age groups and obesity. The age groups 55 to < 65 years and 75 to < 85 years are less likely to be obese comparing to the reference group (44 to < 55 years old). The odds ratios for groups 65 to < 75 years (OR = 0.706), and 85 to < 95 years (OR = 0), were found insignificant.

The variable gender ($p < 0.001$) had a statistically significant association with obesity in the study population. The odds of obesity were 3.347 times more likely in females than males when gender was considered. The duration of residence < 10 years ($p = 0.019$), 10 to < 20 years (p = 0.044), and 30 to < 40 years ($p = 0.006$) were also statistically significant. The groups with the duration of residence 10 to < 20 years (OR = 0.200), and 30 to < 40 years (OR = 0.196), are less likely to be obese comparing to the reference group (< 10 years). The odds ratios of the other groups 20 to < 30 years (OR = 0.804), 40 to < 50 years (OR = 0.712), and ≥ 50 years (OR = 0.588) were found insignificant.

The associations between some educational levels such as High school or less ($p = 0.038$) and Doctoral/Professional degree ($p = 0.039$) and the odds of obesity were also statistically significant. The groups with the High School or less and Doctoral/Professional degree are less likely to be obese comparing with the reference

group (Junior High School or less). The odds ratios of the other groups Associate degree or less (OR = 0.165) and Master's degree or less (OR = 0.186) were found insignificant.

Also, among the individuals who were never married ($p = 0.010$), the association with obesity was statistically significant. The odds of obesity were however less likely (OR = 0.408) than their counterparts who were married. The null hypothesis stating there is no statistically significant association between these categories and the odds of obesity was consequently rejected ($p < 0.05$). It can therefore be deduced from Table 12, that some socio-demographic factors such as age, gender, duration of residence, education, and marital status could predict the odds of obesity.

Table 12

Variables in the Equation of the Binary Logistic Regression Analysis of Sociodemographic Factors and Obesity

	B	*SE*	Wald	*df*	Sig.	Odds ratio	95% CI for odds ratio Lower	Upper
Step 1[a] *Age*								
44 to < 55 years (ref)			9.659	4	.047			
55 to < 65 years	-.744	.302	6.080	1	.014	.475	.263	.859
65 to < 75 years	-.348	.352	.979	1	.322	.706	.355	1.406
75 to < 85 years	-1.313	.522	6.315	1	.012	.269	.097	.749
85 to < 95 years	-23.022	11090.878	.000	1	.998	.000	.000	.
Duration of residence								
< 10 years (ref)			13.453	5	.019			
10 to < 20 years	-1.610	.799	4.057	1	.044	.200	.042	.958
20 to < 30 years	-.218	.604	.130	1	.718	.804	.246	2.629
30 to < 40 years	-1.632	.599	7.432	1	.006	.196	.061	.632
40 to < 50 years	-.339	.522	.422	1	.516	.712	.256	1.981
≥ 50 years	-.531	.489	1.178	1	.278	.588	.226	1.533
Income								
$0.000 to < $15,000 (ref)			8.538	5	.129			
$15,000 to < $30,000	.507	.323	2.461	1	.117	1.660	.881	3.125
$30,000 to < $45,000	-.369	.387	.909	1	.340	.692	.324	1.476
$45,000 to < $60,000	.673	.474	2.018	1	.155	1.961	.774	4.967
$60,000 to < $75,000	.611	.492	1.543	1	.214	1.843	.703	4.834
$75,000 or higher	.474	.475	.997	1	.318	1.607	.634	4.075
Highest level of education								
Junior high school or less (ref)			5.485	4	.241			
High school or less	-1.962	.945	4.311	1	.038	.141	.022	.896
Associate's degree or less	-1.803	.947	3.625	1	.057	.165	.026	1.055
Master's degree or less	-1.681	.983	2.924	1	.087	.186	.027	1.279
Doctoral/professional degree	-2.735	1.328	4.240	1	.039	.065	.005	.876
Gender								
Male (ref)								
Female	1.208	.273	19.596	1	< .001	3.347	1.960	5.713
Current employment								
Yes (ref)			.494	2	.781			
No	.197	.280	.494	1	.482	1.217	.704	2.106
Inapp	-23.583	40192.970	.000	1	1.000	.000	.000	.
Marital status								
Married (ref)			9.293	4	.054			
Separated	.053	.548	.009	1	.923	1.054	.360	3.088
Divorced	-.280	.334	.703	1	.402	.756	.392	1.455
Widowed	.102	.427	.057	1	.811	1.107	.479	2.559
Never married	-.896	.349	6.577	1	.010	.408	.206	.810
Constant	2.286	1.125	4.128	1	.042	9.836		

[a] Variable(s) entered on Step 1: Age, duration of residence, income, highest level of education, gender, current employment, marital status.

Stress as a Predictor of Obesity

In Table 9, the Pearson's chi-square test showed that there was no significant difference between stress ($p = 0.980$), and the odds of obesity, indicating that this variable was not independent of the dependent variable obesity ($p > 0.05$). The model showed that the variable stress was not significant with respect to predicting obesity. Since $p > 0.05$, therefore this result failed to reject the null hypothesis stating that there is no statistically significant association between stress and the odds of obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States.

Table 13 is the model summary for the binary logistic regression analysis of stress and obesity. The NagelKerke R Square of 0.002, means that 0.2% of the variance on the outcome variable obesity is explained by the model as a result of the influence of the explanatory variable stress.

Table 13

Model Summary for the Binary Regression Analysis of Stress and Obesity

Step	-2 log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	450.975 [a]	.001	.002

[a] Estimation terminated at Iteration 3 because parameter estimates changed by less than .001.

The classification table (Table 14) for the binary logistic regression analysis of stress and obesity indicates that the predictive variable stress predicted correctly 2.6% obesity as not obese and 98.3% as obese. The overall correction prediction was 54.1% as shown in Table 14.

Table 14

Classification [a] Table for the Binary Logistic Regression Analysis of Stress and Obesity

			Predicted Body mass index		
	Observed		Not obese (< 30.00 kg/m²)	Obese (≥ 30.00 kg/m²)	Percentage correct
Step 1	Body mass index	Not obese (< 30.00 kg/m²)	4	147	2.6
		Obese (≥ 30.00 kg/m²)	3	173	98.3
	Overall percentage				54.1

[a] The cut value is .500.

Table 15 shows the association between all the categories of stress alone and obesity. The relationship between stress and odds of being obese is not statistically significant ($p > 0.05$). This model suggests that, when considered alone, stress is not a good predictor of obesity in this sample of African American adults.

Table 15

Variables in the Equation of the Binary Logistic Regression Analysis of Stress and Obesity

								95% CI for odds ratio	
		B	*SE*	Wald	*df*	Sig.	Odds ratio	Lower	Upper
Step 1 [a]	*Emotional distress*								
	A lot (ref)			.426	4	.980			
	A medium amount	-.096	.399	.057	1	.811	.909	.416	1.986
	Only a little	-.103	.362	.081	1	.775	.902	.444	1.832
	Not at all	-.080	.383	.044	1	.834	.923	.436	1.954
	Refused	-.533	.826	.416	1	.519	.587	.116	2.963
	Constant	.245	.315	.607	1	.436	1.278		

[a] Variable(s) entered on Step 1: Emotional distress.

Stress and Sociodemographic Factors as Predictors of Obesity

Research Question 2 and associated hypotheses were as follows:

RQ2: Is there a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, controlling for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o2: There is no statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha2: There is a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Table 16 is the model summary for the binary logistic regression analysis of stress, socio-demographic factors and obesity. The NagelKerke R Square of 0.293, means that 29.3% of the variance on the outcome variable obesity is explained by the model as a result of the combined influence of the explanatory variables stress and socio-

demographic factors (age, gender, marital status, duration of residence, education, employment, income).

Table 16

Model Summary of the Binary Logistic Regression of Stress and Sociodemographic Factors as Predictors of Obesity

Step	-2 log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	369.317 [a]	.220	.293

[a] Estimation terminated at Iteration 20 because maximum iterations had been reached. Final solution cannot be found.

The values outlined in Table 17 for the binary logistic regression analysis of stress, socio-demographic factors and obesity indicate that the predictive variable stress predicted correctly 60.9% obesity as not obese and 78.9% as obese. The overall correction prediction was 70.6%.

Table 17

Classification Table [a] of the Binary Logistic Regression of Stress and Sociodemographic Factors as Predictors of Obesity

			Predicted Body mass index		
	Observed		Not obese (< 30.00 kg/m²)	Obese (≥ 30.00 kg/m²)	Percentage correct
Step 1	Body mass index	Not obese (< 30.00 kg/m²)	92	59	60.9
		Obese (≥ 30.00 kg/m²)	37	138	78.9
	Overall percentage				70.6

[a] The cut value is .500.

Table 18 shows that the association between age and the odds of being obese varies within the groups. In the age group 75 to < 85 years (p = 0.024), there was a statistically significant association. The group 75 to < 85 years is less likely to be obese comparing to the reference group (44 to < 55 years old). The odds ratios for other age groups 55 to < 65 years (OR = 0.520), 65 to < 75 years (OR = 0.746) and 85 to < 95 years (OR = 0) comparing to the reference, were not significant.

The association between the duration of residence and the odds of being obese indicated that the duration of residence < 10 years (p = 0.029) and 30 to < 40 years (p = 0.011) were statistically significant. The group 30 to < 40 years is less likely to be obese, comparing to the reference group (< 10 years). Meanwhile, the odds ratios for individuals whose durations of residence were 10 to < 20 years (OR = 0.248), 20 to < 30 years (OR = 0.856), 40 to < 50 years (OR = 0.839) and ≥ 50 years (OR = 0.521) were not found to be significant. In the income categories, the association between income and the odds of obesity for the individuals earning $60,000 to < $75,000 ($p$ = 0.043) was statistically significant. The income group $60,000 to < $75,000 is more likely to be obese comparing to the reference group ($0.0000 to < $15,000). The odds ratios for other groups $15,000 to < $30,000 (OR = 1.483), $30,000 to < $40,000 (OR = 0.666), $45,000 to < $60,000 (OR = 2.110), and $75,000 or higher (OR = 2.097) were found insignificant.

The association between the highest level of education and the odds of being obese indicated that High School or less (p = 0.026), Master's degree or less (p = 0.047), and Doctoral /professional degree (p = 0.017) were statistically significant. These groups were less likely to be obese comparing to the reference group (Junior High School or less

education). The odds ratio of the Associate degree or less (OR = 0.151) was found insignificant.

The association between gender and the odds of being obese also showed a statistical significance ($p < 0.001$). Females were 3.944 times more likely (OR = 3.944) to be obese than their male counterparts.

The association between marital status and the odds of being obese revealed that married ($p = 0.007$), and never married ($p = 0.004$) were statistically significant. Those who were never married are less likely to be obese than the married individuals. The odds ratios of other groups, separated (OR = 1.460), widowed (OR = 1.117), and divorced (OR = 0.644) were found insignificant.

The association between employment, stress and the odds of being obese indicated no statistical significance. These results suggest that, although some categories of age, duration of residence, income, education, gender, and marital status, significantly predict odds of being obese, stress remained an insignificant predictor after the inclusion of these variables in this sample of African American adults.

Therefore, I failed to reject the null hypothesis stating there is no statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, after adjusting for socio-demographic factors (age, gender, marital status, duration of residence, education, employment, income).

Table 18

Variables in the Equation of the Binary Logistic Regression of Stress and Sociodemographic Factors as Predictors of Obesity

		B	*SE*	Wald	*df*	Sig.	Odds ratio	95% CI for odds ratio Lower	Upper
Step 1	*Age*								
	44 to < 55 years (ref)			7.000	4	.136			
	55 to < 65 years	-.654	.345	3.593	1	.058	.520	.265	1.023
	65 to < 75 years	-.293	.401	.531	1	.466	.746	.340	1.639
	75 to < 85 years	-1.288	.572	5.068	1	.024	.276	.090	.847
	85 to < 95 years	-23.173	11295.419	.000	1	.998	.000	.000	.
	Duration of residence								
	< 10 years (ref)			12.448	5	.029			
	10 to < 20 years	-1.394	.894	2.433	1	.119	.248	.043	1.430
	20 to < 30 years	-.156	.683	.052	1	.820	.856	.224	3.264
	30 to < 40 years	-1.718	.674	6.500	1	.011	.180	.048	.672
	40 to < 50 years	-.176	.592	.088	1	.766	.839	.263	2.677
	≥ 50 years	-.652	.551	1.399	1	.237	.521	.177	1.535
	Income								
	$0.000 to < $15,000 (ref)			9.532	5	.090			
	$15,000 to < $30,000	.394	.362	1.186	1	.276	1.483	.730	3.013
	$30,000 to < $45,000	-.406	.443	.842	1	.359	.666	.280	1.587
	$45,000 to < $60,000	.746	.552	1.828	1	.176	2.110	.715	6.225
	$60,000 to < $75,000	1.250	.618	4.090	1	.043	3.489	1.039	11.711
	$75,000 or higher	.741	.572	1.674	1	.196	2.097	.683	6.440
	Highest level of education								
	Junior high school or less (ref)			7.048	4	.133			
	High school or less	-2.164	.972	4.956	1	.026	.115	.017	.772
	Associate's degree or less	-1.889	.972	3.772	1	.052	.151	.022	1.018
	Master's degree or less	-2.041	1.027	3.948	1	.047	.130	.017	.973
	Doctoral/professional degree	-3.267	1.374	5.655	1	.017	.038	.003	.563
	Gender								
	Male (ref)								
	Female	1.372	.318	18.585	1	<.001	3.944	2.113	7.359
	Current employment								
	Yes (ref)			.028	2	.986			
	No	-.054	.322	.028	1	.866	.947	.504	1.781
	Inapp	-23.930	40192.970	.000	1	1.000	.000	.000	.
	Marital status								
	Married (ref)			13.950	4	.007			
	Separated	.379	.646	.343	1	.558	1.460	.412	5.178
	Divorced	-.440	.390	1.270	1	.260	.644	.300	1.384
	Widowed	.110	.469	.055	1	.814	1.117	.445	2.802
	Never married	-1.213	.420	8.359	1	.004	.297	.131	.677
	Emotional distress								
	A lot (ref)			1.080	4	.897			
	A medium amount	-.146	.466	.098	1	.754	.864	.347	2.154
	Only a little	-.004	.429	.000	1	.992	.996	.430	2.308
	Not at all	-.311	.459	.461	1	.497	.732	.298	1.799
	Refused	-.460	.950	.235	1	.628	.631	.098	4.060

	B	*SE*	Wald	*df*	Sig.	Odds ratio	95% CI for odds ratio Lower	Upper
Constant	2.727	1.259	4.690	1	.030	15.292		

[a] Variable(s) entered on Step 1: Age, duration of residence, income, highest level of education, gender, current employment, marital status, emotional distress.

Health Behaviors as Predictors of Obesity

In Table 9, the Pearson's chi-square test indicated that tobacco use ($p = 0.023$) is significant with respect to predicting obesity in the study participants. Therefore, since $p < 0.05$, the null hypothesis stating that there is no statistically significant association between health behaviors defined as tobacco use, physical activity, marijuana use, alcohol use and the odds of obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States was rejected for this variable tobacco use. A p value of < 0.05 for the chi-square (χ^2) value for the independent variable tobacco use and the dependent variable obesity, is an indication that the independent variable is independent of the dependent variable obesity.

However, the model (Table 9) also showed that there were no significant differences between physical activity ($p = 0.981$), marijuana use ($p = 0.583$), alcohol use ($p = 0.087$), and the odds of obesity, indicating that these variables were not independent of the dependent variable obesity ($p > 0.05$). The model showed that the variables were not significant with respect to predicting obesity. Since $p > 0.05$, I therefore failed to reject the null hypothesis stating that there is no statistically significant association between health behaviors defined as physical activity, marijuana use, alcohol use and the odds of obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States.

Table 19 is the model summary for the binary logistic regression analysis of health behaviors (tobacco use, physical activity, marijuana use, alcohol use) and obesity. The NagelKerke R Square of 0.035, means that 3.5% of the variance on the outcome variable obesity is explained by the model as a result of the influence of the explanatory variables tobacco use, physical activity, marijuana use, and alcohol use.

Table 19

Model Summary of the Binary Logistic Regression Analysis of Health Behaviors and Obesity

Step	-2 log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	526.600 [a]	.026	.035

[a] Estimation terminated at Iteration 3 because parameter estimates changed by less than .001.

The classification table (Table 20) for the binary logistic regression analysis of health behaviors (tobacco use, physical activity, marijuana use, alcohol use) and obesity indicates that the predictive variables health behaviors predicted correctly 55.3% obesity as not obese and 58.1% as obese. The overall correction prediction was 56.8% as depicted in Table 20.

Table 20

Classification Table [a] of the Binary Logistic Regression Analysis of Health Behaviors and Obesity

			Predicted Body mass index		
	Observed		Not obese (< 30.00 kg/m²)	Obese (≥ 30.00 kg/m²)	Percentage correct
Step 1	Body mass index	Not obese (< 30.00 kg/m²)	99	80	55.3
		Obese (≥ 30.00 kg/m²)	88	122	58.1
	Overall percentage				56.8

[a] The cut value is .500.

Table 21 shows the association between all the categories of health behaviors (tobacco use, physical activity, marijuana use, alcohol use) alone and obesity. The association between tobacco use and the odds of being obese indicated that those who used tobacco regularly ($p = 0.045$) and those who considered the question of tobacco use inappropriate ($p = 0.014$) were statistically significant. Those who considered the question of tobacco use inappropriate were 1.905 times more likely to be obese than those who regularly used tobacco.

The relationship between other health behaviors (physical activity, marijuana use, alcohol use) and the odds of being obese is not statistically significant ($p > 0.05$). This model suggests that, when considered alone, tobacco use is a good predictor of obesity, while other health behaviors (physical activity, marijuana use, alcohol use) are not good predictors in this sample of African American adults as outlined in Table 21.

Table 21

Variables in the Equation of the Binary Logistic Regression Analysis of Health Behaviors and Obesity

		B	*SE*	Wald	*df*	Sig.	Odds ratio	95% CI for odds ratio Lower	Upper
Step 1 [a]	*Regular tobacco use*								
	Yes (ref)			6.190	2	.045			
	No	.292	.260	1.263	1	.261	1.339	.805	2.226
	Inapp	.644	.262	6.053	1	.014	1.905	1.140	3.182
	Physical activity								
	A lot (ref)			.618	4	.961			
	Often	-.100	.780	.017	1	.898	.904	.196	4.170
	Some	-.269	.772	.121	1	.728	.764	.168	3.467
	A little	-.075	.747	.010	1	.920	.928	.215	4.009
	Never	-.312	.610	.262	1	.609	.732	.222	2.418
	Marijuana use								
	Yes (ref)								
	No	.008	.339	.000	1	.982	1.008	.518	1.958
	Alcohol use								
	No alcohol problem (ref)								
	Alcohol problem	-.524	.356	2.163	1	.141	.592	.295	1.190
	Constant	.264	.659	.161	1	.688	1.302		

[a] Variable(s) entered on Step 1: Regular tobacco use, physical activity, marijuana use, alcohol use.

Health Behaviors and Sociodemographic Factors as Predictors of Obesity

Research Question 3 and associated hypotheses were as follows:

RQ3: Is there a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, controlling for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

H_o3: There is no statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical

inactivity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Ha3: There is a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States after adjusting for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income).

Table 22 demonstrates the model summary for the binary logistic regression analysis of health behaviors (tobacco use, physical activity, marijuana use, alcohol use), socio-demographic factors (age, duration of residence, income, highest level of education, gender, current employment, marital status). and obesity. The NagelKerke R Square of 0.276, means that 27.6% of the variance on the outcome variable obesity is explained by the model because of the combined influence of the explanatory variables health behaviors (tobacco use, physical activity, marijuana use, and alcohol use) and socio-demographic factors (age, duration of residence, income, highest level of education, gender, current employment, marital status) and obesity.

Table 22

Model Summary for the Binary Logistic Regression Analysis of Health Behaviors, Sociodemographic Factors, and Obesity

Step	-2 log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	445.624 [a]	.207	.276

[a] Estimation terminated at Iteration 20 because maximum iterations had been reached. Final solution cannot be found.

Table 23 outlines the classification for the binary logistic regression analysis of health behaviors (tobacco use, physical activity, marijuana use, alcohol use), socio-demographic factors (age, duration of residence, income, highest level of education, gender, current employment, marital status,) and obesity. The classification indicates that the predictive variables health behaviors predicted correctly 58.7% obesity as not obese and 75.6% as obese. The overall correction prediction was 67.8% as demonstrated in Table 23.

Table 23

Classification [a] Table of the Binary Logistic Regression of Health Behaviors, Sociodemographic Factors, and Obesity

			Predicted Body mass index		
	Observed		Not obese (< 30.00 kg/m²)	Obese (≥ 30.00 kg/m²)	Percentage correct
Step 1	Body mass index	Not obese (< 30.00 kg/m²)	105	74	58.7
		Obese (≥ 30.00 kg/m²)	51	158	75.6
	Overall percentage				67.8

[a] The cut value is .500.

Table 24 shows that the association between age and the odds of being obese varies within the groups. In the age groups 55 to < 65 years ($p = 0.022$) and 75 to < 85 years ($p = 0.011$), there was a statistically significant association. The age groups 55 to < 65 years ($p = 0.022$) and 75 to < 85 years ($p = 0.011$) are less likely to be obese comparing to the reference group (44 to < 55 years old). The odds ratios for other groups 65 to < 75 years (OR = 0.673), and 85 to < 95 years (OR = 0) were found insignificant.

The association between the duration of residence and the odds of being obese indicated that the duration of residence < 10 years ($p = 0.018$), 10 to < 20 years ($p = 0.041$) and 30 to < 40 years ($p = 0.004$) were statistically significant. The groups 10 to < 20 years and 30 to < 40 years are less likely to be obese comparing to the reference group (< 10 years). The odds ratios for other groups 20 to < 30 years (OR = 0.702), 40 to < 50 years (OR = 0.647) and ≥ 50 years (OR = 0.550) were found insignificant. In the income categories, the association between income and the odds of obesity was not statistically significant.

There were statistically significant associations between individuals with High School or less ($p = 0.022$), Associate degree or less ($p = 0.031$), and Doctoral /professional degree ($p = 0.014$) and the odds of obesity. The groups High School or less ($p = 0.022$), Associate degree or less ($p = 0.031$), and Doctoral /professional degree ($p = 0.014$) are less likely to be obese comparing to the reference group (Junior High school or less). The odds ratio of the Master's degree or less was found insignificant.

The association between gender and the odds of being obese showed a statistical significance ($p < 0.001$). Females were 3.208 times more likely (OR = 3.208) to be obese

than their male counterparts. In the marital status categories, those who were married (p = 0.039), and never married (p = 0.007) were statistically significant. Those who were never married are less likely to be obese comparing to the reference group (those who were married). The odds ratios for other groups, widowed (OR = 1.110), separated (OR = 1.056), and divorced (OR = 0.709) were found insignificant.

The associations between tobacco use, marijuana use, alcohol use, physical activity and the odds of being obese were not statistically significant. These results suggest that, although some categories of age, duration of residence, education, gender, and marital status, significantly predict odds of being obese, health behaviors (tobacco use, marijuana use, alcohol use, physical activity) remained insignificant predictors after the inclusion of these variables in this sample of African American adults.

Therefore, I failed to reject the null hypothesis stating that there is no statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical inactivity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States after adjusting for socio-demographic factors (age, gender, marital status, duration of residence, education, employment, income).

Table 24

Variables in the Equation of the Binary Logistic Regression of Health Behaviors, Sociodemographic Factors, and Obesity

		B	*SE*	Wald	*df*	Sig.	Odds ratio	95% CI for odds ratio Lower	Upper
Step 1 [a]	*Age*								
	44 to < 55 years (ref)			8.904	4	.064			
	55 to < 65 years	-.714	.312	5.227	1	.022	.490	.265	.903
	65 to < 75 years	-.397	.363	1.191	1	.275	.673	.330	1.371
	75 to < 85 years	-1.362	.536	6.458	1	.011	.256	.090	.732
	85 to < 95 years	-23.362	10788.358	.000	1	.998	.000	.000	.
	Duration of residence								
	< 10 years (ref)			13.643	5	.018			
	10 to < 20 years	-1.682	.821	4.191	1	.041	.186	.037	.931
	20 to < 30 years	-.354	.621	.325	1	.568	.702	.208	2.370
	30 to < 40 years	-1.782	.619	8.285	1	.004	.168	.050	.566
	40 to < 50 years	-.435	.537	.656	1	.418	.647	.226	1.855
	≥ 50 years	-.598	.504	1.407	1	.236	.550	.205	1.477
	Income								
	$0.000 to < $15,000 (ref)			8.176	5	.147			
	$15,000 to < $30,000	.493	.331	2.225	1	.136	1.638	.856	3.133
	$30,000 to < $45,000	-.387	.395	.962	1	.327	.679	.313	1.472
	$45,000 to < $60,000	.660	.490	1.813	1	.178	1.935	.740	5.056
	$60,000 to < $75,000	.587	.507	1.343	1	.247	1.799	.666	4.854
	$75,000 or higher	.435	.487	.797	1	.372	1.545	.594	4.016
	Highest level of education								
	Junior high school or less (ref)			7.143	4	.129			
	High school or less	-2.196	.957	5.260	1	.022	.111	.017	.727
	Associate's degree or less	-2.070	.961	4.638	1	.031	.126	.019	.830
	Master's degree or less	-1.929	.995	3.757	1	.053	.145	.021	1.022
	Doctoral/professional degree	-3.436	1.398	6.043	1	.014	.032	.002	.498
	Gender								
	Male (ref)								
	Female	1.166	.282	17.051	1	< .001	3.208	1.845	5.579
	Current employment								
	Yes (ref)			.659	2	.719			
	No	.233	.287	.659	1	.417	1.262	.720	2.213
	Inapp	-24.257	40192.970	.000	1	1.000	.000	.000	.
	Marital status								
	Married (ref)			10.113	4	.039			
	Separated	.055	.562	.010	1	.922	1.056	.351	3.176
	Divorced	-.344	.342	1.014	1	.314	.709	.363	1.385
	Widowed	.105	.434	.058	1	.809	1.110	.474	2.602
	Never married	-.969	.360	7.255	1	.007	.379	.187	.768
	Regular tobacco use								
	Yes (ref)			4.918	2	.086			
	No	.205	.298	.471	1	.492	1.227	.684	2.202
	Inapp	.680	.307	4.918	1	.027	1.974	1.082	3.601
	Physical activity								
	A lot (ref)			1.171	4	.883			

	B	*SE*	Wald	*df*	Sig.	Odds ratio	95% CI for odds ratio Lower	Upper
Often	.556	.864	.413	1	.520	1.743	.320	9.484
Some	-.214	.836	.066	1	.798	.807	.157	4.153
A little	.369	.811	.207	1	.649	1.446	.295	7.094
Never	.121	.662	.033	1	.855	1.129	.308	4.130
					.			
Marijuana use								
Yes (ref)								
No	-.010	.391	.001	1	981	.991	.461	2.130
Alcohol use								
No alcohol problem (ref)								
Alcohol problem	-.629	.398	2.495	1	.114	.533	.244	1.164
Constant	2.420	1.358	3.176	1	.075	11.246		

[a] Variable(s) entered on Step 1: Age, duration of residence, income, highest level of education, gender, current employment, marital status, regular tobacco use, physical activity, marijuana use, alcohol use.

Summary

In this study, I determined the associations of stress, health behaviors, and obesity among African American immigrant adults residing in Milwaukee County, Wisconsin United States. Descriptive analysis in terms of count and percentages using the cross tabulation to determine the distribution of independent and control variables in the two categories of the outcome variable obesity was done. An inferential analysis was conducted using the Pearson's Chi -Square test and binary logistic regression to determine how much the independent and the control variables predicted the odds of obesity.

For research question 1, the Pearson's chi-square test showed that there were significant differences between gender ($p < 0$ .001), age ($p < 0$ .001), duration of residence ($p < 0$ .037) and the odds of obesity, indicating that these variables were independent of the dependent variable obesity ($p < 0.05$). The binary logistic regression results indicated that some socio-demographic factors such as age, gender, duration of residence, education, and marital status could predict the odds of obesity. The age groups

44 to < 55 years ($p = 0.047$), 55 to < 65 years ($p = 0.014$), 75 to < 85 years ($p = 0.012$) were statistically significant, showing there is an association between these age groups and obesity. The variable gender was also significant ($p < 0.001$) indicating an association between gender and obesity in the study population. The odds of obesity were 3.347 more likely in females than males when gender was considered. The duration of residence < 10 years ($p = 0.019$), 10 to < 20 years ($p = 0.044$), and 30 to < 40 years ($p = 0.006$) and the odds of obesity were statistically significant. Some educational levels such as High school or less ($p = 0.038$) and Doctoral/Professional degree ($p = 0.039$) were also statistically significant indicating an association between these categories and the odds of being obese. Also, among the individuals who were never married ($p = 0.01$), the association with the odds of obesity was statistically significant. The null hypothesis stating that there is no statistically significant association between these categories and the odds of obesity was therefore rejected ($p < 0.05$).

In research question 2, the Pearson's chi-square test showed that there was no significant difference between stress ($p = 0.98$), and the odds of obesity, indicating that this variable was not independent of the dependent variable obesity ($p > 0.05$). The binary logistic regression analysis revealed that there was a statistically significant association between the age group 75 to < 85 years ($p = 0.024$) and the odds of obesity. The duration of residence < 10 years ($p = 0.029$) and 30 to < 40 years ($p = 0.011$) were also statistically significant. In the income categories, the association between income and the odds of obesity for the individuals earning $60,000 to < $75,000 ($p = 0.043$) was statistically significant.

The association between the highest level of education and the odds of being obese indicated that High School or less ($p = 0.026$), Master's degree or less ($p = 0.047$), and Doctoral /professional degree ($p = 0.017$) were statistically significant. Gender and the odds of obesity also showed a statistical significance ($p < 0.001$). Females were 3.944 times more likely (OR = 3.944) to be obese than their male counterparts. In the marital status categories, the married ($p = 0.007$), and never married ($p = 0.004$) were statistically significant. However, the association between employment as well as stress and the odds of being obese indicated no statistical significance. These results suggest that, although some categories of age, duration of residence, income, education, gender, and marital status, significantly predict odds of being obese, stress remained an insignificant predictor after the inclusion of these variables in this sample of African American adults. The null hypothesis stating there is no statistically significant association between stress and the odds of obesity after controlling for the socio-demographic factors was therefore not rejected ($p > 0.05$).

In research question 3, the Pearson's chi-square test indicated that only tobacco use ($p = 0.023$) is significant with respect to predicting obesity in the study participants. The association between age groups 55 to < 65 years ($p = 0.022$) and 75 to < 85 years ($p = 0.011$), and the odds of obesity showed a statistical significance. So also, was the association between the duration of residence < 10 years ($p = 0.018$), 10 to < 20 years ($p = 0.041$) and 30 to < 40 years ($p = 0.004$). However, the association between income and the odds of obesity was not statistically significant. In the education categories, High School or less ($p = 0.022$), Associate degree or less ($p = 0.031$), and Doctoral

/professional degree ($p = 0.014$) showed statistical significance. Gender and the odds of being obese also showed statistical significance ($p < 0.001$). Females were 3.208 times more likely (OR = 3.208) to be obese than the males. The results also showed that a statistically significant association existed between those who were married ($p = 0.039$), never married ($p = 0.007$) and the odds of obesity.

Meanwhile, the associations between tobacco use, marijuana use, alcohol use, physical activity and the odds of being obese were not statistically significant. These results suggest that, although some categories of age, duration of residence, education, gender, and marital status, significantly predict odds of being obese, health behaviors (tobacco use, marijuana use, alcohol use, physical activity) remained insignificant predictors after the inclusion of these variables in this sample of African American adults.

Therefore, the null hypothesis stating that there is no statistically significant association between health behaviors and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States after adjusting for socio-demographic factors was not rejected.

Chapter 5 includes interpretations of results, limitations of the study, recommendations, implications for positive social change, and a conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to determine the associations of stress, health behaviors, and obesity among African American immigrant adults residing in the Milwaukee County, Wisconsin. In this section, I present an interpretation and discussion of the findings, limitations of the study, recommendations, implications for social change, and professional practice, followed by a conclusion. Secondary data were collected from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120) data set, and descriptive and inferential analyses were done using SPSS Version 28.

Overweight and obesity are chronic illnesses affecting many children and adults in the United States. The health consequences of overweight and obesity are enormous, particularly in relation to the risk of developing chronic diseases such as hypertension, Type 2 diabetes mellitus, and cardiovascular disease. Obesity disproportionately affects ethnic minorities, women, and individuals from lower socioeconomic groups (Abrahams et al., 2013). In particular, African Americans are disproportionately affected by obesity, diabetes, hypertension, and cardiovascular disease, and it is likely that a host of factors interact in complex and yet unexplained ways to contribute to these health disparities (Abraham et al., 2013).

There is no doubt that obesity poses one of the greatest threats to society's health. According to the CDC (2019), four in 10 Americans, totaling about 100 million, are living with obesity, and among African American adults, nearly 48% are clinically living

with obesity, compared to 32.6% of Whites. Estimates from the National Health and Nutrition Examination Surveys (CDC, 2019) have found that over one third of adults over age 60 are living with obesity, with older Black women coming in at the highest rates. Statistics such as these are even more alarming given the many health risks associated with this deadly condition. Higher rates of diabetes and heart disease, which are highest in Black communities, are intimately tied to obesity, but simply carrying 20 to 30 pounds of extra weight has been linked to more than 200 serious health conditions, including cancer, high blood pressure, and most recently, COVID-19 (Popkin et al., 2020).

Data were exported from the Midlife in the United States (MIDUS 3): Milwaukee African American Sample, 2016–2017 (ICPSR 37120) to SPSS for data analysis. Data were analyzed using both descriptive and inferential techniques. Cross-tabulation and chi-squared analysis were used to examine the association between the independent variables stress and health behaviors (tobacco use, marijuana use, alcohol use, physical activity) and the control variables sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) on one hand and obesity patterns on the other.

Binomial logistic regression was used to investigate the effect of sociodemographic factors, stress, and health behaviors on the predictive likelihood of obesity outcomes in the sample population. The logistic regression analysis results showed that, although some categories of age, duration of residence, education, gender, and marital status significantly predict the odds of being obese, stress and health

behaviors remained insignificant predictors after the inclusion of these variables in this sample of African American adults.

Interpretation of the Findings

I conducted this research to fill a gap in knowledge on the plausible heterogeneity of predictors of obesity in the population of African immigrant adults residing in Milwaukee County, Wisconsin. This study was guided by questions developed to provide underlying information on probable risk factors in this population, which could shed light on the prevalence of obesity in the population. The study showed that obesity status varies by gender, age, marital status, education, employment, income, and duration of residence in the United States. The prevalence of obesity in this study was 60.2% in females and 42.2% in males. Logistic regression performed to ascertain the effect of gender on the likelihood that participants would be obese showed significant differences by gender ($p < 0$ .001) and that females (60.2%) were 1.5 times more likely to be obese compared to their male counterparts (42.2%). This number was determined to be similar to the prevalence of 56.6% in women and 37.1% in men reported among African American adults by the National Center for Health Statistics (CDC, 2019).

The prevalence of obesity in this study among African American adults was 58.2% for those aged 44 to < 55 years and about 50% among those aged 60 and older. The numbers were determined to be slightly higher than the earlier reported prevalence of 44.3% among African American adults aged 40 to 59 years and 41.5% among adults aged 60 and older (CDC, 2019).

Sociodemographic Factors as Predictors of Obesity

RQ1: Is there a statistically significant association between sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States?

In this study, the Pearson's chi-square test showed that there were significant differences between gender ($p < 0.001$), age ($p < 0.001$), duration of residence ($p < 0.037$), and the odds of obesity, indicating that these variables were independent of the dependent variable obesity ($p < 0.05$). The model showed that these variables were significant with respect to predicting obesity.

The binary logistic regression performed indicated that some sociodemographic factors such as age, gender, duration of residence, education, and marital status could predict the odds of obesity. The age groups 44 to < 55 years ($p = 0.047$), 55 to < 65 years ($p = 0.014$), and 75 to < 85 years ($p = 0.012$) were statistically significant, showing that there was an association between these age groups and obesity. This was consistent with earlier studies by Lee et al. (2013) and Delavari et al. (2013). Lee et al. found that the age of immigrants was statistically associated with greater probability of reporting negative change in health. Delavari et al. found that immigrants' age at arrival in the United States was statistically related to unhealthy weight gain. Regression analysis in this study showed that the relationship between age and obesity was positive, which means that an increase in age increases the odds for being obese. This finding was also in line with a

previous study by Ohlson and Manjer (2020), who found that age was associated with higher BMI in a middle-aged and elder Swedish population.

The variable gender ($p < 0.001$) had a statistically significant association with obesity in the study population. Obesity was 3.347 times more likely in females than males when gender was considered. The result was similar to that of a study by Zeigler-Johnson et al. (2013), who concluded that significant gender differences exist in the prevalence of obesity among eight ethnic groups ($p < 0.001$), with Asian females having a higher prevalence of obesity compared with their male counterparts. The result was also consistent with Ahmed et al. (2018), whose research showed a higher prevalence of overweight and obesity among Somali immigrants in Norway. According to the authors, the high prevalence of overweight and obesity, particularly among women, calls for long-term prevention strategies.

In this study, some categories of the duration of residence (i.e., < 10 years [$p = 0.019$], 10 to < 20 years [$p = 0.044$], and 30 to < 40 years [$p = 0.006$]) were found to be statistically significant. This was similar to a finding by da Costa et al. (2017), whose cross-sectional study of the association between length of residence and overweight among adult immigrants in Portugal reported that the length of residence (≥ 15 years) was positively associated with the prevalence of overweight among the adult immigrant population.

It was also consistent with Goulao et al. (2015) and Lee et al. (2013), who found that increased duration of stay was associated with greater odds of reporting poorer state of health among immigrants residing in Portugal and the United States, respectively. A

similar finding was made by Mensah et al. (2016), whose research detailed that the greater the length of residence in the United States, the greater the predisposition to a higher prevalence of cardiometabolic risk (CMR) factors in immigrants. CMR includes hypertension, overweight/obesity, diabetes mellitus, and hyperlipidemia. The relationship between duration of residence and obesity can plausibly be explained by the fact that longer stay leads to prolonged exposure of immigrants to the mainstream culture, increasing the probability for acculturation.

In this study, among the individuals who were never married ($p = 0.010$), the association with obesity was statistically significant. Obesity, however, was less likely ($OR = 0.408$) than for their counterparts who were married. The finding was consistent with Teachman (2016), who found that marital status affects body weight. In particular, living without a partner, either being divorced or never married, is associated with lower body weight, and cohabitors and married respondents tend to weigh more. This finding was also consistent with that of Liao et al. (2018), who reported that married twins tended to have higher BMI than unmarried twins, independent of genetic and shared environmental factors in both sexes.

This study found statistical significance between some educational levels such as high school or less ($p = 0.038$) and doctoral/professional degree ($p = 0.039$) and the odds of obesity. In the categories of high school or less ($OR = 0.141$) and doctoral/professional degree ($OR = 0.065$), the participants were less likely than those with junior high school or less to be obese. The study was similar to that by Marija et al. (2018), whose research showed that overweight and obesity are more prevalent in less educated and low-income

earners, suggesting that individuals and immigrants or groups with low income and education are more susceptible to obesity. People on the lower scale of socioeconomic status (SES) are more likely to be financially constrained to live in good neighborhoods where there are facilities for physical exercise, recreational parks, and fresh food markets, unlike their socially well-to-do counterparts. People with high SES have a higher probability for healthier habits in nutrition compared to the people with worse SES, who are not able to follow complete nutritive recommendations and guidelines in nutrition, resulting in a worse health state (Marija et al., 2018). This was, however, not consistent with the findings of Hilmers et al. (2016), who, contrary to emerging evidence suggesting a higher prevalence of overweight/obesity in groups with the lowest SES, showed that, among rural-to-urban migrants in Peru, SES was positively associated with their BMI status.

This study found no statistically significant association between SES (respondent's income) and obesity status. This result was similar to that of Ade et al. (2011), who reported a similar finding when the results of their study showed no significant association between SES (measured by income level) and the odds of obesity. The result was also similar to that of Wang et al. (2020), who reported that the association of income and SES index with overweight/obesity was not significant when age at arrival at the host country was considered as a covariate. This study was, however, not consistent with the finding of Shi et al. (2015), who reported that a higher level of income increases the perception of health status and awareness in immigrants.

This study found no statistically significant association between employment status and obesity status. The finding was contrary to that of Park et al. (2014), who reported that almost two thirds of employed U.S. adults nationwide were overweight or obese, with 28% being obese.

Stress as a Predictor of Obesity

In this study, the Pearson's chi-square test showed that there was no significant difference between stress ($p = 0.98$) and the odds of obesity, indicating that this variable was not independent of the dependent variable obesity ($p > 0.05$).

The binary logistic regression performed also suggested that when considered alone, stress was not a good predictor of obesity in this sample of African American adults ($p > 0.05$).

Stress and Sociodemographic Factors as Predictors of Obesity

RQ2: Is there a statistically significant association between stress and obesity among African immigrant adults residing in Milwaukee County, Wisconsin, United States, controlling for sociodemographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

In this study**,** the binary logistic regression performed suggested that, although some categories of age, duration of residence, income, education, gender, and marital status significantly predict odds of being obese, stress remained an insignificant predictor after the inclusion of these variables in this sample of African American adults. This was, however, not consistent with findings in some studies.

Stress has long been suspected to be related to (abdominal) obesity, where high levels of cortisol increase appetite for energy-dense food, thereby causing the distribution of white adipose tissue to the abdominal region and ultimately leading to abdominal obesity (van Rossum, 2017). Studies have shown that psychological stress may play a role in why African Americans are at a much greater risk of death from cardiovascular diseases than are Whites (Schneider et al., 2012). This could be partially attributed to the lack of healthy eating behaviors demonstrated among African Americans during times of stress. Studies show that foods consumed as coping strategies are almost always high in fat (Pickett & McCoy, 2017). The way that people cope with stress is dependent upon the way in which stress is conceptualized (Sternberg et al., 2018). Assari et al. (2016) showed that neighborhood-related stress does in fact lead to obesity in later life. Their data showed that fear of neighborhood violence as a teenager predicted BMI changes from ages 21 to 32 among African American women. Further to the high rates of stress and trauma in African American women, Agyemang and Powell-Wiley (2013) asserted the inevitability of the higher prevalence of obesity in this population than in any other race.

Health Behaviors as Predictors of Obesity

In this study, the Pearson's chi-square test indicated that tobacco use ($p = 0.023$) was significant with respect to predicting obesity in the study participants while physical activity ($p = 0.981$), marijuana use ($p = 0.583$), and alcohol use ($p = 0.087$) showed no significant differences.

Logistic regression showed a statistically significant difference between those who used tobacco regularly ($p = 0.045$) and the odds of obesity. Those who did not use

tobacco regularly were 1.339 times more likely (*OR* = 1.339) to be obese than those who regularly used tobacco. This finding was similar to that of Dare et al. (2015), whose study comprised 499,504 adults aged 31 to 69 years. They found that overall, current smokers were less likely to be obese than never smokers (adjusted *OR* 0.83 95% CI 0.81-0.86). However, there was no significant association in the youngest subgroup (≤ 40 years). Former smokers were more likely to be obese than both current smokers (adjusted *OR* 1.33 95% CI 1.30-1.37) and never smokers (adjusted *OR* 1.14 95% CI 1.12-1.15). Among smokers, the risk of obesity increased with the amount smoked, and former heavy smokers were more likely to be obese than former light smokers (adjusted *OR* 1.60, 95% 1.56-1.64, $p < 0.001$; Dare et al., 2015). Risk of obesity fell with time from quitting. After 30 years, former smokers still had a higher risk of obesity than current smokers but the same risk as never smokers.

The relationship between other health behaviors (physical activity, marijuana use, alcohol use) and the odds of being obese was not statistically significant ($p > 0.05$).

In this study, there was no statistically significant association found between obesity and physical activity. In an earlier study in Canada, it was concluded that in spite of any physical activity engaged by adults, there would be no corresponding weight loss without a reduction in intake of calories (Vanessa et al., 2013). Jackicic et al. (2018) also concluded that including physical activity is a vital lifestyle behavior to modulate obesity. The result of this study contradicts that of Ladabaum et al. (2014), who concluded that physical activity limits the acquisition of obesity or weight gain. The results of a cohort study by Golubic et al. (2013) investigating the relationship between body weight and

physical activity showed that weight gain was a significant determinant of future physical inactivity.

In this study, there was no statistically significant association between alcohol use and the odds of obesity. This contrasts with the finding by Ohlsson and Majer (2020), who explored the associations between sociodemographic factors and smoking and alcohol habits and lower versus higher BMI (≥25 kg/m2) and examined whether categorization into lean, (Normal-Weight Obesity (NWO), and overweight leads to further information about sociodemographic and lifestyle associations, compared with the common categorization defined by BMI. According to Ohlsson and Majer (2020), male sex, age, sick leave/disability, married/cohabitating, divorced/widowed, former smoking, and a high alcohol consumption were associated with higher BMI, whereas higher education and frequent alcohol consumption were inversely associated (all $p < 0.001$).

There was no statistically significant association between marijuana use and obesity in this study. This contrasts with the earlier findings by Sansone & Sansone (2014), who reported data indicating that while low-weight individuals are likely to gain weight with acute marijuana use, individuals in community samples display an inverse relationship between marijuana use and BMI. While purely speculative, perhaps marijuana truly has a broad-spectrum regulatory effect with regard to body weight-increasing weight in those who are underweight, but not in those who are normal or overweight. The authors asserted that only further studies will tease out this intriguing possibility.

Logistic regression showed that, when considered alone, tobacco use was a good predictor of obesity, unlike the other health behaviors (physical activity, marijuana use, alcohol use) in this sample of African American adults. This result supports the earlier finding that population-level reductions in smoking, physical inactivity, and obesity could increase life-years lived in good health (Stenholm et al., 2016).

Health Behaviors and Sociodemographic Factors as Predictors of Obesity

RQ3: Is there a statistically significant association between health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and obesity among African immigrant adults residing in Milwaukee County, Wisconsin United States, controlling for socio-demographic factors (age, gender, marital status, duration of residence in the United States, education, employment, income)?

Logistic regression showed that the associations between tobacco use, marijuana use, alcohol use, physical activity, and the odds of being obese were not statistically significant. These results suggest that, although some categories of age, duration of residence, education, gender, and marital status, significantly predict odds of being obese, health behaviors (tobacco use, marijuana use, alcohol use, physical activity) remained insignificant predictors after the inclusion of these variables in this sample of African American adults.

This research was guided by two theoretical frameworks, the socio-ecological model, and the acculturation theory. The Social-Ecological Model (SEM) provides a framework that captures the influencing factors of specified health behaviors at various

levels (Saquib, 2018). According to SEM, there are multiple levels of influence on behavior and these influences interact across different levels. The levels include intrapersonal, interpersonal, organizational, community, and public policy (Kilanowski, 2017). Theoretically, each level independently acts on the outcome, and the effect accentuates further when the influencing factors interact across levels. In this study, the SEM provided a context to examine the relationship between obesity and its possible risk factors such as stress, health behaviors (tobacco use, alcohol use, marijuana use, physical activity) and socio-demographic factors (age, gender, marital status, duration of residence) in African American immigrants. It identified behavior changes among these populations and categorized the predictors of obesity into different levels (individual level, interpersonal level, community, societal level, and policy/enabling environment level).

This research's findings do align with the construct of both theories that postulate that certain factors exist at individual and societal levels in socio-ecological environment that contribute or do not contribute to obesity outcomes in the African American immigrant population. The findings of this study suggest that in the African American immigrant population, consideration should be given to other extenuating circumstances that contribute to the lack of association between socio-economic status (income), employment status, tobacco use, marijuana use, alcohol use, physical activity, stress and obesity outcomes, which several studies have identified as predictors of obesity. The socio-ecological framework has been reported to elucidate how interactions across multiple contexts may affect an individual's perception of stress (Junne et al., 2017). The

perception of stress by an individual is an evaluation of stressful experiences being dealt with, cognitive appraisal, and coping strategies with the stressors. Obesity-associated behaviors such as consumption of high caloric foods and drinks, dietary limitation which tends to reduce obesity, for example vegan or keto diet, and eating disorders can be predicted by stress (van der Valk et al., 2018). Socio-ecological theory may be extended to include social-ecological resilience to explain how specific characteristics in African American immigrant adults increase their resilience to obesity, despite possessing certain risks for obesity. In this study, the model examined how environmental and individual factors interacted to determine behaviors and to target such behaviors with health promotion.

Acculturation, as a multifaceted concept, reflects the overall adaptation to a new society when in contact with individuals and groups from another culture, including the complex and dynamic nature of cultural identity, social connection, and preferences in the residence culture (e.g., language, history, and foods) (Huang et al., 2018; Maehler et al., 2019). Particularly, during migration, the change of environment and adaptation process may influence their diet, physical activity, and other life behaviors, which may further be bi-directionally associated with health status. While migration may contribute to overweight and obesity among migrant populations when they formed bonds with natives and adapt to the obesogenic diet, behaviors, and environment in a receiving society, it has also been reported that migration into a healthy environment may reduce the risk of being overweight or obese (Huang et al., 2018).

It is important that health interventions should target first generation migrants to promote retention of their original healthy behaviors. Recent migrant groups report healthier behaviors than comparative host country populations, and therefore interventions should be promoted at the initial stages following migration to avoid uptake of unhealthy behaviors. (Alidu & Grunfeld, 2018).

Limitations of the Study

A significant limitation of the cross-sectional design is that it is time-constrained to a specific period when the investigation is being done. Therefore, researchers may be unable to identify the order of events to that point. This means that causality cannot be established (Setia, 2016; Szklo & Nieto, 2014). The use of a cross-sectional study was appropriate in investigating the prevalence of obesity in the sample population and the factors that contribute to its prevalence. This was, however, limited in its ability to conclude that there are temporal cause and effect relationships between the independent variables age, gender, level of education, duration of residence, income, employment status, stress, physical activity, tobacco use, marijuana use, alcohol use and obesity outcomes in the sample population (Sawa & Kurihara., 2014). This distinction between prevalence and incidence is what hinders the ability to state with precision that the independent variables were positively associated with obesity outcomes in the sample population**.** In secondary data analysis, there is the likelihood of an inadvertent exclusion of some variables in the data set that may have added value to the study. Also, missing data may affect the inferences drawn from this study.

Information bias resulting from varying levels of recall capacities of the respondents (who may have had various levels of health literacy) may negatively impact the findings of the study. (Obisesan et al., 2017). In addition, the use of a convenience sample during the initial primary data collection phase will pose a significant limitation to this study. The convenience sampling method is not a representation of the entire population of African Americans in the United States. It only collects data from some parts of the country. Consequently, the results of this study may not be generalized to the entire population of African Americans. The quality of the data set may have been affected by the various manipulations of the data set over the past years. Apart from the age of the data set, the quality would also depend on the researchers and field workers who collected the primary data, the statisticians and data clerks who uploaded the data into the system, as well as the capacity of the staff who watched over the data set.

The use of self-reported data regarding the weight and height of participants may also be a limiting factor. As established in a study by Olfert et al. (2018), further investigation is needed to better assess self-reported vs measured height and weight discrepancies across populations as participants tend to exaggerate their measurements.

Another factor that may constrain the study is the use of BMI as the only measure of obesity. Although BMI is accepted as a standard measure for obesity, it is not a perfect measure. The main feature that defines obesity as a medical condition is the presence of an excess amount of fats in the body (Ashwell & Gibson, 2015; Haijan-Tilaki & Heidari, 2015).

Recommendations

Further to findings in the existing literature, and what this study has found, there are some predictors of obesity that exist which are not applicable to all immigrant populations in the United States. It seems evident that there are still so many things unknown. For instance, besides well-known predictors of obesity, are there specific variables or unique interactive clusters that increase the susceptibility to obesity after immigration in specific immigrant populations? Also, one may wish to know if obesity is a temporary phenomenon in this population and whether it changes as socio-economic status improve or as people move from one geographical location to another, within the United States. It may be pertinent to also clarify if socio- cultural dynamics influence obesity in immigrants, and whether it calls for investigations.

Therefore, the dire need for further clarifications calls for future research to include longitudinal investigations that provide more than snapshot information of what exists in the African immigrant population living in the Milwaukee County, Wisconsin United States. By carrying out longitudinal studies, researchers can track obesity outcomes in relation to different predictive factors, which influence variable clusters and because longitudinal studies are repeated observations of same variables over time, they can examine obesity outcomes relatively to length of stay, change in socio-economic status and acculturation since this are time factors.

Researchers can also carry out future research by using a randomized sample of African immigrant population living in the Milwaukee County, Wisconsin United States, instead of a convenience sample, which may comprise of only Africans who share similar

cultural characteristics. A randomized study will allow for a more generalized result that could be applied to a larger population of African immigrants in the United States. Future researchers should also consider increasing the length of time for data collection, which would allow more participants to access the survey. The use of qualitative research, especially interviews, may be of a greater necessity to obtain an in-depth understanding of what participants consider increasing their risk for obesity. It is also important to investigate participants' perception of the roles that participation in social and cultural events and gatherings play in their risk for obesity.

Another significant limitation in the current study entailed the use of self-reported data of height and weight. Future studies should address this limitation by using investigator- measured rather than self-reported weight and height data. The quality of data on obesity may also be enhanced by including other measurement approaches such as waist-circumference, waist circumference-to-height ratio, and waist-to-hip ratio. In fact, studies by Ashwell et al. (2014) and Ashwell and Gibson (2015) found that waist circumference-to-height ratio is a more effective predictor of years of life lost and early health risk, respectively. Hajian-Tilaki and Heidari (2015) also found waist circumference and waist circumference-to-height ratio are slightly better predictors of diabetes than BMI.

Implications for Social Change

Further to this research, better health outcomes may be provided by reducing risks of chronic diseases and their related healthcare associated cost. The intervention efforts towards a decrease in disparities related to obesity in African American immigrants may

be improved when the physical environment and the societal norms are identified (Noonan et al., 2016). This study has provided new information that suggests heterogeneous predictors of obesity in the African immigrant population. This information is of interest to health professionals and organizations that serve this population. Because the results of this study indicate that certain predictors of obesity that exist in certain immigrant populations may not apply to the African immigrant population in the Milwaukee County, Wisconsin United States, public health professionals can use this information to screen for other underlying predictors of obesity or the identification of specific demographic or socio-ecological factors that should be targeted when developing obesity prevention interventions in this population.

In identifying a lack of association between commonly known predictors of obesity and obesity outcomes, this study may have identified protective psychosocial factors that are unique to this population. Health professionals who work with this population may, therefore, have the opportunity to develop appropriate interventions that promote and strengthen these factors, as well as other known general factors, such as level of physical activity and dietary patterns. Because this study has identified that a higher prevalence of obesity exists in female African immigrants, health organizations who serve this population may use this information to develop culturally appropriate health education programs, as well as to screen for the risk for obesity-related chronic diseases and health conditions.

This study also brings awareness to an association between tobacco use and obesity in the African immigrant population, which alerts public health professionals to

the need to screen for tobacco use in this population and how this increases their risk for obesity. This finding establishes that obesity is a growing problem with the population of African immigrants living in the Milwaukee County, Wisconsin United States. It implies that the African immigrant adult population should be of interest to stakeholders in the public health field when it comes to design and implementing programs aimed at preventing and reducing obesity. To address the problems associated with obesity in the country effectively, future programs should also target the African immigrant population.

Implications for Practice

Researchers and public health professionals may use the findings of this study to integrate a social change activity, such as develop health education materials and programs. Also, policymakers may use this to advance health policies in the fight against obesity and its risk factors/behaviors in the African American population.

Conclusion

This study examined the relationship between stress, health behaviors and obesity pattern among African immigrant adults residing in the Milwaukee County, Wisconsin, United States.

Variables that were studied in this research were age, gender, highest level of education, income, duration of residence, employment, marital status, stress, health behaviors (alcohol use, tobacco use, marijuana use, and physical activity). The results showed that some categories of socio-demographic factors such as age, gender, duration of residence, education, and marital status could predict the odds of obesity while stress and health behaviors showed no statistical significance.

These results suggest that well-known predictors of obesity may not be homogeneous in all populations and may not specifically apply to this sample population. The overgeneralization of obesity factors in minority and immigrant populations may hide diverse, unique, and significant predictors of obesity that remain unrecognized and unknown. This could result in blanket interventions that may or may not address the increasing prevalence of obesity in specific populations.

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