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Effects of Socioeconomic Status, Demographic Characteristics, and Education on Sarcopenic Obesity

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Abstract

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by

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The general problem is that although the body of research about obesity is robust, there is a lack of research addressing the problem of sarcopenic obesity. Specifically, there is a lack of research examining the statistical significance of the relationship between the independent variables of socioeconomic status, demographic characteristics, and education and the dependent variable of sarcopenic obesity. This research may advance practice and policy by lending support for developing interventions to address factors that have a statistically significant relationship with sarcopenic obesity. The purpose of this quantitative causal-comparative study was to identify independent variables among socioeconomic, demographic, and education factors which were significantly related to sarcopenic obesity. Participants were 65 years and older and living in the Houston, Texas area, with a sample of 213 included. The theoretical framework was the socioecological model to address three research questions involving what degree education, demographic variables, and socioeconomic status predicted sarcopenic obesity. Data analysis entailed descriptive statistics and binary logistics regression analyses. Results were that socioeconomic, demographic, and education factors do not significantly predict the sarcopenic obesity classification of participants at the .05 level. This study underscores the importance of understanding risk factors associated with sarcopenic obesity and social change via inclusion of socioecological theories in the creation of community health programs.

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Dedication

This work is dedicated to my wife, Aisha, for her patience, love, friendship and support through this endeavor.

And also to my children, Maryam, Zainab, Amira, and Fatima for giving me their love and believing in me.

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Chapter 1: Introduction to the Study

Sarcopenic obesity is a specific form of obesity associated with a loss of skeletal muscle mass and the development of obesity (Barazzoni et al., 2018). Obesity is a condition that continues to grow in prevalence in the US (Atkins, 2019), especially as people continue to live lifestyles which lead to obese conditions. As people get older, obesity becomes a higher likelihood, as does loss of skeletal muscle mass (Sun et al., 2018). Hence, as people age, the obese condition becomes increasingly dangerous. Obesity is related to the development of several other adverse health problems, and when individuals develop sarcopenic obesity, these health problems become even more dangerous. While there is an abundance of research on the topic of obesity, there are still several areas of sarcopenic obesity that must be researched. This research has the potential for significant and positive social change. Understanding factors which lead to the development of sarcopenic obesity can have implications because strategies can be formed to prevent the condition or even reverse it. If healthcare professionals understand problems which lead to sarcopenic obesity, they can track patients that are the highest risk and identify signs that sarcopenic obesity is forming and suggest strategies to patients to maintain skeletal muscle mass and reduce obesity.

This chapter begins with a background of the problem of obesity and sarcopenic obesity. The chapter continues with problem and purpose statements, as well as research questions and hypotheses which focus on examining the significance of socioeconomic status, demographic characteristics, and education as influencers of obesity. The chapter continues with the theoretical framework and nature of the study. The chapter concludes with a definition of key terms related to sarcopenic obesity and variables in this study, as well as assumptions, delimitations, limitations, and the study's significance.

Background

The research related to the problem of obesity is abundant, with a multitude of variables examined as predictors of obesity. Hajan-Tilaki and Heidari (2010) examined the relationship between education level and obesity among Iranian adults and said both men and women had an inverse association between education level and obesity, where there were more significant odds of obesity at lower levels of education than higher levels of education. The relationship was more distinct among women than men, as only women had a significant relationship for abdominal obesity. Wardle et al. (2002) said there was a significant relationship between socioeconomic status and obesity, but education and economic circumstances were significantly greater risk factors for men than women; however, occupational status had a greater impact on women than men. Socioeconomic status and gender are factors which can have an impact on obesity; hence, further examination of these factors involving specific forms of obesity could add the body of knowledge on obesity.

Obesity's prevalence continues to grow; however, researchers continue to learn more about factors predicting obesity. While obesity is a global public health challenge, the US has among the highest rates of obesity in the world, and has since the 1970s (James, 2017). Lower income or lower levels of education both significantly related to higher rates of obesity (Ogden et al., 2017; Tilaki & Heidari, 2010; Wardle et al., 2002). For example, college graduates had a 40% lower prevalence of obesity compared to those with a high school education or less. Individuals with income that was >350% of the poverty level had a 39% lower prevalence of obesity than those whose income was <130% of the federal poverty level.

Garcia-Hermoso and Marina (2015) examined the relationship between weight status, physical activity, and academic achievement among adolescents in Chile, and found that

adolescents who spent ≥2 hours a day on screen time (time spent watching television or in front of the computer) had significantly higher odds of obesity. These lifestyle choices impact behavior later in life. Moreover, as obesity is related to many other severe health conditions such as metabolic diseases, cancer, heart disease, and chronic organ failure, obesity is a challenge that physicians believe must be addressed. Barazzoni et al. (2018) said specific types of obesity create critical health problems for patients. Sarcopenic obesity poses specific problems because the condition involves a low level of skeletal muscle function and mass, and is a problem that occurs most frequently among older populations.

Sarcopenic obesity remains an important issue for researchers because of its relationship with several other health problems. Atkins (2019) examined the effect of sarcopenic obesity on patient cardiovascular disease as well as all-cause mortality and said the disease's age-related nature makes it especially important to understand because of difficulties associated with turning around its impact on individuals. Her synthesis of the extant literature on the topic of sarcopenic obesity emphasized the health implications of the disease on older adults because of the significant relationship between the disease with cardiovascular disease and mortality.

Pickett et al. (2005) said income inequality is a significant predictor of obesity, and countries with greater levels of income inequality also have higher levels of obesity. These positive correlations further support the inclusion of socioeconomic status as an independent variable in research on the topic of sarcopenic obesity. Sarcopenic obesity research is essential because people live lifestyles which support the development of obesity (Sun et al., 2018), the mean population is getting older, and people are living longer lives. Therefore, to support healthier lives in later years, research must involve how factors such as education, socioeconomic status, and demographic characteristics relate to sarcopenic obesity.

Problem Statement

Sarcopenic obesity is a critical problem in the US as the mean age of the population grows (Vespa et al., 2018). Older people continue to make up a more substantial proportion of the overall population (Roberts et al., 2018), and obesity rates continue to climb (Callahan, 2019). In general, obesity is a chronic non-communicable disease impacting 40% of adults in the US (CDC, 2019). It involves loss of muscle and the presence of obesity (Johnson-Stoklossa et al., 2017). Batsis and Villreal (2018) said prevalence of sarcopenic obesity ranges between 1.3-15.4% in men and 0.8-22.3% in women between 20 and 80. As sarcopenic obesity emerges over time, its presence lags behind generalized obesity because muscle loss is more likely to occur with age (Zhao et al., 2018). Lags in time between presence of generalized obesity and development of sarcopenic obesity and upward trends in obesity over the past four decades supports increased concern about sarcopenic obesity, as the rate of generalized obesity increased from 6.4% to 14.9% among women and 3.2% to 10.8% among men between 1975 and 2016 (Callahan, 2019). Therefore, both the frequency and number of older individuals with sarcopenic obesity shall likely increase in the US in the future, making sarcopenic obesity a problem that will grow in importance with time.

Research related to obesity as a generalized condition is fecund. Research on the topic of obesity includes numerous quantitative studies examining the relationship between contextual and environmental factors involving this factor. These studies examine many different predictors, including socioeconomic status, demographic characteristics, and education levels of participants. Research supports the existence of a relationship between these factors in terms of obesity; however, there is a limited body of research examining the relationship between socioeconomic status, demographic characteristics, and education as independent variables

influencing the dependent variable of sarcopenic obesity. Research on the topic of sarcopenic obesity is especially crucial among adults aged 65 years and older because the condition continues to increase among that age cohort, and muscle loss and weight increase are common occurrences among older individuals (Batsis & Villareal, 2018). Atkins (2019) discussed these independent variables as factors influencing sarcopenic obesity. The general problem is that while the body of research involving obesity is robust, there is a lack of research addressing the problem of sarcopenic obesity. Specifically, there is a lack of research examining the statistical significance of the relationship between the independent variables of socioeconomic status, demographic characteristics, and education and the dependent variable of sarcopenic obesity.

Purpose of the Study

The purpose of this quantitative causal-comparative study is to examine the statistical significance of the relationship between the independent variables of socioeconomic status, demographic characteristics, and education and the dependent variable of sarcopenic obesity using the socioecological model. There is a dearth in research examining these factors as predictors of sarcopenic obesity. The location of this research was the Houston, Texas area, and the research focused on the 65+ age group because of the prevalence of the condition among individuals in that age cohort. The sampling strategy in this research was convenience sampling, and the sample was determined to be 220 following a priori power analysis. I used binomial logistic regression as the statistical test for this research. Data were collected by advertising this research in the offices of local physicians who often deal with older patients. The outcome of this research has the potential for social benefit because the mean of the US population is getting older and the proportion of older individuals in the US continues to rise; therefore, as sarcopenia and sarcopenic obesity impacts older individuals, the problem shall continue to grow, and

research investigating factors which impact it can be useful for predicting factors leading to the condition, and knowledge from this study can support the design of treatment strategies for older individuals.

Research Questions and Hypotheses

RQ1: To what degree does socioeconomic status predict sarcopenic obesity amongst individuals aged 65 and older?

H10: The relationship between socioeconomic status and sarcopenic obesity is not statistically significant at $p < .05$.

H1A: The relationship between socioeconomic status and sarcopenic obesity is statistically significant at $p < .05$.

RQ2: To what degree do demographic variables, such as race or gender, predict sarcopenic obesity amongst individuals aged 65 and older?

H20: The relationship between demographic characteristics and sarcopenic obesity is not statistically significant at $p < .05$.

H2A: The relationship between demographic characteristics and sarcopenic obesity is statistically significant at $p < .05$.

RQ3: To what degree does education predict sarcopenic obesity amongst individuals aged 65 and older?

H30: The relationship between education and sarcopenic obesity is not statistically significant at $p < .05$.

H3A: The relationship between education and sarcopenic obesity is statistically significant at $p < .05$.

Theoretical Framework

The theoretical framework of this research was the socioecological model, a model adapted from Bronfenbrenner's social-ecological theory. The social-ecological model involves different levels of influence and how they have different magnitudes of impact on individuals. The focus of the social-ecological model is the relationship between the individual, interpersonal (microsystem), organizational (mesosystem), community (exosystem), and public policy (macrosystem) levels (Bronfenbrenner, 1977). The model involves an ecological framework for human development, which is constructed on the assumption that to understand human development, ecological systems involving individuals must be understood (Bronfenbrenner, 1979). These levels interact, and outcomes are changed.

von Bertanaffy (1950) said interactions between systems are dynamic, where each system has an impact on the other. Discussion of the social-ecological model, as well as social-ecological and systems theories continues in the theoretical framework section in Chapter 2.

The socio-ecological model is also crucial to this research because it supports discussion of findings and what they can mean for theory and practice. Stokols (1996) said the role of the socioecological model is to establish guidelines for the promotion of community health initiatives. Stokols said a common deficiency in health promotion programs is that they often lack a specified theoretical foundation. Socio-ecological models are the foundation of programs for lifestyle modification programs and development of behavior change strategies. Therefore, the theoretical framework also supports discussion of future research and implications of the findings of the study.

Nature of the Study

The study involved using a quantitative causal-comparative research design. Research questions and hypotheses involve understanding the statistical significance of relationships between independent variables and a dependent variable. Quantitative methods involve determining the strength and significance of relationships between variables (Bruce et al., 2017). Socioeconomic status was measured in terms of income and occupation in this study. Demographic characteristics include factors such as age, gender, race/ethnicity, geographic location, marital status, education, and income level. Education level is measured as highest degree and is includes the following categories: high school, undergraduate degree, graduate degree, and doctorate.

A causal-comparative design was most suitable for this research because the design supports establishing whether there is a statistically significant link between different categories of the independent variables and the presence of sarcopenic obesity. Further, the design was the preferred research design for this study because it does not involve manipulation of independent variables, as would be required in an experimental study. A correlational research design was considered because qualities of the independent variables already exist, and manipulation of variables is not necessary; however, the hypotheses of the study include the assumption that the independent variables are factors that cause respondents to either have sarcopenic obesity or not. Therefore, a causal-comparative design was the best research design for this study.

Definitions

Body Mass Index (BMI): A measure of obesity based on height and weight of individuals (Pickett et al., 2005).

Demographic characteristics: Data that are related to a specific population and groups within that population (Hinde, 1998).

Obesity: State which is considered over healthy body weight. Obesity is measured as a BMI of 30.0 or higher (Pickett et al., 2005).

Sarcopenia: Muscle loss brought about by the process of aging (Lee et al., 2016).

Sarcopenic obesity: A condition involving both muscle loss and obesity (Lee et al., 2016).

Socioeconomic status: The social standing or class of an individual which grants them privilege, power, and control (Erreygers & Kessels, 2017).

Assumptions

This research includes multiple assumptions. One fundamental assumption is that participants can completed the yubi-wakka test to measure the nondominant calf for sarcopenia. Tanaka et al. (2018) determined that the outcome of the test is significantly related to whether an individual has sarcopenia. Another assumption is that participants accurately knew their height and weight, and determined their BMI accurately. Reported BMI from their most recent visit to their primary care practitioner was not used because it was not possible to determine when they received their last BMI measurement. Capability of participants to accurately use computers and web browsers to access and accurately report responses for surveys was another assumption of this research. Older individuals still have difficulty using technology (Delello & McWhorter, 2017). It was also assumed that participants responded truthfully and accurately to surveys. Participants were required to measure their current weight or height; therefore, I assumed they did this rather than reporting an estimate.

Scope and Delimitations

The research problem involves sarcopenic obesity. Selection of sarcopenic obesity as the focus of this research is based on the presumption that the problem will grow as the mean of the US population continues to age. The number of people in the 65+ age range continues to grow, and the problem of obesity continues to grow and remain with individuals into old age. The research is also focused on sarcopenic obesity because previous research supported the significance of the independent variables of the study as relating to generalized obesity. Participants were not included in this research if they were under the age of 65, had a leg amputated, or were incapable of performing measurements necessary to report the presence of sarcopenic obesity. Findings of this research could be generalized to people who are 65 years and older and live in the geographic location of the study.

Limitations

This study includes several limitations. One limitation is that the measurement for sarcopenia is completed through a self-test method rather than performed by physicians. The yubi-wakka test does not differ extensively from physician-performed measurements of sarcopenia. Another limitation is that the BMI of individuals is a generally accepted means of measuring obesity; however, research is limited regarding this. While sarcopenia and sarcopenic obesity are possible in other age ranges, sarcopenic obesity is more prevalent as well as dangerous for older individuals (Atkins, 2019). Another limitation of this research is that it involved measuring causality in an ex post facto form. Unlike experiments, there are no controls for data, and there is no manipulation of independent variables.

Significance

This study has the potential to contribute to the scholarly body of knowledge involving sarcopenic obesity, advancement of practice, and policies addressing the condition. It has the potential to lead to significant social change. This research adds to the body of knowledge on the topic of sarcopenic obesity as an extension of research involving factors related to obesity where socioeconomic status, demographic characteristics, and education each have significant relationships with generalized obesity. I accomplish this objective by examining the impact of those factors on sarcopenic obesity as a specific form of obesity. This research may advance practice and policies by developing interventions to address factors that have a statistically significant relationship with sarcopenic obesity. In addition to interventions, public policies could be drafted to fund programs that support weight loss and prevent loss of muscle among people who are 65 and older. These findings could support this population in terms of understanding factors that put them at significant risk of developing sarcopenic obesity. If people in this age cohort understand risk factors, they can take steps to prevent muscle loss and lose weight.

Summary

Chapter 1 began with an introduction describing the need for research regarding the relationship between socioeconomic status, demographic characteristics, and education as independent variables which cause sarcopenic obesity, in addition to implications for social change. The chapter includes background information on the topic and a summary of research on obesity and sarcopenic obesity, and why independent variables may cause sarcopenic obesity. The problem statement followed, supporting the need for further research by identifying the relationship between socioeconomic status, demographic characteristics, and education and

obesity while noting there is a lack of research on these factors and sarcopenic obesity, while also making a case for the significance of sarcopenic obesity research as the number of older people in the US will continue to grow.

The purpose of the study was to understand the relationship between independent and dependent variables using a quantitative causal-comparative design, with research questions and hypotheses structured to determine whether a statistically significant relationship exists. I then introduced the social-ecological model as supported by the social-ecological theory as the theoretical framework. I described variables in the study, with a rationale for the research design, followed by definitions of keywords. A brief explanation of assumptions, delimitations, limitations, and the significance of the study followed. Chapter 2 includes a thorough description of the theoretical framework and literature, as well as socioeconomic status, demographic characteristics, education, and obesity. The literature review in Chapter 2 contributes to this research.

Chapter 2: Literature Review

Introduction

This literature review includes a synthesis of research related to the problem of micro, meso, and macrosystemic factors impacting individual weight gain and skeletal muscle mass loss. The purpose of this research is to examine the relationship between several predicting factors and sarcopenic obesity using a quantitative causal-comparative research method with the social-ecological theory as the framework for the study. This study had the potential to be significant because findings shall inform physicians about care of older patients by adding to the body of literature on factors that predict sarcopenic obesity. Physicians may address significant relationships and determine strategies for reducing the likelihood of sarcopenic obesity. Prior research has shown them to have an influence on obesity in general, and there is a lack of inclusion of these factors in research on sarcopenic obesity. The social-ecological theory functions as a framework upon which personal, contextual, and process factors related to the development of sarcopenic obesity are compared with demographics, socioeconomic status, and education. Therefore, this literature review is the basis for an evidence-based argument that there are possible relationships between predicting factors and sarcopenic obesity.

An exhaustive review of extant literature on the topic of obesity and sarcopenic obesity exposed gaps in the body of literature that must be filled in order to understand the topic with greater breadth and depth. The literature review supported inclusion of variables such as individual demographics, socioeconomic status, and education as factors that could potentially predict sarcopenic obesity. This literature review begins with a discussion of the social-ecological theory. This includes a description of its history and development, and how systems theory contributed to its development. The literature review continues with a discussion of

socioeconomic status, with emphasis placed on the relationship between socioeconomic status and health outcomes. The literature review continues with a discussion of the issue of obesity, with a focus on sarcopenic obesity. It includes information about obesity and sarcopenic obesity to illustrate there is a relationship between these factors and obesity in general; however, there is a lack of research examining the impact of these factors on sarcopenic obesity. The literature review concludes with a review of research on the topic of education and obesity. There is also a lack of research on the relationship between education and sarcopenic obesity; there is research supporting the relationship between education and obesity.

Literature Search Strategy

The literature review began with scholarly literature from several academic databases and search engines which was collected and reviewed to understand the relevance and importance of the problem. I reviewed literature that was published between 2016 and 2020. Subsequently, these constraints were removed to determine if other literature would contribute further support for understanding the problem and rationale for completing this study. The literature review included research on both obesity and sarcopenic obesity in order to compare and contrast bodies of research and support further examination of sarcopenic obesity. The literature review also includes seminal works involving the social-ecological theory. This review included scholarly articles to support the definition of the theory.

Search terms were: *social ecological theory*, *social ecological model*, *obesity*, *sarcopenic obesity*, *socioeconomic status*, and *education*. Studies were selected based on results of multiple searches. Further review of articles was completed to determine inclusion based on fitness of articles in terms of the topic. After the review, articles were annotated to support synthesis of research in this chapter.

Theoretical Foundations

Bronfenbrenner's socio-ecological model is the theoretical foundation for this research. Bronfenbrenner's (1970) research on socio-ecological models began as an extension of von Bertalanffy's (1950) systems theory, with research on human development; however, it grew to become a theoretical framework applied in many fields (Wold & Mittelmark, 2018). Socio-ecological models are included in research across several fields, including education, business, and healthcare. This research benefits from the inclusion of the socioecological model as the theoretical foundation because there are both internal and external factors that impact an individual's weight and whether they are obese. Socioeconomic status, education, and demographic characteristics are microsystemic, macrosystemic, and mesosystemic factors which impact individual status as obese and whether they have sarcopenic obesity or not.

The environment influences individuals, and individuals influence the environment (Wold & Mittelmark, 2018). Development of socio-ecological models began with Bronfenbrenner (1970; 1979); however, some prior research touched on its importance (Wold & Mittelmark, 2018). While the development of this theoretical framework began in the 1970s (Bronfenbrenner 1970; 1979), systems theory is the starting point for the development of socio-ecological models, where von Bertalanffy (1950) constructed systems theory which, like socio-ecological models, expressed robust links between different elements and structures in society. Distinct theory, such as the establishment of socio-ecological models aside from systems theory, is essential because useful theoretical models are those which are specific in context (Wold & Mittelmark, 2018); therefore, the general nature of von Bertalanffy's (1950) systems theory is not sufficient for this research. Moreover, while Parsons and Shils (1951) and Luhmann et al. (2013) developed avenues of systems theory that are more specific than the initial work on

systems theory, socio-ecological models remain a more robust and more specific fit for this research.

While scant research and scholarly conceptualization of socio-ecological models occurred before the 1970s, Bronfenbrenner's (1979) text on human development represents the initial scholarly discussion of socio-ecological models. Bronfenbrenner (1970) said interactions between surroundings of individuals and their peers, education, career, and social setting is influential for individual development. Bronfenbrenner considered the state of research in the field of developmental psychology as limited to the observation of abnormal phenomena, where researchers explored the "strange behavior of children in strange situations with strange adults for the briefest possible periods" (p. 19). Hence, Bronfenbrenner sought to understand how external forces cause problems for individuals and why individuals adapt to changes in ways that they do. Subsequently, the development of socio-ecological models became a pervasive element of social-ecological theory (Bronfenbrenner, 1979). In this dissertation, the focus is on understanding the influence of demographics and education forces on obesity, where socio-ecological models may support the discussion of findings in terms of how the several demographic and education variables are connected to systemic factors. The literature included in this exhaustive review of extant literature shall support the discussion later in this dissertation.

The foundation for the social-ecological theory, and thus socio-ecological models, is systems theory (Wold & Mittelmark, 2018). Systems theory is the study of how systems work together with interrelated and independent parts and how all systems in the environment connect (Wold & Mittelmark, 2018). The seminal work on systems theory came from von Bertalanffy's (1950; 1968) initial work on general systems theory. Systems theory functions better as a starting point for the construction of other theoretical frameworks than as a specific theoretical

framework alone because the theory is quite broad and all-encompassing. As von Bertalanffy (1968) states “it seems legitimate to ask for a theory, not of systems of a more or less special kind, but universal principles applying to systems in general” (p. 32), the appearance is that even in the initial construction of systems theory, the theory is general of all systems. Therefore, systems theory is essential as the starting point for understanding the theoretical framework in this study; however, systems theory is a poor replacement for socio-ecological modeling. Ultimately, the limitation of systems theory as a theoretical framework is that the ends of systems theory construction were to establish an epistemologically-focused redesign of science, rather than to develop new theory to conduct science where inter-relationships between limitless factors undergird the axioms of observing the world.

These models often include multiple disciplines or different layers of the environment (individual, microsystem, mesosystem, exosystem, and macrosystem (Bronfenbrenner, 1977)). These terms relate to systems theory as layers in the environment (Bronfenbrenner, 1977). Microsystems is the system that is closest to the individual, while the mesosystem is the relationship between the systems in the environment. The exosystem is the relationship between two systems, which causes an effect indirectly for another system. The macrosystem is then a system that influences individuals (Bronfenbrenner, 1979). According to systems theory (von Bertanaffy, 1950), these systems share associations, and when there is a change or disruption, then systems adapt by making internal changes to maintain their purpose. The construction of socio-ecological models depends on systems theory because the models function on the same concepts where changes and disruptions lead to a reaction from the system and for the system to adapt. The objective of this dissertation is to examine the relationship between several factors, including demographics and education, with obesity.

The hypotheses of this dissertation are based on the prediction that demographic and education-related factors are significantly related to obesity, based on the socio-ecological model where demographics relate to obesity because of behaviors caused by the environment. The body of research utilizing socio-ecological models includes several studies where systemic factors influence individual behavior (Wold & Mittelmark, 2018), and these behaviors relate significantly to outcomes. The findings of previous studies support the investigation completed for this dissertation where demographic and education factors predict behaviors (Wold & Mittelmark, 2018), and some behaviors predict obesity. Therefore, based on the findings of the abundant body of research on the topic of obesity, the research conducted for this dissertation examines the relationship between demographics and education with obesity.

Previous research related to health topics has included social-ecological theory as a theoretical framework. Holt-Lunstad (2018) investigated the issue of understanding and modifying risk and protection in the scope of social relationships. Her research focused on the importance of social relationships to the maintenance of physical health. According to her findings, there are causal mechanisms at play where individuals develop relationships with others and form bonds in their communities, which leads to positive health and wellness choices, which in turn lead to positive physical health through social relationships. Holt-Lunstad's research noted that individuals and health-relevant biological processes in family, neighborhood, and community remain factors that positively facilitate physical health. Based on these findings, there are individual and communal factors that support physical health. van Kasteren et al., (2020) support the findings of Holt-Lundtad (2018); however, they do so through the scope of functional studies. Their research focused on the topic of physical activity in the workplace. The researchers developed a social-ecological model approach to the problem of occupational

sedentary behavior as a response to a lack of movement in the workplace. van Kasterenet al.'s (2020) model supports overcoming the problem of a lack of movement leading to obesity among workers. Therefore, these findings support the design of this dissertation, as the research investigated the role of individual demographic factors and the social institution of education as factors that influence the physical health factor of obesity.

The topic of occupational health has been a common theme in research based on social-ecological models. While van Kasteren et al. (2020) developed a model to improve workplace health and wellness by increasing movement and exercise levels, Doran et al. (2017) investigated the implementation of the worksite heart health improvement project as a way to reduce the risk of cardiovascular disease among long-term care workers and to facilitate worksite health promotion. Their research was an action-based project with the implementation of the model over nine months, with both the social-ecological model and social cognitive theory elements influencing the research. Based on the conclusions from Doran et al. (2017), social-ecological theory played a decisive role in the structure of the program's implementation; however, a limitation to their article was that they failed to produce results and only described it as ongoing with some preliminary measures of success. Both van Kasteren, Lewis, and Maeder (2020) and Doran et al. (2017) support social-ecological theory as a framework for healthcare-related research in action research projects; however, this dissertation did not involve the implementation of a treatment. Still, these studies support the current research because they include evidence of social-ecological theory being a framework through which positive health outcomes can be achieved. The difference is that in this dissertation, the research focused on a quantitative, cross-sectional examination.

The social-ecological theory remains an essential element of research in several areas of social science. Healthcare delivery is one of those areas. McLeroy et al. (1988) investigated health promotion programs in the scope of the social-ecological theory. Their research aimed to develop a stronger ecological perspective on the issue of health promotion programs. Their research utilized social-ecological theory by exploring the roles of the different social levels of the social-ecological system to understand how individual and social, environmental factors interact to understand how the system interacts and supports the continuance of unhealthy behaviors. A problem with their research was that while context and the population involved were addressed, a lack of focus on process existed. The researchers failed to explain how the different levels interact to create a social-ecological system that reinforces poor health maintenance and the failure of individuals to follow healthcare maintenance programs. This is a problem that frequently occurs in research utilizing social-ecological theory as the theoretical framework for research.

Researchers have also reviewed the literature on the topic of ecological systems theory, concluding that it is one of the most commonly used theoretical frameworks in an empirical study, while discussing where the research should go in the future. Neal and Neal (2013) relied on Simmel's notion of intersecting social circles in conjunction with Bronfenbrenner's theory, concluding that there should be an overlap of structures and that their arrangement should be indirectly and directly connected through a network of social circles. Their conceptualization of how Bronfenbrenner's theory should be modified included several levels: the micro, meso, exo, macro, and chrono levels of social interaction. Based on their research, there must be some modification to the construction of the ecological systems theory model to accommodate different parts of the overall system. Tudge et al. (2009) discussed the issue in terms of how

researchers have failed to elucidate changes in how ecological systems theory is applied in their research or ways in which the model may be modified in different studies. Therefore, while Neal and Neal (2013) note the existence of different directions that future research can go, Tudge et al. (2009) note that researchers continue to fail to apply the theory correctly, to begin with. Research utilizing ecological systems theory as a framework should follow it as established and note deviations from the established framework and describe the validity of these changes based on prior research.

A critical problem with the application of Bronfenbrenner's theory is that the theory is frequently misused. Tudge et al. (2009) reviewed research on the application of Bronfenbrenner's theory from its initial introduction as the bioecological theory of human development to becoming social-ecological theory, finding that of the 25 papers included in their study, only 16% of those papers utilized the theory correctly. They posited that the reason for the poor frequency of correct application of the theory was because researchers likely wanted to support their ideas that context influences individuals. Another reason noted in the discussion by Tudge et al. (2009) was that scholars did not adequately review the theory to such an extent that they adequately understand how the theory should be applied. Over time, Bronfenbrenner's theory advanced, and Tudge et al. argued that the application of the theory as ecological systems theory infrequently occurred because researchers failed to apply the systems part of theory in research. Specifically, they note that researchers focusing only on the person-context interaction fail to examine the role of process. This dissertation is structured to understand the outcome of obesity along the lines of person and context, while also accounting for education as a process that associates with obesity. Therefore, this research escapes some of the problems noted by Tudge et al. in terms of common problems and limitations with the application of theory.

As noted by Tudge et al. (2009), many examples of how research focuses on people and context, without acknowledging process exist. One such study was Hollander and Haber's (2009) exploration of sexual identity change in lesbian. Their research focused on women coming out as lesbians, utilizing Bronfenbrenner's (1979) social-ecological model as a framework for understanding the behavior of women who come out as lesbians. Hollander and Haber (2009) note the importance of context in the scope of the model as a way to connect sexual identity to other aspects of the social-ecological model. While the research utilizes the findings to propose interventions that professionals could use in practice, a limitation to the study is the lack of focus on process and that the research heavily relies on the social context in terms of the design and the interpretation of the findings. Hence, as Tudge et al. (2009) point out, the social-ecological model is not thoroughly utilized in this research. This also remains a problem across the lines of several different fields of research. While Hollander and Haber (2009) focused on the utilization of social-ecological theory in the scope of gender studies, Harkonen (2007) utilized the theory in education. Harkonen noted that the application of the theory is prevalent in psychology and pedagogy, as she focused on child development and education. Nonetheless, her research also remained focused on context, extensively reviewing the issue of social orientation. The research design and discussion of both Hollander and Haber (2009) and Harkonen (2007) both exhibit a lack of focus on process, with the context being a factor receiving significant attention.

Research, including social-ecological theory as a framework, is located in many other disciplines, including education. Shapira-Lishchinsky and Litcha (2018) examined the relationship between teacher perceptions of transformational leadership and social-ecological models to understand the role that universal and national culture play in the transformational leadership practices of teachers from the US and Israel. Based on their findings, there are

significant differences in transformational leadership processes. The problem with this research is that it shares the same missing piece that Tudge et al. (2009) point out when reflecting on other literature utilizing social-ecological theory, which is that while the research involves people and context, the research fails to address the issue of process. People are addressed as teachers involved and their locations as being in the US or Israel, and context is addressed through the use of Hofstede's culture dimensions. The researchers do not address the process involved in the differences.

There is also some support for the extension of social-ecological models to include institutional factors. Ling and Leng (2018) explored the issue of qualitative modeling and the development and validation of conceptual models, particularly those in governance and quality practices. They noted that while quantitative research frequently includes environmental-related modeling with conceptual theory-based models, there is a lack of research utilizing environmental models in qualitative research. They noted the need for focus on conceptual theory-based models, using a single case study as the foundation for their assertion. They noted that the methodology would rely on a multi-step process to support validation. While Ling and Leng sought to establish a novel approach to qualitative research where the environment could become a factor more frequently explored, their approach does not seem to offer much new from Bronfenbrenner's (1979) theory. Further, their research shares the same limitation with other research where they fail to consider the process. The process is a factor investigated in this dissertation, where education is a process which is hypothesized to result in a significant relationship with obesity.

Bronfenbrenner's theory on social ecology remains frequently used with several studies utilizing the framework in different ways, particularly in medicine and the application of

healthcare practices. Kolff et al. (2018) investigated the use of technology as a tool to promote the use of vaccinations. In their research, technology functioned as the process through which people understood the importance of receiving vaccinations. In their research, Kolff et al. (2018) found that technology is a tool that could be leveraged to address the problem of undervaccination at the individual, interpersonal, organizational, community and society levels and that through the social-ecological model it was possible to manipulate these levels to interact in ways that would benefit citizens while encouraging vaccine use. Their research utilizes the social-ecological model as a framework to support their findings where different levels within the framework can influence one another. In the case of their research, individuals are influenced by interpersonal relationships, with organizations within communities impacting those relationships, and that technology is the tool that facilitates the process. Based on the application of the model and the findings, the social-ecological framework is a useful tool for structuring and interpreting research designs and their outcomes.

Literature Review Related to Key Variables and/or Concepts

This section includes a review of extant literature, with a focus on the critical variables in this study. The literature review begins with a discussion of generalized obesity and narrows the discussion to sarcopenic obesity. The literature review continues with a focus on how socioeconomic status, demographics, and education related to health problems, often with the focus placed on obesity. The literature review supports the research proposal because of the several studies concluding that obesity is related to the independent variables; however, there is also a lack of research where the relationship between sarcopenic obesity and the independent variables were tested.

Obesity

The structure of this research is built around deducing some factors which significantly relate to the problem of sarcopenic obesity. Obesity is a medical condition where individuals develop excess body fat and growth to their body mass, which in turn harms health. Chooi et al. (2019) noted that obesity is a complex, multifactorial disease and that the prevalence of obesity has doubled since 1980. About one-third of the world's population meets the classification of obesity, as measured by a BMI greater than 24.9. Obesity remains a problem for individuals of many different profile-specific categories (Chooi et al., 2019). Rhode et al. (2019) said obesity is a global problem that represents a significant health challenge, especially among older individuals. This section of the literature review includes a synthesis of current scholarly literature on the problem of obesity, with a focus on sarcopenic obesity. This section also provides some rationale for the inclusion of factors such as demographics, socioeconomic status, and education in the research. Based on the findings from previous research on the problem of obesity, particularly sarcopenic obesity, there must be further research on the problem, with a focus on how demographics, socioeconomic status, and education predict the disease.

Demographics and Obesity

Overall, obesity remains a significant problem, and trends in obesity and severe obesity prevalence support an increase in obesity in the US over time. Hales et al. (2018) investigated the issue of obesity prevalence in the US among youth and adults. Their longitudinal quantitative study began with data from the 2007-2008 time period and concluded with 2015-2016. They noted that obesity has become increasingly prevalent since the 1980s among adults; however, the prevalence of obesity among youth plateaued in the period where this research is completed. Hales et al. (2018) utilized survey data from the National Health and Nutrition Examination

Survey, finding that among youths, the prevalence of obesity was 16.8% in the 2007-2008 period and 18.5% in the 2015-2016 period, with a lack of significance in the trend between the two periods. For adults, there was an increase from 33.7% in 2007-2008, to 39.6% in 2015-2016, with the trend for the increase being statistically significant at $p = .001$. These statistics support the current research as this research involves the investigation of the issue of sarcopenic obesity. As obesity continues to increase significantly among older people, the problem of obesity must receive further focus from researchers as sarcopenic obesity will likely become increasingly frequent.

These results are consistent with those from Ogden et al. (2018). They examined the prevalence of obesity among youths according to household income and the education level of the head of the household. The impact of the head of household on the behaviors of youths in the household was the focus of Ogden et al.'s work in the 2011-2014 period. While Hales et al. (2018) found obesity trends among significant adults and a lack of significance in obesity trends among youth, Ogden et al. (2018) examined how the leader of the household impacted youth obesity as a way to determine how behaviors were impacting obesity follow-through from one generation to the next. Based on the findings, while the mean youth obesity rate was 17.0% in the 2011-2014 period, obesity in youths was lower for youths from households where the head of the household was in the highest income bracket and the highest education group (10.9% and 9.6%, respectively). Based on these findings, the home income and education level for parents plays a significant factor in whether children in the home will develop obesity or not. Therefore, these findings and the findings from Hales et al. (2018) are essential to the issue of sarcopenic obesity because obesity avoidance should begin as early as possible. These findings can motivate

the scholarly agenda related to sarcopenic obesity by influencing scholars to examine the impact that childhood and adulthood obesity have on adults in terms of developing obesity later in life.

The problem of obesity frequently relates to demographic factors and the contextual factors surrounding an individual. Okube et al. (2020) investigated the gender differences in the pattern of socio-demographics related to metabolic syndrome with central obesity. Okube et al. (2020) examined metabolic syndrome as a risk factor related to morbidity and mortality, with gender-based demographics as factors that require focus when examining central obesity. They found that several factors relating to the prevalence of metabolic syndrome and an obese condition. Advanced age among both males and females had a significant impact, as did being divorced, separated, or widowed and holding a high income. Being unemployed and having tertiary education resulted in a significantly less likely risk of metabolic syndrome. Based on these findings, there is further support for the examination of demographic and socioeconomic data in this research to understand the factors which lead to sarcopenic obesity.

Obesity remains a problem among people from different backgrounds, meaning that the demographics of people experiencing obesity vary significantly. Mei-Wei et al. (2019) examined the relationship between stress, demographics, and dietary intake among women on a low income who are overweight and obese. Based on their findings, obesity or an overweight condition relates to the presence of stress, and that when women have a higher level of stress, they will make dietary choices which include foods that are high in fat, while neglecting food such as fruits and vegetables. These findings are supported by Lorts and Ohri-Vachaspati (2016), whose research investigated the eating behaviors among low-income obese adults. They noted that a diet that incorporates fruits and vegetables is a benefit for health and that it is a preventative measure. They found that the most common suggestions from healthcare providers

regarding positive eating habits included salad and fruit consumption (Lorts & Ohri-Vachaspati, 2016). Weight-loss attempts were also negatively associated with sweet snack consumption, consumption of sugar-sweetened beverages, and consumption of fast food. Based on these findings, there are possible conditions that are related to an individual's profile characteristics, which will result in poor health and obesity being a problem. The findings also do not support the role of education or employment as significantly associated with dietary choices. Therefore, the role of these factors is examined in this research to understand their relationship with sarcopenic obesity in this current dissertation study.

Fighting obesity is difficult, and while diet and exercise are essential, bariatric surgery is considered the best treatment for obesity. The Roux-en-Y gastric bypass and sleeve gastrectomy are the two most frequently utilized methods for weight loss (Kizy et al., 2017). Based on research by Kizy et al. (2017), while these procedures are often successful, there are risks for people receiving these procedures in terms of mortality and hospital readmission to address complications. These procedures are also costly, with the mean for sleeve gastrectomies being $11,183, while the cost for the Roux-en-Y bypass being $13,485. These findings are based on the mean for the population, and the cost for older patients would likely be higher because of the higher risk of complications. In terms of the current research, these findings do not support gastric bypass surgery as a solution for sarcopenic obesity because of the cost and high risk, as well as failing to address sarcopenia. Therefore, while diet and exercise could be factors to discuss as beneficial in future research, gastric bypass should not be a part of that discussion because of the health and cost challenges associated with the use of gastric bypass surgery as a solution.

Sarcopenic Obesity

Several categories of obesity exist; hence, research must focus on different forms of obesity to establish an understanding of the factors which drive them. Barazzoni et al. (2018) note the importance of overcoming sarcopenic obesity and meeting the challenge through lifestyle changes. As noted by Villareal and Batsis (2018), sarcopenic obesity is a form of obesity that is frequent among adults 65 years and older. Sarcopenic obesity is a form of obesity that takes place when an individual loses muscle mass and strength while gaining body weight; however, there is no generally accepted definition of sarcopenic obesity or its cut-off points, making the diagnosis a challenge (Batsis & Villareal, 2018; Polyzos & Margioris, 2018). Sarcopenia and sarcopenic obesity are common among older individuals experiencing diseases such as advanced cirrhosis. Therefore, research methods often include different approaches for determining muscle mass loss, with Halmer and O'Donovan measuring muscle mass loss by grip strength and Hara et al. (2016) measuring muscle mass loss by changes in the visceral fat area and skeletal muscle. Yoo et al. (2020) defined sarcopenic obesity as "an appendicular skeletal muscle mass divided by weight (%) of < 1 SD below the sex-specific mean" (p. 1). Research by Kemmler et al. (2017) noted the existence of differences in definitions and that there is a low level of overlap where participants fit different definitions for sarcopenic obesity. Therefore, a possible limitation for this research is how sarcopenic obesity is measured. While older people benefit from healthcare advancements that extend lifespans, the problems associated with aging continue to be a problem. As older people live longer, and their problems persist, the population of old age adults continues to grow. Obesity remains one of these problems, as 38.5% of men and 43.1% of women are classified as obese in the 65+ cohort (Batsis & Villareal, 2018). As sarcopenic obesity is a common obesity condition, especially among older individuals, research on the factors related to sarcopenic obesity is essential as it represents a health challenge for

older people and an economic issue, health programs must cover treatments for sarcopenic obesity and health problems it may cause.

Sarcopenic obesity is a condition that becomes increasingly prevalent with age. Du et al. (2018) investigated sarcopenia and sarcopenic obesity to understand some of the demographic factors related to the condition. They noted that adults have longer lifespans now and that the population of older individuals in the US is increasingly diverse, particularly in terms of ethnicity; therefore, genetic variability and obesity is an essential factor for researchers to consider. Based on their findings, gender and ethnicity play a statistically significant role in the development of sarcopenic obesity, where non-Hispanic Blacks have the lowest prevalence, while Hispanics had the highest. Further, males had a higher prevalence than females. Kemmler et al. (2017) contribute further support for ethnicity as a factor playing a role in the prevalence of sarcopenic obesity by ethnicity. Based on their findings, sarcopenic obesity continues to increase as a condition in Germany as the population becomes older. Based on these factors, research on the topic of sarcopenic obesity should include demographic factors because the findings of this research support there being a significant difference between participants according to demographic factors.

The presence of sarcopenia and sarcopenic obesity in different cultures elucidates the importance of research on the topic because of the impact it has on different populations throughout the world. Yoo et al. (2020) investigated the problem of sarcopenic obesity in Korea according to participant nutrition and lifestyle to understand whether these factors contribute to the development of sarcopenic obesity later in life. The findings support lifestyle choices, including participation in flexibility exercises, and aerobic exercises support the avoidance of sarcopenic obesity. Participants with a high participation frequency in flexibility exercises had an

11% lower prevalence of sarcopenic obesity than the mean. Lee et al. (2016) and Trouwborst et al. (2018) also support the importance of exercise and nutrition. Prevalence can also depend on the methods selected to measure sarcopenic obesity. According to Kemmler et al. (2020), prevalence among Bavarian men 70+ years of age was between 2.1-4.1%. Based on these findings, sarcopenic obesity is difficult to define, and even when defined, it can remain challenging for researchers to understand how to avoid it, but ethnicity plays an apparent role. Therefore, research should include demographic information to understand the predictors of sarcopenic obesity.

An abundance of literature exists on the topic of sarcopenic obesity, with researchers examining the issue with many different research designs and approaches. Halmer and O'Donovan (2017) utilized a longitudinal research design. Batsis and Villareal (2018) contributed a systematic review of the literature on the topic. The many different approaches to study on the topic of sarcopenic obesity support the body of research as diverse; however, further research is necessary to understand how personal, contextual and process factors contribute to sarcopenic obesity, and a framework such as socio-economic models supports further research.

Conditions Arising from Sarcopenic Obesity

A factor supporting the importance of investigating sarcopenic obesity is the mortality of older individuals with the condition. Sarcopenic obesity can be a factor relating to greater obesity, moving the class of obesity for individuals to advanced obese stages (Johnson Stoklossa et al., 2017). Sarcopenic obesity is related to several dangerous conditions such as cancer (Carniero, Mazurak, & Prado, 2016), heart failure (Carbone et al., 2019), and fatty liver (Merli et al., 2019), as well as cirrhosis (Eslamparast et al., 2018). Sarcopenia is a condition which often works as a precursor to sarcopenic obesity (Choi, 2016). In research by Tian and Xu (2015), the

researchers discovered that sarcopenic obesity had a significantly increased risk of all-cause obesity at $p< 0.001$. An abundance of research exists on the topic; hence, the availability of findings for a meta-analysis on the relationship between sarcopenic obesity and all-cause mortality (Tian & Xu, 2015). Tian and Xu's (2015) findings supported a higher likelihood of mortality for older individuals with sarcopenic obesity, primarily when sarcopenic obesity was defined through mid-arm muscle circumference and muscle strength criteria. Based on their findings, there is a 24% increased risk in all-cause mortality among older individuals with sarcopenic obesity over those who do not have sarcopenic obesity. These findings support the importance of research on the topic to understand the factors which significantly relate to sarcopenic obesity to understand if there are possible warning signs.

While the body of research related to sarcopenic obesity includes many studies where the focus is on understanding the factors which predict sarcopenic obesity, research also exists where the focus is on understanding what sarcopenic obesity may predict or lead to. Hamer and O'Donovan (2017) investigated the relationship between sarcopenic obesity, weight loss, and mortality. Their research design included a longitudinal approach, where there was a mean follow-up of eight years. Their research defined sarcopenic obesity through criteria where the participant had a BMI ≥30 and measured muscle by grip strength (<35.3 kg for men and <19.6 kg for women). Based on their findings, sarcopenic obesity did not create a more significant risk of mortality than if the individual only experienced sarcopenia. Further, individuals experiencing weight loss with sarcopenia had the most significant risk of mortality.

Sarcopenia and sarcopenic obesity often follow older individuals developing many other conditions, which can have an impact on mortality. One of those conditions is cirrhosis. Hara et al. (2016) examined the relationship between sarcopenia and sarcopenic obesity as predictors of

survival for patients experiencing cirrhosis. Like Halmer and O'Donovan (2017), Hara et al. (2016) was a longitudinal study with a mean observation period of 1,005 days. Their findings supported a statistically significant relationship between skeletal muscle mass. They decreased serum albumin levels, a common outcome of liver disease, inflammatory disease, and malnutrition and that body composition is a significant factor influencing long-term survival for patients experiencing cirrhosis (Hara et al., 2016). Malnutrition also remains a concern because of its relationship with obesity, as well as being a factor that has negative consequences for postoperative complications (Fu et al., 2016). For example, according to Fu et al. (2016), patients receiving a total hip arthroplasty have a significantly higher risk of postoperative complications and run the risk of complications when malnutrition is present along with obesity. These findings support the conditions present with sarcopenic obesity as having some impact on the health and wellness of an older person in the post-operative period. Therefore, further research is essential to understand sarcopenic obesity as the findings could support the discussion of possible treatment options to prevent mortality as well as contribute to a scholarly agenda for possible future research.

In addition to mortality, other health problems linked to sarcopenia and sarcopenic obesity. The body of research on the topics of sarcopenia and sarcopenic obesity includes some research on the presence of obesity in sarcopenic obesity; however, the emergence of obesity among older individuals with sarcopenia is not understood thoroughly. Bellfanti et al. (2017) examined the issue of oxidative stress and its influence on cardiovascular disease risk among older individuals with sarcopenic obesity. Bellfanti et al. noted that oxidative stress could represent the line between sarcopenia and obesity because there is a significant increase in circulating oxidative stress markers present in sarcopenia and that there is a close relationship

between the HNE and MDA adducts and sarcopenia. Bellfanti et al. (2017) supported further research on the topic of sarcopenia to understand prevention strategies and how to limit sarcopenia. While this dissertation is not designed to complete an investigation of best practices for limiting sarcopenia, Bellfanti et al. and other research support including suggestions for future research related to prevention and mitigation in Chapter 5 of this dissertation.

Benefits of Sarcopenic Obesity Research

Scholarly literature on the topic of sarcopenic obesity includes some solutions for the problems which follow with the presence of sarcopenic obesity. While Halmer and O'Donovan (2017) found that weight loss relates to mortality for an older individual with sarcopenic obesity, some solutions exist. Jung and Park (2018) completed a systematic review of a small grouping of literature on the topic of health-related factors tied to sarcopenic obesity. Their findings from their review included the existence of some low-risk exercises which have a positive impact on the health and wellness of patients experiencing sarcopenic obesity. The researchers support using circuit training rather than resistance training because of the substantially lower risk of injury. The focus of this dissertation is on understanding the factors which relate to older individuals being diagnosed with sarcopenic obesity; however, the discussion and conclusion of this project also include some discussion of a scholarly agenda and future research to come following this work. Jung and Park (2018) note that while prior research supports circuit exercise, there is a lack of research with findings related to the intensity, frequency, time, and duration in which older individuals should complete the exercise. A possible avenue is exploring treatment for the condition of sarcopenic obesity in a way that results in healthy outcomes; hence, the inclusion of these findings in this review.

Socioeconomic Status

Socioeconomic status is the social class or standing of a group or an individual. Measurements of socioeconomic status include factors such as education, occupation, and income, with the focus of socioeconomic status research focusing on issues such as privilege (Pathirana & Jackson, 2018). This section involves a review of the extant literature on the topic of socioeconomic status. In terms of health and wellness, socioeconomic status is an essential factor because of differences in health outcomes for people of a different race (Williams et al., 2016), income (Prag et al., 2015), education (Stormacq et al., 2019), and many other factors. Socioeconomic status fits with the current research because it is an individual factor that aligns with the socio-ecological model (Bronfenbrenner, 1979). Further, socioeconomic status also ties to the cost of healthcare, and understanding how costliness impacts different citizens is essential to the delivery of healthcare (de Boer et al., 2019). This section reviews socioeconomic status concerning health outcomes, with the specific ties between socioeconomic status and obesity remaining the focus in a subsequent section.

Understanding Socioeconomic Status and Health

An abundance of scholarly literature exists on the association between socioeconomic status and health, with the body of literature extending into several divergent directions. The body of literature includes studies involving research examining the role of the national origin of participants (Prag et al., 2015), health literacy (Stormacq et al., 2019), and race (Williams et al., 2016). Establishing health and wellness in the population requires some degree of healthcare self-management and education. Stormacq et al. (2019) completed an integrative review of the issue of healthcare literacy as a mediator of the relationship between socioeconomic status and health. Health literacy involves the capability of an individual to read and understand material on

health and wellness and understanding how it applies to their situation (Stormacq et al., 2019). Health literacy is an essential factor based on their review of 16 studies investigating health literacy as a mediator of the relationship between socioeconomic status and participant health. Based on their review, socioeconomic status factors, but particularly education, are significantly associated with both health literacy and participant health, particularly health status, quality of life, health behaviors, and preventative service use (Stormacq, Van den Broucke, & Wosinski, 2019). As education is significantly related to several health outcomes, these findings support the line of research pursued in this dissertation. While the focus of this dissertation is not on health literacy, the scholarly agenda propositions made in the future research discussed in Chapter 5 is influenced by the importance of health literacy. Several other socioeconomic factors exist to consider.

There are many demographic and socioeconomic factors to consider concerning health, where issues such as race can result in significantly different health outcomes under otherwise similar conditions. Williams et al. (2016) investigated the relationship between socioeconomic status and health. Their article included a synthesis of research on these factors. They noted that for racial and ethnic stigmatized individuals, there are higher rates of impairment, illness, and earlier death than the mean for their society. Assari et al. (2018) also investigated race as a factor in the relationship between socioeconomic status and health. Their research was a follow-up to research completed through the National Urban Sample of Youth, which focused on the diminished health return for Black individuals through family structure and socioeconomic status. According to the findings of their longitudinal research, race by gender stratified regression models resulted in the most consistent relationship between socioeconomic status and future BMI for White females and males. These findings contribute further support for this

research because of the role that socioeconomic status plays in BMI, a measurement of individual height-to-weight, and a factor suggesting obesity.

Further, socioeconomic status, as measured by education, income, and occupational status, remain significant predictors of health outcomes. Their review supported Praget al. (2015), who noted that the relationship between socioeconomic status factors and the health and wellness of individuals is, in part, related to the nation in which they live. Williams et al. (2016) noted the same; however, they also discussed the importance of racial divisions, something not discussed at-length by Prag et al. (2015). Hence, socioeconomic status is essential to understand; however, demographics remain a consideration when examining the impact on health outcomes for individuals.

While socioeconomic status relates to health, it can also be a factor influencing multiple issues related to health. Pathirana and Jackson (2018) investigated the issue of socioeconomic status and multimorbidity through a systematic review of literature and meta-analysis of findings. Multimorbidity is the presence of several health problems in the same individual (Pathirana & Jackson, 2018). Their research included education as a factor influencing the relationship between socioeconomic status and multimorbid health problems. Based on their findings, education level has a significant influence on socioeconomic status and multimorbidity, with there being a 64% increase in the likelihood of multimorbidity between individuals with low education and those with high levels of education. Obesity is associated with multimorbidity in other research. Canizares et al. (2018) noted that “obese individuals, particularly Gen Xers and younger boomers, reported multimorbidity at an earlier age than those of normal weight. We observed divergent trajectories of greater multimorbidity for lower than higher income individuals” (p. 1303). Therefore, obesity is a problem that can relate to several different issues.

These findings further support for this dissertation, as the dissertation includes education as a factor hypothesized to influence the health outcome of obesity.

While low levels of education hold a substantial impact on the relationship between socioeconomic status and health outcomes, low levels of socioeconomic status can also have an impact on health and wellness. One of these health outcomes is health shocks. Health shocks are healthcare issues that have a significant and negative impact on an individual's lifestyle (Leonard et al., 2016). Leonard et al. (2016) investigated health shocks where participants were required to experience changes in household structure, had changes in residential mobility, or were forced to make use of social services. Socioeconomic status plays a role in the event of health shocks where there is an impact on the ability of families to travel to gain access to food or the need for additional members of the household to live in the home. These findings further elucidate how socioeconomic status impacts the dietary habits of people in a low socioeconomic status category, where food access and choice are limited for people who experience health shocks, meaning that living arrangements impact diet. Leonard et al. (2016) discussed the role of nonprofit food distribution centers and food cost as factors having further impact on health.

Several healthcare self-management factors can also impact health-related outcomes and should be considered in research alongside research on socioeconomic status and education. The impact of socioeconomic status on health outcomes among individuals from different ethnic backgrounds was the focus of Shea et al. (2016). Their findings did not support significant differences according to ethnicities; however, the findings did support the existence of other factors concerning poor health outcomes. Shea et al. (2016) found that several factors such as old age, smoking, hypertension, diabetes, not taking a statin and high coronary calcium were factors related to poor health outcomes; however, income and education had a 7% and 14% greater risk,

respectively, of poor health outcomes. Further, participants with the lowest level of income and education had a 21% greater risk of poor health outcomes than those who had the highest category of risk. Hence, education and socioeconomic status are factors that remain important to consider in research related to health outcomes. Therefore, these findings contribute further support for this dissertation.

Obesity is a health-related problem that individuals frequently experience. Obesity is often measured by a body mass index (BMI) of ≥ 30. Hobbs et al. (2017) examined the relationship between socioeconomic status and obesity, accounting for participant levels of physical activity. Based on the findings, participants believed that the optimal location for physical activity was a physical facility, followed by parks; however, access to physical facilities and park access is limited by economic factors such as cost or facility. Hence, there is support for the relationship between socioeconomic factors and obesity; however, further research on the topic is essential to understand how this relates to specific forms of obesity, specifically sarcopenic obesity.

Age is another factor to consider in terms of socioeconomic status and the role of socioeconomic inequality. Elgar et al. (2016) investigated the differences in adolescent health among different levels of socioeconomic position. They noted that socioeconomic differences in health and wellness remain common across age groups and health domains, but that socioeconomic position, even among adolescents, can play a factor in health outcomes. Included in their findings was the discovery of inequalities in health and life satisfaction among different levels of socioeconomic positioning. Additionally, subjective and objective socioeconomic positioning relates differently to health outcomes for adolescents. Their research also supports the existence of possible bi-directional effects on health and wellbeing, where health inequality

impacts social status, and social status impacts health inequality. Based on these findings, a review of literature reflecting on an iterative influence between socioeconomic status and health is essential in terms of understanding the conceptual model of this research.

Iterative Influence Among Socioeconomic Status and Health

In addition to the existence of several socioeconomic and demographic factors that influence health, how they impact health is essential to understand. While Stormacq et al. (2019) found several studies supporting the existence of a factor mediating the relationship between socioeconomic status and health, Hoffmann et al. (2018) examined the different pathways through which socioeconomic status impacts health. Their research included retrospective survey data from 10 separate European countries and the investigation of the relationship between socioeconomic status and health through structural equation models utilizing a cross-lagged panel design. The different models examined the existence of three distinct causal mechanisms where social causation, health selection, and indirect selection were how socioeconomic status impacted health. The findings support changes throughout an individual's lifetime in terms of the relationship between socioeconomic status and health. Social causation, where socioeconomic status impacts health, and health selection where health impacts socioeconomic status are both equal during childhood and in the transition to working age. In the transition between working age to old age, causation becomes the most dominant model. These findings are supported by Ansari et al. (2018), who found that demographic factors such as gender and race can impact the relationship between socioeconomic status and health, specifically with there being differences in health improvements over time where Black males and female health improves less than White male and female health. While these findings support the existence of relationships where socioeconomic status and health can be either independent or dependent to one another,

understanding the possibility of complex interrelationships between these factors remains essential as well.

As researchers continue to investigate the relationship between socioeconomic status and health, the direction of the relationship between socioeconomic status and health remains challenging to classify. Alvarez-Galvez (2016) investigated the interrelationships between these factors, relying on a Bayesian Network approach to modeling the relationship. Through his research, Alvarez-Galvez determined that there is a complex interrelationship, and that socio-demographic factors such as gender and age are essential elements when interpreting the framework for the relationship between socioeconomic status and health. Within the complex structure are relationships where economic determinants impact health, while health and wellness impact economic viability. The findings support socioeconomic and socio-demographic factors as playing a more significant role as predictors than outcomes in the relationship with health and wellness in the study. Based on these findings, the relationship between socioeconomic status and health factors is one where socioeconomic status predicts health.

As researchers continue to investigate the relationship between socioeconomic status and health, different approaches to measuring the relationship along the lines of different factors are designed into models. Erreygers and Kessels (2017) investigated the relationship between socioeconomic status and health, accommodating for the issue of inequality. The researchers noted that inequality is a factor that must be considered as a measurement of bivariate inequality, utilizing an index in research on the topic. Their research included secondary data from the Survey of Health, Ageing, and Retirement in Europe Wave 4. The novelty of their research included the possibility of developing health variable levels, which are based on both socioeconomic and health variables, with the capacity to include sensitivity in the measure of

inequality in the research. Their research elucidated the extent to which quantitative research on the relationship between socioeconomic status and health could be constructed around modified indices.

Demographics remain an essential factor in research involving socioeconomic status and healthcare because they are a way to determine how personal characteristics lead to differences in healthcare and treatment. Gyasi and Phillips (2018) discussed this relationship where the outcome was health service utilization to understand the implications for healthcare policy. Their quantitative research relied on secondary data collected from the 2016/17 Ageing, Health, Psychological Wellbeing, and Health-seeking Behavior Study, with a focus on individuals 50 years and older to understand factors that influence healthcare use. Based on their findings, several demographics play a role in whether an individual accesses health services. Relevant to this dissertation, education has a positive impact on health service utilization, as do demographics such as gender, marital status, age, and income (Gyasi & Phillips, 2018). These findings support this research as education, and personal factors impacted health service utilization, and health service utilization is a critical means of avoiding obesity. Just as research on the topic of socioeconomic status and health includes several demographic factors, research supports the existence of disparities in healthcare treatment among people from mixed rural and urban communities in the US. Wi et al. (2016) investigated the relationship between ethnicity, socioeconomic status and healthcare disparities in mixed rural-urban communities. “While the association of ethnicity with the prevalence was observed for all the chronic diseases, SES modified the effect of ethnicity for clinically less overt conditions (interaction P-value < .05 for each condition [diabetes, hypertension, and mood disorder]), but not for CHD, a clinically more overt condition” (Wi et al., 2016, p. 612). Based on these findings, socioeconomic status has an

impact on the effect of ethnicity on chronic disease risk. Therefore, research, including the investigation of socioeconomic status, is improved by adding demographic variables into the research.

Socioeconomic status plays a pervasive role in healthcare outcomes for individuals, and there continues to be an increase in the number of obese individuals in the US. In research on the epidemiology of obesity, Hruby (2015) noted that obesity in the US increased substantially from 1960-2015, with age-adjusted obesity rate increasing from 13% to 23% from 1960-1994 and from 23% to 32% from 1994-2004. Obesity's rapid increase in frequency in the US is a factor contributing to the importance of research focused on understanding the factors which predict an obese condition. Further, Hruby found that socioeconomic status, ethnicity, and gender all play a role. Specifically, Hispanics and non-Hispanic Blacks had a 43% and 48% rate of obesity, respectively. As Hispanics and non-Hispanic Blacks also have lower income levels and education levels than the median in the US, there is a socioeconomic and education-related tie to the problem of obesity. The focus of this dissertation is on a specific form of obesity, sarcopenic obesity, which occurs when an individual experiences both loss of muscle mass and obesity at the same time (Tyrovolas et al., 2015). The following section of this dissertation involves a review of the current body of research related to obesity, specifically sarcopenic obesity and the demographics and socioeconomic status factors related to obesity.

Education and Obesity

Demographics play a role in the presence of obesity, as discussed in the previous sections of this exhaustive review of extant literature. In addition to these individual internal characteristics, some research supports the role of education as a factor influencing obesity. Barcellos et al. (2018) examined the role of education as a factor reducing the health differences

related to obesity. They noted the presence of health differences that relate to genetic risk; however, these differences may be reduced by education factor. Gene-by-environment interactions were the term used to describe these interactions. The findings included a significant impact on body size, lung function, and blood pressure in middle age for people with higher levels of education. Further, the results included there being a reduction of genetic risk of obesity from 20% to 6% because of education level. Therefore, when a person's genetics predispose them to obesity, education is a factor that may reduce their risk of obesity. While this research elucidates the benefits of education as a factor for overcoming the genetic risks of obesity and unhealthy body size in the context of genetic predisposition, the findings do not address the context of disease. Hence, while these findings support education as a factor that impacts obesity, the research does not give conclusive evidence in the context of sarcopenic obesity.

The research on the impact of higher education on obesity is essential because of the importance of preventative care in the scope of obesity avoidance. Bockerman et al. (2017) investigated the role of higher education as a factor protecting against obesity. This research relates to the research completed by Barcellos et al. (2018), as their research design investigated the role of education as a factor reducing the prevalence of obesity. Bockerman et al. (2017) differ from Barcellos et al. (2018) in that while Barcellos et al. sought to understand how well education reduces the prevalence of obesity, Bockerman et al. (2017) sought to identify the causal effects. Their research relied on Mendelian randomization, which involves reliance on genes of known function as a way to determine the causal effect of exposure on the disease when completing observational research (Bockerman et al., 2017). Their findings supported the existence of a statistically significant impact, where education significantly reduced BMI. Based on these findings, education is a protective factor that holds a significant impact on obesity;

however, like Barcellos et al. (2018), this research does not include the issue of obesity onset because of disease or even consider issues such as a reduction in muscle mass or advancement of age. This dissertation uncovered the strength of the relationship between education and obesity in the case of obesity, where the disease was a driving factor. In this case, sarcopenic obesity.

While education appears to play a role in obesity, other factors may play a role as well. Assari (2018) investigated the link between education and obesity while examining the strength of the association based on sexual orientation. Assari (2018) noted that previous research supported the strength of education as a predictor of obesity differed according to other factors. Factors such as ethnicity can impact the relationship between education and obesity, where Whites experienced the most significant difference. In Assari's research, the results supported the relationship between education and obesity, but the results also included a significant interaction where sexual orientation and education significantly impact obesity. The relationship is more influential among heterosexual than homosexual individuals. Based on these findings, there is further support for research on the relationship between education and obesity, but there is also support for examining other factors in the same research. Further support for investigating the role of demographic factors and education comes from Flegal et al. (2016), who investigated the role of sex, age, race, smoking status, and education as factors impacting the development of obesity between 2005 and 2014. Their findings include further support for the investigation of the impact of demographics and education on obesity as the results include statistical significance were adjusted for age, race/Hispanic origin, smoking status, and education significantly related to obesity in women, but not in men. Therefore, further research is necessary to understand differences. This research did not differentiate between different forms of obesity; however, the focus of this dissertation is focused on the condition of sarcopenic obesity.

The research on the topic of the relationship between education and obesity remains relatively consistent in that there appears to be a significant, negative relationship between the factors. Further examination of the relationship includes the examination of factors interacting with the relationship. Perez-Ferrer et al. (2018) examined the role of wealth in the relationship between education and obesity. This research included income to understand whether obesity was influenced by specific categories of wealth and income in the 1988-2016 time-frame. Their findings were somewhat similar to those of Assari (2018), where the relationship with obesity was significant for women, but not for men. For women, holding the lowest level of education led to a 45% higher prevalence of obesity than women with the highest level of income. Based on these findings, there appears to be a relationship among women where a low level of education will likely lead to obesity, but a high income will likely not. However, for men, this relationship is not present.

One of the reasons for the impact of education on obesity prevention could be nutrition education. Goldberg and Wright (2015) investigated the relationship between nutrition education and obesity prevention over two decades to understand the long-term impact of nutrition education as a factor impacting obesity. They noted the importance of nutrition education as a factor impacting obesity, and that the inclusion of alcohol education can have a significant impact on the prevention of obesity. This research was different from most other research on the topic of education and obesity, as while research typically takes a quantitative approach, this research was qualitative; however, the research did rely on frequencies as a measure of the most common interventions. Goldberg and Wright's research supports the implementation of interventions that positively influence behavior and where there is a clear understanding of the way that desired outcomes are achieved. While their research supports interventions that

influence behavior, the nature of these interventions must be considered as research does not support there being a statistically significant impact in all instances of intervention.

The role of education as an intervention to avoid obesity remains an important topic to explore, with some researchers investigating the issue of limitations of studies focused on school-based nutrition education. Kong et al. (2016) investigated the body of research, completing a systematic review and meta-analysis of the topic. Their research includes a critique of the body of research surrounding the relationship between education and obesity. They noted that research has a short intervention duration, and that the randomization methods appear inappropriate, with there being selection bias and that the baseline characteristics are unbalanced. Based on their findings, nutrition education does not have a significant impact on obesity. Therefore, further work is necessary to improve nutrition education. However, while Kong et al. do not find that nutrition education has a significant impact on obesity, education, in general, does have a significant impact. This research contributes further support for the examination of the relationship between education and obesity.

Education and Sarcopenic Obesity

The issue of education as a factor related to sarcopenic obesity is discussed in relatively few studies. Often, education is included with a group of other variables and does not receive featured status either in analysis or discussion. An example of this is in research by Batsis et al. (2016). The focus of this research was on understanding how a multitude of factors related to sarcopenia and sarcopenic obesity. Their research included education as a covariate covering socioeconomic status with smoking, and the extent of education was measured by whether an individual completed 12 years of school or not. A similar approach to understanding sarcopenic obesity and mortality was taken by Van Aller et al. (2017), where the researchers included

education as a covariate. However, there was a lack of focus on how education-related to sarcopenic obesity. Like Batsis et al. (2016), Van Aller et al. (2017) measured education as being greater than or less than or equal to 12 years of schooling. Based on the statistics included in the model measuring the relationship between several demographic factors and factors measuring socioeconomic status, there was a statistically significant relationship; however, reporting on education was relatively weak, and determining the impact of education alone on sarcopenic obesity is not possible. A similar problem arises with the research by Ozturk et al. (2018), where education was encompassed in the discussion of the relationship between health-related quality of life and the development of sarcopenic obesity. The problem remains that there is a lack of research that features the relationship.

There is some evidence on the relationship between education and sarcopenic obesity; however, the evidence does not support a link. Tyrovolas et al. (2016), not that that there is little difference in the frequency of people who do not have sarcopenia and those with sarcopenic obesity, and that this is consistent among three education cohorts (primary, secondary and tertiary). Pang et al. (2020) noted that education level does play a significant role, where people with the highest level of education were also the least likely to develop sarcopenic obesity. Based on these findings, there is a lack of consistent evidence and a gap in the literature involving understanding the role of education as a factor influencing sarcopenic obesity. However, there is also evidence of a significant impact where education generally influences obesity. Therefore, there is a role for education as an independent variable included in the research for this dissertation.

Research on the topic of obesity is necessary because of the generally high levels of obesity in the US, with 35% of men and 40.4% of women reporting an obese condition, and

5.5% of men as well as 9.9% of women being class 3 obese (Flegal et al., 2016). There is also support for further investigation into obesity and education because several studies support there is a significant relationship between the factors (Assari, 2018; Barcellos et al., 2018; Bockerman et al., 2017). One of the problems is that there is a lack of research investigating the relationship between education and sarcopenic obesity. This dissertation fills a gap by investigating this relationship with a focus on sarcopenic obesity as a specific form of obesity that has not been the focus of current research. As obesity and old age become increasingly frequent in the US, further research deducing significant predictors of sarcopenic obesity is essential.

Summary

This chapter included an exhaustive review of the extant literature on the topic of sarcopenic obesity, a proposed theoretical framework for research on the topic, and factors that may predict sarcopenic obesity. The chapter began with an introduction discussing the purpose of the research and how the theoretical framework aligns with the purpose. The introduction also included a brief argument on how the different factors involved in the research fit together into this study and the several different databases and search engines utilized in this research. The chapter progressed to a description of the theoretical framework. The discussion of the theoretical framework was robust, even incorporating some discussion of systems theory, which was a motivating theory that drove the development of social-ecological theory. This discussion was necessary to elucidate the theoretical framework further and shed light on the history of the framework. The theoretical framework section included many seminal writings, including work by Bronfenbrenner (1970; 1979) and von Bertanaffy (1950), as well as different views on the development of the social-ecological theory, as well as research which rely on social-ecological

models. This discussion supported the use of social-ecological theory as the support for the quantitative model examined in this research.

The literature review continued with the synthesis of socioeconomic status. The review of socioeconomic status involved literature published between 2016 and 2020 to illustrate recency and relevance of the topic in terms of its current popularity. Socioeconomic status was reviewed in terms of how it is that it is measured in different studies and the importance of socioeconomic status as a predictor of health-related outcomes. The section on socioeconomic status did not touch on obesity at great length; however, it did incorporate some literature focused on obesity and sarcopenic obesity. The bulk of the discussion on obesity and sarcopenic obesity would follow in future sections of the literature review. Obesity was the next section of the literature review. The section began with a discussion of obesity in general, and how many other factors cause the condition. The discussion on obesity was thorough in terms of discussing the role of factors related to this dissertation as influencers of obesity. However, also to express that while these factors are influencers of obesity in general, there is a lack of research supporting the impact of factors such as demographics, socioeconomic status, and education as factors related to sarcopenic obesity. The literature review then continued with a discussion of sarcopenic obesity, while highlighting that there are still gaps in the research on the topic and that this dissertation can contribute to filling some of those gaps.

The literature review concluded with the relationship between education and obesity. This section began with a discussion of how education relates to obesity, focusing on several quantitative studies where the relationship between the factors was established. The previous literature on the topic of education and obesity supports the existence of links between the factors; however, there is a lack of research on the relationship between education and

sarcopenic obesity. In terms of sarcopenic obesity, there is scant research involving education. Research involving the relationship between education and sarcopenic obesity often involves education as a minor factor that does not receive a great deal of attention. Indeed, education is not a featured factor in most current research where it is examined as affecting sarcopenic obesity. Often it is a covariate in a much larger model or a factor that is a part of a measurement of a more significant factor.

There is a gap in the body of research involving factors that influence sarcopenic obesity, and filling this gap requires further evidence involving demographic, socioeconomic, and education as factors influencing sarcopenic obesity. This research will fill that gap using the quantitative design. Chapter 3 includes the research methodology of this study. The chapter includes a discussion of the research method and design, how data were collected, as well as data analysis methods. Data analysis involved filling a substantial gap involving factors influencing sarcopenic obesity. Chapter 3 includes the process to fill the gap in research.

Chapter 3: Research Method

Introduction

The purpose of this quantitative causal-comparative study is to identify socioeconomic, demographic characteristic, and education factors which are significantly related to sarcopenic obesity. The literature review in Chapter 2 involved the relationship between socioeconomic status, demographics, and education. The body of research supports the existence of a relationship between the independent variables and obesity; however, there must be more research involving sarcopenic obesity. This research was focused on the Houston metropolitan area in Texas among participants who were 65 and older.

This chapter begins with an introduction to the research design and rationale supporting the quasi-experimental research design. The chapter continues with the population and sampling strategy and power analysis, justifying the use of a medium effect size, an alpha level of .05, and a power level of 0.80. Procedures for recruitment, participation, and data collection follow the population and sampling techniques with a description of recruiting, informed consent distribution, and follow up. The chapter then includes a discussion of instrumentation and operationalization and the use of chi-square analysis and logistic regression for data analysis. The chapter concludes with a discussion of threats to validity and ethical procedures.

Research Design and Rationale

The research involved a single dependent variable and three separate independent variables. The dependent variable in this study is sarcopenic obesity. This was measured based on respondents' BMI and pass-fail status on the yubi-wakka test. There must be both a BMI > 29.9 and a passing status on the yubi-wakka test to consider participants positive for sarcopenic obesity (Tanaka et al., 2018). The survey was used to collect data on participants' age, gender,

marital status, ethnicity, socioeconomic status, and education level. The proposed model for sarcopenic obesity only included socioeconomic status as measured by income, education level, and race as possible predictors. Income was measured based on highest income level attained by the respondent in their lifetime, while education level was measured based on the highest degree completed.

A quantitative causal-comparative design was best for this project. This design was used to determine the significance of cause-effect relationships between variables. Independent variables are often categorical and categories represent preexisting groups (Bruce et al., 2017). This study required a research design which aligned with the objective of determining the causal significance of independent variables on a dependent variable. Therefore, a quantitative causal-comparative design was used in this study.

The quantitative causal-comparative design is common in healthcare research and frequently employed to understand the role of different factors as influencers of specific forms of obesity (Chandler et al., 2017; Kurz & Konig, 2020). This study involves examining factors which lead to sarcopenic obesity. Factors leading to obesity often pre-exist prior to research, as they do in this dissertation; hence, the need for causal-comparative research to identify causal links between predictors and obesity. If the research focus had included understanding factors that reduce obesity, an experimental research design would have been more appropriate. Seida et al. (2018) reviewed research focused on patients with obesity to understand the factors which reduce patient obesity. Each of the 29 studies included in the research was experimental. A critical difference between those studies and this dissertation is that they involved in determining ways to reduce obesity, whereas this research involved understanding the factors that lead to obesity. Therefore, an ex post facto research design was more appropriate to determine causality.

Completing this research did not involve significant constraints on time or resources that would have resulted in research no longer being feasible. This research involved collecting data from participants during a single period of time, and there was no time window which constrained data collection. The population, as discussed later in this chapter, was large enough that identifying participants did not require a special timeliness consideration. This research did not require purchase of materials. The only purchase associated with this research was a temporary membership with SurveyMonkey in order for participants to complete the survey.

Methodology

Population

The population in this study was people who were 65 years and older living in the Houston metropolitan area of Texas. As of 1 July, 2019, Houston, Texas had a population of 2,320,268, of which 10.3% are individuals over 65. The Texas Department of State Health Services (2018) said 34.8% of people in Texas are obese, and obesity in Houston's public health region is 40.6%. the entire US population is composed of 328.2 million individuals, with a mean age of 38.2, and an obesity rate of 39.8% among adults over the age of 20 (CDC, 2020). The population of people 65 and over is 49.2 million. The CDC projected that the frequency of obesity among people 65 and older between 2007 and 2010 was 35% (Fakhouri et al., 2012). Differences, according to demographic factors, support examining demographics as a factor predicting obesity. For example, non-Hispanic White men between the ages of 65 and 74 had an obesity rate of 43.9%; non-Hispanic Black women who were 75 and over had an obesity rate of 49.4%. Men 75 years and older had obesity rates of 26.4% for non-Hispanic White, 30.6% for non-Hispanic Black, and 27.9% for Hispanic Americans (Fakhouri et al., 2012). For women 75 and older, rates were 27.5% for non-Hispanic White, 49.4% for non-Hispanic Black, and 30.2%

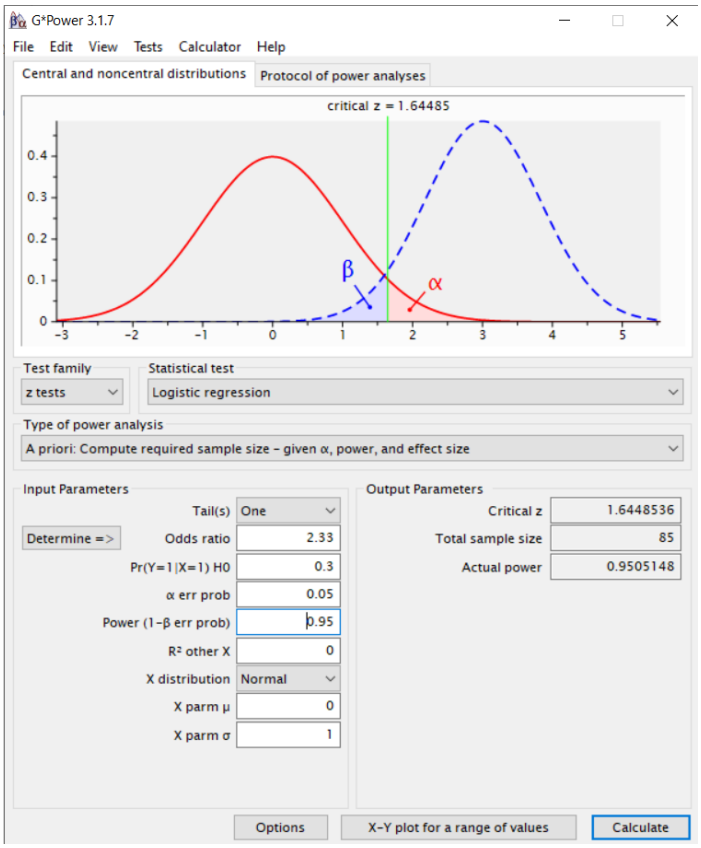
for Hispanic (Fakhouri et al., 2012). Differences in frequencies support the possibility of significant differences in terms of obesity based on demographics. In particular, I focused on sarcopenic obesity.

Sampling and Sampling Procedures

Sampling in this research involved participant selection based on availability and willingness to take part in research. Therefore, I used a convenience sampling method. This strategy was used in this research because a nonprobability sampling method was appropriate, and criteria did not require me to fill a quota or judgment on a case-by-case basis. Further, research did not include a hard-to-reach group; therefore, snowball sampling was not necessary. Volunteer bias is a form of bias where research involves participants who want to take part in the research (Neale, 1993). It should also be noted that there is a lack of research on reducing convenience sampling in causal-comparative research. Hence, this was a limitation for this dissertation. A priori power analysis was conducted to determine the sample size for the study. The tool used to calculate the sample size was G*Power version 3.1.9.2. The odds ratio was set for 2.33, Pr (Y=1|X=1) H0 was set for 0.3, alpha error probability was set for 0.05, power was set for 0.95, and a normal distribution was assumed. Results of the priori power analysis indicated that the minimum sample size given these parameters was 85, with an actual power of 0.951 (see Figure 1).

Figure 1

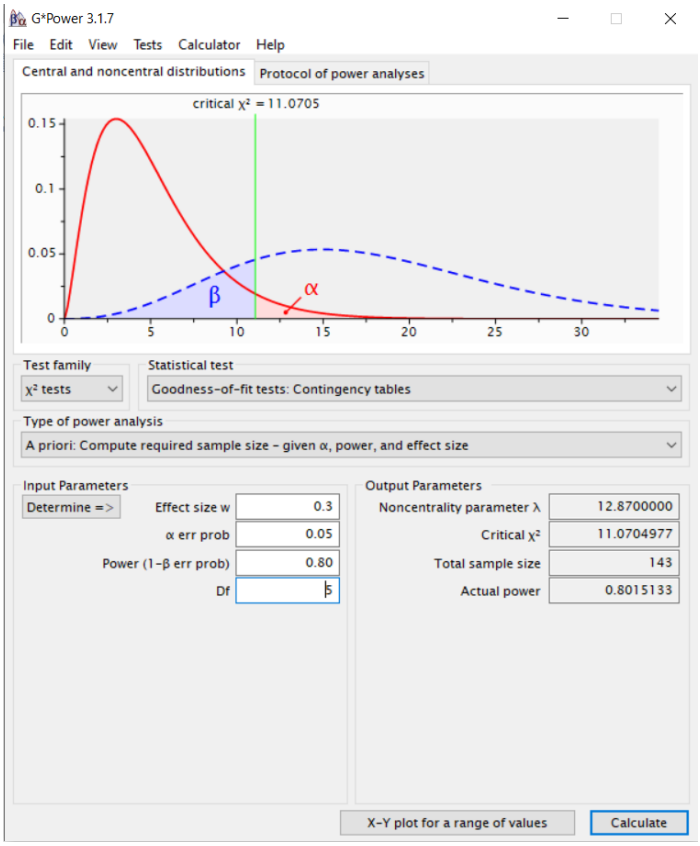
*Output of Priori Power Analysis in G*Power (Logistic Regression)*



A second a priori analysis was conducted to determine the required sample for the chi-squared tests. The priori test took into account the following parameters: an alpha value of .05, a desired medium effect size, and a power level of 0.80. Given these considerations, a minimum sample size of 143 participants was required. Assuming a 50% non-response rate, a minimum sample size of 220 respondents were targeted for this study.

Figure 2

*Output of a Priori G*Power Analysis for Chi-Squared Tests*



Procedures for Recruitment, Participation, and Data Collection

Three main channels of recruitment were used. First, the researcher contacted physicians in the Houston metropolitan area in Texas and asked these physicians to give an invitation flyer to patients who fit the inclusion criteria. Posters were likewise placed in the waiting room of the physician's office, and invitation flyers were made available for interested patients. Second, posters were also posted in local senior centers and invitation letters were provided. For these two recruitment channels, interested individuals were asked to visit the SurveyMonkey website for the study. The link to the website was provided on the invitation letter. Lastly, online recruitment was also conducted using social media. The invitation to participate in the study was posted in Facebook groups specific to elderly individuals, with a web link that interested

individuals clicked for more details about the study. The link redirected them to SurveyMonkey website for the study.

The inclusion criteria for this research were the participant's age as 65 years or older and living in the Houston metropolitan area in Texas.

SurveyMonkey is a web service used by researchers to collect data that includes options for digital survey creation and public links to surveys that researchers can distribute to possible volunteers. For this study, the first page potential participants encountered was the page outlining the inclusion criteria for the study. On this page, interested individuals were asked to answer two questions. The first question asked if they are aged 65 and above. The second question asked if the individual resides in the Houston metropolitan area of Texas. Individuals that answered any of the two questions with a "No" were redirected to a page thanking them for their interest in the study and informing them that they did not meet the inclusion criteria. Individuals that answered any of the two questions with a "Yes" were then allowed to proceed to the page containing the informed consent form for the study. The informed consent form contained all relevant data for the study, such as the nature of participation and time required for the participants and the risk and benefits involved in participating in the study. The participants were also made aware of options for counseling or mental health assistance if the items on the survey cause mental distress. At the end of the page containing the informed consent form, participants were made to click the "I agree" button before they proceeded to the page with the survey instrument. Participants who did not agree with the terms outlined in the informed consent form were made to click the "I do not agree" button, upon which they were redirected to a page thanking them for their interest in the study.

The last page on the SurveyMonkey website contained the survey instrument for the study. Data collected in the survey instruments included data related to the patient's demographic characteristics, starting with their age, gender, and marital status, followed by questions on their race, education level, and income. The information was collected to generate a demographic profile of the study participants, and the responses to the questions on race, education level, and income were used in the inferential analysis procedures for the study. Participants werealso asked to indicate their height and weight, which were used by the researcher to calculate BMI after the data collection period. The last question on the survey pertained to the yubi-wakka test, which provided instructions on how to conduct the test.

This research study was ex post facto in nature. Hence, the participant's survey item response was completed based on conditions already in place. The research was cross-sectional, meaning that participants responded based on their perceptions at one point in time. Participants did not undergo debriefing procedures. The only requirement for a participant to exit the study was to send their response at the end of the survey instrument. Participants were able to end their participation in the survey at any time by either sending the survey before completion or closing the browser window. Participation in this research was completely anonymous, and participant's privacy was maintained; therefore, there are no follow-up procedures for this research.

After data collection, the data file was downloaded from SurveyMonkey for data processing. One key procedure that was undertaken was processing the data to identify participants with sarcopenic obesity. This was done in four steps. First, using the data collected on the participants' height and weight, the BMI of the participants was calculated and generated as a new variable in the spreadsheet. Second, patients with a BMI greater than 29.9 were coded as obese. Third, another variable was generated to determine if the patient passed or failed the

yubi-wakka test. Participants who responded to the ninth question in the survey with “bigger” or “fits exactly” were coded as “0” to indicate that they have passed the yubi-wakka test. Participants who responded to the ninth question with “smaller” were coded as “1” to indicate that they have failed the yubi-wakka test. Lastly, a final variable for sarcopenic obesity was generated. Participants who were identified to be obese and have failed the yubi-wakka test were coded with “1” to indicate a positive diagnosis of sarcopenic obesity. Participants who were not obese or have passed the yubi-wakka test were coded with “0” to indicate that they are negative for sarcopenic obesity.

Instrumentation and Operationalization of Constructs

This research involved three independent variables and a single dependent variable. Each of the variables in this research was measured according to the categories that the variables fit into. All of the variables in this study are categorical. This section of the chapter describes how these variables were operationalized in this study.

Sarcopenic Obesity

Sarcopenic obesity served as the dependent variable of this study and was operationalized based on the participants’ responses to questions 7, 8, and 9 on the survey. These three questions pertained to their height, weight, and pass/fail status on the yubi-wakka test. For the purpose of this study, sarcopenic obesity was identified based on two criteria. First, the participant must have a BMI greater than 29.9. This was determined by calculating the participant’s BMI based on their height and weight. Second, the participant must fail the yubi-wakka test. The yubi-wakka test was conducted by having the participant place both of their hands around their non-dominant walking leg’s calf with the thumbs and ring fingers touching (Tanaka et al., 2018). If the measure of the non-dominant walking leg’s calf was smaller than the diameter of the fingers,

then the participant was considered to have failed the yubi-wakka test (Tanaka et al., 2018). Both conditions must be in place for the participant to be positive for sarcopenic obesity. Participants who had calculated BMI greater than 29.9, and failed the yubi-wakka test were coded as "1" to indicate that they are is diagnosed with sarcopenic obesity. Participants that had a body mass index less than 29.9, or had a body mass index greater than 29.9 but passed the yubi-wakka test were coded with a "0" to indicate that the participants are not diagnosed with sarcopenic obesity.

Race

Race was included as an independent or predictor variable in this study, and was operationalized as a categorical variable. Data for this variable was collected based on the responses to question number four on the survey. Multiracial individuals were asked to indicate the race that they predominantly identify with.

Education Level

Education level was included as an independent or predictor variable in this study, and was likewise operationalized as a categorical variable. Data for this variable was collected based on the responses to question number five on the survey. Participants were asked to indicate the highest level of education they have completed.

Income

Income was included in this study as an independent or predictor variable to represent the participants' socioeconomic status. Income was operationalized as a categorical variable based on their highest reported income in their lifetime. This specification was made based on the fact that one of the inclusion criteria of the study was that the participant must be at least 65 years old. Thus, it was assumed that many of the participants are already retired during the time of the

study, and were asked to report the highest yearly income they have earned during their lifetime. This information was collected based on the responses for question number six on the survey.

Other Demographic Characteristics

Aside from the three predictor variables of race, education, and income, data was also collected for other demographic variables, namely age, gender, and marital status. Participants were asked to indicate their age as of their most recent birthday. Thus, age was operationalized as a continuous variable based on responses to the first question on the survey. Gender and marital status were both operationalized as categorical variables, based on the participants' responses to survey questions two and three, respectively.

Data Analysis Plan

Analysis began with importing the data from the SurveyMonkey system to Microsoft Excel 2020. In Excel, the data was visually scanned to determine if any of the responses did not match options on the survey. The data was then scanned to determine if any of the surveys were not complete. Incomplete surveys were removed. The data was then processed to generate the additional variables necessary to identify participants diagnosed with sarcopenic obesity. The data was then exported to SPSS for descriptive and inferential statistical analysis. The variables included in the research are categorical; hence, descriptive statistics included frequency distributions. For the continuous variables like age and BMI, measures of central tendency were calculated. Crosstabulation with frequencies was included with the hypothesis test findings. The research questions and hypotheses in this dissertation are:

RQ1: Is there a statistically significant relationship between socioeconomic status, as measured by income, and sarcopenic obesity amongst individuals aged 65 and older?

$H1_0$: Among individuals aged 65 and older, there is no statistically significant relationship between socioeconomic status and sarcopenic obesity.

$H1_A$: Among individuals aged 65 and older, there is a statistically significant relationship between socioeconomic status and sarcopenic obesity.

RQ2: Is there a statistically significant relationship between race and sarcopenic obesity amongst individuals aged 65 and older?

$H2_0$: Among individuals aged 65 and older, there is no statistically significant relationship between race and sarcopenic obesity.

$H2_A$: Among individuals aged 65 and older, there is a statistically significant relationship between race and sarcopenic obesity.

RQ3: Is there a statistically significant relationship between education level and sarcopenic obesity amongst individuals aged 65 and older?

$H3_0$: Among individuals aged 65 and older, there is no statistically significant relationship between education level and sarcopenic obesity.

$H3_A$: Among individuals aged 65 and older, there is a statistically significant relationship between education level and sarcopenic obesity.

RQ4: Do income, race, and education level influence the incidence of sarcopenic obesity among individuals aged 65 and older?

$H4_0$: Income, race, and education level do not influence the incidence of sarcopenic obesity among individuals aged 65 and older.

$H4_A$: Income, race, and education level influence the incidence of sarcopenic obesity among individuals aged 65 and older.

Two statistical tests were used to address the research questions and test the corresponding hypotheses. For the first three research questions, a chi-square analysis was used to determine the existence of a statistically significant relationship between the demographic characteristics of income, race, and education level and sarcopenic obesity. A chi-square analysis was determined to be appropriate because it is commonly used to test relationships between categorical variables. Null hypotheses of chi-square analysis procedures posit that no relationship exists between the identified categorical variables. Hence, the chi-square analysis was appropriate for this study.

For the fourth research question, a binomial logistic regression was applied as a hypothesis test. In this research, each of the variables included are categorical variables. Groups included in the research are not dependent/matched groups; they are independent groups with two or more levels. These are the conditions that supported the binomial logistic regression test as the preferred test in this research, as binomial logistic regression includes the assumption that the dependent variable is dichotomous, and the independent variables are either continuous or categorical. The categorical predictor variables were dummy coded to match the requirements of the binary logistic regression. The number of dummy-coded variables was one less than the number of available categories under each variable. For socioeconomic status, the highest income achieved category had a numeric value of 1 for participants who responded the category as their highest income, otherwise, the numeric value was zero. The same was done for the education level variable. For race, the different ethnicity categories were considered. A numeric value of 1 was given to participants who were under the race or ethnicity and 0 if the participant was under a different race or ethnicity. All demographic categories were inputted as a predictor variable to determine which among the demographic characteristics significantly predicted the

classification of participants to sarcopenic obesity. There are no confounding or covariate variables included in this test. The significance of the association between socioeconomic status, demographic characteristics, and education level with sarcopenic obesity was determined at a significance level of $p < .05$. The Statistical Package for Social Science (SPSS) version 24.0.0.0 was the statistic software used to conduct all analysis procedures for this study. Table 1 below shows the summary of the analysis procedures conducted to address the research questions and hypotheses.

Table 1

Summary of Research Questions and Analysis Procedures

Research Question	Variables		Survey Questions	Statistical Test
RQ1: Is there a statistically significant relationship between socioeconomic status, as measured by income, and sarcopenic obesity amongst individuals aged 65 and older?	IV	Income	6	Chi-square analysis
	DV	Sarcopenic obesity	7, 8, 9	
RQ2: Is there a statistically significant relationship between race and sarcopenic obesity amongst individuals aged 65 and older?	IV	Race	4	Chi-square analysis
	DV	Sarcopenic obesity	7, 8, 9	
RQ3: Is there a statistically significant relationship between education level and sarcopenic obesity amongst individuals aged 65 and older?	IV	Education level	5	Chi-square analysis
	DV	Sarcopenic obesity	7, 8, 9	
RQ4: Do income, race, and education level influence the incidence of sarcopenic obesity among individuals aged 65 and older?	IV	Income, race, education level	4, 5, 6	Binary logistic regression
	DV	Sarcopenic obesity	7, 8, 9	

Threats to Validity

There were several threats to validity involved in this research. Not every threat can be mitigated, but threats that cannot be reduced are noted in the limitations of the research. Internal, external, and construct validity were three critical threats to validity considered. Confounding factors not accounted for as variable can have an impact on the association between socioeconomic status, race, and education level. The research design and the method of analysis did not account for how these other factors impacted the association between the independent variables and the dependent variable. Therefore, this is a limitation. Another threat to internal validity is that the participant was being observed by receiving and completing the survey instrument. This may have influenced the participant to make a response that was different from their honest beliefs. Another is the extent to which instrumentation was accurate. For example, the yubi-wakka test could have inaccurately described the state of a participant as sarcopenic or not. Participants responded to the survey anonymously and through a digital portal. Therefore, face-to-face instruction on how to correctly complete the yubi-wakka was not possible.

Bias is another possible threat to external validity. In this study, volunteer bias is a possible concern because of the sampling method used. There are a few different threats to construct validity. One is the definition of socioeconomic status. Because the participants in the research are older, typical definitions of socioeconomic status would not work. A participant's income and occupation are likely to be much different than during prime working years. Therefore, the highest income was used instead. This presents a threat to construct validity because it is possible that a participant had a high income for only a few years. Another threat is the measurement of sarcopenic obesity. There is no clear definition of sarcopenic obesity; however, the condition does involve weight gain and muscle loss. The tools used to measure

weight gain and muscle loss were relevant to this study. Therefore, this threat was addressed by using an evidence-based method to measure muscle loss.

Ethical Procedures

Human participants were treated in accordance with institutional review board standards. This included addressing ethical concerns related to recruitment materials and data collection. Recruitment materials described the purpose of the study and the data required from the potential participant. An ethical concern was a possibility of prioritizing encouragement over the health and wellness of the patient. This was addressed by reviewing materials with the committee chair and physicians supporting recruitment to determine if the posters accurately described the study and did not place undue pressure to participate. Another ethical concern involved data collection. Participants may find that they do not feel comfortable with completing the survey. The introduction to the survey informed the participant that they are free to stop taking the survey at any time and may do so by closing the browser window or clicking “Exit” at the bottom of the survey. The participant also had a number to call in case there was an adverse effect from taking part in the research.

Data treatment is another ethical concern. The data must remain anonymous and confidential to protect participants. Therefore, participants were not required to give their names to participate in the research. Internet Protocol data was collected; however, this data was used to support the claim that primary data was collected for this research. Once data collection was complete, the data was exported from SurveyMonkey. Once exported, the SurveyMonkey account was canceled to destroy the data. The data was exported to an encrypted thumb drive. The encrypted thumb drive was only accessed to complete data analysis. On completion of data analysis, the thumb drive will remain in a locked filing cabinet. It will remain there for five years

for the possibility that a third party would want to audit the data file. Once five years pass, the thumb drive will be destroyed.

Summary

Chapter 3 contains an explanation of the research design and methodology. The chapter began with a discussion of the research design, supporting the use of a causal-comparative research design based on its fit with the research questions and the poor fit of other quantitative research designs. The chapter continued with a description of the methods. The description included a description of the population and the sampling strategy. A convenience sampling method was selected. The power analysis supported a minimum sample size of 220 participants. The chapter proceeded with a description of the recruitment and data collection strategy. Data collection depended on working with physicians to advertise the research project and the possibility to volunteer to take the survey, advertisements in local senior centers, and through the use of social media. The chapter concluded with a discussion of instrumentation and operationalization of the variables, as well as the selection of data analysis methods. The statistical tests for this research are the chi-squared test and the binomial logistic regression test. The chapter ended with a discussion of threats to validity and ethical procedures.

Chapter 3 includes a review of procedures for data collection and analysis as well as research methods. Chapter 4 includes results of data analysis with tables illustrating findings, including a discussion of how the data collection process occurred and any deviations from the research plan. The chapter also includes descriptive statistics and concludes with hypothesis testing.

Chapter 4: Results

Introduction

The purpose of this quantitative causal-comparative study is to identify socioeconomic, demographic, and education factors which are significantly related to sarcopenic obesity. A sample of participants who are 65 and older and living in Houston, Texas in the US was included in the study. Data were gathered regarding age, gender, race, education level, and socioeconomic status as well as measures of sarcopenic obesity. The following research questions and hypotheses guided this study:

RQ1: To what degree does socioeconomic status predict sarcopenic obesity amongst individuals aged 65 and older?

H10: The relationship between socioeconomic status and sarcopenic obesity is not statistically significant at $p < .05$.

H1A: The relationship between socioeconomic status and sarcopenic obesity is statistically significant at $p < .05$.

RQ2: To what degree do demographic variables, such as race or gender or marital status, predict sarcopenic obesity amongst individuals aged 65 and older?

H20a: The relationship between race and sarcopenic obesity is not statistically significant at $p < .05$.

H2Aa: The relationship between race and sarcopenic obesity is statistically significant at $p < .05$.

H20b: The relationship between gender and sarcopenic obesity is not statistically significant at $p < .05$.

H2Ab: The relationship between gender and sarcopenic obesity is statistically significant

at $p < .05$.

H20c: The relationship between marital status and sarcopenic obesity is not statistically significant at $p < .05$.

H2Ac: The relationship between marital status and sarcopenic obesity is statistically significant at $p < .05$.

RQ3: To what degree does education predict sarcopenic obesity amongst individuals aged 65 and older?

H30: The relationship between education and sarcopenic obesity is not statistically significant at $p < .05$.

H3A: The relationship between education and sarcopenic obesity is statistically significant at $p < .05$.

This chapter includes data collection procedures that were used in the study. This chapter also includes demographic characteristics as well as obesity measures. Results of binomial logistic regression are also presented in this chapter. This chapter includes a summary of key findings in order to address research questions.

Data Collection

Participants were recruited through contacting physicians in the Houston, Texas area. I asked physicians to give survey information to patients who fit the inclusion criteria. All participants were 65 or older and lived in the Houston, Texas. Physicians were also asked for permission to place posters advertising the study in their offices. Requests for permission to place posters were also made to local senior centers. Interested participants were asked to access the link to the survey questionnaire in SurveyMonkey. Upon accessing the link, participants were asked to electronically sign the informed consent form. Participants were asked to respond to the

survey questionnaire containing demographic questions as well as the sarcopenic obesity test. All data were imported to SPSS version 26.0 for data analyses.

Data were cleaned using listwise deletion for missing values. Height values were converted to centimeters while weight values were converted to pounds. From a total of 243 respondents, 213 participant responses were included in analyses. Data were analyzed using frequencies and percentages to present demographic characteristics of participants. Descriptive statistics were used to present continuous variables such as age, height, and weight of participants. To test hypotheses, binary logistics regression analyses were conducted. Assumptions of binary logistic regression were also tested to ensure there were no violations prior to conducting analyses.

Results

A total of 213 participants provided complete responses on surveys (see Table 2). There are more female participants (n = 123, 57.7%) than male (n = 90, 42.3%). In terms of marital status, there are 110 married participants (51.6%), 45 divorced or separated participants (21.1%), 41 widowed participants (19.2%), and 17 single participants (8%). In terms of race, the majority of participants were White (n = 182, 85.4%). In terms of highest educational attainment, 76 participants have completed high school (35.7%), 59 completed a bachelor's degree (27.7%), 40 completed an associate's degree (18.8%), and 38 completed a postgraduate degree (17.8%). For household income, most participants had an annual income of between $25,000 and $49,999 ($n$ = 52, 24.4%). Sarcopenic obesity was assessed based on responses of participants to the yubi-wakka test. A total of 117 participants failed the test (54.9%), while 96 participants passed the test (45.1%).

Table 2

Frequencies and Percentages of Demographic Characteristics (N=213)

		Frequency	Percent
Gender	Male	90	42.3
	Female	123	57.7
	Total	213	100.0
Marital Status	Single	17	8.0
	Married	110	51.6
	Divorced/Separated	45	21.1
	Widowed	41	19.2
	Total	213	100.0
Race	White	182	85.4
	Black or African American	12	5.6
	Hispanic or Latino	12	5.6
	Asian	3	1.4
	American Indian or Alaska Native	2	0.9
	Other	2	0.9
	Total	213	100.0
Highest Educational Attainment		76	35.7
	Bachelor's Degree	59	27.7
	Associate's Degree	40	18.8
	Post-graduate Degree	38	17.8
	Total	213	100.0
Household Income	Below $25,000	43	20.2
	$25,000 to $49,999	52	24.4
	$50,000 to $74,999	48	22.5
	$75,000 to $99,999	24	11.3
	$100,000 to $150,000	31	14.6
	Above $150,000	15	7.0
	Total	213	100.0
Sarcopenic Obesity	Fail	117	54.9
	Pass	96	45.1
	Total	213	100.0

Continuous demographic characteristics were presented using measures of central tendencies (see Table 3). Age of participants ranged from 65 to 92 with a mean of 70.54 (*SD* = 4.93). Height of participants ranged from 152 to 231 centimeters, with a mean of 171.27 centimeters (*SD* = 14.84). Weight of participants ranged from 100 to 325 pounds, with a mean of

186.31 pounds (*SD* = 44.05).

Table 3

Descriptive Statistics of Demographic Characteristics (N=213)

	N	Min	Max	Mean	SD
Age	213	65.00	92.00	70.54	4.93
Height	213	152.00	231.00	171.27	14.84
Weight	213	100.00	325.00	186.31	44.05

To test RQ1, household income of participants was considered as the predictor while sarcopenic obesity was the dependent variable. To test assumptions of binary logistic regression, the dependent variable must be a binary variable. In this analysis, the dependent variable was coded as 1 if participants passed the yubi-wakka test and 0 if they failed. The second assumption was that the observations were independent of each other. The third assumption was that there was little or no multicollinearity between predictors. For this analysis, there was only one predictor. Thus, assumption of multicollinearity was not violated. The fourth assumption was that there was linearity of independent variables and log odds. The predictor variable in the analysis is categorical. Therefore, this assumption does not apply. Finally, the assumption that binary logistic regression requires a large sample size. The sample size in the study is 213, which is above the minimum required sample size of 85 for this study. Therefore, all assumptions were met.

The result of the binary logistic regression is presented in Table 4. The result showed that none of the household income categories significantly predict the sarcopenic obesity classification of participants (all *p*-values> .05). The model also explains 3.2% of the variance in sarcopenic obesity and correctly classified 58.2% of the cases. Therefore, there is insufficient evidence to reject the null hypothesis which stated that the relationship between socioeconomic status and sarcopenic obesity is not statistically significant at $p<.05$ level.

Table 4

Binary Logistic Regression for RQ1 – Sarcopenic Obesity as Dependent Variable

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Below $25,000			5.106	5	0.403			
	$25,000 to $49,999	-0.266	0.609	0.190	1	0.663	0.767	0.232	2.531
	$50,000 to $74,999	-0.875	0.599	2.135	1	0.144	0.417	0.129	1.348
	$75,000 to $99,999	-0.828	0.604	1.880	1	0.170	0.437	0.134	1.427
	$100,000 to $150,000	-0.916	0.675	1.843	1	0.175	0.400	0.107	1.502
	Above $150,000	-0.341	0.638	0.286	1	0.593	0.711	0.204	2.483
	Constant	0.405	0.527	0.592	1	0.442	1.500		

a. Variable(s) entered on step 1: Household Income.; Nagelkerke R square = .032, Correct Classification = 58.2%

To test RQ2, the gender of participants was considered as the predictor while the sarcopenic obesity classification was considered as the dependent variable. To test the assumptions of binary logistic regression, the dependent variable must be a binary variable. In this analysis, the dependent variable is 1 if the participants passed the yubi-wakka test and 0 if the participants failed the yubi-wakka test. The second assumption is that the observations are independent of each other. For this study, the observations are independent of each other. The third assumption is that there is little or no multicollinearity between the predictors. For this analysis, there is only one predictor. Thus, the assumption of multicollinearity is not violated. The fourth assumption is that there is linearity of independent variables and log odds. The predictor variable in the analysis is categorical. Therefore, this assumption does not apply. Finally, the assumption that binary logistic regression requires a large sample size. The sample size in the study is 213 which is above the minimum required sample size of 85 for this study.

Therefore, all assumptions are met.

The result of the binary logistic regression is presented in Table 5. The result showed that the gender categories do not significantly predict the sarcopenic obesity classification of participants (p = .689). The model also only explained .1% of the variance in sarcopenic obesity and correctly classified 54.9% of the cases. Therefore, there is insufficient evidence to reject the null hypothesis which stated that the relationship between gender and sarcopenic obesity is not statistically significant at p <.05 level.

Table 5

Binary Logistic Regression for RQ2a – Sarcopenic Obesity as Dependent Variable

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Female	0.112	0.279	0.160	1	0.689	1.118	0.648	1.930
	Constant	-0.245	0.182	1.820	1	0.177	0.783		

a. Variable(s) entered on step 1: Gender.; Nagelkerke R square = .001, Correct Classification = 54.9%

The result of the binary logistic regression is presented in Table 6. The predictor variable is the race categories. The result showed that the race categories do not significantly predict the sarcopenic obesity classification of participants (all p-values>.05). The model also only explained 5.3% of the variance in sarcopenic obesity and correctly classified 58.2% of the cases. Therefore, there is insufficient evidence to reject the null hypothesis which stated that the relationship between race and sarcopenic obesity is not statistically significant at p<.05 level.

Table 6

Binary Logistic Regression for RQ2b – Sarcopenic Obesity as Dependent Variable

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	White			3.637	5	0.603			
	Black or African American	20.938	28421.430	0.000	1	0.999	1239074329.609	0.000	
	Hispanic or Latino	21.539	28421.430	0.000	1	0.999	2261702763.666	0.000	
	Asian	21.896	28421.430	0.000	1	0.999	3231003948.095	0.000	
	American Indian or Alaska Native	21.896	28421.430	0.000	1	0.999	3231003948.095	0.000	
	Other	0.000	40193.471	0.000	1	1.000	1.000	0.000	
	Constant	-21.203	28421.430	0.000	1	0.999	0.000		

a. Variable(s) entered on step 1: Race.; Nagelkerke R square = .053, Correct Classification = 58.2%

The result of the binary logistic regression is presented in Table 7. The predictor variable is the marital status categories. The result showed that the marital status categories do not significantly predict the sarcopenic obesity classification of participants (all *p*-values> .05). The model also only explained 1.3% of the variance in sarcopenic obesity and correctly classified 56.3% of the cases. Therefore, there is insufficient evidence to reject the null hypothesis which stated that the relationship between marital status and sarcopenic obesity is not statistically significant at $p<.05$ level.

Table 7

Binary Logistic Regression for RQ2c – Sarcopenic Obesity as Dependent Variable

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Single			2.051	3	0.562			
	Married	0.029	0.578	0.002	1	0.960	1.029	0.331	3.196

	Divorced/Separated	-0.221	0.368	0.360	1	0.548	0.802	0.389	1.650
	Widowed	0.280	0.433	0.419	1	0.518	1.323	0.567	3.091
	Constant	-0.147	0.313	0.219	1	0.640	0.864		

a. Variable(s) entered on step 1: Marital Status.; Nagelkerke R square = .013, Correct Classification = 56.3%

For RQ3, the result of the binary logistic regression is presented in Table 8. The predictor variable is the highest education categories. The result showed that the highest education categories do not significantly predict the sarcopenic obesity classification of participants (all *p*-values> .05). The model also only explained .3% of the variance in sarcopenic obesity and correctly classified 54.9% of the cases. Therefore, there is insufficient evidence to reject the null hypothesis which stated that the relationship between highest education and sarcopenic obesity is not statistically significant at $p<.05$ level.

Table 8

Binary Logistic Regression for RQ3 – Sarcopenic Obesity as Dependent Variable

							95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Highest Educational Attainment			0.536	3	0.911			
	Bachelor's Degree	-0.053	0.398	0.018	1	0.894	0.949	0.435	2.070
	Associate's Degree	-0.065	0.417	0.024	1	0.877	0.938	0.414	2.123
	Post-graduate Degree	-0.300	0.458	0.429	1	0.512	0.741	0.302	1.818
	Constant	-0.105	0.325	0.105	1	0.746	0.900		

Note. Variable(s) entered on step 1: Highest Educational Attainment.; Nagelkerke R square = .003, Correct Classification = 54.9%

Summary

The purpose of this quantitative causal-comparative study is to identify socioeconomic,

demographic, and education factors which are significantly related to sarcopenic obesity. A sample of participants who were 65 years or older and living in Houston, Texas was included in the study. Results of analyses determined that socioeconomic, demographic characteristic, and education factors did not significantly predict sarcopenic obesity of participants at the $p < .05$ level.

Chapter 5: Discussion, Conclusions, and Recommendations

Research involving sarcopenic obesity and possible contributing factors is particularly relevant to adults who are 65 and older because muscle loss and weight gain associated with the condition are common occurrences among older individuals (Batsis & Villareal, 2018). In the United States (US), concern about the increase in obesity over the last four decades (Callahan, 2019), coupled with an aging population underscores the importance of understanding which factors significantly predict sarcopenic obesity. Further, research involving sarcopenic obesity is lacking depth and robustness found in obesity literature. This study begins to fill a gap in the literature.

The purpose of this study was to ascertain whether a statistically significant relationship existed between sarcopenic obesity and three independent variables: socioeconomic status, demographic characteristics, and education. The guiding framework for this study was Bronfenbrenner's social-ecological theory. A quantitative causal study design was employed to answer the following research questions:

RQ1: To what degree does socioeconomic status predict sarcopenic obesity amongst individuals aged 65 and older?

H10: The relationship between socioeconomic status and sarcopenic obesity is not statistically significant at $p < .05$.

H1A: The relationship between socioeconomic status and sarcopenic obesity is statistically significant at $p < .05$.

RQ2: To what degree do demographic variables, such as race or gender, predict sarcopenic obesity amongst individuals aged 65 and older?

H20: The relationship between demographic characteristics and sarcopenic obesity is not statistically significant at p< .05.

H2A: The relationship between demographic characteristics and sarcopenic obesity is statistically significant at p< .05.

RQ3: To what degree does education predict sarcopenic obesity amongst individuals aged 65 and older?

H30: The relationship between education and sarcopenic obesity is not statistically significant at p< .05.

H3A: The relationship between education and sarcopenic obesity is statistically significant at p< .05.

Results from data analyses indicated sarcopenic obesity is not significantly predicted by socioeconomic status, demographic characteristics, or education at the .05 level. However, strong to moderate associations were identified among marital status and income. This chapter includes a discussion of these results in relation to current literature and the theoretical framework. In addition, study limitations and recommendations for future research are addressed. Finally, this chapter includes contributions this study makes to treat sarcopenic obesity and implications for social change at the individual, family, and organizational levels, as well as methodological implications and recommendations for practice.

Interpretation of Findings

This research involved exploring socioeconomic, demographic, and education factors with sarcopenic obesity. Results indicated these factors do not predict sarcopenic obesity at a statistically significant level. Following is a discussion of how these results contribute to current literature on sarcopenic obesity.

Socioeconomic Status

The first factor explored in this study was socioeconomic status. For this research, socioeconomic status was defined as participants' highest level of income earned while employed. Many studies exploring the impact of socioeconomic status on health and wellbeing define the term differently. Pathirana and Jackson (2018), for example, include education, occupation, and income when measuring socioeconomic status. Ogden et al. (2018) defined socioeconomic status as household income and education. Alvarez-Galvez (2016) operationalized socioeconomic status as income and occupation. These disparate operational definitions must be considered when comparing and contrasting results found here with other studies. The American Psychological Association (APA, 2021) said, "Socioeconomic status is the social standing or class of an individual or group. It is often measured as a combination of education, income, and occupation".

Associations between sarcopenic obesity and household income were found among all income groups, although none were statistically significant. The strongest association occurred in the household income group where the highest level of income was between $25,000 and $49,999. The weakest association occurred in the lowest-earning income group among those earning < $25,000.

The impact of socioeconomic status was found in health literature relating to obesity (Ogden et al., 2018; Chang et al., 2019), metabolic syndrome (Okube et al., 2020), BMI (Assari et al., 2018), and poor health outcomes (Shea et al., 2016) but not sarcopenic obesity. Lorts and Ohri-Vachaspati (2016) found no association between obesity and employment. Ogden et al. (2018) found household income significantly predicted obesity in youths. Assari et al. (2017) found future BMI of White participants was consistently predicted by socioeconomic status. The

impact of the relationship between income and sarcopenic obesity remains unclear, and further study is warranted. Recommendations for future studies are addressed in the limitations section of this chapter.

Demographic Characteristics

Demographic factors examined in this study included participants' age, ethnicity, gender, and marital status. Results indicated demographic characteristics did not significantly predict sarcopenic obesity. However, a strong association was found for gender as well as a moderate association among cohorts in terms of marital status. Race was not found to be associated with sarcopenic obesity.

As with socioeconomic factors, there exists an abundance of literature relating demographic factors to health and obesity. Williams et al. (2016) said differences in race can significantly impact health outcomes. Assari et al. (2017) said Blacks and Whites differ in terms of health improvements when measured over time. Hruby and Hu (2015) said ethnicity plays a role in the development of obesity. Du et al. (2018) determined ethnicity related significantly to the development of sarcopenic obesity, with the highest prevalence among Hispanics. However, given that the sample population of the current study is primarily White (85.4%), it is difficult to make meaningful comparisons related to differences in race.

Gender is another demographic characteristic that was examined in this study. Much research exists on the impact gender has on health and obesity. Chang et al. (2019) said stress in women relates to obesity. Flegal et al. (2016) found obesity in women but not men was related to age, race, smoking, and education. Perez-Ferrar et al. (2018) reported low education predicted obesity in women but high income did not. Results from the current study indicate a moderate

association between gender and sarcopenic obesity between men and women. Du et al. (2018) found gender to be a significant predictor of sarcopenic obesity in men.

A third demographic characteristic explored here is age. The participants of this study were 65 or older. A study in Germany found the rate of sarcopenic obesity is increasing as its population ages (Kemmler et al., 2017). This research is similar to the current study in that the cohort was 70 or older. However, only men from Northern Bavaria were included in the study and the research focused on determining the prevalence of sarcopenic obesity when measured using three different definitions, not the predictability of the malady by different factors. Both studies, the current and Kemmler et al.'s (2017) study, underscore the importance of reaching a consensus regarding definitions surrounding sarcopenic obesity and contributing factors to facilitate understanding of risk factors.

Marital status, specifically divorced, separated, or widowed, had the strongest association with sarcopenic obesity among all other demographic characteristics. Only one study included in the literature review addressed marital status in association with health and obesity. Okube et al. (2020) found being divorced, separated, or widowed related to the prevalence of obesity and metabolic syndrome. These results align with the current study because results showed being single or married had a weaker effect.

Education

Highest level of education obtained by participants was the independent variable examined as a predictor of sarcopenic obesity. Results indicated education does not significantly predict sarcopenic obesity. Weak associations were consistent among all education levels.

These results contradict the abundance of evidence found in obesity literature that suggests education is associated with obesity. Böckerman et al. (2017), for example, reported a

significant negative association between higher education and BMI that was also most likely to be causal. Barcellos et al. (2017) found education to reduce the risk of obesity in people genetically predisposed to the disease.

The relationship between education and obesity has also been studied in combination with other factors including income (Perez-Ferrar et al., 2018) and demographics (Flegal et al., 2016). The current study is distinct in that it examined each variable independently and did not explore the interrelationships of the variables and their effects on one another's relationship with sarcopenic obesity. Further, these results do not support the significant associations reported in the previous studies.

Two studies were found in the literature about education and sarcopenic obesity. Tyrovalas et al. (2015) reported a significant negative association between higher education and skeletal muscle mass. However, subsequent examination did not reveal a significant association between education and sarcopenic obesity. The frequency of sarcopenic obesity was consistent among all three educational cohorts. In contrast, Pang et al. (2020) noted a negative relationship exists between the highest education levels and sarcopenic obesity. Results reported here contribute to resolving this contrast in the literature by lending weight to Tyrovalas et al.'s (2015) results.

Socioecological Model

The socio-ecological model adapted from Bronfenbrenner’s social-ecological theory was used as the framework for this study. Bronfenbrenner (1977) said behavior and development can be understood by examining the contextual factors within a person's environment. The environment consists of different layers Bronfenbrenner (1977) referred to as systems that include the microsystem, mesosystem, exosystem, and macrosystem. Microsystem refers to

factors closest to the individual. In the current study, the independent variables socioeconomic status, certain demographic characteristics, and education represent microsystems. Mesosystem describes how two factors interact. In this study, a mesosystem is represented by the independent variable's association with the dependent variable (sarcopenic obesity). Exosystem is the effect the relationship between two factors has on a third, unique factor. For example, when Alvarez-Galvez (2016) explored the interrelationships between socioeconomic status, demographics, and health he found differences between Social-Democratic welfare states and Conservative regimes where occupation changed the causal direction of the relationship between income and health. Finally, macrosystem refers to how all of this influences the individual.

In the current study, individual characteristics (demographics) were examined concerning sarcopenic obesity. Demographics, such as age and race, are not choices made by individuals and therefore cannot be influenced by environmental systems. Marital status, however, is a state entered into by the choice of the individual. Interestingly, marital status, specifically divorced, separated, or widowed individuals, had the strongest association with sarcopenic obesity among all other demographic characteristics, albeit a non-significant relationship. These findings support previous research by Okube et al. (2020) who found the prevalence of metabolic syndrome and obesity was increased amongst individuals who were divorced, separated, or widowed.

Socioeconomic status and education are factors creating an exosystem that has been shown to impact obesity in the literature. For instance, the risk of poor health outcomes increased 21% for individuals in both the lowest income and education cohorts in a study by Shea et al. (2016). These results demonstrate that multiple factors, when present in the same environment,

have a stronger impact on the individual. Examined independently, socioeconomic status and education did not have a significant relationship with sarcopenic obesity in the current study.

The scope of the current study was delimited by the methodological choice of binary logistical regression. Therefore, the complex interrelationships between variables and their impact on sarcopenic obesity were not revealed. The purpose of this study was to examine socioeconomic status, demographic characteristics, and education at the macrosystem level. Specifically, this research sought to identify causal relationships with each independent variable and sarcopenic obesity separately. Perhaps a future study exploring the complex relationships between the mesosystems of socioeconomic status and education will reveal a significant association with sarcopenic obesity. This will be explored more fully in the recommendations section of this chapter.

Limitations of the Study

This study has several limitations. First, this research relies on participants to accurately measure BMI and conduct the self-administered yubi-wakka test for sarcopenic obesity. While the yubi-wakka test itself is significantly related to sarcopenic obesity (Tanaka et al., 2017), it cannot be known if all participants performed the test correctly. Digital survey instrumentation prohibited participants from receiving face-to-face instructions on how to self-administer the yubi-wakka test nor were participants able to ask questions or receive feedback on test administration. Further, participants were asked to take a current measurement of their BMI instead of reporting results from their most recent visit to a primary care provider. This research assumes participants accurately measured their height and weight and were able to calculate their BMI. However, because survey data was anonymous, there is no way to follow up with

participants to confirm accuracy. Therefore, the reliability of these results must be brought into question.

A second limitation of this research is the non-experimental design with which this study was conducted. The researcher cannot rule out confounding variables that might explain the results due to a lack of experimental controls. Therefore, internal validity is a concern. However, the ex post facto research design is widely used in healthcare research to identify causal links in pre-existing conditions (Chandler et al., 2015). Hence, the quantitative, causal-comparative research design used in this study was an appropriate choice.

A third limitation of this study is the sampling method. A convenience sampling method was employed to recruit participants from offices of local physicians in the Houston, Texas area. The sample population included in the study is 85.4% White, 5.6% Hispanic or Latino, and 5.6% Black or African American. The most recent population estimates for the city of Houston indicated 57% of people living there are White, 45% Hispanic or Latino, and 22.6% Black or African American (US Census Bureau, 2021). The sample population included in this study may have been unintentionally affected by the researcher's selection of which physician offices to approach for inclusion in the study or volunteer bias is present. In either case, the results of this study should not be generalized as only a subset of the entire population is represented.

Finally, the targeted number of participants was not achieved due to the elimination of 30 surveys with incomplete responses. A priori power analysis indicated 220 participants were necessary to detect any effect at a p-value of .05, yet only 213 participants were included in the data analyses. This represents a low power in providing statistically relevant results (Kettler, 2019). Therefore, results may not be accurate.

Recommendations

This study contributes to the gap in the literature surrounding factors predicting sarcopenic obesity. Several study limitations and results contradictory to current literature indicate the need for further research on this topic to improve reliability, validity, and generalization. For example, future research should enroll physicians or individuals trained in the accurate measurement of BMI and diagnosis of sarcopenic obesity to collect participant data to ensure the reliability of results. Further, the selection of physician offices should be randomized to improve construct validity. To minimize the impact of volunteer bias, Mahtani et al. (2018) recommended recruiting more volunteers. Doubling the target population would allow future researchers to randomly select which participants would be included in the study up to the target number. This would also increase the validity of the results.

Given the complexity of the interrelationships among factors predicting obesity (Alvarez-Galvez, 2016), a phenomenological study design might elucidate the context within which factors influencing the development of sarcopenic obesity could be understood. Phenomenology seeks to identify themes through the lived experiences of participants (Moustakas, 1994). Using this method may provide the researcher with a deeper understanding of factors contributing to the disease. In addition, a Bayesian Network methodology, as utilized by Alvarez-Galvez (2016), would be appropriate for examining variables at the exosystem level. This approach may yield significant associations when examining the effect of multiple independent variables on sarcopenic obesity and address the limitations of the binary logistical regression selected as the methodology for this study.

Implications

Results of this quantitative, causal study did not reveal statistically significant relationships between socioeconomic status, demographic characteristics, and education with

sarcopenic obesity. However, insufficient evidence was produced to reject the null hypotheses as moderate to strong associations were found among subcategories of independent variables. Further, while the targeted number of participants was not achieved bringing reliability and validity into question, the results reported in this study have implications at several levels. Following the socio-ecological framework used as the foundation for this study, these implications will be discussed at the individual, familial, and social levels. Implications for social change and recommendations for practice will also be discussed.

Individual Implications

While this study did not produce significant results, it does bring attention to the dangers of sarcopenic obesity. Individuals experiencing sarcopenic obesity are at a higher risk for cancer (Carneiro et al., 2016), heart failure (Carbone et al., 2020), fatty liver disease (Merli et al., 2019), and cirrhosis (Eslamparast et al., 2018). They can expect to be impacted financially through the cost of prescription medicine, diagnostic tests, and healthcare services (de Boer et al., 2019). Further, poor health may impact life satisfaction (Elgar et al., 2016). As sarcopenic obesity is more likely to afflict older individuals (Batsis & Villareal, 2018), activities planned for retirement might be impacted.

Individuals must become aware of the risk factors associated with sarcopenic obesity so that they may take preventative action. Exercise and lifestyle choices support the avoidance of sarcopenic obesity (Lee et al., 2016; Trouwborst et al., 2018; Yoo et al. 2020). Even flexibility exercises were found to reduce the prevalence of sarcopenic obesity below the mean in individuals who performed these exercises frequently (Lee et al., 2016). Park and Jung (2018) recommended low-impact circuit training for older individuals more susceptible to injury as a way to positively affect the health and well-being of sarcopenic obesity sufferers.

Familial Implications

In addition to the financial impact of sarcopenic obesity (de Boer et al., 2019), families of sarcopenic obesity patients may be impacted in several ways. Results of this study showed a moderate association between sarcopenic obesity and marital status, specifically divorced, separated, or widowed individuals. This represents a possible increased risk of sarcopenic obesity for married couples who later divorce or lose a spouse to death. Family members may also find themselves caring for loved ones suffering from the disease. Leonard et al. (2016) found health shocks in low-socioeconomic households might result in the need for additional family members to live inside the home. Finally, family members may suffer the premature loss of loved ones with the condition as obese individuals reported multimorbidity conditions earlier than those at healthier weights (Canizares et al., 2017).

Family support is needed to facilitate physical health in individuals with sarcopenic obesity. Holt-Lunstad (2018) found individuals are influenced to make positive health and wellness choices by their social and familial relationships. Family support could include participation in exercise classes, healthy cooking classes, or increased sexual activity between romantic partners.

Implications for Social Change

Obesity is a global problem, particularly in the US where obesity prevalence is among the highest in the world (James, 2017). This research has the potential for positive social change by bringing awareness to the risk factors of sarcopenic obesity. Understanding these factors and their complex interrelationships can inform strategies to prevent the condition or even to reverse it. While the results presented here did not establish significant relationships between sarcopenic obesity and the three independent variables included in the study, this study does highlight the

importance of understanding the risk factors and establishes a need for future research. Further, this study demonstrates the need for community health initiatives through the application of a socio-ecological model as the individual is influenced by systems in their environment. This need was echoed by Stokols (1996) who called for the use of socio-ecological models to be used as the foundation for health promotion programs.

Recommendations for Practice

The results presented here can inform healthcare practice. Risk factors for sarcopenic obesity can be included in health screening questions asked at healthcare facilities to identify individuals at high risk for developing the disease. Improving the awareness of risk factors among healthcare providers will also facilitate the identification of high-risk individuals. Once identified, healthcare providers can inform these individuals of the risk of potential negative health outcomes and offer strategies to prevent or ameliorate the disease. Strategies focused on maintaining skeletal muscle mass and reducing obesity will be of the most importance. Prior research supports exercise, namely flexibility exercises (Lee et al., 2016), aerobics (Yoo et al., 2020), and circuit training (Park & Jung, 2018) for avoiding or ameliorating sarcopenic obesity.

Conclusion

This quantitative, causal research examined the predictive effect of socioeconomic status, demographic characteristics, and education on sarcopenic obesity. A socio-ecological model provided the theoretical framework guiding this work. The abundance of research found in the literature that contributed to the understanding of factors relating to health and obesity provided the foundation for the development of the research questions and hypotheses included. The results were the antithesis of what was expected given all that was learned from the examination of the literature. Several limitations previously noted might explain these distinct results.

However, given the limited research surrounding sarcopenic obesity, caution is warranted in disregarding non-significant results.

Future research may uncover new factors that are uniquely related to sarcopenic obesity. Nonetheless, every effort should be made to improve the reliability and validity of the current study by addressing the limitations in future research. Moderate to strong associations were found between sarcopenic obesity and gender, marital status, and income. These associations should be used to guide future research that addresses this study's limitations, specifically the sampling method and target number of participants, to confirm or strengthen results.

Sarcopenic obesity research has important implications for individuals, families, and social change. Individuals expecting to enjoy their golden years in retirement may find themselves unable to do so as a result of the physical and financial impacts of sarcopenic obesity. Family members may necessarily become caregivers to elderly parents or spouses afflicted with the condition or suffer their premature loss. This study underscores the importance of understanding the risk factors associated with sarcopenic obesity and calls for social change through the inclusion of socio-ecological theories in the creation of community health programs.

Obesity is a non-communicable disease afflicting all age groups that has steadily increased in the US over the past four decades (Callahan, 2019). Sarcopenic obesity usually occurs in older adults as they lose muscle as a result of aging (Zhao et al., 2018). As the US population ages, sarcopenic obesity is likely to increase in prevalence. The scant literature relating to sarcopenic obesity warrants further research on the topic. Finally, the potential implications for individuals, families, and society necessitate understanding the risk factors related to sarcopenic obesity.

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