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Obesity-Related Health Behaviors and Stress Among Sexual Minority Women

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Kristen Andrea Smith

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Walden University
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Abstract

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by

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MPhil, Walden University, 2019

MS, Logan University, 2017

MAEd, Virginia Tech, 2007

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Psychology

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Abstract

Adult obesity rates have continued to rise with 40% of the adult population in the United States currently being categorized as obese. Sexual minority women are more prone to obesity than heterosexual women. Obesity has been linked to several causes of premature and preventable death and has often been attributed to changeable health behaviors such as physical activity, diet, and sleep. Additionally, stress has been shown to impact health behaviors as well as rates of obesity. Sexual minority women are known to experience more stress due to their minority status, a concept described in minority stress theory which states that sexual minorities experience higher stress levels due to stigma, prejudice, and discrimination. The increased stress levels then lead to poorer health outcomes. Thus, in this quantitative study I examined differences in obesity-related health behaviors (e.g., physical activity, diet, and sleep) between heterosexual women, lesbian women, and bisexual women by analyzing data collected in the 2017 Behavioral Risk Factor Surveillance System survey. Results from this analysis showed statistically significant differences in several but not all behaviors. Among sexual minority women, I also examined the relationships among stress, obesity, and health behaviors. Stress was correlated with several health behaviors for lesbian and bisexual women. Understanding the differences in health behaviors and how stress plays a role in these behaviors may promote positive social change by helping to decrease the rates of obesity in sexual minority women and by helping health practitioners to develop appropriate interventions based on the variables significant to this population.

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Dedication

This is dedicated first and foremost to my parents, Gene and Janice Smith, for all of the sacrifices they made in order for me to pursue this journey. They had to survive this process just as much as I did.

For my furbaby, Geo, who sacrificed numerous walks and belly rubs in my pursuit of earning a PhD while also helping to keep me sane and reminding me to take breaks.

For my friends who understood when I needed to focus on school versus when I needed time to socialize and never questioned my sanity.

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Chapter 1: Introduction to the Study

Introduction

This study examined the relationship between health behaviors, stress, and obesity in sexual minority women. Obesity is a growing epidemic throughout the United States with over 40% of the adult population's weight categorized as obese (Centers for Disease Control and Prevention [CDC], 2020a). Researchers have shown that sexual minority women are diagnosed with obesity at a higher rate than their heterosexual peers (Eliason et al., 2015; Fogel et al., 2016; Gonzalez & Henning-Smith, 2017; Simoni et al., 2016), but the mechanisms for this disparity are unknown. Using heterosexual women as a comparison group, obesity-related health behaviors such as physical activity, diet, and sleep duration were compared. Knowing if changeable health behaviors are related to obesity rates in sexual minority women can help health practitioners treat their sexual minority female patients by tailoring obesity intervention programs.

Lesbian and bisexual women have reported higher stress levels than their heterosexual peers (Mason & Lewis, 2016). Minority stress theory shows a path from unique stressors related to being a sexual minority to negative mental health outcomes (Meyer, 2003). The minority stress path can also be applied to negative physical health outcomes as stress, in general, has been associated with changes in health behaviors, which can lead to increased rates of obesity (Tomiyama, 2019). The relationship between stress, health behaviors, and obesity needs to be further examined to help understand the mechanisms behind the health disparity of obesity seen in sexual minority women.

In the following sections in this chapter, I further discuss the background of obesity in sexual minority women, the problem statement, the purpose of the study, the research questions driving this study and their associated hypotheses, the theoretical framework behind this stud, the nature of the study, definition of terms for the purpose of this study, any assumptions made, the scope and delimitations of the study, any limitations to the study, and the significance of conducting this study.

Background

Existing research relating to obesity prevalence and obesity-related health behaviors, such as physical activity, diet, and sleep, among sexual minority women has been contradictory and inconclusive at best (McPhail & Bombak, 2015). Researchers using data from the 2014-2015 BRFSS showed that lesbian and bisexual women were significantly more likely to be obese when compared to heterosexual women (Lew et al., 2018). This mirrors results from previous research on the subject (Eliason et al., 2015; Fogel et al., 2016; Gonzales & Henning-Smith, 2017; Simoni et al., 2016). More recently, researchers have shown that lesbian and bisexual women continue to have higher odds of being overweight or obese when compared to other sexual minorities as well, including gay men and bisexual men (Azagba et al., 2019); therefore, lesbian and bisexual women are considered an at-risk group for obesity. The higher prevalence of obesity in sexual minority women, therefore, is well established; however, there is much less known about the mechanisms behind this disparity.

With regards to obesity-related health behaviors, data from the Nurses' Health Study II showed that lesbian and bisexual women have higher quality diets, higher levels

of physical activity, and higher levels of sedentary behavior when compared to their heterosexual peers (VanKim et al., 2017a; VanKim et al., 2017b). These results, however, may not be generalizable to women outside of the nursing profession. For women outside of the nursing profession, studies have shown contradictory results with regards to physical activity with some reporting that lesbian and bisexual women have higher levels of physical activity while others report they have less physical activity when compared to heterosexual women (Eliason & Fogel, 2015). Other research has also shown no significant difference in either physical activity or sedentary behavior (Boehmer & Bowen, 2009; Bowen et al., 2008).

Research on diet and sleep are similar in their results, often showing that there are no significant differences in behavior among varying sexual orientations (Jackson et al., 2016). Despite this, some researchers have shown a difference in various aspects of both diet and sleep. Sexual minority women, for example, may be more prone to substance addiction including food addictions (Rainey et al., 2018). While the quality or caloric intake of the overall diet may not be significantly different, a difference in food choices has been shown for some sexual minorities (Boehmer & Bowen, 2009, Smalley et al., 2016, VanKim et al., 2017b). Additionally, sexual minority women may experience lower levels of "restedness" and increased sleep disturbances when compared to heterosexual women (Chen & Shiu, 2017; Martin-Storey et al., 2018). This has been shown particularly for sexual minority women who live in non-LGBTQ-friendly locations and bisexual women, respectively.

Researchers have shown that lesbian and bisexual women report higher levels of stress and this is often viewed as one of the potential reasons for the difference in obesity rates (Caceres et al., 2017; Mason & Lewis, 2016; Wardle et al., 2011). Lesbian and bisexual women who experienced more discrimination reported increased minority stress, leading to feelings of shame and concern about their sexual orientation (Mason & Lewis, 2016). Stress is known to have an impact on health behaviors such as eating more overall calories, an increase in unhealthy food consumption, a decrease in physical activity levels, or a disruption in normal sleeping patterns (Tomiyama, 2019). The increased stress levels experienced by lesbian and bisexual women have been associated with disordered eating patterns, such as binge eating or the consumption of comfort foods, as an emotional coping mechanism (Mason & Lewis, 2015; Mason & Lewis, 2016; Watson et al., 2015). Thus, the additional stress experienced by lesbian and minority women may play a significant role in their higher obesity rates.

Given the long-term consequences of obesity, it is important to understand the mechanisms behind it, especially for groups that are more at risk for developing obesity such as sexual minority women. One objective of Healthy People 2020 is to improve the health and wellbeing of LGBT individuals (US Department of Health and Human Services, 2014). This study may help in furthering this objective by providing greater understanding of the mechanisms behind the higher obesity rates for lesbian and bisexual women.

Problem Statement

According to CDC National Center for Health Statistics data brief, adult obesity rates continued to rise between 1999 and 2014 with the prevalence of obesity estimated at 39.8% of the adult population over age 18 years (Hales et al., 2017). Obesity has been correlated with some of the leading causes of preventable and premature death including heart disease, stroke, type 2 diabetes, and certain types of cancers (CDC, 2020a). Additionally, CDC noted that obesity affects some groups more than others. Sexual minority women comprise one of the groups shown to have a higher prevalence of obesity.

Boehmer et al. (2007) confirmed the disparity of obesity in sexual minority women with a population-based study using the 2002 Cycle 6 National Survey of Family Growth. More recent research has shown that this health disparity continues to exist when lesbian and bisexual women are compared to other sexual identity groups as well, including gay men and bisexual men (Azagba et al., 2019). Thus, lesbian and bisexual women are an at-risk group for obesity; however, the mechanisms involved in their higher rate of obesity prevalence remain unknown.

Often cited in studies regarding obesity in sexual minority women is the fact that they may suffer from additional stressor and experience more stress than heterosexual women (Caceres et al., 2017). These additional stressors include having to conceal one's sexual orientation, an expectation of rejection, and internalized homophobia (Meyer, 2003). Mason and Lewis (2019) found that lesbian women who had more motivation to conceal their sexual identity generally had more stress and exhibited more unhealthy

behaviors. Stress, especially chronic stress, can impact a person in several ways: cognitively, physiologically, behaviorally, and biochemically (Tomiyama, 2019). A meta-analysis of research on the relationship between stress and weight in the general population showed that stress is associated with an increase in weight (Wardle et al., 2011).

In the general population, stress has been linked to changes in diet, physical activity, and sleep patterns (Tomiyama, 2019). When under stress, a person is likely to eat more or eat differently, often choosing to consume foods that are high in sugar, fat, and calories (Tomiyama, 2019). Richardson et al. (2015) showed that perceived stress is associated with uncontrolled and emotional eating, which can impact a person's weight. With regards to physical activity, stress can lead some people to increase their physical activity levels as a way to cope with stress; however, the majority of studies on the relationship between stress and physical activity report a decrease in leisure time physical activity levels with increased stress (Tomiyama, 2019). Stress can also interfere with sleep patterns, often resulting in shorter sleep duration and decreased quality of sleep. Sleep duration, independent of stress levels, has been shown to be predictive of weight with shorter sleep duration associated with higher levels of obesity (Tomiyama, 2019).

Health-related behaviors, including physical activity, diet, and sleep, are oft-cited mechanisms related to levels of obesity (CDC, 2020a). Several researchers have previously looked at the links between these behaviors and obesity rates in sexual minority women. Boehmer and Bowen (2009) found that women who had female partners did not have a significant difference in caloric intake or physical activity when

compared to women who had male partners; therefore, while they were still more at risk for being overweight or obese, the researchers did not find any significant links to possible mechanisms. Results using data from the Nurses' Health Study II showed that lesbian women, when compared to heterosexual women, have higher quality diets and higher levels of physical activity; however, they also have higher rates of sedentary behavior (VanKim et al., 2017a). Recent reviews of the literature have found that much of the research conducted in this area has been contradictory or inconclusive (McPhail & Bombak, 2015). The methodology, population used, or the definition of sexual minority women may have played a role in the contradictory or inconclusive results, meaning the possible mechanisms related to the higher prevalence of obesity among sexual minority women remain unknown. This study will add to the existing literature by further examining the relationship between obesity-related behaviors, stress, and female sexual identities.

Purpose of the Study

The purpose of the present study was to examine the relationship among stress, obesity, and health behaviors in sexual minority women as well as determine any differences in health behaviors between sexual minority women and heterosexual women. The research used a quantitative design with secondary data from a national database. Specifically, this study attempted to determine if there are differences among lesbian, bisexual, and heterosexual women in their obesity-related health behaviors. Additionally, the present study attempted to determine if stress predicts behaviors and obesity in sexual minority women, an area of research that has been underexplored.

Results from this study will help facilitate a better understanding of the causes of the health disparity of obesity among sexual minority women and whether obesity-related behaviors play a significant role in this health disparity.

Research Questions and Hypotheses

The following research questions guided this study:

1. To what extent are there differences in obesity-related health behaviors as measured in the 2017 Behavioral Risk Factor Surveillance System (BRFSS) among heterosexual, lesbian, and bisexual women?

$H1_0$: There are no significant differences in physical activity among lesbian, bisexual, and heterosexual women.

$H1_a$: There are significant differences in physical activity among lesbian, bisexual, heterosexual women.

$H2_0$: There are no significant differences in the amount of fruit and vegetable consumption among lesbian, bisexual, and heterosexual women.

$H2_a$: There are significant differences in the amount of fruit and vegetable consumption among lesbian, bisexual, and heterosexual women.

$H3_0$: There are no significant differences in the amount of potato consumption among lesbian, bisexual, and heterosexual women.

$H3_a$: There are significant differences in the amount of potato consumption among lesbian, bisexual, and heterosexual women.

$H4_0$: There are no significant differences in the amount of regular soda or sugar-sweetened drinks consumed among lesbian, bisexual, and heterosexual women.

$H4_a$: There are significant differences in the amount of regular soda or sugar-sweetened drinks consumed among lesbian, bisexual, and heterosexual women.

$H5_0$: There are no significant differences in the average hours of sleep among lesbian, bisexual, and heterosexual women.

$H5_a$: There are significant differences in the average hours of sleep among lesbian, bisexual, and heterosexual women.

2. To what extent does stress, measured as the frequency of stressful feelings over the timespan of a month in the 2017 BRFSS, predict higher obesity levels as measured by the calculated body mass index (BMI) in lesbian and bisexual women?

H_0: Stress is not a predictor of obesity levels in sexual minority women.

H_a: Stress in a predictor of obesity levels in sexual minority women.

3. To what extent is stress, measured as the frequency of stressful feelings over the timespan of a month in the 2017 BRFSS, correlated to health behaviors in lesbian and bisexual women?

H_0: Stress is not correlated to health behaviors in sexual minority women.

H_a: Stress is correlated to health behaviors in sexual minority women.

4. To what extent do health behaviors as measured in the 2017 BRFSS mediate

the relationship between stress, measured in frequency of stressful feelings over

the timespan of a month, and obesity in lesbian and bisexual women?

H_0: Health behaviors do not mediate the relationship between stress and

obesity in sexual minority women.

H_a: Health behaviors do mediate the relationship between stress and

obesity in sexual minority women.

Theoretical Framework

Meyer's (2003) minority stress theory was the theoretical framework for the

present study. The theory stemmed from the higher prevalence of mental disorders in the

lesbian, gay, and bisexual (LGB) population due to stigma, prejudice, and discrimination

often experienced in society (Meyer, 2003). Minority stress is unique in that it not only

encompasses the daily stressors of life experienced by everyone, but also includes a level

of stress that goes above and beyond and is tied to the distinct experiences of the LGB

population. Minority stress theory includes the concealment of one's sexual orientation,

expectations of rejection, and internalized homophobia often due to underlying social and

cultural mechanisms that go beyond the individual (Meyer, 2003). Stress, in general, has

been shown to interfere with self-regulation, increase the consumption of unhealthy food,

lower physical activity levels, and reduce quality sleep (Tomiyama, 2019). These

behaviors have all been associated with higher levels of obesity. Therefore, it is plausible

that the increased levels of stress experienced by the LGB population can negatively

impact their health behaviors and increase the likelihood of obesity. In other words, the

stress felt by the lesbian and bisexual women due to stigma, prejudice, and discrimination can influence their health behaviors, including physical activity, diet, and sleep patterns. The change in health behaviors can then, in turn, impact obesity levels.

Nature of the Study

In this study I used a quantitative design using secondary data. The target population was adult women living in the United States who self-identify as heterosexual, lesbian, or bisexual. For the first research question, the independent variables were the sexual orientations of females: heterosexual, lesbian, or bisexual. The dependent variables were the obesity-related health behaviors: physical activity, diet-related variables, and average hours of sleep. For the second research question, the independent, or predictor, variable was stress while the dependent variable was obesity, measured as the body mass index. For the third research question, the independent or predictor variable was stress while the dependent variables were the health behaviors. For the fourth research question, stress was the independent variable, obesity was the dependent variable, and the health behaviors were mediating variables. This type of study will help determine if there are differences in obesity-related health behaviors among lesbian women, bisexual women, and heterosexual women. Additionally, it can help determine the role of stress and health behaviors in obesity levels among sexual minority women.

Definition of Terms

Behavioral Risk Factor Surveillance System (BRFSS): A phone-based survey conducted through the CDC with the aid of state health departments. The survey collects

data regarding health-related risk behaviors, chronic disease, and use of preventive services in addition to demographic information.

Obesity: Having a body mass index (BMI) above 30 as calculated by taking a person's weight in kilograms divided by their height in meters squared (CDC, 2017). Obesity categories can be further broken down into severity levels with people having a BMI above 40 being classified as having extreme obesity.

Body mass index (BMI): BMI is broken down into four categories: underweight, normal, overweight, and obese (CDC, 2017). It is a ratio of a person's weight and height and used as a screening tool for a person's fatness and health. A BMI under 18.5 is underweight, between 18.5 and 24.9 is normal, between 25 and 29.9 is overweight, and 30 or above is obese (CDC, 2017). The obese category is sometimes further broken down into class I, class II, and class III signifying levels of severity.

Sexual minority women: Often used to describe women who have sex with women, a behavioral definition, or who self-identify as any sexual orientation other than straight or heterosexual. It typically includes some level of same sex attraction, feelings, and sexual behavior throughout the lifespan (Mereish et al., 2017). For the purpose of this study, sexual minority women will include those that self-identified as lesbian or bisexual on the BRFSS.

Sexual orientation: Previously viewed as a dichotomous category with only two options, heterosexual or homosexual, it has now expanded to include any number of sexual behaviors and identities along a fluid continuum (Salomaa & Matsick, 2019). A person's sexual orientation is a way to self-identify their patterns of physical, romantic,

and emotional attractions to other people (Salomaa & Matsick, 2019). For the purpose of this study, only the sexual orientations of heterosexual women, lesbian, and bisexual women are being studied due to the complexity of defining other sexual orientations and a lack of concrete numbers for other distinct sexual orientations. For example, most surveys, including the BRFSS, utilize an "other" category for any self-identified sexual orientation other than heterosexual, lesbian or gay, or bisexual; therefore, it is difficult to examine differences among all female sexual orientations.

Lesbian: According to the Lesbian and Gay Community Services Center, Inc. (2020), a lesbian is a woman who experiences physical, romantic, or emotional attraction to other women. For the purpose of this study, the term lesbian refers to any woman who self-identifies as such regardless of sexual experience.

Bisexual: Refers to a person capable of physical, romantic, or emotional attractions to people of either the opposite sex or the same sex (Lesbian & Gay Community Services Center, Inc., 2020). The degree of attraction to either sex can vary throughout a person's lifetime. For the purpose of this study, the term bisexual refers to any woman who self-identifies as such regardless of sexual experience.

Health-related behavior: Refers to any behavior that either promotes or reduces physical, psychological, or social wellbeing (Babao & Mascoso, 2008; Hassen & Kibret, 2016). These behaviors are a person's individual choice and can include partaking in physical activity, consuming certain foods and beverages, and prioritizing sleep among many other behaviors. Health-related behaviors have a 70% to 80% impact on a person's life expectancy (Babao & Mascoso, 2008). For the purpose of this study, the health-

related behaviors analyzed are those that have been shown to be correlated with weight gain and obesity.

Physical activity: Often defined as any movement that requires energy expenditure and provides a health benefit (World Health Organization [WHO], 2020). Physical activity helps to improve overall fitness and functional health while reducing the risk of coronary heart disease, stroke, diabetes, depression, bone fractures, and weight gain (WHO, 2020).

Diet: A person's diet consists of any food and beverages consumed. A healthy diet for adults, according to the WHO (April 2020), consists of fruit, vegetables excluding potatoes and other starchy roots, nuts, and whole grains. Additionally, the diet should limit added sugars, fats, and salt.

Sleep: Often thought of as the opposite of being awake and defined by its observable characteristics such as reduced activity, a typical posture of laying down with closed eyes, decreased responsiveness to stimuli, and easy to reverse (Division of Sleep Medicine at Harvard Medical School, 2007). Healthy sleep patterns can include several measurable dimensions including duration, efficiency, timing, quality, and sleepiness level throughout the day (Buysse, 2014). In this study, sleep will be measured in duration.

Stress: An emotional response caused by an external circumstance (APA, 2019). Stress can be either sort-term or chronic. Short-term stress is often due to a one-time issue such as a deadline whereas chronic stress is due to an ongoing issue such as having a low socioeconomic status, experiencing discrimination or prejudice, or suffering from a lifelong illness.

Assumptions

The following assumptions were made for the purpose of this study: Obesity is viewed as a changeable outcome since the lifestyle variables associated with obesity are changeable (Hassen & Kibret, 2016). While evidence suggests that obesity is in part due to genetic factors, there is also evidence that modifiable health behaviors have a significant impact on weight (Babao & Mascoso, 2008; Hassen & Kibret, 2016). The chosen variables to assess as obesity-related health behaviors (physical activity, diet, and sleep) have all been shown to be correlated with obesity, though there have been some contradictory results. With regards to the chosen dataset, it is assumed that there is enough data for each sexual orientation group (e.g. heterosexual women, lesbian, and bisexual women) from which to draw meaningful conclusions. In other words, enough people from each sexual orientation group responded to the questions being analyzed that comparisons between groups could be made.

Scope and Delimitations

The present study focused on sexual minority women who self-identify as lesbian or bisexual, though the term *sexual minority women* could also refer to those who self-identify as transgender, queer, questioning, asexual, or any other term referring to one's sexual orientation. These other groups were not included in this study for several reasons: (a) the BRFSS does not recognize individual sexual orientation groups beyond heterosexual, lesbian, and bisexual in the read-aloud options for this question, (b) transgender individuals could have been born as either male or female and could identify as any sexual orientation, and (c) the inclusion of an "other" group for one's sexual

orientation may not allow for meaningful conclusions as it would include a diverse range of sexual orientations. Other national health surveys were reviewed to examine if they included a more comprehensive breakdown of sexual orientations and the variables being studied. Other surveys reviewed included the National Health Interview Survey, the National Health and Nutrition Examination Survey (NHANES), and the National Survey of Family Growth. None of these surveys included all of the variables being studied; thus, the BRFSS proved to be the most applicable secondary dataset available.

Limitations

In using secondary data, the data collected was bound by the questions asked on the BRFSS. For example, in researching the past questionnaires, it was discovered that the 2018 BRFSS questionnaire did not include specific questions about food consumption, but the 2017 BRFSS questionnaire did. Despite this, these questions did not provide a comprehensive view of a person's diet. They may consume numerous fruits and vegetables during the day, but also consume numerous candy bars or treats that were not asked about on the questionnaire. Therefore, the questions regarding diet may provide some insight into the health behaviors being studied, but they do not provide the full picture.

Additionally, the BRFSS itself has limitations. The wording of questions could have led people to answer in a particular way that may or may not be appropriate to the question (Washington State Department of Health, n.d.). The data collected was also dependent on each participant's ability to recall information and provide accurate details. For example, it may be difficult to provide an accurate weight if someone does not own a

scale at home and relies on remembering what they weighed the last time they visited a doctor. Frequency questions may also include response errors due to people overstating how often they consume fruits and vegetables versus understating how often they consume sugary beverages.

Quantitative studies have limitations in and of themselves as well. The use of a survey to collect data can be beneficial due to its ease of data collection and analysis; however, it may not provide a comprehensive view of each variable due to the rigidity of the questions (Queirós et al., 2017). Each answer must fit into a specific category. For example, when asking about sexual orientation, the only categories typically listed are heterosexual, lesbian or gay, bisexual, or other. The "other" category can contain a plethora of sexual orientations making it hard to analyze. Additionally, the reliability of the data is highly dependent on the quality of responses (Queirós et al., 2017). For example, the 2017 BRFSS asks about sleep duration but not about subjective sleep quality, which are both aspects of healthy sleep (Buysse, 2014). Therefore, while sleep duration is an important aspect and may correlate to obesity, it does not provide a whole picture.

The design of this study was correlational in nature; therefore, no cause and effect relationship could be determined (Queirós et al., 2017). There was no definitive way to say that stress predicts obesity. While the data may show that it does, it may also be that the reverse is true: obesity predicts stress. Thus, the relationship, even if shown to be correlated, may be bidirectional as opposed to unidirectional. Along the same lines, the data for this study was from a secondary source, the BRFSS. This survey used a cross-

sectional design which only allows for conclusions to be drawn based on a set time period which is often the month preceding the interview (Andersen et al., 2011; CDC, July 2018b). Again, only using data from a set point in time would not allow any cause and effect relationships to be determined, but rather show how strongly the variables are related to each other.

Significance

This study examined the differences in obesity-related health behaviors among lesbian, bisexual, and heterosexual women through the use of secondary data from a national database. Sexual minority women have been shown to have a higher prevalence of obesity than heterosexual women and other sexual minorities (Azagba et al., 2019; Boehmer et al., 2007). Prior research into the health behaviors of sexual minority women has shown inconsistent or contradictory results (McPhail & Bombak, 2015), thus leading to the need to examine this relationship further. Additionally, sexual minority women have been shown to report higher levels of stress (Caceres et al., 2017). Therefore, this study examined the relationship between stress, obesity, and health behaviors among sexual minority women.

Given the poor health outcomes associated with obesity such as type 2 diabetes, heart disease, stroke, and certain cancers (CDC, 2020a), it is important to have a better understanding of what factors are associated with the higher prevalence of obesity for sexual minority women. Prior attempts to respond to the obesity epidemic for the general population have relied on the individual: educate a person about obesity and they will make healthy choices (Sullivan, 2010). These attempts, however, rarely succeed as the

cultural and social environment in the U.S. promotes obesogenic behavior (e.g. lack of physical activity due to working desk jobs and poor diet due to fast food and convenient, cheap snacks; Sullivan, 2010). While there needs to be systemic changes made for the entire population of the United States that address the obesity epidemic as a whole, this research may promote positive social change by changing the narrative from individual choices to a population-based social problem in order to alleviate the obesity disparity for sexual minority women.

Targeted interventions should consider that sexual minority women may view fitness and beauty differently than heterosexual women, thus interventions geared toward all women may not work for sexual minority women (Bowen et al., 2006; Brittain et al., 2006; Haines et al., 2008). Understanding the unique variables associated with the health disparity of obesity for sexual minority women may help by focusing interventions on variables that are significant for this specific population.

Summary

Obesity is a growing epidemic throughout the United States that disproportionately effects some groups of people more than others (CDC, 2020a). One such group is sexual minority women who have consistently been shown to have higher obesity rates than their heterosexual counterparts. Research into possible mechanisms behind this disparity have thus far been inconclusive or contradictory, signifying a need for further study. Additionally, lesbian and bisexual women have reported higher stress levels than their heterosexual peers, thus stress may be a potential pathway leading to the higher rates of obesity in sexual minority women. In the present study I aimed to examine

the relationship between health behaviors, stress, and obesity in sexual minority women

by analyzing the differences in health behaviors among heterosexual women, lesbian

women, and bisexual women. Additionally, I examined whether stress predicts obesity,

whether stress predicts health behaviors, and whether health behaviors mediate the

relationship between stress and obesity. The results of this study can help health

practitioners when working with obese sexual minority women and further the objectives

of Healthy People 2020, which includes reducing the proportion of LGBT adults who are

obese (Office of Disease Prevention and Health Promotion, 2014).

Chapter 2: Literature Review

Introduction

Obesity is defined as a BMI of 30.0 or higher based on a person's height and weight (CDC, 2020b). It can further be divided into categories based on severity with class 2 obesity including a BMI range of 35.0 to 39.9 and class 3 obesity including a BMI of 40.0 or higher. Class 3 obesity is also sometimes labeled as extreme or severe obesity. Obesity is a growing concern around the world, especially as it is correlated with some of the leading causes of preventable and premature death including heart disease, stroke, type 2 diabetes, and certain types of cancers. Statistics from the CDC and the National Institute of Health (NIH) show that adult obesity rates have continued to rise between 1999 and 2014 with the prevalence of obesity estimated to be between 37.7% and 39.8% for the adult population over age 18 in 2014 (Hales et al., 2017; NIH, 2017). While no significant increases have been shown for men over the past 15 years, the prevalence of obesity and extreme obesity has increased significantly for women, with more than 40% of women currently being classified as having obesity or extreme obesity (NIH, 2017).

CDC (2020a) has also noted that obesity impacts some groups of people more than others. One such group that has been shown to have a higher prevalence of obesity is sexual minority women. Sexual minority women, as a term, has been defined in several different ways throughout the literature but most commonly refers to women who self-identify as lesbian or bisexual as many surveys only include sexual orientation groups of heterosexual, gay/lesbian, bisexual, or other (CDC, 2016; Mereish et al., 2017; Salomaa & Matsick, 2019). The health disparity of obesity among sexual minority women was

confirmed most notably by Boehmer et al. (2007), who conducted a population-based study using the 2002 Cycle 6 National Survey of Family Growth. This health disparity continues to exist when lesbian and bisexual women are compared to other sexual identity groups as well, including gay men and bisexual men (Azagba et al., 2019). While the exact mechanisms behind this disparity are not yet known, a possible factor is the additional stress experienced by sexual minority women (Caceres et al., 2017).

Literature Review Strategy

An initial search was conducted through Thoreau to get a sense of what articles were available for the topic. Searches were further conducted through the psychology and health sciences databases, mostly using the PsycINFO and ProQuest Health & Medical Collection databases. Initial terms searched for included *obesity* and *sexual minority or LGBT*. The search was then expanded to include all psychology databases contained in the Walden Library. Google Scholar was also used to chain articles together, helping to find more recent research that had cited an older article. Additional search terms used included *physical activity*, *sedentary*, *diet or nutrition*, *sleep*, and *stress*. While most literature was limited to the years 2015 to 2020, some older articles were used in relation to minority stress theory and to get a broader view of the topic.

Theoretical Foundation

The theoretical foundation of the present study is Meyer's (2003) minority stress theory. This theory creates a model of the interactions between environment, minority identity, stress, and mental health outcomes. As seen in figure 1 below (Meyer, 2003), box a and box b are overlapping due to the close relationship between environmental

circumstances and minority status. Environmental circumstances can include factors such as geographic location or socioeconomic status. A poor lesbian woman would experience stress related to both living in poverty and having a minority status which may overlap and stem from the same experiences. Environmental circumstances (a) lead to general, day-to-day stressors, (c) experienced by everyone in the general population.

Minority status (b) leads to distal minority stress processes (d) such as discrimination and antigay violence. A person who associates with their minority status has a minority identity (e) and, therefore, may then experience proximal, or internal, minority stress processes, including expectations of rejection, concealment of minority identity, and internalized homophobia (f). For example, people who experienced the antigay violence at the Pulse nightclub in Orlando may identify more strongly with their minority status in the aftermath, but this stronger minority identification may lead to heightened expectations of rejection and feelings of needing to conceal their sexual orientation in their daily lives. Despite this, having a minority identity can both act as a stressor itself and as a modifier for the effects of stress. Certain characteristics of having a minority identity (g) can either strengthen or weaken the impact of stress. For example, a person who identifies prominently with being a sexual minority may have worse health outcomes than someone who identifies more prominently with other aspects of their life, especially when those other aspects do not pertain to a minority status. Having a minority identity can also be associated with opportunities to belong to a social network and, thus, lead to increased social support and beneficial coping mechanisms (h). The interactions between environmental circumstances (a), minority status (b) and identity (e), and the

associated stress (c, d, and f) then leads to either negative or positive mental health

outcomes (i) depending on the influence of minority identity characteristics (g), coping

skills (h), and social support (h).

Figure 1

Conceptualization of minority stress theory
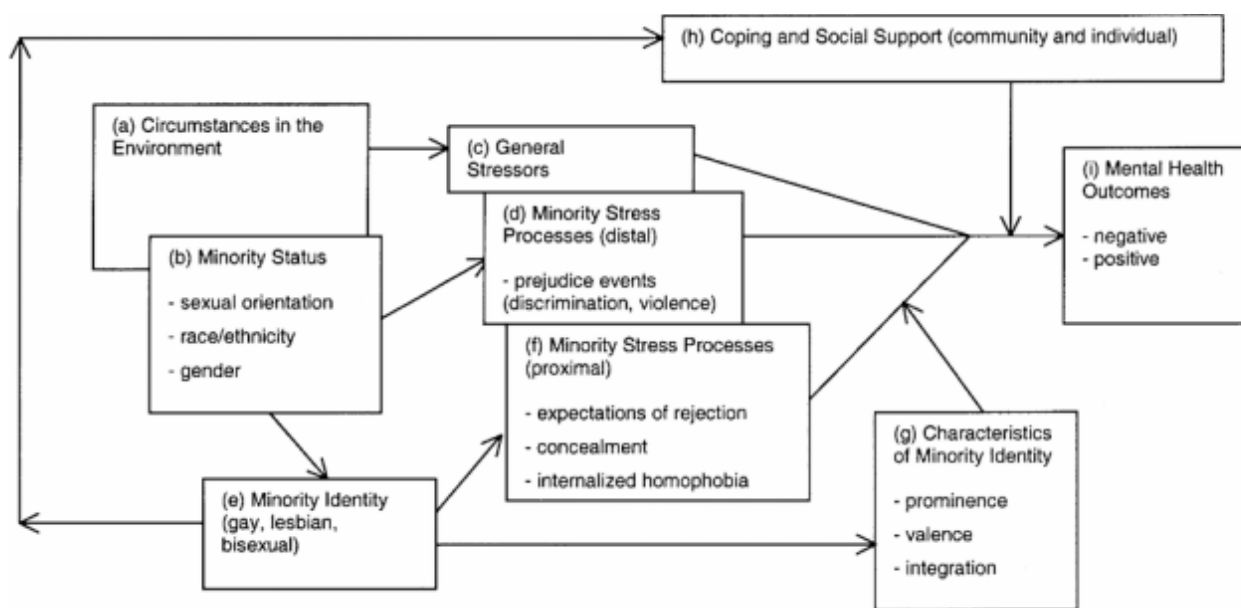
Note. This figure shows the conceptualization of minority stress theory as it was originally conceived as a path from environmental and personal circumstances to stressors to potential mental health outcomes. Research later associated this theory with physical health behaviors and outcomes. From "Prejudice, Social Stress, and Mental Health in Lesbian, Gay, and Bisexual Populations: Conceptual Issues and Research Evidence," by Ilan H. Meyer, 2003, *Psychological Bulletin*, *129*(5), p. 679 (doi: 10.1037/0033-2909.129.5.674). Copyright 2003 by the American Psychological Association.

Meyer (2003) conceptualized this theory based on the higher prevalence of mental

disorders in the lesbian, gay, and bisexual (LGB) population due to stigma, prejudice, and

discrimination often experienced in society. This theory is based on a level of chronic

stress experienced by sexual minorities that is above and beyond what is experienced by heterosexual people and includes the concealment of one's sexual orientation, expectations of rejections, and internalized homophobia (Meyer, 2003). Minority stress also stems from social processes, institutions, or structures as opposed to individual variables (Eliason & Fogel, 2015).

While initially related to the higher prevalence of mental disorders in sexual minority populations, the theory has now been expanded to include stress's impact on the physical health and health behaviors of sexual minorities (Frost et al., 2015; Katz-Wise et al., 2015; Mereish, 2014). Stress, in general, has been shown to influence a person's behaviors and create physiological changes that can increase fat storage (Tomiyama, 2019). Stress has been correlated with lower physical activity levels, an increase in the consumption of unhealthy foods, and a reduction in quality sleep (Tomiyama, 2019). Those identifying as a sexual minority are likely to experience more stress and, thus, have poorer levels of obesity-related health behaviors such as less physical activity, poorer diets, and less sleep duration. Therefore, it would be expected that sexual minority women would have lower physical activity levels, consume more unhealthy foods, and sleep less than their heterosexual peers due to having more stress as a result of experiencing chronic minority stress. Additionally, the stress experienced by sexual minority women should predict both their level of obesity and their levels of obesity-related health behaviors.

Literature Review Related to Key Variables

In the present study I examined the differences in health behaviors such as physical activity levels, diet, and sleep duration between lesbian, bisexual, and heterosexual women. In addition, I examined the impact of stress on both obesity and health behaviors.

Obesity

Obesity, in general, has numerous causes that can be classified into six categories: genetic factors; physical factors; emotional, mental, and psychological factors; social factors; food types factors; and other factors (Albu-Shamah & Zhan, 2013). Studies done on adults that had been adopted as children, identical twins raised separately, and certain ethnic groups have all shown that genetics play a role in weight management (Albu-Shamah & Zhan, 2013; Ghosh & Bouchard, 2017; Silventoinen & Konttinen, 2020; Stunkard et al., 1986). Despite the role of genetics, the other categories show that changeable factors also play an important role in obesity. Physical factors, referring to a person's active and sedentary levels, have long been associated with weight (Hill & Wyatt, 2005; Myers et al., 2017). Emotional, mental, and psychological factors can also influence weight due to an influence on eating habits (Albu-Shamah & Zhan, 2013). People often state that they overeat due to boredom or emotional reasons. Additionally, overeating can be a triggered response related to childhood experiences. Social factors can impact obesity as people's attitudes and habits surrounding food and physical activity are learned through social interactions (Albu-Shamah & Zhan, 2013). For example, a person who grows up in a family that does not value physical activity, and chooses to

lead sedentary lives, is more likely to be sedentary throughout their entire life. Specific food types are increasingly associated with increased rates of obesity. The standard American diet consists of refined sugars, hydrogenated and refined oils, chemicals and preservatives, highly processed foods, and junk foods. As these types of foods have increased in the diet, obesity rates have increased as well showing the connection between food choice and weight (Albu-Shamah & Zhan, 2013). Other factors involve habits that are not easily fit into any of the other categories such as overconsumption of food, sleep quality and duration, big dinner meals, and bedtime snacking. A lack of sleep, for example, has been shown to be correlated with an increase in weight over the lifespan (Patel et al., 2008)

Obesity Among Women

For all women over the age of 20 years in the United States, obesity rates have increased from about 25% in 1990 to over 40% in 2016 (NCHS, 2018). Obesity increases the risk for developing certain serious health conditions such as high blood pressure, type 2 diabetes, heart disease, stroke, sleep apnea, and certain cancers (America's Health Rankings, 2020; CDC, 2020a). Obesity in women has also been shown to impact a woman's reproductive health, influencing fertility, contraception effectiveness, and pregnancy (America's Health Rankings, 2020). Obese women who become pregnant are more likely to experience gestational hypertension and diabetes, complications during birth, or the inability to carry a pregnancy to term (America's Health Rankings, 2020).

Additionally, society's anti-fat bias may impact women more than it impacts men (McHugh & Kasardo, 2012). Anti-fat bias is defined as a general dislike of people who

are perceived to be overweight and includes stereotyping and discrimination against those people (McHugh & Kasardo, 2012). For overweight or obese women, discrimination is regularly seen in all areas of their lives from employment opportunities, healthcare experiences, and shopping experiences. Unlike overweight men who can generally shop anywhere without judgment, many overweight women must shop at specialty stores that carry larger sizes (e.g. Torrid or Lane Bryant). While researchers have shown no difference in the psychopathology of obese women versus thin women, living in an anti-fat environment can increase a woman's level of stress and leave an obese woman more susceptible to depression, poor body image, and disordered eating patterns (Frederick et al., 2019; McHugh & Kasardo, 2012).

Obesity Among Sexual Minority Women

Obesity in sexual minority women specifically has been confirmed in several studies with 37% of adult lesbian women and 41% of adult bisexual women being identified as obese according to the 2013 National Health Interview Survey, in comparison to 28% of heterosexual women (Eliason et al., 2015; Fogel et al., 2016; Gonzales & Henning-Smith, 2017; Simoni et al., 2016). Most notably, a systematic review of the literature that covered studies conducted between July 2006 and February 2014 showed that sexual minority women were more likely to have a higher BMI or be classified as obese than their heterosexual counterparts (Eliason et al., 2015). In some instances, obesity is seen as the result of 'lesbian culture' which allows for a larger body size (McPhail & Bombak, 2015; Rinaldi et al., 2016; Wright, 2018). Lesbian and bisexual women may be more accepting overall of various body sizes, but they also feel that their

personal attitudes towards weight are no different than heterosexual women's (Roberts et al., 2010). Therefore, 'lesbian culture' does not fully justify or explain the higher prevalence of obesity among sexual minority women, especially as all women in Western cultures are socialized to believe in the thin ideal (Smith, 2019). The mechanisms behind the health disparity of obesity in sexual minority women are not yet fully understood; however, lesbian and bisexual women have expressed that current weight reduction interventions are not helpful in that they solely focus on a number versus on overall health (Roberts et al., 2010). There have been several studies examining the relationship between health behaviors and obesity rates in sexual minority women, though most have provided contradictory or inconclusive results (Boehmer & Bowen, 2009; McPhail & Bombak, 2015).

Obesity-Related Health Behaviors

Physical Activity

Obesity is often thought to be the result of energy imbalances; therefore, a person's level of physical activity can impact this balance. For example, a person who consumes 3000 calories of food per day but who expends only 1000 calories in physical activity per day is likely to gain weight over time. Longitudinal studies conducted in the 1980s showed that people whose physical activity level decreased over time or who had remained inactive throughout tended to gain weight while those who remained consistently active or increased their physical activity levels either maintained or lost weight (Hill & Wyatt, 2005). Despite this, physical activity has often been devalued as a means of managing weight with some researchers claiming that it has no significant

impact on weight (Myers et al., 2017). This discrepancy may be due to the variables being tested. For example, the type and intensity of physical activity may have an impact on whether there is an effect on weight, rather than simply asking whether someone is physically active or not.

The intensity of physical activity can range from light to vigorous and is typically measured in energy expenditure during the activity. For example, walking at a casual pace is usually classified as light physical activity while brisk walking or running would be moderate to vigorous physical activity. CDC (2018b) has recommended at least 150 minutes of moderate to vigorous physical activity per week to see any benefits of physical activity. Moderate to vigorous physical activity has been associated with lower body mass, lower BMI, lower fat mass, and lower body fat percentage while light physical activity has been associated with higher levels of each (Myers et al., 2017).

A corresponding aspect to physical activity levels is the amount of time a person is sedentary. Sedentary behavior, or the amount of time someone is inactive, has been correlated to higher body mass, higher BMI, more fat mass, metabolic syndrome, type 2 diabetes, and cardiovascular disease (Hamilton et al., 2007; Myers et al., 2017). The relationship between sedentary behavior and adiposity is mediated by moderate to vigorous physical activity but not by light physical activity (Myers et al., 2017). Thus, as it relates to energy expenditure, the time spent in sedentary behavior and the time spent in physical activity is not a zero sum, but rather depends on the intensity of the physical activity.

Physical activity among women. Among women, physical activity has been shown to play a role in the level of metabolic healthiness (Camhi et al., 2015). In other words, a woman can be obese but have more favorable health conditions: better lipid profiles, higher insulin sensitivity, and lower risk for cardiovascular disease (Camhi et al., 2015). Metabolically healthy obese women have been shown to spend less time in sedentary behavior and more time in physical activity when compared to metabolically unhealthy obese women.

Physical activity among sexual minority women. Some researchers have shown that women who had female partners did not have significantly different levels of physical activity when compared to women who had male partners (Boehmer & Bowen, 2009; Eliason & Fogel, 2015). Other researchers have shown that women who identify as lesbians have higher levels of physical activity than their heterosexual counterparts (Eliason & Fogel, 2015; VanKim et al., 2017a). Still other studies have shown that lesbian and bisexual women partake in less physical activity than their heterosexual counterparts (Eliason & Fogel, 2015). Interestingly, women who identify as lesbians have also been shown to have higher rates of sedentary behavior, though some earlier studies showed no difference in sedentary behaviors (Bowen et al., 2008; VanKim et al., 2017a). In general, research has shown that the physical activity behaviors of sexual minority women can vary just as much as for heterosexual women. In addition, many believe that their sexual orientation does not hinder their level of physical activity but may actually help support their physical activity goals (VanKim et al., 2016). Any barriers perceived to achieving physical activity were in line with those of heterosexual women, in that they

felt uncomfortable at the gym due to a lack of knowledge about the equipment or a lack of time for physical activity. This more recent research is encouraging as previous research showed that the environment in physical activity settings, such as the gym or organized sport teams, was generally homophobic and created a negative environment for sexual minorities (Gill et al., 2010).

Diet

As with physical activity, diet plays a role in the energy balance theory of weight management. The body naturally regulates its energy expenditure in times of food scarcity and easily stores fat for survival; however, food today is cheap and plentiful in addition to being highly processed and eaten in ever-growing portions without any additional energy expenditure, a scenario the body does not regulate well (Wadden et al., 2020). Over the years, as society has changed from being agricultural and physical labor to more information and sedentary labor, work-related physical activity has decreased while food availability has increased, thus leading to a discrepancy in energy expenditure and an increase in weight gain (Myers et al., 2017).

Food availability worldwide has also changed throughout the years, leading to a more diverse availability of foods. People are no longer limited to the foods available during certain growing seasons. There may be some belief that having more diverse options is beneficial for one's health and diet; however, a higher dietary diversity score has been correlated with higher rates of obesity (Karimbeiki et al., 2018). In particular, higher dietary diversity scores in fruits, vegetables, and dairy groups were associated with an increase in obesity rates (Karimbeiki et al., 2018). These dietary groups include higher

consumption of starchy vegetables (e.g. peas, potatoes, and corn), fruit juices, and dairy products such as cheese and milk (Benatar et al., 2013; Bertoia et al., 2016; Pan et al., 2013). Additionally, consumption of sugary drinks such as sodas have been associated with an increase in weight (Carroll et al., 2018). The dietary diversity of these foods and their increased consumption lead to increased obesity levels due to an overall increase in caloric intake throughout the day, perhaps with a higher consumption of unhealthy or junk foods as well.

A person's feelings surrounding food choice also play an important role in diet quality. People who believe that "healthy" food tastes good and is good for them are less likely to be overweight whereas people who believe that "unhealthy" foods are tastier are more likely to be overweight (Cooremans et al., 2017). Americans, when compared to people from the United Kingdom, France, and Belgium, are more likely to seek out food that tastes good, rather than seeking out food that is healthy for them (Cooremans et al., 2017). Lampuré et al. (2016) found that people with a high liking for fats generally had a more unhealthy diet with a higher caloric intake and higher consumption of processed meats, cheese, fatty-sweet products, and sugar-sweetened beverages and a lower consumption of fruits and vegetables. Interestingly, people have a tendency to believe that foods claiming to be "reduced fat" or "low fat" are healthier for them due to the media portrayal of these foods; however, these foods are often not any healthier and contain the same or an insignificantly smaller amount of overall calories (Schermel et al., 2016). Erroneous beliefs and misleading information about nutritional values and healthiness can undermine a person's attempts to manage weight and prevent obesity.

For people who are already obese, poor food choices are often a result of the reinforcing value of food (Carr & Epstein, 2020). Frequently, an already-obese person may seek out tasty food as a reward, rather than eating due to hunger, thus leading to an increase in energy intake. For example, as a reward for completing a household task, a person may seek out a favorite candy bar. This is likely the result of behavioral patterns learned in childhood such as when a parent would allow a child to have dessert if they finished eating their vegetables first.

Diet among women. In women, diet also plays a role in metabolic healthiness. Metabolically healthy obese women reported higher intakes of fiber and vegetables with lower intake of milk and saturated fats when compared to their metabolically unhealthy counterparts (Camhi et al., 2015). Despite this, women who felt overweight were more likely to consume snack foods, even if the woman was not actually overweight (Oldham et al., 2018). The combination of these two conditions can result in an excess of caloric intake and ultimately weight gain. Additionally, women who preferred the tastes of fatty foods and sweet foods were more likely to be obese compared to those who did not prefer those tastes (Lampuré et al., 2016).

Remarkably, research has also shown that dieting, or caloric restriction to induce weight loss, has often resulted in weight gain for women but not for men (van Strien et al., 2020). While dieting may work initially to lose weight, women tend to partake in emotional eating or to eat due to external cues and, therefore, regain any weight lost. The consumption of comfort foods, or the act of emotional eating for women is often triggered by feelings of frustration, anxiety, and depression in addition to social and

personal stressors (Boggiano et al., 2017). Dieting, overall, has been shown to be

ineffective for women which suggests that a longer-term, perhaps lifelong, dietary change

is required for successful weight loss. This may play an especially important role for

women who are food addicted, an issue that is more commonly found in women and

includes the overconsumption or disordered eating patterns of highly palatable foods, e.g.

candy, cakes, or ice cream (Ayaz et al., 2018).

Diet among sexual minority women. One study found that women who had

female partners did not have significantly different caloric intake when compared to

women who had male partners (Boehmer & Bowen, 2009). A more recent study,

however, found that lesbian women had higher quality diets when compared to

heterosexual women (VanKim et al., 2017b). The results of these studies can both be true

as caloric intake does not necessarily correlate with dietary quality, e.g. the difference

between consuming a 300-calorie doughnut versus consuming a 300-calorie salad.

Younger sexual minority women are also more likely to report restrictive dieting, or

extreme levels of food intake restriction, which has been theorized to be due to a

combination of minority stressors and a perception of being overweight (Luk et al.,

2019). Additionally, some sexual minority women may partake in binge eating behaviors

due to added minority stress (VanKim et al., 2016).

Previous studies have shown a correlation between having a sexual minority

identity and substance addiction, which in recent years has included food addiction.

While not specific to sexual minority women, it has been shown that people who identify

as a sexual minority are more likely to exhibit symptoms of food addiction (Rainey,

Furman, & Gearhardt, 2018). Additionally, the likelihood of food addiction among sexual minorities increases with increased exposure to minority stressors such as discrimination and harassment (Rainey et al., 2018). Food addiction may be the result of poor coping strategies employed to deal with minority stressors.

Differences in specific dietary behaviors, e.g. fruit and vegetable consumption or soda consumption, have not been studied between heterosexual women and sexual minority women specifically. However, this difference has been compared with all sexualities studied: lesbian, gay, bisexual, queer, pansexual or omnisexual, and straight (Smalley et al., 2016). While not all comparisons were significant, some important risks were noted. Lesbian women and bisexual people (men and women) were more likely to consume fried foods and caloric beverages when compared to people who identified as queer (men and women). No significant differences were found in fruit or vegetable consumption among lesbian women and other sexualities; though there was a difference between gay men and those that identified as queer (men and women). The results from this study show that there may be differences in obesity-related dietary behaviors by sexual orientation, but that further study is necessary.

Sleep

A lack of sleep has been associated with several health consequences such as overweight and obesity, hypertension, metabolic syndrome, diabetes, and cardiovascular morbidity, though some studies have shown inconclusive results (Andreeva et al., 2017; Krističević et al., 2017). In the past several decades as the rates of obesity have risen, sleep duration has decreased (Andreeva et al., 2017; Patel et al., 2008). According to

research by the National Sleep Foundation (2020), adults should average seven to nine hours of sleep per night; however, by 2005, only a quarter of adults were reporting getting at least eight hours of sleep per night (Patel et al., 2008).

Research has shown a correlation between a lack of sleep and an increase in weight throughout the lifespan (Patel et al., 2008). Conversely, weight gain over time has been shown to correlate to a shorter sleep duration. Therefore, weight gain and sleep duration may have a symbiotic effect, both impacting the other. While the exact mechanisms for this relationship are unknown, it has been theorized that short sleep duration may induce hormonal changes associated with regulating appetite and satiety as well as increase the likelihood of choosing unhealthy foods (Vézina-Im et al., 2018). Some studies have reported that people increase their food intake by 300 calories when sleep is reduced by 2.5 – 4 hours per night (St-Onge, 2016). Over time, this additional caloric intake due to reduced sleep can result in weight gain. Additionally, some studies have shown that spending too much time in bed, typically defined as being in bed for over nine hours, can also lead to additional weight gain, likely due to a lack of energy expenditure (Krističević et al., 2018).

Sleep among women. Women are at greater risk for sleep disturbances, including shorter sleep duration and lower sleep quality (Bei et al., 2015; Hall et al., 2018). This may be due to several factors unique to women such as menstrual cycles, pregnancy, menopause, other hormonal factors, or socio-demographic factors (Vézina-Im et al., 2018). Women who suffer from high levels of chronic stress are more likely to experience sleep disturbances or to have poor sleep quality overall than women who

experience low or moderate chronic stress levels (Hall et al., 2015). Chronic stress, therefore, can impact sleep in women over the long-term which can negatively impact their health.

Women's sleep quality is often associated with their psychological and physical well-being in a bidirectional relationship (Bei et al., 2015; Shade et al., 2016). Women who suffer from mental health problems such as depression report lower sleep quality with more sleep disturbances (Bei et al., 2015). This is true whether the symptoms of depression were present before having sleep disturbances or vice versa. Women also report higher levels of sleep disturbances if they are suffering from any kind of pain, are overweight, or have high blood pressure (Shade et al., 2016). These physical symptoms may be due a medical condition or lifestyle choices; however, Shade et al. (2016) found that even a small amount of weight loss can improve sleep quality for women.

Sleep among sexual minority women. There has been little research conducted into sleep differences due to sexual orientation. In general, research has not found any differences in sleep duration due to sexual orientation (Chen & Shiu, 2017; Jackson et al., 2016). However, research has found a difference in perceived levels of "restedness" and sleep disturbances (Chen & Shiu, 2017; Martin-Storey et al., 2018). Women with same-sex partners have reported experiencing lower levels of "restedness" when compared to women with opposite-sex partners (Martin-Storey et al., 2018). This perception was related to the amount of sleep with less sleep resulting in lower feelings of "restedness", despite there being no difference in average sleep duration between sexual minority women and heterosexual women (Martin-Storey et al., 2018). Additionally, sexual

minority women living in more LGBT-friendly locations report better levels of "restedness" versus those that live in less LGBT-friendly locations (Martin-Storey et al., 2018).

Some research has indicated that sexual minorities are more prone to sleep disturbances, which can impact their sleep quality (Chen & Shiu, 2017; Patterson & Potter, 2020; Patterson et al., 2018). While all sexual minorities have been shown to report higher levels of sleep disturbances than their heterosexual counterparts, bisexual women report the most difficulty sleeping (Patterson & Potter, 2020). For sexual minority women, research has shown that they experience more symptoms of insomnia, including difficulty falling asleep and difficulty staying asleep, than their heterosexual counterparts (Patterson et al., 2018). Sexual minority women are also more likely to wake up throughout the night when compared to sexual minority men (Chen & Shiu, 2017). A proposed reason for increased sleep disturbances is sexual minority stress brought on by emotionally distant and strained relationships with parents (Patterson et al., 2018); however, other mechanisms or stressors may also play a role in sleep disturbances among sexual minority women.

Stress and Obesity

Stress can impact a person in several ways: cognitively, physiologically, behaviorally, and biochemically (Tomiyama, 2019). This is especially true when a person experiences chronic stress. In the general population, stress has been shown to be associated with an increase in weight (Wardle et al., 2011). This is likely due to the influence stress has on physical activity, diet, and sleep patterns (Diggins et al., 2015;

Tomiyama, 2019). The adverse effects of stress on these behaviors has been documented in several articles and is often associated with an increase in weight (Geiker et al., 2018).

With regards to physical activity, stress can both increase and decrease physical activity levels (Tomiyama, 2019). Some people will turn to physical activity as a way to cope with additional stress, thus increasing their physical activity levels (Tomiyama, 2019). Despite this, the majority of research shows a decrease in physical activity levels as stress levels increase. This makes sense as stress may minimize a person's energy, thus leaving them without the energy to partake in any physical activity beyond their normal day-to-day routines.

When stressed, a person is likely to change their normal dietary patterns. Oftentimes, a person will choose to consume foods that are higher in sugar, fat, and calories than they would normally choose to consume (Tomiyama, 2019). Additionally, stress may contribute to uncontrolled and emotional eating, impacting a person's food choices and, ultimately, their weight (Richardson et al., 2015). According to one study, the additional calories consumed due to a single additional stressor can add up to a potential weight gain of almost 11 pounds over the course of a year (Kiecolt-Glaser et al., 2015). Consuming comfort foods to mediate stress becomes a learned response and is reinforced every time someone partakes in this behavior and feels relief afterward, even if the relief is temporary. The patterns of emotional eating have been shown to be particularly true for women (Diggens et al., 2015).

Stress also interferes with sleep patterns (Tomiyama, 2019; Tousignant et al., 2019). Both acute and chronic stress often result in shorter sleep duration and decreased

quality of sleep (Tomiyama, 2019). Additionally, people who tend to worry about the future or ruminate about the past before attempting to sleep have shown a statistically significant relationship between stress and sleep quality (Tousignant et al., 2019). While all levels of worry or rumination showed statistical significance, those with higher levels of worry or rumination had the strongest relationship between stress and sleep. The higher the level of worry or rumination a person felt, the more perceived stress they felt, and the more their sleep was impacted.

Stress and Obesity Among Women

Women, in general, may respond to stress in different ways than men. As an example, it has been noted that men's response to stress is often seen as a "fight or flight" response whereas women's response to stress is characterized by "tend and befriend," which involves behaviors associated with protection of oneself, reducing stress, and maintaining social networks (Taylor et al., 2000; Verma et al., 2011). Consequently, women's response to stress may manifest in behaviors that increase the likelihood of weight gain, such as partaking in the consumption of comfort foods in order to reduce stress and feel protected or nurtured.

Stress for women has been shown to often take the form of overthinking, especially just prior to bedtime. Women have been shown to experience more cognitive pre-sleep arousal, which can impact their quality of sleep (Morin et al., 2003). Cognitive pre-sleep arousal consists of both worry about the future and rumination about the past, often resulting in negative cognitions, increased stress levels, and disturbed sleep. Additionally, women who experience high chronic stress report lower sleep quality when

compared to women who have low or moderate chronic stress levels (Hall et al., 2015).

While research has shown that stress and poor sleep may not contribute to a higher BMI

in women, there remains a commonality among women in that they are likely to

experience poor sleep quality, have high levels of stress, and be overweight (Tom &

Berenson, 2013); therefore, other factors are likely to correlate with these commonalities.

As previously stated, poor sleep and high stress may alter a person's behaviors, such as

physical activity levels or the types of foods consumed, and thus lead to weight gain in an

indirect manner for women.

Stress and obesity among sexual minority women

As previously stated, stress impacts every facet of life and can have a profound

effect on one's well-being. In a mixed-methods study, lesbian women kept expressive

journals about their experiences as a sexual minority in addition to completing surveys

regarding mood states and stress (Braitman et al., 2008). This study found that lesbian

women experienced unique stressors related to their sexual orientation and that feeling

"different" was significantly correlated with feelings of depression, tension, confusion,

and additional perceived stress (Braitman et al., 2008). Likely due to the fact that lesbian

women live in two different worlds, the heteronormative main culture and the lesbian

sexual subculture, lesbian women may experience more internalized stress levels related

to their self-identity. Lesbian and bisexual women who experienced more discrimination

from those in the heteronormative main culture reported increased minority stress,

resulting in feelings of shame and concern about their sexual orientation (Mason &

Lewis, 2016). These feelings can lead to social anxiety and social isolation which have

been shown to result in emotional coping mechanisms including binge eating or the consumption of so-called comfort foods in order to help regulate mood and find relief from the experienced stressors (Mason & Lewis, 2015; Mason & Lewis, 2016). For sexual minority women, the earlier they came out and experienced sexual minority developmental milestones (e.g. same-sex attraction or figuring out one's sexual orientation identity), the more likely they were to experience bullying due to their sexual orientation and the more likely they were to use unhealthy eating patterns to cope (Katz-Wise et al., 2015). Differences in specific unhealthy eating patterns were discovered for those that identified as lesbian versus those that identified as bisexual. Lesbian women were more likely to turn to emotional eating patterns whereas bisexual women were more likely to partake in uncontrolled or binge eating sessions (Katz-Wise et al., 2015). Thus, the experience of minority stressors due to bullying led to unhealthy eating patterns.

For some lesbian and bisexual women, internalized heterosexism or internalized homophobia may result in additional stress and promote body shame, which has also been associated with disordered eating patterns (Watson et al., 2015). These internalized beliefs may make it difficult to change unhealthy behaviors, including dietary patterns (Wright, 2018). Lesbian and bisexual women who have internalized these beliefs may also be attempting to prove to both themselves and the world that their lifestyle is acceptable. They experience additional stress due to having to have constant vigilance about their surroundings: where is it acceptable to be out and where is it not (Roberts et al., 2010). This constant stress impacts their health behaviors, often leading lesbian and

bisexual women to drink more, smoke more, and partake in other unhealthy behaviors in order to cope with the stress.

Mereish (2014) demonstrated that lesbian women were more likely to experience minority stress in the form of heterosexist discrimination and that this stress is associated with a higher likelihood of being overweight or obese. The mechanisms behind this association are not fully understood but may include a combination of stress-related hormonal changes and unhealthy behavioral coping methods. It is unknown if this same type of minority stress is associated with higher rates of obesity for bisexual women.

Summary and Conclusions

Sexual minority women have defined their own health in a variety of ways, but in general consider themselves healthy if they feel well rested, have enough energy to do the things they need and want to do, eat healthy food, do not overeat, and exercise regularly as well as have a feeling of overall peace or a lack of stress (Fogel et al., 2012). Despite their own definition of being healthy, the health disparity of obesity among lesbian and bisexual women continues to persist. Previous research regarding obesity-related health behaviors including physical activity, diet, and sleep have generally shown inconclusive results or shown that while differences exist, they may or may not relate to the increase in obesity levels. Research has also tended to group lesbian and bisexual women together which may further complicate the findings as these are two unique groups of women for which obesity-related health behaviors may play different roles in their levels of obesity. Additionally, lesbian and bisexual women experience unique minority stressors that can

impact their overall health, resulting in the use of maladaptive coping mechanisms that increase the likelihood of obesity.

The higher likelihood of lesbian and bisexual women to be overweight or obese is well established in the literature (Eliason et al., 2015; Fogel et al., 2016; Gonzales & Henning-Smith, 2017; Simoni et al., 2016); however, gaps remain in terms of the potential correlational links to obesity-related health behaviors and how stress plays a role, particularly for bisexual women. Much of the research on sexual minority women claims that minority stress may play an important role in their health behaviors and health outcomes but does not directly show if the added minority stress predicts health behaviors or obesity. Therefore, this study first analyzed obesity-related health behavior differences between heterosexual, lesbian, and bisexual women based on the 2017 BRFSS in order to add to the knowledge base about the relationship between health behaviors and sexual orientation. Then, this study focused on the extent to which stress predicts both obesity and health behaviors in sexual minority women. Additionally, this study examined whether health behaviors mediate the relationship between stress and obesity in sexual minority women. The methods for conducting this study are detailed in the next chapter.

Chapter 3: Research Method

Introduction

The purpose of the present study was to examine the relationship among stress, obesity, and health behaviors in sexual minority women as well as determine any differences in health behaviors between sexual minority women and heterosexual women. The research used a quantitative design with secondary data from a national database, namely the 2017 Behavioral Risk Factor Surveillance System (BRFSS). Specifically, in this I study attempted to determine if there are differences among lesbian, bisexual, and heterosexual women in their obesity-related health behaviors, including differences in physical activity, diet, and sleep. Additionally, this study attempted to determine if stress predicts behaviors and obesity in sexual minority women, an area of research that has been underexplored. Results from this study will help facilitate a better understanding of the causes of the health disparity of obesity among sexual minority women and whether obesity-related behaviors play a significant role in this health disparity. In addition, the results from this study helped determine if stress is a significant factor in the health behaviors and obesity levels of sexual minority women.

This chapter includes an overview of the research design and rationale, the population used and sampling methods, data collection procedures, and information about the BRFSS. Additionally, I outlined the proposed data analysis plan used to analyze each of the hypotheses and discussed any potential threats to internal and external validity as well as any ethical considerations.

Research Design and Rationale

This study used secondary data from the 2017 BRFSS (CDC, 2016) to examine

the relationship between stress, health behaviors, and obesity among sexual minority

women. For comparative purposes, health behaviors known to be correlated to obesity

such as physical activity, diet, and sleep were analyzed for three groups of adult women:

heterosexual women, lesbian women, and bisexual women. Then the predictive

relationships between stress and obesity and between stress and health behaviors were

analyzed for sexual minority women. Finally, this study analyzed whether health

behaviors mediate the relationship between stress and obesity in sexual minority women.

Methodology

Population

The target population for the BRFSS was adults aged 18 years or older living in

private residences or college housing in any US state or territory. For the present study,

the target population was adult women over the age of 18 residing in any US state or

territory. Based on a preliminary analysis of the data, the total number of eligible

participants for this study was 110,228 adult women over the age of 18 years. Broken

down by self-identified sexual orientation, there were 106,595 heterosexual women, 1330

lesbian women, and 2303 bisexual women included in the full dataset for the 2017

BRFSS.

Sampling and Sampling Procedure

For the BRFSS, sampling procedures used either a disproportionate stratified

sample (DSS) design or a simple random-sample design for landline calls (CDC [2], July

2018). For those that used the DSS design, landline telephone numbers were divided into two strata consisting of either high-density or medium-density strata based on the amount of phone numbers with the same area code, prefix, and first two digits of the suffix. This allowed for a probability sample of all households with landline telephones. Cell phone calls used a commercially available sampling frame and specific protocols in order to obtain a random sample. Based on a calculated interval, the BRFSS would select one random cell phone number to call.

As this study utilized secondary data from the 2017 BRFSS, it was appropriate to use all participants that meet the inclusion criteria. Therefore, participants for this study were women over the age of 18, living in the United States or a U.S. territory, and who self-identify as heterosexual, lesbian, or bisexual.

Recruitment, Participation, and Data Collection

Recruitment

The CDC with the aid of state health departments contracted with call centers or universities that conducted the BRFSS interviews, which consisted of a core questionnaire, optional modules, and state-specific add-on questions. Participants were selected via random digit dialing (RDD) on both landlines and cell phones. When calling a landline, the participant was a random adult over the age of 18 in the household. For cell phones, any adult that answered the phone was eligible to participate as long as they reside in either a private residence or college housing.

Participation

Participants had to be 18 years or older. For landline telephone calls, the participant could be any random adult over age 18 in the household. For cell phone calls, any adult that answers the phone was eligible to participate, regardless of landline use, and only if they resided in a private residence or college housing. The script used for the interviews started with an introduction of the project and included preliminary questions to ensure that the number dialed was a private residence, that the person who answered was at least 18 years old, and their state of residence. At this point, the interviewer stated that they will not collect any identifying information and that the person could choose whether or not to answer the questions. Additionally, they let the participant know that they could end the interview at any time.

Data Collection

The data were collected via the state health departments or contracted interviewers, typically via telephone interviews although some localities used in-home interviewing. Interview protocols were in place to ensure uniformity and consistent wording. For telephone interviews, the use of Computer-Assisted Telephone Interview (CATI) systems was used in 53 states or territories for the 2017 BRFSS. CATI systems provided programming for the core questionnaire and questionnaire scripting for any add-on state-specific questions. Calls were made seven days per week during both daytime and evening hours throughout the year. Once collected, the data was sent to the CDC for editing, processing, weighing, and analyzing. Datasets for the BRFSS are maintained on

the CDC website and are publicly accessible. The 2017 dataset included all the variables examined in this study.

Instrumentation

Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS was publicly accessible through the CDC, with access to an overview, the questionnaire, the codebook, and the dataset (CDC, August 2020). Each year, a group of representatives from the BRFSS and the CDC must agree on the specific content for that year's survey. New questions must go through cognitive and field testing in order to be included and many questions come from already established national surveys, such as the National Health Interview Survey or the National Health and Nutrition Examination Survey.

The BRFSS consisted of three components: a core questionnaire, optional modules, and state-specific add-on questions (CDC, July 2018b). The core component included questions that all states and territories were required to ask and included questions regarding demographics, health-related perceptions, chronic conditions, and certain health behaviors. The optional modules asked about specific topics such as caregiving, cancer survivorship, and sugary beverage consumption. A list of states that used optional modules included in this study (sleep disorder, sugar sweetened beverages, social determinants of health, and sexual orientation and gender identity) was included in Appendix B. State-added questions were developed by individual states and were not edited, evaluated, or tracked by the CDC. Questions on the core questionnaire and the

optional modules remained the same throughout the year; however, state-added questions could be changed at any time.

While exact reliability and validity values were not published, the BRFSS Comparability of Data for the 2017 survey states that the data were both reliable and valid (CDC, July 2018a). Several past studies have examined the reliability and validity of the BRFSS and found that the data was comparable to other well-established national surveys.

Operationalization of Variables

Sexual Orientation

Measured as the self-identification of straight/heterosexual, lesbian, or bisexual. The three groups were analyzed separately as prior research has shown that lesbian women and bisexual women are unique groups with bisexual women reporting lower levels of general well-being than lesbian women (Fredriksen-Goldsen et al., 2010).

Physical Activity

There are several questions on the BRFSS pertaining to physical activity (See Appendix A). For the purpose of this study, the variables analyzed were the calculated variables "minutes of total physical activity per week" and "minutes of total vigorous physical activity per week". Vigorous activity was calculated based on responses given to the type of exercise partaken in, the calculated estimated age-gender specific maximum oxygen consumption, and the calculated Metabolic Equivalent of Task (MET) value.

Fruit and vegetable consumption

The 2017 BRFSS contained several questions related to fruit and vegetable consumption (See Appendix A). The calculated variables "computed fruit intake in tames per day" and "computed vegetable intake in times per day" were used to analyze this variable. Both of these calculated variables were reported with two implied decimal places; therefore, a reported value of 100 is equivalent to 1 time per day (CDC, July 2018c).

Potato Consumption

There were two questions on the 2017 BRFSS related to potato consumption (See Appendix A). From the dataset, the variable "computed potato servings per day" was used to analyze potato consumption. The calculated variable for potato consumption was reported with two implied decimal places; therefore, a reported value of 100 is equivalent to 1 time per day (CDC, July 2018c). Potato consumption was a proxy for starchy vegetables in general, which have been shown to be related to an increase in weight.

Regular soda or sugar-sweetened drink consumption

Two questions on the BRFSS were related to regular soda or sugar-sweetened beverage consumption (See Appendix A). In order to determine if the consumption of either regular soda or sugar-sweetened beverages was statistically different between groups, both variables were analyzed separately.

Sleep Duration

Measured in number of whole hours with partial hours either rounded up or down.

Stress

Measured via a five-point Likert scale ranging from none of the time to all of the time.

Data Analysis Plan

The data was analyzed using IBM SPSS Statistics 25. The following table shows the research questions and hypotheses with their associated variables and proposed statistical procedures:

Table 1

Statistical Procedures per Research Question and Hypothesis

Research Question	Hypothesis (H_a)	Variables	Statistical Procedure/Analysis
1. To what extent are there differences in obesity-related health behaviors as measured in the 2017 Behavioral Risk Factor Surveillance System (BRFSS)?	$H1_a$: There are significant differences in physical activity among heterosexual, lesbian, and bisexual women. $H2_a$: There are significant differences in the amount of fruit and vegetable consumption among heterosexual, lesbian, and bisexual women. $H3_a$: There are significant differences in the amount of potato consumption among heterosexual, lesbian, and bisexual women. $H4_a$: There are significant differences in the amount of regular soda or sugar sweetened drinks consumed among heterosexual, lesbian, and bisexual women. $H5_a$: There are significant differences in the average hours of sleep among heterosexual, lesbian, and bisexual women.	Independent: sexual orientation groupings-heterosexual, lesbian, and bisexual Dependent: physical activity, fruit and vegetable consumption, potato consumption, regular soda or sugar-sweetened beverage consumption, average hours of sleep	One-way ANOVA or Kruskal-Wallis H test

Research Question	Hypothesis (H$_a$)	Variables	Statistical Procedure/Analysis
2. To what extent does stress, measured as the frequency of stressful feelings over the timespan of a month in the 2017 BRFSS, predict higher obesity levels as measured by the calculated body mass index (BMI) in lesbian and bisexual women?	H$_a$: Stress is a significant predictor of obesity levels in sexual minority women.	Dependent: BMI Predictor: stress	Multiple Regression
3. To what extent is stress, measured as the frequency of stressful feelings over the timespan of a month in the 2017 BRFSS, correlated to health behaviors in lesbian and bisexual women?	H$_a$: Stress is correlated to health behaviors in sexual minority women.	Dependent: health behaviors Independent: stress	Spearman's Correlation
4. To what extent do health behaviors as measured in the 2017 BRFSS mediate the relationship between stress, measured in frequency of stressful feelings over the timespan of a month, and obesity in lesbian and bisexual women?	H$_a$: Health behaviors mediate the relationship between stress and obesity in sexual minority women.	Dependent: BMI Independent: stress Mediating: health behaviors	Multiple regression and the Sobel test to show estimated percentage of the direct effect of the independent variable and the indirect effect of the mediating variable

Threats to Validity

As the present study was correlational in nature, internal validity was generally low. A correlation between the variables in the present study could not determine causality (Price et al., 2018). In other words, the variables tested in the present study may have played a role in the higher obesity rates of sexual minority women, but other factors could have also played a significant role. Additional factors could have included ethnicity, age, socioeconomic status, education, or geographic location among others. In the case of stress, research has shown that increased stress was associated with higher BMI; however, having a higher BMI may have also led to increased levels of stress due to fat bias in society. Additionally, obesity itself could have led to unhealthy behaviors;

therefore, while a correlation may exist, the directionality between the variables was unknown.

Another threat to internal validity was recall bias which can impact a participant's ability to accurately report past emotions or behaviors (Ross & Wing, 2018). The data collected through the BRFSS was based on self-report through telephone interviews. Participants could have easily underestimated or overestimated their physical activity levels, dietary intakes, or sleep duration either because they truly did not remember or they were attempting to appear healthier than they were. People generally want to be viewed in a positive light and, therefore, are more likely to overestimate information such as the amount of vegetables consumed or minutes spent exercising and to underestimate information such as their soda consumption, a phenomenon related to one's desire to respond in a socially desirable manner (McKibben & Silvia, 2016). Additionally, as the data was collected through telephone interviews and only included people living in private residences or college housing, the data excluded any sexual minority women who may not have had access to telephones or who lived in another form of housing or were homeless.

The use of secondary data could have posed a threat to validity in that the methodology and data processing were not in the control of the researcher (Cheng & Phillips, 2014). The data from this dataset was not collected with the intention of answering my specific research questions or of testing my specific hypotheses, thus presenting one disadvantage for the use of secondary data (Cheng & Phillips, 2014). Therefore, the use of secondary data may not have included data on other variables that

could relate to the research questions or hypotheses. For example, there were no questions related to the consumption of junk food, such as candy bars, or the frequency of consuming fast food, both of which are important aspects of an individual's diet and have been shown to be correlated with an increase in weight.

Ethical Procedures

Data from the BRFSS was publicly accessible through the CDC website and did not include any identifying information. Some demographic data may have been removed from the accessible dataset in order to protect the privacy and confidentiality of respondents, an ethical consideration that has been applied to the use of secondary data (Cobban et al., 2008). The ethical procedure for protecting the participants' privacy and confidentiality in publicly accessible data could be accomplished in several ways, including removing identifying information, encrypting some of the data, or restricting access to identifiable information. In the BRFSS, the procedure for protecting privacy and confidentiality included removing data that may contain information regarding substate geographic identifiers, detailed race or ethnicity, or when the participant's age is older than 80 years (CDC, July 2018b). No individuals that participated in the survey were identified so no further protections were needed. Participants were not given any form of compensation for participating, but rather they were informed that their responses can help improve the overall health of US citizens. The CDC website maintains all data collected through the BRFSS and the data was freely available to the public, thus implying permission for use (Tripathy, 2013). Formal approval from the Walden IRB was

required prior to the use of the data and the data analysis process. The approval number for the present study is 09-29-20-0744073.

Summary

Chapter three discussed the methodology that was used for this correlational quantitative study. Using data from the 2017 BRFSS, which collects health risk and demographic information from a national sample through landline and cell phone interviews, the relationship between obesity-related health behaviors (i.e., physical activity, diet, and sleep), stress, and sexual orientation were analyzed. Obesity-related health behaviors were compared between heterosexual, lesbian, and bisexual women, with the null hypotheses indicating that there were no differences in behaviors among these sexual orientation groups. For sexual minority women, the extent to which stress predicts obesity and to which stress predicts health behaviors were also analyzed. Additionally, the extent to which health behaviors mediate the relationship between stress and obesity were analyzed. Potential threats to the validity and ethical concerns were also discussed as they may impact the meaningfulness of the study. The results of this study were described in Chapter 4.

Chapter 4: Results

Introduction

The present quantitative study aimed to determine the extent of differences in obesity-related health behaviors, including physical activity, diet, and sleep duration, among heterosexual, lesbian, and bisexual women. For lesbian and bisexual women, this study also aimed to determine if stress predicted obesity and if stress predicted health behaviors. Finally, this study aimed to determine if health behaviors mediated the relationship between stress and obesity for lesbian and bisexual women. This chapter restates the research questions and hypotheses before reporting on the data collection, data analysis results, and summery of the overall findings.

Research Questions and Hypotheses

The following research questions and hypotheses guided this study:

1. To what extent are there differences in obesity-related health behaviors as measured in the 2017 Behavioral Risk Factor Surveillance System (BRFSS) among heterosexual, lesbian, and bisexual women?

> $H1_0$: There are no significant differences in physical activity among lesbian, bisexual, and heterosexual women.
>
> $H1_a$: There are significant differences in physical activity among lesbian, bisexual, heterosexual women.
>
> $H2_0$: There are no significant differences in the amount of fruit and vegetable consumption among lesbian, bisexual, and heterosexual women.

$H2_a$: There are significant differences in the amount of fruit and vegetable consumption among lesbian, bisexual, and heterosexual women.

$H3_0$: There are no significant differences in the amount of potato consumption among lesbian, bisexual, and heterosexual women.

$H3_a$: There are significant differences in the amount of potato consumption among lesbian, bisexual, and heterosexual women.

$H4_0$: There are no significant differences in the amount of regular soda or sugar-sweetened drinks consumed among lesbian, bisexual, and heterosexual women.

$H4_a$: There are significant differences in the amount of regular soda or sugar-sweetened drinks consumed among lesbian, bisexual, and heterosexual women.

$H5_0$: There are no significant differences in the average hours of sleep among lesbian, bisexual, and heterosexual women.

$H5_a$: There are significant differences in the average hours of sleep among lesbian, bisexual, and heterosexual women.

2. To what extent does stress, measured as the frequency of stressful feelings over the timespan of a month in the 2017 BRFSS, predict higher obesity levels as measured by the calculated body mass index (BMI) in lesbian and bisexual women?

H_0: Stress is not a predictor of obesity levels in sexual minority women.

H_a: Stress in a predictor of obesity levels in sexual minority women.

3. To what extent is stress, measured as the frequency of stressful feelings over the timespan of a month in the 2017 BRFSS, correlated to health behaviors in lesbian and bisexual women?

H_0: Stress is not correlated to health behaviors in sexual minority women.

H_a: Stress is correlated to health behaviors in sexual minority women.

4. To what extent do health behaviors as measured in the 2017 BRFSS mediate the relationship between stress, measured in frequency of stressful feelings over the timespan of a month, and obesity in lesbian and bisexual women?

H_0: Health behaviors do not mediate the relationship between stress and obesity in sexual minority women.

H_a: Health behaviors do mediate the relationship between stress and obesity in sexual minority women.

Data Collection

The dataset from the 2017 BRFSS was downloaded from the CDC website for this study (CDC, 2018a). Original data was collected through random-digit dialing techniques used for landline and cell phone interviews following protocols set by the CDC (CDC, July 2018b). Computer-assisted Telephone Interview (CATI) systems provided programming for the core questionnaire and questionnaire scripting for any add-on state-specific questions. The data, once collected, was then sent to the CDC for editing, processing, weighing, and analyzing (CDC, July 2018b). All data and related materials are publicly available on the CDC website and available for use without permission.

The 2017 BRFSS questionnaire (CDC, 2016) asked about sexual orientation and gender identity in module 27, which is an optional module and not part of the core questions (see Appendix B for which states opted to use this module). Sexual orientation responses that were read aloud were limited to straight (1), lesbian or gay (2) or bisexual (3). Respondents could also respond with other, don't know/not sure, or refuse to answer. As there was no breakdown of the "other" category, only those that responded as straight, lesbian, or bisexual were included in this study. This sample is not representative of all sexual minority women for that reason. Of the women that responded to the sexual orientation question, 106595 self-identified as straight, 1330 self-identified as lesbian, and 2303 self-identified as bisexual. This resulted in an original sample size of 110,228 women; however, to avoid the problem of unequal group sizes, the heterosexual women category was reduced to 2000 participants. This was done by first creating separate datasets based on sexual orientation (one dataset for heterosexual women, one for lesbian women, and one for bisexual women). Then the heterosexual women dataset was reduced via random selection in the SPSS software through the data/select cases/random sample of cases option. Finally, all three datasets were recombined into one dataset.

As part of the demographics section in the core questionnaire, the 2017 BRFSS asked respondents about age, race/ethnicity, education level, and income level. A breakdown of this demographic information can be found in Table 2. For heterosexual women, the largest group were over 65 years old (39.8%). The largest age group for lesbian women was between 55 and 64 years old (23.5%). Bisexual women were generally younger with the largest age group being between 25 and 34 years old (27.6%).

The majority of women in each group were non-Hispanic white: 74.1% for heterosexual

women, 75.8% for lesbian women, and 67.3% for bisexual women. All groups also

reported mostly attending or graduating from college and having incomes above $50,000

per year.

Table 2

Demographic Characteristics by Sexual Orientation

		Heterosexual n (%)	Lesbian n (%)	Bisexual n (%)
Age	18-24	76 (3.8)	112 (8.4)	539 (23.4)
	25-34	160 (8.0)	195 (14.7)	636 (27.6)
	35-44	222 (11.1)	175 (13.2)	377 (16.4)
	45-54	317 (15.9)	285 (21.4)	283 (12.3)
	55-64	430 (21.5)	312 (23.5)	227 (9.9)
	65 and older	795 (39.8)	251 (18.9)	241 (10.5)
	Total	2,000 (100)	1,330 (100)	2,303 (100)
Race/Ethnicity	Non-Hispanic White	1481 (74.1)	1,008 (75.8)	1,549 (67.3)
	Non-Hispanic Black	176 (8.8)	100 (7.5)	206 (8.9)
	Non-Hispanic Other	104 (5.2)	68 (5.1)	126 (5.5)
	Non-Hispanic Multiracial	59 (3.0)	50 (3.8)	123 (5.3)
	Hispanic	149 (7.5)	86 (6.5)	251 (10.9)
	Refused	31 (1.6)	18 (1.4)	48 (2.1)
	Total	2000 (100)	1,330 (100)	2,303 (100)
Education Level	Did not graduate high school	135 (6.8)	58 (4.4)	161 (7.0)
	Graduated high school	539 (27.0)	245 (18.4)	569 (24.7)
	Attended college or technical school	564 (28.2)	352 (26.5)	784 (34.0)
	Graduated college or technical school	755 (37.8)	673 (50.6)	783 (34.0)
	Refused	7 (0.4)	2 (0.2)	6 (0.3)
	Total	2000 (100)	1,330 (100)	2,303 (100)
Income Level	Less than $15,000	172 (8.6)	119 (8.9)	310 (13.5)
	$15,000 – less than $25,000	295 (14.8)	188 (14.1)	448 (19.5)
	$25,000 – less than $35,000	187 (9.4)	128 (9.6)	233 (10.1)
	$35,000 – less than $50,000	232 (11.6)	169 (12.7)	266 (11.6)
	$50,000 and over	752 (37.6)	581 (44.6)	693 (30.1)
	Refused	362 (18.1)	145 (10.9)	353 (15.3)
	Total	2000 (100)	1,330 (100)	2,303 (100)

Additionally, the core section asked how much they weighed without shoes and how tall they were without shoes. Respondents could answer in any form of metrics. Weight could be reported in either pounds or kilograms while height could be reported in feet and inches or meters and centimeters. From this information, calculated variables for weight in kilograms and height in meters were derived in order to calculate the respondents' body mass index, measured in kilograms per meter squared. This variable could then be used to determine body mass index (BMI) categories: underweight (1), normal weight (2), overweight (3), obese (4), or don't know/refused/missing. For the chosen sample, 133 (2.5%) women were underweight, 1,800 (34.5%) were normal weight, 1,444 (27.7%) were overweight, and 1,840 (35.3%) were obese. A breakdown of the BMI categories by sexual orientation is included in Table 3.

Table 3

BMI Categories by Sexual Orientation with Percentages by Group

		Computed Body Mass Index Categories				
		Underweight n (%)	Normal Weight n (%)	Overweight n (%)	Obese n (%)	Total n (%)
Sexual Orientation	Straight	42 (2.3)	664 (36.4)	549 (30.1)	568 (31.2)	1,823 (100)
	Lesbian	25 (2.0)	371 (29.7)	376 (30.1)	479 (38.3)	1,251 (100)
	Bisexual	66 (3.1)	765 (35.7)	519 (24.2)	793 (37.0)	2,143 (100)
Total		133 (2.5)	1,800 (34.5)	1,444 (27.7)	1,840 (35.3)	5,217 (100)

Data Cleaning

In the CDC dataset, responses labeled as "don't know/not sure" or "refused" were reported as 777 or 999, respectively, and were deleted from the file so as not to be calculated in the analyses. Responses labeled as 888 signified a response of "never" and

were transformed to be coded as 0. The variables for sugar-sweetened beverage consumption and regular soda consumption were listed in the dataset with only the raw data. The values were reported as 1_ _ for times per day, 2 _ _ for times per week, and 3_ _ for times per month. For accurate analysis, values were recalculated to reflect consumption over a 28-day period, or roughly equivalent to a month's consumption. Thus, values in the 300s were calculated by subtracting 300 from the given value, values in the 200s were calculated by subtracting 200 and then multiplying by 4, and values in the 100s were calculated by subtracting 100 and then multiplying by 28.

Evaluation of Statistical Assumptions

One-way ANOVA assumptions that were addressed included having a continuous dependent variable, a categorical independent variable, independence of observations, no significant outliers, approximately normal distributions, and homogeneity of variances. Multiple regression requires having a continuous dependent variable, either a continuous or nominal independent variable, independence of observations, linearity, homoscedasticity, multicollinearity, no unusual points, and normal distribution of residuals. Spearman's Correlation, chosen due to the non-parametric distribution of the variables, requires paired, continuous, or ordinal variables.

Variable Assumptions

For the one-way ANOVA, the independent variable and the dependent variables met the assumptions. For the multiple regression, all variables were also measured accordingly and met the assumption. For the Spearman's Correlation, all variables met the assumption.

Independence of Observations

This assumption requires that there is no relationship between the groups. As each group was a separate entity, this assumption was met for each statistical test.

One-way ANOVA: Normality of Distribution and Outliers

Normality of distribution was tested by checking the skewness and kurtosis of each variable for each sexual orientation. Critical values for normal distribution are ± 2 for skewness and ± 3 for kurtosis (Westfall & Henning, 2013). Only sleep duration, BMI, and stress were shown to have normal distribution; thus, all other variables violated this assumption.

One-way ANOVA: Homogeneity of Variances

The homogeneity of variances was tested using the Levene statistic within the one-way ANOVA SPSS process. A statistically significant Levene statistic indicates that the data does not have equal variances and, thus, has violated this assumption (Laerd Statistics, 2013). Using the standard cutoff for significance of $p < .05$, only potato consumption and sleep duration were shown to not have violated this assumption. Therefore, only sleep was analyzed using a one-way ANOVA.

Use of the Kruskal-Wallis H Test

Given the violations of multiple assumptions for the remaining health behavior variables, they were analyzed using the nonparametric Kruskal-Wallis H test, a rank-based test that uses the average of the ranks for all data points. The only assumption for this test not previously shown to be met was the shape of distribution. While outliers are not a consideration for this type of test, some outliers were removed in order to clearly

assess the distribution shape. The removal of these outliers did not impact the significance of the outcome. Based on a visual inspection of the generated boxplots, the distributions of scores for each variable were similar for all groups.

Multiple Regression: Independence of Observations

This assumption was assessed using the Durbin-Watson statistic which can range from 0 to 4. A value of approximately 2 indicates that there is no correlation between residuals. The Durbin-Watson statistics for all independent variables were close to 2, therefore this assumption has not been violated.

Multiple Regression: Linearity and Homoscedasticity

Linearity must be assessed in two ways: a linear relationship must exist between the dependent variable and independent variables collectively and a linear relationship must exist between the dependent variable and each independent variable. The first relationship was assessed via a scatterplot of the studentized residuals against the unstandardized predicted values. The second relationship was assessed via a partial regression plot between each independent variable and the dependent variable. None of the scatterplots showed a curvilinear pattern, thus the assumption of linearity was not violated.

Using the same scatterplots, homoscedasticity was assessed. No increasing, decreasing, or fan shape pattern to the points was shown, thus the assumption of homoscedasticity has not been violated.

Multiple Regression: Multicollinearity

Multicollinearity was assessed using Variance Inflation Factor (VIF) values where a value greater than 10 means that multicollinearity exists (Laerd Statistics, 2013). The VIF for all variables was below 2.0, thus the assumption for multicollinearity was not violated.

Multiple Regression: No Unusual Points

Unusual points can include outliers, high leverage points, or highly influential points. Outliers were assessed via casewise diagnostics showing cases where the standardized residual was greater than ±3 standard deviations. Both the leverage value and highly influential points, assessed via Cook's Distance value, were assessed via variables created during the multiple regression process. Leverage values less than 0.2 are considered safe. A Cook's Distance value above 1 would need to be investigated. The values for each are shown in Table 4. Given that there were no high leverage points nor highly influential points, the outliers for each variable were maintained in the dataset.

Table 4

Values Assessing Unusual Points in the Dataset by Independent Variable

	Outliers (n)	Leverage Value (highest)	Cook's Distance Value (highest)
BMI	11	.00625	.05500
Physical Activity	20	.00872	.07180
Vigorous Physical Activity	16	.00872	.08195
Fruit Intake	15	.00599	.02438
Vegetable Intake	19	.00600	.03842
Potato Intake	35	.00591	.07586
Sugar-Sweetened Beverage Consumption	3	.14193	.20517
Regular Soda Consumption	3	.14355	.58376
Sleep Duration	2	.02691	.24115

Multiple Regression: Normal Distribution of Residuals

Normal distribution was assessed via a histogram with a superimposed normal curve. A histogram should show a mean of approximately 0 and a standard deviation of approximately 1. All histograms showed that the standardized residuals appear to be approximately normally distributed meaning this assumption has not been violated.

Results

Descriptive Statistics

Descriptive statistics for the continuous variables are shown in Table 5. This table includes both the means and medians for the variables as the tests used for analysis used one or the other. Based on assumptions testing, some variables required the use of a nonparametric test in which case the Kruskal-Wallis H test was used. The Kruskal-Wallis H tests utilizes either the median value or a mean rank value for analysis. In cases where one-way ANOVA assumptions were met, the mean value was used.

With regards to health behaviors, the total physical activity means were similar across groups (heterosexual = 462.32 minutes, lesbian = 435.84 minutes, and bisexual = 387.23 minutes); however, the means for vigorous physical activity had a wider range with bisexual women spending almost half the amount of time as heterosexual women (heterosexual = 122.64 minutes, lesbian = 90.02 minutes, and bisexual = 63.16 minutes). Most of the variables showed that the median value was the same for each group, showing that the health behaviors for the different groups may be similar despite different mean values. Stress, which was measured on a Likert scale, showed that the median value for heterosexual women and lesbian women were the same, representing *a little of the*

time, whereas the median value for bisexual women was higher, representing *some of the time*.

With regards to fruit consumption, vegetable consumption, and potato consumption, the questions, as shown in Appendix A, specifically ask about how often the respondents ate these types of foods. No time frame was provided unless the respondent provided only a numerical answer, at which point, the interviewer would ask to clarify the time frame by asking "was that per day, week, or month." The dataset then converted the responses into a times per day calculated variable that included two implied decimal places, thus a data point of 100 is equivalent to one time per day (CDC, July 2018c). The numbers represent times per day of consumption rather than servings or portions. Numbers listed in Table 5 represent adjusted values that exclude the implied decimal places in the dataset. Both the median and mean values for fruit intake, vegetable intake, and potato intake show that each group consumed these items only once per day on average.

Table 5

Medians, Means, and Standard Deviations for Continuous Variables by Sexual Orientation

Variable	Sexual Orientation	N	Median	Mean	Standard Deviation	Range
Total Physical Activity Minutes/Week	Straight	1,366	270	462.32	601.851	0 – 4,620
	Lesbian	939	270	435.84	550.285	0 – 4,740
	Bisexual	1,680	238	387.23	513.373	0 – 4,613
Total Vigorous Physical Activity Minutes/Week	Straight	1,368	0	122.64	266.138	0 – 1,800
	Lesbian	940	0	90.02	181.040	0 – 1,680
	Bisexual	1,689	0	63.16	155.936	0 – 1,560
Fruit (Times/Day)	Straight	1,949	1	1.20	0.99	0 – 6
	Lesbian	1,301	1	1.07	0.94	0 – 6
	Bisexual	2,237	1	1.13	1.00	0 – 6

Variable	Sexual Orientation	N	Median	Mean	Standard Deviation	Range
Vegetables	Straight	1,945	1	1.03	0.76	0 – 7
(Times/Day)	Lesbian	1,291	1	0.99	0.78	0 – 5
	Bisexual	2,250	1	1.04	0.87	0 – 7
Potato (Times/Day)	Straight	1,942	0.14	0.22	0.24	0 – 2
	Lesbian	1,306	0.14	0.20	0.22	0 – 2
	Bisexual	2,250	0.14	0.22	0.25	0 – 2.14
Sugar-Sweetened	Straight	231	0	5.04	10.719	0 – 84
Beverages	Lesbian	202	0	4.83	12.155	0 – 84
Consumed/Month	Bisexual	287	1	6.79	12.872	0 – 84
Regular Soda	Straight	232	0	5.84	13.156	0 – 84
Consumed/Month	Lesbian	198	0	7.95	16.221	0 – 84
	Bisexual	286	2	9.94	16.004	0 – 84
Sleep Time/Day	Straight	168	7	7.05	1.220	4 - 12
	Lesbian	124	7	7.11	1.283	4 – 13
	Bisexual	202	7	6.79	1.430	2 – 14
Stress	Straight	608	2	2.10	1.173	1 – 5
	Lesbian	408	2	2.34	1.208	1 – 5
	Bisexual	666	3	2.88	1.251	1 – 5

Research Question 1: Obesity-Related Health Behaviors

The first research question asked, "to what extent are there differences in obesity-related health behaviors as measured in the 2017 BRFSS among heterosexual, lesbian, and bisexual women." This question had several hypotheses in order to analyze the various health behaviors associated with obesity. These hypotheses included the behaviors: physical activity, fruit and vegetable consumption, potato consumption, regular soda or sugar-sweetened drink consumption, and sleep duration. Each of these behaviors were analyzed either via the Kruskal-Wallis H test or a one-way ANOVA. When using the Kruskal-Wallis H test, some information is shown using medians while others use mean rank if the median value was the same for all groups. Pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni

correction for multiple comparisons, thus statistical significance was accepted at the $p <$ .00625 level (.05/8 comparisons).

Physical Activity

The first hypothesis tested was for physical activity and was analyzed used the Kruskal-Wallis H test. There are two parts to this question which include *any physical activity*, which includes vigorous physical activity, and *vigorous physical activity* alone. Physical activity minutes were calculated based on the duration and frequency of the participant's responses to questions regarding which physical activities they partook in. Vigorous physical activity also took into account the estimated activity intensity, which was a calculated variable based on the type of activity, participant's gender, and participant's age. Both values were assessed as it has been shown that moderate to vigorous physical activity has been associated with lower body mass, lower BMI, lower fat mass, and lower body fat percentage while light physical activity has been associated with higher levels of each (Myers et al., 2017).

Median minutes of physical activity per week were statistically significantly different among groups, $\chi^2(2) = 20.294$, $p < .001$. Post hoc analysis showed significant differences in physical activity levels between heterosexual women (*Mdn* = 270) and bisexual women (*Mdn* = 238) ($p < .001$) and between bisexual women and lesbian women (*Mdn* = 270) ($p = .001$). No significant difference was found between heterosexual women and lesbian women.

The distribution of minutes of vigorous physical activity per week were statistically significantly different among groups using the Kruskal-Wallis H test, $\chi^2(2) =$

124.977, $p < .001$. As the median for vigorous physical activity for all groups was 0, the mean rank was used. Mean rank was calculated by ranking each data point of the dependent variable regardless of which group it is in then averaging the ranks for each individual group (Laerd Statistics, 2013). An identical or similar mean rank would show a nonsignificant result and the distribution of values would be identical between groups whereas differing mean ranks may indicate a statistically significant result with a nonidentical distribution of values even if the median was the same value. Post hoc testing showed significant differences between all groups: between heterosexual women (mean rank = 2,203.37) and lesbian women (mean rank = 2,066.77) ($p = .005$), between heterosexual women and bisexual women (mean rank = 1,795.75) ($p < .001$), and between lesbian women and bisexual women ($p < .001$). Higher mean ranks show more vigorous physical activity whereas lower mean ranks show less vigorous physical activity. The mean rankings of these groups indicated that heterosexual women partook in significantly more vigorous physical activity than lesbian women who partook in significantly more vigorous physical activity than bisexual women.

Fruit and Vegetable Consumption

The second hypothesis tested was for fruit and vegetable consumption. The distribution of fruit intake was statistically significantly different based on the Kruskal-Wallis H test, $\chi^2(2) = 19.591$, $p < .001$. The median score for fruit consumption was 1 for all groups thus the results are shown using the mean ranks. The post hoc testing showed significant differences between heterosexual women (mean rank = 2,866.08) and lesbian women (mean rank = 2,640.86) ($p < .001$) and between heterosexual women and bisexual

women (mean rank = 2697.62) (p = .001). No significant difference was shown between lesbian women and bisexual women. Therefore, heterosexual women have a higher fruit intake on average than either lesbian women or bisexual women.

The distribution of vegetable intake was statistically significantly different at the $p < .05$ level based on the Kruskal-Wallis H test, $\chi^2(2) = 8.454$, $p = .015$. However, when considering the adjusted accepted significance level of $p < .00625$ due to the Bonferroni correction, this comparison is no longer statistically significant.

Potato Consumption

The third hypothesis tested regarded potato consumption. Based on the Kruskal-Wallis H test, there were no statistically significant differences between groups, $\chi^2(2) = 2.395$, $p < .302$.

Sugar-Sweetened Beverage and Regular Soda Consumption

The fourth hypothesis tested was about sugar-sweetened beverage and regular soda consumption. Based on results of the Kruskal-Wallis H test, the distribution of sugar-sweetened beverage consumption was statistically significantly different among groups, $\chi^2(2) = 14.056$, $p = .001$. The median value for both heterosexual women and lesbian women were 0 while the median value for bisexual women was 1; however, the post hoc testing only showed significant differences between lesbian women (mean rank = 331.96) and bisexual women (mean rank = 392.72) ($p = .002$) with bisexual women consuming more sugar-sweetened beverages than lesbian women. At a non-adjusted significance level, a statistically significant difference was also found between

heterosexual women (mean rank = 345.42) and bisexual women (p = .016). No

significant difference was found between heterosexual women and lesbian women.

The distribution of regular soda consumption was statistically significantly

different based on results from the Kruskal-Wallis H test, $\chi^2(2)$ = 15.771, p <.001. The

median value for heterosexual women and lesbian women was 0 while the median value

for bisexual women was 2; however, the post hoc testing only showed a significant

difference between heterosexual women (mean rank = 325.89) and bisexual women

(mean rank = 392.40) (p < .001) with bisexual women consuming more regular soda than

heterosexual women. At a non-adjusted significance level, the distribution of regular soda

consumption was also significant between lesbian women (mean rank = 347.75) and

bisexual women (p = .039). No significant difference was found between heterosexual

women and lesbian women.

Sleep Duration

The last hypothesis tested was for sleep duration. For this variable, the groups

consisted of 168 heterosexual women, 124 lesbian women, and 202 bisexual women.

This variable met all assumptions to be analyzed via a one-way ANOVA. The following

data is presented as mean ± standard deviation in number of hours. Sleep time was shown

to increase from bisexual women (6.96 ± 1.330) to heterosexual women (7.05 ± 1.220) to

lesbian women (7.11 ± 1.283); however, the differences between groups were shown not

to be statistically significant, $F(2, 491)$ = 2.866, p = .058.

Summary of RQ1 Results. Results from Kruskal-Wallis H testing showed that

many of the null hypotheses could be rejected. There were statistically significant

differences among groups for physical activity, vigorous physical activity, fruit intake, sugar-sweetened beverage consumption, and regular soda consumption. Heterosexual women and lesbian women were shown to partake in more physical activity then bisexual women. Heterosexual women spent more time doing vigorous physical activity followed by lesbian women and then bisexual women. Both lesbian women and bisexual women consumed less fruit than heterosexual women. Bisexual women drank more sugar-sweetened beverages than lesbian women and more regular soda than heterosexual women. Vegetable intake showed statistically significant differences, but not at the adjusted significance level. Potato intake showed no significant difference and, therefore, the null hypothesis for this variable must be maintained. Results from the one-way ANOVA used for sleep duration did not produce statistically significant results.

Research Question 2: Stress as a Predictor of Obesity in Sexual Minority Women

A multiple regression was run to predict body mass index, or obesity, from stress and sexual orientation. While the data met all assumptions for the analysis, the multiple regression model was not statistically significant, $F(2,998) = 1.965$, $p = .141$.

Research Question 3: Correlation between Stress and Health Behaviors in Sexual Minority Women

To test the relationship between stress and the examined health behaviors for sexual minority women, a correlation analysis was run for both lesbian women and bisexual women. The Spearman's Correlation test was chosen due to the non-parametric distribution of numerous variables. This correlation uses a rank-order correlation coefficient value, r, where a value of 0 indicates no association. Similar to a Pearson's

correlation, lower correlation coefficients indicate a weaker correlation whereas higher

correlation coefficients indicate a stronger correlation. Table 6 shows the correlations

among stress and health behaviors for lesbian (top quadrant) and bisexual (bottom

quandrant) women.

Table 6

Correlations among Stress and Health Behaviors

	Stress	PA	VPA	Fruit	Veg	Potato	SSB	RS	Sleep
Stress		-.25**	-.16**	-.11*	-.07	.06	.13	.08	-.16
PA	-.03		.51**	.16**	.11**	.01	-.05	.00	.01
VPA	-.14**	.42**		.13**	.11**	-.04	-.06	-.24**	.09
Fruit	-.16**	.07**	.10**		.43**	.03	-.10	-.13	-.11*
Veg	-.08*	.10**	.10**	.41**		.03	-.06	-.20**	-.07
Potato	-.01	.10	.05*	.09**	.13**		.12	.02	.06
SSB	.19	-.05	-.13	-.11	.20**	-.05		.42**	N/A
RS	.07	-.03	-.17*	-.14*	-.22**	.03	.45**		N/A
Sleep	-.20*	.05	-.14**	-.16**	-.08*	-.09	N/A	N/A	

Note: top quadrant shows correlations for lesbian women; bottom quadrant shows correlations for bisexual women.

$*r < .05$; $** r < .01$; N/A = no paired data points

Stress was not shown to be correlated to all of the obesity-related health behaviors; and

many of the statistically significant correlations were small. However, the null hypothesis

can be rejected as stress was correlated to some of the health behaviors. For lesbian

women, stress was statistically significantly negatively correlated with physical activity,

vigorous physical activity, and fruit intake. In other words, higher stress levels were

correlated with lower physical activity, lower vigorous physical activity, and lower fruit

intake. For bisexual women, stress was statistically significantly negatively correlated

with vigorous physical activity, fruit intake, vegetable intake, and sleep duration. Like

lesbian women, higher stress levels were correlated to lower levels of the associated

health behaviors. Potato intake, sugar-sweetened beverage consumption, and regular soda

consumption were shown to not be statistically significantly correlated for either lesbian women or bisexual women.

Research Question 4: Health Behaviors as a Mediator for the Stress/Obesity Relationship

To test whether mediation has occurred, three conditions must first be established: (1) stress predicts obesity, (2) stress predicts the mediator, and (3) the mediator predicts obesity. Two of these steps were included in the previous research questions: stress predicting obesity and stress predicting health behaviors (the mediator). While there were some significant relationships between stress and health behaviors, notably between vigorous physical activity, fruit intake, vegetable intake, and sleep duration, the results for stress predicting obesity were not statistically significant in the present study. Thus, as the first condition of mediation has not been established for this study, no mediation relationship could be tested. The null hypothesis could not, therefore, be rejected.

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Summary

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The first research question asked, "to what extent are there differences in obesity-related health behaviors as measured in the 2017 BRFSS among heterosexual, lesbian, and bisexual women." The 2017 BRFSS included questions regarding physical activity, diet-specific food and beverage intakes, and sleep duration. Each variable was tested using either the Kruskal-Wallis H test or a one-way ANOVA. For physical activity, both total minutes of physical activity and total minutes of vigorous activity showed statistically significant results. Post hoc tests showed that physical activity had statistically significant differences between heterosexual women and bisexual women as

well as between lesbian women and bisexual women. Vigorous physical activity had statistically significant differences between heterosexual women and both lesbian women and bisexual women as well as between lesbian women and bisexual women. Fruit intake, but not vegetable intake, showed statistically significant results with post hoc tests showing significant differences between heterosexual women and both lesbian women and bisexual women. Both sugar-sweetened beverage consumption and regular soda consumption showed statistically significant results. Post hoc testing showed a statistically significant difference between lesbian women and bisexual women for sugar-sweetened beverage consumption and between heterosexual women and bisexual women for regular soda consumption. Thus, all alternate hypotheses for these variables were accepted. The null hypotheses for potato consumption and sleep duration were accepted due to the results for these variables not being statistically significant.

The second research question used multiple regression to test whether stress predicted BMI in sexual minority women. Results showed that stress did not predict BMI in this population.

For the third research question, Spearman's correlation was used to assess whether stress was correlated to each health behavior tested for the first research question. This was tested only for lesbian women and bisexual women. Some of the variables showed statistically significant results. For lesbian women, physical activity, vigorous physical activity and fruit intake showed statistically significant negative correlations with stress. For bisexual women, vigorous physical activity, fruit intake, vegetable intake, and sleep duration showed statistically significant negative correlations

with stress. While not all of the health behaviors were correlated, or predicted, by stress, the null hypothesis for this research question was still rejected as stress did correlate with some of the health behaviors.

The fourth research question asked the extent that health behaviors mediated the relationship between stress and obesity. One of the conditions for mediation is that stress, must predict obesity. This condition was tested in the second research question and produced non-statistically significant results. Therefore, mediation could not occur and the null hypothesis was accepted.

In Chapter 5, these results are discussed further with an interpretation of the findings, limitations of the study, recommendations for future research, implications of this study, and general conclusions.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to determine the extent of differences in obesity-related health behaviors among heterosexual, lesbian, and bisexual women. Additionally, this study intended to determine if stress was related to obesity and health behaviors in sexual minority women. The final purpose of this study was to determine if health behaviors mediated the relationship between stress and obesity for lesbian and bisexual women. Analysis showed differences in physical activity minutes, vigorous physical activity minutes, fruit intake, sugar-sweetened beverage consumption, and regular soda consumption. Stress was associated with some of the assessed health behaviors for sexual minority women, albeit with small correlations for many of these. However, stress did not predict obesity and, thus, health behaviors could not be determined to mediate the relationship between stress and obesity in this population.

Interpretation of the Findings

Obesity-Related Health Behaviors

The existing body of research into obesity-related health behaviors among sexual minority women, and especially in comparison to heterosexual women, was inconclusive at best (Boehmer & Bowen, 2009; McPhail & Bombak, 2015). Much of the research showed no significant differences or, when differences were found, they were often contradictory to similar studies. For example, research on physical activity has shown no significant differences (Boehmer & Bowen, 2009; Eliason & Fogel, 2015), more physical activity among lesbian women when compared to heterosexual women (VanKim et al.,

2017a), and less physical activity among both lesbian women and bisexual women when compared to heterosexual women (Eliason & Fogel, 2015). Prior dietary research has been minimal and any significant results found were not in comparison to heterosexual women (Smalley et al., 2016). Similarly, prior research into sleep has found no differences in sleep duration among various sexual orientations (Chen & Shiu, 2017; Jackson et al., 2016; Martin-Storey et al., 2018). In essence, very little research has been conducted regarding the differences in health behaviors among heterosexual women, lesbian women, and bisexual women. What has been done in the past has not been replicated in such a way as to produce similar results nor conducted with a representative national sample of participants. The results of this study, on the other hand, expand on the prior research by utilizing a national sample and comparing health behaviors among heterosexual women, lesbian women, and bisexual women. The present study adds to our understanding in the areas of physical activity, diet, and sleep among sexual minority women as noted in the sections below that focus on differences between groups.

Physical Activity

The benefits of physical activity may depend on the intensity level (Myers et al., 2017); thus, it was important to distinguish between physical activity in general and vigorous physical activity. The 2017 BRFSS asked numerous questions regarding physical activity, including the type of physical activity and how often they partook in their top two forms of exercise. The responses to these questions were then utilized to calculate the estimated intensity of physical activity and the total minutes per week spent in both regular physical activity and vigorous physical activity.

Results of the present study showed that there were significant differences in both physical activity and vigorous physical activity. Total minutes spent partaking in physical activity was shown to be significantly different between heterosexual women and bisexual women and between lesbian women and bisexual women, with bisexual women partaking in less physical activity than either heterosexual women or lesbian women based on the means shown in Table 5. Total minutes spent partaking in vigorous physical activity was shown to be significantly different between all groups. Bisexual women partook in the least amount of vigorous physical activity with heterosexual women partaking in the highest amount of vigorous physical activity.

These results were both similar and different to prior results regarding physical activity. Lesbian and bisexual women were shown to partake in less physical activity than heterosexual women in prior research (Eliason & Fogel, 2015); however, no distinction was made about the intensity of the physical activity in the prior studies. The present study made this distinction, showing that bisexual women spent less time in both physical activity and vigorous physical activity than either lesbian women or heterosexual women. Additionally, and perhaps most important, both lesbian women and bisexual women were less likely to partake in vigorous physical activity which has been shown to be associated with lower rates of obesity (Myers et al., 2017). It is not simply a matter of time spent in any physical activity that could impact obesity levels, but the intensity level of that physical activity that has been shown to impact obesity rates more significantly.

Therefore, the present study, in showing poorer health behaviors for sexual minority women than heterosexual women, both expands and clarifies prior research by

extending the population studied to a national sample and comparing groups not previously compared. With bisexual women partaking in the least amount of both total physical activity and vigorous physical activity, an effort should be made to increase their amount of total physical activity and, more importantly, their amount of vigorous physical activity in order to reduce the likelihood of obesity.

Diet

The 2017 BRFSS asked several diet-specific questions including fruit and vegetable intake, potato consumption, sugar-sweetened beverage consumption, and regular soda consumption. The dataset contained a calculated variable for total vegetables consumed per day, which was derived from questions regarding green vegetable consumption, French fry consumption, potato consumption, and other vegetable consumption. The calculated variable for total fruits consumed per day was derived from questions regarding fruit juice intake and fruit intake. Sugar-sweetened beverage and regular soda consumption were recalculated from the raw data in order to have a per month response. These questions specifically asked about "how often" a person consumed these items; thus, the data represents times per day of consumption rather than servings or portions per day.

There were five subparts to the diet that were analyzed: fruit consumption, vegetable consumption, potato consumption, sugar-sweetened beverage consumption, and regular soda consumption. Potato consumption was included in the calculated total vegetable variable; however, prior research showed that consuming starchy vegetables such as potatoes could lead to weight gain (Benatar et al., 2013; Bertoia et al., 2013).

Thus, it was analyzed alone as well as part of the vegetable intake. Drinking sugar-sweetened beverages, including regular soda, has also been associated with increased weight (Carroll et al., 2018). There has been minimal research into specific dietary intake and none that has compared these behaviors to heterosexual women (Smalley et al., 2016).

The present study did this and showed that there were some differences in dietary consumption. In particular, fruit consumption, sugar-sweetened beverage consumption, and regular soda consumption all showed significant differences. The analysis on fruit consumption showed that lesbian women consumed the least amount of fruit, then bisexual women, then heterosexual women, though there was not a significant difference between lesbian women and bisexual women. Fruit intake has been shown to help reduce chronic disease and help with weight management by suppressing fat growth (Pem & Jeewon, 2015), thus the lower level of fruit intake among lesbian and bisexual women when compared to heterosexual women could be problematic for their overall health and lead to weight gain. Lesbian women were shown to consume significantly less sugar-sweetened beverages than bisexual women while heterosexual women were shown to consume significantly less regular soda than bisexual women. Higher levels of sugar-sweetened beverage and regular soda consumption for bisexual women would likely lead to an increase in weight (Carroll et al., 2018).

These results show that bisexual women, in particular, were more likely to consume less fruit, more sugar-sweetened beverages, and more regular soda than either lesbian women or heterosexual women. This is additional information that prior research

has not shown as prior research focused solely on fruit and vegetable consumption among various sexual minority populations and did not include heterosexual women (Smalley et al., 2016). While this prior study utilized sexual orientation to differentiate groups, no significant difference was found for lesbian women with regards to fruit and vegetable consumption when compared to other sexual minorities; however, the present study showed that lesbian women did consume significantly less fruit than heterosexual women. Bisexual women were not a separate group from bisexual men in the prior study and, thus, conclusions could not be drawn about any potential differences. The present study focused solely on the differences among women, whose obesity rates have continued to rise significantly over the past 15 years while no significant increase has been shown in that time for men (NIH, 2017). The results of the present study showed that bisexual women may be most at risk for increased obesity rates due to their lack of fruit intake and increased consumption of both sugar-sweetened beverages and regular soda.

Sleep

Prior research into sleep has shown no differences in sleep duration among sexual orientations (Chen & Shiu, 2017; Jackson et al., 2016; Martin-Storey et al., 2018). This study confirmed this finding. According to the means in Table 5, bisexual women sleep less than both heterosexual women and lesbian women. While the difference shown is only equivalent to roughly half an hour per night, over time this can add up and have negative consequences. Less sleep over the lifespan has been shown to correlate with an increase in weight (Patel et al., 2008). Additionally, researchers have hown that bisexual

women report the most difficulty sleeping (Patterson & Potter, 2020); thus, the mean hours shown in this data could relate to difficulty sleeping rather than a statistically significant difference in sleep duration.

While the present study did not find a significant difference in sleep duration among heterosexual women, lesbian women, and bisexual women, these results do not represent a full picture of sleep as it relates to obesity. Duration is only a small factor in overall sleep quality, which has been associated with women's psychological and physical well-being in a bidirectional relationship (Bei et al., 2015; Shade et al., 2016). Moreover, lesbian and bisexual women have been shown to be more prone to sleep disturbances (Chen & Shiu, 2017; Patterson & Potter, 2020; Patterson et al., 2018), which can impact their overall sleep quality while not necessarily impacting their sleep duration.

Stress in Sexual Minority Women and Its Relation to Health Outcomes and Behaviors

The remaining hypotheses in the current study were based on the theoretical framework of minority stress theory. In essence, sexual minority women would have poorer health outcomes based on experiencing higher levels of chronic stress that stems from real or perceived discrimination, prejudice, and stigma. In the general population, increased stress has been shown to be correlated with increased weight (Geiker et al., 2018; Wardle et al., 2011). Additionally, increased stress has been shown to alter a person's normal health behaviors, including their physical activity, dietary intake, and sleep (Tomiyama, 2019). Mereish (2014) showed that increased stress in lesbian women was correlated to an increased likelihood of being overweight or obese. While it was not

known if the stress felt by lesbian and bisexual women in the present study was due to minority stress, stress in general could still have a negative impact on their health. Given the prior research and the theoretical framework, it would have been expected that stress would have predicted obesity and health behaviors among lesbian and bisexual women.

The results were not as expected in the present study. Stress was shown to not be a predictor of obesity for sexual minority women. If it were, increased stress levels would have shown a correlated increase in BMI, but this did not occur. Stress did correlate with some health behaviors, but not all. Stress was not correlated with potato consumption, sugar-sweetened beverage consumption, or regular soda consumption for either lesbian women or bisexual women. It was, however, correlated with physical activity, vigorous physical activity, and fruit consumption for lesbian women and with vigorous physical activity, fruit intake, vegetable intake, and sleep duration for bisexual women. In each case, higher reported stress levels were correlated to lower levels of each variable. As stress did not predict obesity in this study, it could not be determined if health behaviors mediated the relationship between stress and obesity.

While the results of stress predicting obesity for sexual minority women were not as expected, the results of stress being correlated to health behaviors was expected based on prior research in the general population and for women. Stress has been shown to decrease physical activity levels in the general population (Tomiyama, 2019) and lead to unhealthy eating patterns for women (Katz-Wise et al., 2015). The present study expanded on these results to show that stress has a negative impact on physical activity levels for both lesbian women and bisexual women. For lesbian women, stress was

correlated with lower levels of both total physical activity and vigorous physical activity while, for bisexual women, stress was correlated with lower levels of vigorous physical activity. As lesbian women and bisexual women already partake in less physical activity than heterosexual women, the addition of stress could further decrease their levels of physical activity and negatively impact their health. Additionally, diet was shown in the present study to be negatively impacted by stress for both lesbian women and bisexual women, with stress being correlated to lower intake of both fruits and vegetables. It has been shown that women, in general, that experience increased stress levels have poorer sleep quality (Morin et al., 2003) which is a similar result to this study for bisexual women where stress was shown to be correlated with sleep duration.

While there were no differences in sleep duration among the sexual orientations in this study, stress was shown to be correlated with less sleep duration for bisexual women only. Thus, stress may have a greater influence on sleep duration and sleep quality for bisexual women in particular as there was no significant correlation between stress and sleep duration for lesbian women.

Summary of Interpretations

Prior research results into the health behaviors differences among heterosexual women, lesbian women, and bisexual women were either confirmed or expanded on in the present study. The results for physical activity expanded on prior research by breaking down the levels of physical activity into any physical activity and vigorous physical activity, a distinction that had yet to be made in this population but one that has been shown to be important with regards to weight control. The results for diet-related

behaviors also expanded on previous research as this was a much-underexplored area, with no research comparing lesbian and bisexual women to heterosexual women. Results regarding sleep confirmed prior research showing no significant differences in sleep duration among various sexual orientations (Chen & Shiu, 2017; Jackson et al., 2016; Martin-Storey et al., 2018).

With regards to stress, the present study contradicted the expected results with regards to stress predicting obesity. This relationship has been shown in the general population (Wardle et al., 2011) and has been shown to likely be due to the impact stress has on health behaviors (Geiker et al., 2018). While stress did correlate to some of the examined health behaviors in the present study, it did not predict obesity in sexual minority women. Despite this, the correlation between stress and health behaviors shows that stress may influence behaviors that could ultimately impact one's health.

Limitations

This study had several limitations. Some of these limitations were known prior to conducting the study: the use of secondary data (Anderson et al., 2011), the use of a survey (Queirós et al., 2017), and the use of a cross-sectional design (Anderson et al., 2011). Secondary data, while convenient, is not comprehensive and may not provide a well-rounded view of the variables (Queirós et al., 2017). Surveys are often an easy way to collect data and analyze it, but are subject to recall bias, especially for health behaviors and, again, may not be as comprehensive as a researcher may want it to be. Cross-sectional designs are based in a single time period and the answers may change over time.

Limitations of Secondary Data

Secondary data, when a suitable dataset is found, can be a convenient way to expand on a knowledge base (Anderson, 2011). The BRFSS, in general, is the most comprehensive health behavior survey available and provides data from participants nationwide. The core questionnaire included information on demographics, fruit and vegetable consumption, and physical activity which provided much of the needed data for this study (CDC, 2016). Questions regarding sugar-sweetened beverage consumption, regular soda consumption, sleep, sexual orientation, and stress were included in optional modules. States can choose which, if any, of the optional modules to use based on their state program purposes. Therefore, participants may have answered questions regarding sleep but not have answered questions regarding stress as they were in two separate optional modules. This led to the decision to attempt to use a one-way ANOVA for analysis as opposed to using a MANOVA, which would have provided more statistical power and the ability to analyze health behavior interactions as opposed to single variable comparisons. Assumptions testing ultimately led to the use of the nonparametric Kruskal-Wallis H test as well.

While the BRFSS was a suitable secondary source to use, it was not the most comprehensive with regards to health behaviors. The National Health and Nutrition Examination Survey (NHANES) is more comprehensive in its health and nutrition questions (CDC, 2017-2018). It breaks down dietary behaviors much more so than the BRFSS, asking questions about dining out, consuming frozen meals, and ready-to-eat meals. Participants chosen for the NHANES may also choose to participate in a 24-hour

dietary recall interview which breaks down a day's meals into nutritional components. It also includes components for physical activity, sleep, weight and height, and self-identified sexual orientation. Despite its more comprehensive health behavior questions, the NHANES lacked questions regarding stress, thus making it unsuitable for the present study. Given the design of the present study, the BRFSS, despite its limitations, was the most suitable secondary source.

Limitations of a Survey

Surveys are often used to collect data due to the ease in which the data can be analyzed. However, they are limited in their design by the questions being asked (Anderson, 2011). As previously stated, the BRFSS is fairly comprehensive in its design, but it is still limited in what it asks. Additionally, states can choose which optional modules to use, thus the data is not totally inclusive. A good example of this is regarding dietary questions and sleep. Diet plays a large role in weight control, but the BRFSS only asked about fruit and vegetable consumption in their core questionnaire. Other dietary questions were included in optional modules; however, these still do not provide a comprehensive overview of a participant's diet. There were no questions regarding the consumption of sweets, bread, milk products, meats or seafood, or water. With regards to sleep, while sleep duration is important, prior research showed that sleep quality may be more important and this was not asked about at all.

The wording of the questions was also problematic. For example, a sample question about dietary behavior was worded as: "During the past 30 days, how often did you drink regular soda or pop that contains sugar? Do not include diet soda or diet pop."

This is problematic and limiting because it does not help to determine a true quantity. For one person, drinking a 20 oz. Coca-Cola could be perceived as one time or one serving whereas for another person, drinking a Big Gulp (30 oz.) from 7-11 could be considered as one time or one serving. The CDC website (September 2020) says to limit sugary drinks due to health problems and lists the teaspoons of sugar based on 12 oz. servings. Serving sizes on nutrition facts labels also often show a discrepancy: both a 12 oz. Coca-Cola and a 20 oz. Coca-Cola may be listed as one serving since a person is likely to drink the entire bottle at one time. This means the comparisons between individuals are not accurate in terms of a true amount of product being consumed. The questions were not worded in a precise manner.

A third issue with the use of surveys is recall bias (Queirós et al., 2017). Participants were often asked to recall their activities for the past month. It is often hard to provide a precise answer to these types of questions. People also want to appear good; therefore, they may overestimate or underestimate their responses based on what is being asked. For example, people generally know that eating fruit and vegetables is a "good" thing and may overestimate how often they consume those foods. They could also genuinely not know the answer as it is difficult to recall previous events or experiences accurately.

Limitations of a Cross-Sectional Design

Cross-sectional designs collect data from a single point in time (Anderson et al., 2011). Even though the questions on the BRFSS often asked about how often a person partook in a specific health behavior over the past month, this was still a single time

period of response. The answers may change over time. For example, the participants in the present study generally had low levels of stress. However, in the recent political climate an increase in sexual minority-related stress has been reported. People in the LGBT population have reported experiencing more trauma, depression, and anxiety since the 2016 election (Gonzalez, Ramirez, & Galupo, 2018). Had this survey been done at a later date, the responses may have been different. Stress may have been increased overall and the results of this study may have been different.

Recommendations

Further research is needed in this area. While there are many strengths to this study, there are also many limitations. Statistically significant differences in health behaviors between sexual orientations were found in a nationwide sample of participants. This was particularly true for physical activity and some dietary behaviors. Prior research in this area was inconclusive or contradictory, showing the need for these results to be replicated. Given the limitation of statistical analysis due to testing variables independently, research into the health behaviors should be conducted that allows for each participant to answer all related questions, permitting the use of a MANOVA and analysis of behavior interactions. Additionally, the available responses for sexual orientation should be expanded as there may be further differences to be discovered. Prior research has often grouped sexual minorities together (Roberts, Horne, & Hoyt, 2015) and the present study showed that there are differences between sexual orientations, thus leading to the recommendation to further explore various sexual orientations separately.

Stress did not correlate with obesity in this study despite prior research showing that increased stress is correlated with an increase in weight in the general population (Wardle et al., 2011). This is perhaps due to the questions regarding stress and sexual orientation being included in optional modules as only ten states opted to include these modules. A different sample may provide a different result, as the prior research by Mereish (2014) did show a correlation between stress and weight for lesbian women. Additionally, it would be recommended that these questions be asked over time, perhaps in a longitudinal study. Weight and stress can both fluctuate depending on life events. This question could be broken down into other demographic attributes as well. For example, as shown in prior research, health behaviors and outcomes may change depending on geographic location: an LGBT-friendly location versus a non-LGBT-friendly location.

This study was quantitative in nature, limiting the scope of the questions and ability to determine context. Obesity and stress are both complex issues. The data used for this study did not determine if the stress felt was due to being a sexual minority. For some, this stress may feel like a normal consequence of being a sexual minority and not be included in the given responses for this question. A qualitative study on stress and health behaviors may provide a more robust understanding of the link between stress and obesity. Additionally, a qualitative study can introduce themes related to the health disparity of obesity in sexual minority women that are omitted in quantitative research.

Implications

The present study can contribute to social change by helping sexual minority women and their health care providers understand the specific health behaviors associated with increased obesity in this population. Understanding which obesity-related health behaviors are more likely to impact sexual minority women versus heterosexual women can help to tailor programs designed to prevent or reverse the health disparity of obesity for sexual minority women. For example, focusing on vegetable or potato consumption may not be beneficial, but focusing on increasing vigorous physical activity and decreasing sugary beverage consumption would be. Additionally, this study can help sexual minority women and mental health care providers by focusing stress reduction techniques or coping strategies on the health behaviors most impacted by increased stress: vigorous physical activity, fruit and vegetable intake, and sleep duration.

Stress reduction techniques may be especially impactful for bisexual women as stress was correlated to more health behaviors for them. Stress had a negative correlation with vigorous physical activity, fruit intake, vegetable intake, and sleep duration for bisexual women whereas it had a negative correlation with only physical activity, vigorous physical activity and fruit intake for lesbian women. The stress bisexual women feel, and which impacts their health behaviors, may be due to the increased discrimination they feel from both the heterosexual community and the gay community (Flanders, Robinson, Legge, & Tarasoff, 2016; Roberts et al., 2015). This increased discrimination comes from bisexuality being characterized as sexual confusion or as a phase before figuring out one's true sexual orientation. In other words, within the LGB

population, there is an intragroup stigma toward those that identify as bisexual that can lead to further stress and worse health outcomes.

While mental health program and research funding has been shown to be among the top funded, complementary and integrative health funding as well as minority health and health disparities funding has been among the lowest funded (Mao & Ramratnam, 2017), suggesting that more funding may also be necessary to help reduce the health disparity of obesity in sexual minority women. The additional knowledge presented in this study can be used in conjunction with the existing literature to help develop health initiatives aimed at sexual minority women, and especially those aimed at bisexual women as they may be more at risk than their lesbian counterparts.

Conclusions

The present study utilized the 2017 BRFSS to determine the extent to which obesity-related health behaviors differed among heterosexual women, lesbian women, and bisexual women. Significant differences were found in the health behaviors of physical activity, vigorous physical activity, fruit intake, sugar-sweetened beverage consumption, and regular soda consumption. In addition, it was found that stress is correlated with some of these same health behaviors for sexual minority women. Stress was not found to predict obesity in sexual minority women however and, because of this, this study was unable to determine if health behaviors mediate the relationship between stress and obesity in sexual minority women. The findings of this study contribute to the existing literature regarding the health disparity of obesity among sexual minority women and the role that stress may play in that disparity. While there is still research to be

conducted on this subject, the current study can help address the health disparity through

increased knowledge and the development of population-based treatment initiatives.

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Appendix A: BRFSS Questions Pertaining to Study Variables

BRFSS Questions Pertaining to Demographics

1. Are you …

    1. Male

    2. Female

2. Do you consider yourself to be:

    1. Straight

    2. Lesbian or gay

    3. Bisexual

3. What is your age?

    1. _ _ Coded age in years

4. Are you Hispanic, Latino/a, or Spanish origin?

    1. Yes

        1. If yes, then asked if Mexican, Mexican American,

            Chicano/a; Puerto Rican; Cuban; or another Hispanic,

            Latino/a, or Spanish origin

    2. No

5. Which one or more of the following would you say is your race?

    1. White

    2. Black or African American

    3. American Indian or Alaska Native

    4. Asian

5. Pacific Islander

6. What is the highest grade or year of school you completed?

    1. Never attended school or only attended kindergarten

    2. Grades 1 through 8 (Elementary)

    3. Grades 9 through 11 (Some high school)

    4. Grade 12 or GED (High school graduate)

    5. College 1 year to 3 years (Some college or technical school)

    6. College 4 years or more (College graduate)

7. Is your annual household income from all sources –

    1. Less than $25,000 (2-4 asked if "yes" response provided here)

    2. Less than $20,000

    3. Less than $15,000

    4. Less than $10,000

    5. Less than $35,000

    6. Less than $50,000

    7. Less than $75,000

    8. $75,000 or more

BRFSS Questions Pertaining to Obesity

1. About how much do you weigh without shoes?

2. About how tall are you without shoes?

BRFSS Questions Pertaining to Physical Activity

1. During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?

2. How many times per week or per month did you take part in this activity during the past month?

3. And when you took part in this activity, for how many minutes or hours did you usually keep at it?

4. What other type of physical activity gave you the next most exercise during the past month?

5. How many times per week or per month did you take part in this activity during the past month?

6. And when you took part in this activity, for how many minutes or hours did you usually keep at it?

7. During the past month, how many times per week or per month did you do physical activities or exercises to STRENGTHEN your muscles? Do NOT count aerobic activities like walking, running, or bicycling. Count activities using your own body weight like yoga, sit-ups or push-ups and those using weight machines, free weights, or elastic bands.

Note: Vigorous physical activity was a calculated variable based on the type of activity, the person's age and gender, and other calculated variables based on the information provided.

BRFSS Questions Pertaining to Diet

1. Not including juices, how often did you eat fruit? You can tell me times

    per day, times per week, or times per month.

2. How often did you eat a green leafy or lettuce salad, with or without other

    vegetables?

3. How often did you eat any kind of fried potatoes, including French fries,

    home fries, or hash browns?

4. How often did you eat any other kind of potatoes, or sweet potatoes, such

    as baked, boiled, mashed potatoes, or potato salad?

5. Not including lettuce salads and potatoes, how often did you eat other

    vegetables?

6. During the past 30 days, how often did you drink regular soda or pop that

    contains sugar? Do not include diet soda or diet pop.

7. During the past 30 days, how often did you drink sugar-sweetened fruit

    drinks (such as Kool-aid and lemonade), sweet tea, and sports or energy

    drinks (such as Gatorade and Red Bull)? Do not include 100% fruit juice,

    diet drinks, or artificially sweetened drinks.

BRFSS Questions Pertaining to Sleep

1. On average, how many hours of sleep do you get in a 24-hour period?

BRFSS Questions Pertaining to Stress

1. Stress means a situation in which a person feels tense, restless, nervous, or

    anxious, or is unable to sleep at night because his/her mind is troubled all

the time. Within the last 30 days, how often have you felt this kind of stress?

Appendix B: States Using Optional Modules

Optional Module 9: Sleep Disorder (Sleep Duration)

> Arizona, District of Columbia, Kansas, Kentucky, Minnesota, Nebraska, Nevada,
> North Dakota, Oregon, Tennessee

Optional Module 14: Sugar Sweetened Beverages

> Alaska, Arizona, Arkansas, Delaware, District of Columbia, Hawaii, Iowa, New
> York, North Carolina, Ohio, Vermont, West Virginia, Wisconsin

Optional Module 25: Social Determinants of Health (Stress)

> Colorado, Florida, Georgia, Iowa, Kentucky, Maryland, Massachusetts,
> Minnesota, Mississippi, New Hampshire, Ohio, Oklahoma, Pennsylvania, Utah,
> West Virginia, Wisconsin, Wyoming

Optional Module 27: Sexual Orientation and Gender Identity

> California, Connecticut, Delaware, Florida, Georgia, Guam, Hawaii, Illinois,
> Iowa, Louisiana, Massachusetts, Minnesota, Mississippi, Montana, Nevada, New
> York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South
> Carolina, Texas, Vermont, Virginia, Washington, Wisconson