2021

The Impact of Obesity, Race, Age, Education, Income, and Healthcare Coverage on Cervical Cancer Screening Among Mississippi Women

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Walden University
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Abstract

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MPH, Walden University, 2014

BA, Spelman College, 2004

Dissertation Submitted in Partial Fulfillment

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Doctor of Philosophy

Public Health

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Abstract

The human papilloma virus is the necessary agent in the development of cervical cancer. It is through screening exams like the Papanicolaou (Pap) test that cervical changes can be identified, and cervical cancer can be diagnosed in the early stage of cancer. The Pap test has aided in decreasing the rate of cervical cancer and the morbidity of cervical cancer. However, cervical cancer rates and mortality rates from cervical cancer are still the highest among women in Mississippi. Additionally, obesity rates among those who reside in Mississippi are the second highest in the United States. The purpose of this quantitative study was to determine if there was an association between obese and nonobese Mississippi women and their participation in Pap testing. Guided by Andersen's behavioral model conceptual framework, the study focused on the extent to which race, age, educational level, income, and healthcare coverage (insured or not insured) has an effect on cervical cancer screening between obese and nonobese women who reside in Mississippi. Data from the 2018 Behavioral Risk Factor Surveillance System were analyzed. Results of the multiple logistic regression showed that as obesity levels of Mississippi women (Obesity I, Obesity II, and Obesity III) increased, the likelihood of participating in Pap testing decreased. Results of the multiple logistic regression also showed that age, race, income, education, and insurance coverage influenced participation in cervical cancer screening. Increasing cervical cancer screening participation among Mississippi women has important implications for positive social change, including reducing cervical cancer rates among Mississippi women by addressing sociodemographic, socioeconomic, and sociocultural barriers to Pap testing.

Mississippi Women and Cervical Cancer Screening

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Dedication

I dedicate this dissertation to my loving mother, Edwina Grooms, who instilled in me that education is power, my husband, Kervance Ross, who championed me to the finish line, and my beautiful daughter, Kenley-Rose Ross. This labor of love is also dedicated to my grandfather, Windell C. Grooms, and my loving aunt, Portia Elaine Ward. You both are missed beyond measure.

Acknowledgments

Without God I am nothing and without Him I will surely fail. It was only by the grace of God that I made it through this unrelenting journey, so I give Him all the praise and all the honor and all the glory.

I would like to extend my sincere thanks to my committee chair, Dr. Howell Sasser. You kept me sane when I was teetering on the line of insanity, your guiding hand led me through some of the most tedious moments of the writing process and for that I am forever grateful to you and for you. Thank you to Dr. Feresu, my committee member, and Dr. Davis my URR.

I am deeply indebted to my family and friends, without whom completion of this doctoral study would have remain a dream and not a reality. Thanks for your unwavering love, support, encouragement and for seeing greater in me than I saw in myself.

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Chapter 1: Introduction to the Study

Introduction

Cervical cancer is a threat to women's health and lives (World Health Organization [WHO], 2018). In the year of 2016, which is the most recent year that incidence data were available, over 4,000 women within the United States died of cervical cancer (Centers for Disease Control and Prevention [CDC], 2019). Cancer remains as one of the lead causes of death, second only to heart disease (CDC, 2019). One in every four deaths in the United States is due to cancer (CDC, 2019).

For women within the United States, cervical cancer was once the leading cause of cancer death (CDC, 2020). However, the last 40 years have brought about a decrease in the number of new cases of cervical cancer as well as the number of deaths from cervical cancer (CDC, 2020). This decline largely is the result of many women getting regular Pap tests, which can find cervical precancer before it turns into cancer (CDC, 2019). The American Cancer Society (2020) estimated that in the year of 2020 approximately 13,800 new cases of invasive cervical cancer (cancer that affects the deeper tissue of the cervix and may have metastasized) will be diagnosed and 4,290 women will die from cervical cancer. Cervical cancer rates in the United States have declined by more than 50% between 1988 and 2018 (American Cancer Society, 2018; Gibson et al., 2019; Siegel et. al, 2018). The overall cervical cancer incidence rates have decreased from 17.2 to 7.6 (per 100,000 women) and the mortality rate has decreased from 5.6 to 2.3 (per 100,000 women; Gibson et al., 2019; et al., 2018). The decline in incidence and death rates for cervical cancer was largely the result of the increase of

women participating in regular Papanicolaou tests, referred to as Pap tests henceforth (CDC, 2018). Pap test screening procedure can find changes in the cervix before cancer develops and cervical cancer can be found early, while the cancer is smaller and easier to cure (American Cancer Society, 2019).

During recent decades, the consensus has been that there was a direct relationship between human papilloma virus (HPV) infection and cervical carcinogenesis (i.e., the formation of cancer; Agorastos et al., 2015). However, now it has been well established that HPV is the necessary agent in the development of cervical cancer (Thaxton & Waxman, 2015). HPV is a double-stranded, encapsulated DNA virus. More than 200 HPV types have been identified and those viruses that infect the cervix have been categorized according to their oncogenic potential (Agorastos et al., 2015). The virus has been categorized based on its potential to cause cervical cancer. Of the 200 HPV types, 15 have been identified as being potentially oncogenic; of those 15, two types – Types 16 and 18 – are the most potent (Agorastos et al., 2015; Thaxton & Waxman, 2015). HPV types 31,33, 35, 39, 45,51, 52, 56, 58, and 59 have also been identified as high risk (Thaxton & Waxman, 2015). According to Thaxton and Waxman (2015), HPV types 16 and 18 are responsible for two-thirds to three-quarters of cervical cancer cases.

It is through screening tests like the Pap test/HPV test that cervical cancer can be prevented or found early (CDC, 2019). The Pap test, also called the Pap smear, is performed by a medical professional that will use a metal or plastic speculum to widen the vagina (CDC, 2019). Through the widening of the vagina the medical professional can examine the vagina and cervix along with collecting cells and mucus from the cervix

and the surrounding area of the cervix (CDC, 2019). The cells are sent to a laboratory where they are checked for normalcy and tested for HPV.

Preventative tests such as the Pap test have aided in decreasing the rate of cervical cancer and the morbidity of cervical cancer. The WHO and their partners are working on the definition of a threshold under which cervical cancer will no longer be considered a public health concern (WHO, 2018). However, cervical cancer remains a public health concern and for the state of Mississippi, cervical cancer rates are the highest among the 50 states (CDC, 2017). The CDC (2017) reported that women in Mississippi develop cervical cancer at a rate of 10.4 for every 100,000 women in Mississippi. Not only are cervical cancer rates the highest among women in Mississippi, but mortality rates are also high. Mississippi women are dying from cervical cancer at a rate of 3.3 per 100,000 women, only second to the state of Alabama where women were dying at a rate of 3.8 per 100,000 women (CDC, 2017). In addition to having the highest cervical cancer rates, Mississippi has the second highest obesity rate in the U.S. (Robert Wood Foundation, 2018). The question then becomes why are women in Mississippi developing and dying from cervical cancer at alarming rates? Are women in Mississippi participating in cervical cancer screenings? Which group of Mississippi women, nonobese or obese, participates in cervical cancer screenings at a higher rate?

No study has yet been conducted that identifies the rate obese women in Mississippi participate in Pap testing in comparison to nonobese Mississippi women. There is a need for this study to explore if obesity has an impact on the prevalence of Pap testing among Mississippi women. Pap testing is vital to a woman's health because

screening can identify precancer or identify cancer in the early stage when treatment is more favorable and the cancer can be cured (Jin, 2018). However, cervical cancer rates are the highest among women in Mississippi and obesity rates of Mississippians are the second highest of the 50 states. The knowledge obtained from this study can be used to design programs that will decrease cervical cancer rates and obesity rates of women in Mississippi through policy and clinical practice.

Chapter 1 consists of the background of the study, problem statement, the purpose of conducting the research, research questions, hypotheses, and theoretical framework. Additional sections of this chapter include the nature of the study/research design, assumptions, scope and delimitations, limitations, significance, summary, and transition to Chapter 2.

Background of Problem

Cervical cancer is the fourth most common type of cancer in women and the leading cause of cancer death around the world, resulting in nearly 300,000 deaths per year (Zhao et al., 2015). According to the WHO, as cited by Zhao et al. (2015), as of 2015 there were about 500,000 new cases of cervical cancer each year; 85% of the pathologic types were squamous cell carcinoma. There are two types of cells in the cervix (the organ that connects the uterus to the vagina), squamous cells and glandular cells. It was the squamous cells that were more likely to turn into cancer than the glandular cells, resulting in squamous cell carcinoma. Although, the benefits of cervical cancer screening through Pap testing are early detection and early treatment, cervical cancer morbidity rates remain high, and more cases of younger women were being diagnosed (Zhao et al.,

2015). Cervical cancer rates in the United States have decreased significantly due in part to preventative screenings, the Pap test.

The culprit for the development of cervical cancer is HPV, which can be discovered through the Pap test. The burden of HPV infection in the United States is high, as 70% of cervical cancers are linked to HPV (Arain, 2015). The annual projected new incidence of cancers, among women in the United States, associated with HPV is 17,000 (CDC, 2014). The risk of HPV transmission increases with first sexual intercourse at an early age and multiple sexual partners resulting in a high incidence of cervical cancer (Arain, 2015).

However, despite the possibility of early detection that cervical cancer screening provides, participation in Pap testing is low (Chang et al., 2017). According to Akinlotan et al. (2017) some of the barriers or perceived risk factors to Pap testing were age, education, total household income, and employment status. Results of the study conducted by Chang et al.(2017) suggested that participation rate for cervical cancer screening was 46% among women aged 40 or younger who were represented in the study. For those participants of the study who were employed, the results indicated lower cervical cancer screening rates than those who were not employed (Chang et al., 2017). It was from Chang et al.'s and Akinlotan et al. 's (2017) study that I made the decision to use the following covariates (age, education, income, and healthcare coverage).

There is a higher risk among obese women, in the United States, of developing cervical cancer (Clarke et al., 2018). The obesity epidemic is a significant, worldwide public health challenge, with important implication for global cancer rates (Clarke et al.,

2018). This problem is particularly acute in the United States, where obesity has tripled over the past 30 years (Clarke et al., 2018). Although, some studies have reported an association of obesity with increased cervical cancer incidence and mortality, findings have been inconsistent, and the mechanism unknown (Clark et al., 2018).

Data from Friedman et al. (2012) substantiates that obesity is associated with a higher incidence of and mortality from breast and cervical cancer. Despite the availability of Pap testing, obese women receive screenings less frequently than their counterparts of normal weight (Friedman et al., 2012). Friedman et al. (2012) also found when differentiating among obese women, cervical cancer mortality is higher for black women. Race modifies the possible association between obesity and cervical cancer screening, which unveiled the discovery that higher body mass index was associated with lower participation in Pap testing among white women, but not among black women.

Previous research suggested that white obese women have lower rates of cervical cancer screenings in comparison to nonobese white women. Leone et al. (2012) determined there was an association between obesity and lower rates of cervical cancer screenings among African American (Black) women compared to the results of their White counterparts. For the Leone and associates' study, body mass index (BMI) was calculated using self-reported height and weight. Individuals were then categorized into weight groups based on their BMI: normal weight (BMI 18.5 – 24.94); overweight (BMI 24.95 – 29.94); obese I (BMI 29.95 – 34.94); obese II+ (BMI 34.95+). The findings suggested that African American women categorized as overweight or obese I have higher screening rates than those of normal weight. Although, not found to be statistically

significant, the analyses showed higher screening rates among overweight and obese II + women.

From these studies, I added the variables of obesity and race/ethnicity to determine if there was an association between cervical cancer screenings and those variables. The cultural norms that accompany race/ethnicity could predict perceived behaviors toward healthcare services, like the use of preventative services such as Pap testing. Roncancio et al. (2015) offered insight into acculturation, cultural modification of individuals, attitude, and subjective norms, all of which influence the usage of healthcare services and align with the predisposing factors of Andersen's behavioral model, the theoretical model informing my study. Health beliefs are the attitudes, values, and knowledge that people have concerning and toward the healthcare system (Umanitoba, n.d.).

For those who reside in the United States, the burden of cervical cancer is the greatest among women in Mississippi. For every 100,000 women in Mississippi, 10,400 women developed cervical cancer, the highest rate among the 50 states (CDC, 2017). Not only do women who reside in Mississippi have the highest burden of cervical cancer among women in the United States, Mississippians have the second highest obesity rate (Robert Wood Foundation, 2018). Despite the efforts employed to focus on the guiding goals and objectives of Healthy People 2020 and Mississippi State Health Department, Mississippi's adult obesity rate is steadily on the rise (Robert Wood Foundation, 2018). The adult obesity rate for Mississippians in 2018 was 37.3%, up from 23.7% in 2000 and from 15% in 1990 (Robert Wood Johnson Foundation, 2018).

Therefore, my doctoral study explored if there is a difference in the rates in which obese and nonobese women in the state of Mississippi participate in cervical cancer screening via Pap testing. Additionally, the barriers or risk factors (race/ethnicity, age, education, healthcare coverage, income) that could possibly affect the rate in which obese and nonobese Mississippi women participate in cervical cancer screening will also be explored. The knowledge this study furnishes will be useful in designing programs to increase the participation of cervical cancer screenings and decrease cervical cancer rates, through an integrated approach to clinical practice and theory-based intervention to address cultural differences.

Problem Statement

In 2014, 12,578 women in the United States were diagnosed with cervical cancer; furthermore, in that same year, 4,115 women in the United States died of cervical cancer (CDC, 2017). In the early 1990s, it was discovered that the prerequisite for cervical cancer was an HPV (CDC, 2015). HPV is labeled as the "necessary cause," meaning that in all cases of cervical cancer analyzed, there was not one case that was absent of HPV DNA (Beavis & Levison, 2016; Dasari et al., 2015). For women, screening for the presence of HPV and cervical cancer is done through the Pap test. Based on data retrieved from the 2015 National Health Interview Survey (NHIS), 81.4% of women aged 21 to 65 reported having a Pap test within the past 3 years (according to 2012 cervical screening guidelines; American Cancer Society, 2017). The prevalence of Pap test use in 2015 was similar among white (83.1%) and black (84.75%) women, but lower among Hispanic (77.4%), Asian (73.3%), and American Indian/Alaska Native women (70.9%;

American Cancer Society, 2017). Furthermore, 2015 NHIS data reveals that about one-third (32.4%) of women ages 30-64 reported having a Pap test within the past 5 years with the proportion of women in their 30s (43.1%) being higher compared to women 40 years of age and older (22.3%-31.6%; American Cancer Society, 2017). Other statistical data suggests that women (aged 25 to 65) who have not graduated from high school (69.9%) have a lower prevalence of Pap testing as compared to women, of the same age group, who are college graduates (88.6%). Uninsured women (aged 21 to 64; 60.8%) also have a lower prevalence of Pap testing as compared to those who are insured (84.4%; American Cancer Society, 2017).

While literature on the different factors associated with Pap testing is abundant, no research has been found about cervical cancer screening among obese women who reside in Mississippi. The choice to research cervical cancer screening (Pap testing) among women in Mississippi is due to the high rate in which women in Mississippi develop cervical cancer compared to women who reside in other states within the United States. The CDC reported that women in Mississippi develop cervical cancer at a rate of 10.4 for every 100,000 women in Mississippi, the highest rate among the 50 states (CDC, 2017). Furthermore, Mississippi has the second highest obesity rate in the nation (Robert Wood Foundation, 2018). Despite continued focus from guiding goals and objectives of the national health promotional efforts of Healthy People and Mississippi State Health Department, Mississippi's adult obesity rate is currently 37.3%, up from 23.7% in 2000 and from 15% in 1990 (Robert Wood Foundation, 2018). Poverty levels in Mississippi are substantial; in 2013 median household income in Mississippi was $40,000 compared

to the national median household income of $56,000 (Uproot Mississippi, 2016). From 2011 to 2013, 17.3% of Mississippians lacked health insurance. Disparities in access to healthcare among different races is also a barrier, 20% of African American residents and 38% of Latino residents lack healthcare compared to 15% of White residents of Mississippi (Uproot Mississippi, 2016). The looming problem is obesity rates are high, income levels are below the national average, and cancer rates (inclusive of cervical cancer rates) are the highest among people who reside in Mississippi in comparison to people who reside in other states in the United States. In addition, women in Mississippi are dying at an alarming rate from cervical cancer (at a rate of 3.3 per 100,000), only second to the state of Alabama (at a rate of 3.8 per 100,000; CDC, 2017). This research study addresses the gap in literature by identifying the rate at which obese women who reside in Mississippi participate in Pap testing in comparison to nonobese women who reside in Mississippi. . To grasp an understanding of the rate of cervical cancer among obese women and nonobese women the question of perceived barriers to cervical cancer screening comes into question. The second problem then becomes are their perceived barriers such as race, age, education level or healthcare coverage that influence the probability, partially or wholly, of cervical cancer screening among the two groups (obese and nonobese women in Mississippi). Therefore, the intent of this research is to examine these relationships to characterize perceived barriers to cervical cancer screening among obese women and nonobese women. More importantly, this research might contribute to an understanding of the relationship among obesity and variables such as

race, age, educational level, income, and healthcare coverage that may affect the rate of cervical cancer screening among women in Mississippi.

Purpose of the Study

The purpose of this study is to compare cervical cancer screening between nonobese and obese women who reside in Mississippi as a means of testing the hypothesis that obesity is a barrier to screening within this population. A secondary purpose is to assess the impact of race, age, educational level, income, and healthcare coverage (insured or not insured) on cervical cancer screening on the relationship between obese and nonobese women who reside in Mississippi. Scholars have not examined if there is a disparity in cervical cancer screening among obese and nonobese Mississippi women and the difference in the two groups of women based upon factors such as race, age, educational level, income, and healthcare coverage. In this study, I address this gap by statistically quantifying if an association or relationship exists by examining the prevalence of Pap testing from 2015-2017, which is the most recent years of the Behavioral Risk Factor Surveillance System (BRFSS). The target population is women age 21 to 65 living in Mississippi. A quantitative design is employed using secondary data. Data on obesity and Pap testing from 2015 to 2017 was obtained through BRFSS. The variables evaluated are obesity (independent variable) and cervical cancer screening/Pap testing (dependent variable). The covariate variables are race/ethnicity, age, education, healthcare coverage, and income. The knowledge this study provides will be beneficial in designing programs that aim to decrease the rate of cervical cancer

among women who live in Mississippi and to work toward the goal of eliminating cervical cancer.

Research Questions and Hypotheses

Research Question 1 (RQ1): Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income?

$H_0$1: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

H_a1: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

Research Question 2 (RQ2): Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

$H_0$2: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a

statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured).

H_a2: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured).

Conceptual Framework

The theoretical framework applied to this study was Andersen's behavioral model. This behavioral model (1968) was used to understand situations that either facilitate, or impede, utilization of healthcare services (Umanitoba, n.d.). In Andersen's behavioral model there are three characteristics that influence an individual's access and use of health services: predisposing, enabling, and need factors (Aday & Andersen, 1974; Andersen, 1968; Babitsch et al., 2012; Umanitoba, n.d.). Predisposing factors refer to the sociocultural characteristics of an individual that existed before the individual became ill (Unamitoba, n.d.). Those sociocultural characteristics include education, occupation, ethnicity, social networks, and social interactions (Babitsch et al., 2012 & Umanitoba, n.d.). Enabling factors refer to the logistical aspects of obtaining healthcare, such as health insurance, the means, and the know-how to access healthcare, available health personnel and facilities within the community, travel time to a healthcare facility, and the wait time (Babitsch et al., 2012 & Umanitoba, n.d.). Need factors consist of the most immediate cause of healthcare use: health problems that generate the need for healthcare services (Babitsch et al., 2012 & Umanitoba, n.d.). This theoretical framework is ideal for

this study because the use of healthcare services, like participation in cervical cancer screening by Mississippi women is examined.

The constructs in Andersen's behavioral model applied to my study are predisposing factors of race/ethnicity, age, and education. The enabling factor applied to my study is income and the need factor applied to my study is healthcare coverage. The variables that pertained to my study are cervical cancer screening – Pap testing, obesity, race/ethnicity (predisposing factor), age (predisposing factor), education (predisposing factor, healthcare coverage (need factor) and income (enabling factor).

The U.S. Preventative Services Task Force recommended that women between the ages of 21 and 65 should take part in cervical cancer screening (AAFP, 2019 & American Cancer Society, 2020). Therefore, Mississippi women between the ages of 21 and 65 and the aforementioned variables are assessed to determine if there is an association between obese women and Pap testing and nonobese women and Pap testing and the variables that could possibly affect Pap test participation of obese and nonobese Mississippi women. The outcome may help in making mandates that enhance the use of preventative services such as Pap testing to lessen the burden and decrease the rate of cervical cancer.

Nature of the Study

For this study, I employed a quantitative approach involving secondary analysis of the BRFSS, Behavioral Risk Factor Surveillance Survey. This approach is most appropriate for this study because I was able to obtain data regarding Pap test participation for women who reside in Mississippi in the BRFSS. Because I reside in

Georgia, it is more cost effective to analyze data that has already been collected, verses traveling to another state to find the needed population to conduct the study. I compared the Pap test participation among obese and nonobese Mississippi women from 2015 to 2017. As the data was collected in a natural setting of the participant's human population, the observational design of secondary analysis was appropriate for my research. For the design, cervical cancer screening – Pap testing rate (dependent variable) was measured across obesity level (either obese or nonobese); race/ethnicity and age (moderator variables); healthcare coverage and income (mediator variables).

Target population was females, between the ages of 21 and 65, living in Mississippi. The nature of the study aligned with the theoretical framework of Andersen's behavioral model that aimed to identify factors that influence the use of healthcare services. It helped me to ascertain the factor that had the most impact on participation in cervical cancer screening. Determining the factors that had the most significant effect and which group of women (obese or nonobese) were more likely to participate in cervical cancer screening will be useful in formulating strategies that enhance the participation of cervical cancer screening among the target population.

Definition of Terms

Age: The length of an existence extending from the beginning to any given time (Merriam-Webster's collegiate dictionary, 1999). In my study, age was defined in years, at the time in which the participants responded to the BRFSS survey questions.

Cervical cancer screening: Testing of women to detect precancerous changes, comprised of two tests, the Pap smear (i.e., Pap test) and the HPV test. For both tests, the

cells are collected from the surface of the cervix and checked for abnormalities or cancer. The Pap smear is the only test that has been used in large populations and that has been shown to reduce cervical cancer incidence and mortality (WHO, 2019).

Education Level: The highest grade completed or the highest position of education that an individual has successfully completed (Statistics Canada, 2016).

Healthcare Coverage: Legal entitlement to payment or reimbursement for your healthcare costs, generally under a contract with a health insurance company, a group health plan offered in connection with employment, or a government program like Medicare, Medicaid, or the Children's Health Insurance Program (CHIP) (HealthCare.gov, n.d.).

Human Papilloma Virus (HPV): A large group of viruses, which consists of more than 180 different types, among which 15 have high oncogenic properties. Of the 180 viruses, 21 HPV types (HPV 6, 11, 16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 70, 73, and 82) are the most prevalent for their association with cervical cancer (Aimagambetova & Azizan, 2018).

Income: Income was defined in levels, Level 1-8. Responses were self-reported to the question, "What is your annual household income from all sources", with responses falling into one of the 8 following levels: Level 1 – less than $10,000; Level 2 – less than $15,000 ($10,000 to less than $15,000); Level 3 – less than $20,000 ($15,000 to less than $20,000); Level 4 – less than $25,000 ($20,000 to less than $25,000); Level 5 – less than $35,000 ($25,000 to less than $35,000); Level 6 – less than $50,000 ($35,000 to less than

$50,000); Level 7 – less than $75,000 ($50,000 to less than $75,000); Level 8 ($75,000 or more).

Nonobese: Weight that is considered as a healthy weight for a given height. Body mass index (BMI) – a person's weight in kilograms divided by their height in meters. A BMI of 18.5 to <25 falls within the normal range (CDC, 2017).

Obese: Weight that is higher than what is considered as a healthy weight for a given height. Body mass index (BMI) – a person's weight in kilograms divided by their height in meters. A BMI ≥ 30 falls within the obese range (CDC, 2017).

Race/Ethnicity: Race defined as a person's self-identification with one or more social group, which can be reported as White, Black or African American, Asian, American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, or some other race. Ethnicity determines whether a person is of Hispanic origin or not. Ethnicity is broken out into two categories: Hispanic or Latino and Not Hispanic or Latino. Hispanics may report as any race (U.S. Census Bureau, 2017).

Assumptions

I made several assumptions in this study. I assumed that the data from BRFSS could be generalized to represent people from all 50 states and all ages. Specifically, I assumed that BRFSS had a significant representation of Mississippi women between the ages of 21 and 65. Data for BRFSS was gathered using a random digit dialing telephone of households, using a combination of landline and cellular phone, including collecting information on race/ethnicity, age, education, healthcare coverage, income, obesity, and participation in cervical cancer screening – Pap testing. These multiple data collections

methods, landline and cellular phone, strengthened the validity of data. I also assumed that the staff that collected the data were adequately trained, unbiased, and accurately reported the participants' responses. Lastly, I assumed that the sampling, data collection methods, and weighting procedures applied made the data reliable.

Scope and Delimitations

The main delimitation was the focus only on women who reside in Mississippi between the ages of 21 and 65. This research was a secondary analysis of partly exported data from BRFSS. In addition, the respondent's BMI was not given; the respondent's BMI was calculated by using their height and weight to determine if the respondent was considered obese or nonobese. Additionally, all the answers were given by the respondents, so it was assumed that the data given was true and accurate, which means response bias had to be taken into consideration.

Significance

This study is significant because it provides a broader scope of some of the barriers to cervical cancer screening and potential insight into why Mississippi has the highest cervical cancer rate among the 50 states. Additionally, my study provides insight into cervical cancer screening rates of obese women in Mississippi to determine if there is a disparity in cervical cancer screening rates among them and their nonobese counterparts. Identifying and filling the gap in the literature was vital in creating a positive social change. Monitoring the trend of cervical cancer screenings among Mississippi women between the ages of 21 and 65 from 2015 to 2017 will help in determining the participation rate of Mississippi women in cervical cancer screenings.

The results of my study will assist in formulating an integrated approach that includes clinical medicine and public health entities to develop strategies that will increase the use of cervical cancer screenings.

Positive Social Change

The potential of positive social change is vast. The results of my study may help in developing specific strategies that will increase the usage of cervical cancer screening and decrease the rate of cervical cancer to attain the WHO's goal of eliminating cervical cancer as a global health issue. The social change implication include knowledge in formulating policies by public health workers, program developers, and researchers to find different avenues to increase the use of cervical cancer screening. The long-term goal is to significantly decrease the rate of HPV-related cancers such as cervical cancer. On a broader range, my study could possibly assist with women taking more of a proactive approach to their health and well-being. Reproductive health is essential to the health of a woman, but that is only one part of being in good health. It is important that women take part in their physical and mental health by participating in wellness checks (annual physical, bi-annual dental cleanings) as well as making healthier decisions (exercising, eating healthy, eliminating stress) to operate in their optimal level of health.

Summary

Although cervical cancer rates have decreased within the last 40 years cervical cancer is still a significant public health issue. This issue of cervical cancer is most especially prevalent for the women who reside in Mississippi. Mississippi women develop cervical cancer at a rate of 10.4 per 100,000 women, which is the highest among

the 50 states. The most disparaging aspect of the burden of disease among Mississippi women, as it relates to cervical cancer, is that preventative tests such as cervical cancer screenings – Pap testing can decrease the rate of cervical cancer. Participation in Pap testing can offer early detection of cervical cancer when the treatment of the disease is more favorable. Abnormal cells can be removed before they become cancer, lessening the rate of cervical cancer. Exploring cervical cancer participation rates of Mississippi women and then comparing the rates of obese women and nonobese women will determine if being obese decreases a woman's participation in cervical cancer screening. Exploring the factors of Andersen's behavioral model (race/ethnicity, age, education, healthcare coverage, and income) that could possibly influence the participation of cervical cancer screening helped me in identifying the most significant factors related to participating in cervical cancer screenings. The knowledge gained will be useful in formulating strategies to increase participation in cervical cancer screenings. The goal is to eliminate cervical cancer as a global health issue.

In Chapter 1, I introduced the study, background, problem statement, purpose of the study, research question and hypotheses, and conceptual framework. I followed those sections up with the nature of the study, definitions, assumptions, scope and delimitations, and limitations. Chapter 1 concluded with the significance of the study, implications of social change, and the summary. Chapter 2, I will complete a review of the literature that supports the study along with giving a full explanation of the theoretical framework that will support the study.

Chapter 2: Literature Review

Introduction

In 2016, the latest year in which incidence data are available, 12,984 women in the United States were diagnosed with cervical cancer and 4,188 died of cervical cancer in that same year (CDC, 2019). In the early 1990s, it was discovered that the prerequisite for cervical cancer was HPV (CDC, 2015). HPV is labeled as the "necessary cause", meaning that in all cases of cervical cancer analyzed, there was not one case that was absent of HPV DNA (Beavis & Levison, 2016; Dasari et al., 2015). For women, screening for the presence of HPV and cervical cancer is done through the Pap test, also referred to as a Pap smear and cervical cancer screening.

Screening tests such as the Pap test offer early detection of cervical cancer when successful treatment of the disease is more favorable (American Cancer Society, 2018). The detection of precancerous cells can also be found through the Pap test. These cells can be treated or removed before cancer forms. The American Cancer Society (2018), as referenced by Smith et al. (2018), recommends that women between the ages of 21 and 65 follow these guidelines:

- Pap testing commences at the age of 21 with women between the ages of 21 and 29 being tested every 3 years. It should be noted that cervical cancer screening for this age group should not include HPV testing. HPV testing is not included within this age group (age 21-29) because women who are sexually active are more prone to have an HPV infection that will clear up on its own.

- The age of 30 is when the HPV testing is included with Pap test and it is recommended that the Pap test (inclusive of the HPV test) be done every 5 years until the age of 65.
- An option for women between the ages of 30 and 65 is to be screened with only the Pap test every 3 years.
- Women who have suppressed immune systems from HIV infection, organ transplantation, or long-term steroid use are considered high risk and should follow the cervical cancer screening of their healthcare provider. Additionally, women who were exposed to diethylstilbestrol (DES), a synthetic form of the female hormone estrogen, are also considered high risk and should follow the cancer screening recommendation of their healthcare provider.
- Women over the age of 65 who have followed the recommended cervical cancer screening guidelines in the previous 10 years should stop cervical cancer screening. However, women over the age of 65 who have had cervical intraepithelial neoplasia (CIN) in the last 20 years should continue to have cervical cancer screening for at least 20 years after the abnormality was found.
- Women who have had a total hysterectomy, which is the removal of the uterus and the cervix, should stop cervical cancer screening, unless the total hysterectomy was the result of cervical precancer or cervical cancer. In this case, the woman should follow the recommendation of the

healthcare provider. Women who have undergone a partial hysterectomy where the cervix is still intact should follow the aforementioned guidelines.

- It should be noted that women who have received HPV vaccinations should also follow the recommended cervical cancer screening guideline.

Based on data retrieved from the 2015 National Health Interview Survey (NHIS) 81.4% of women aged 21 to 65 reported having a Pap test within the past 3 years (according to 2012 cervical screening guidelines; American Cancer Society, 2017). The prevalence of Pap test use in 2015 was similar among white (83.1%) and black (84.75%) women, but lower among Hispanic (77.4%), Asian (73.3%), and American Indian/Alaska Native women (70.9%; American Cancer Society, 2017). Furthermore, 2015 NHIS data reveals that about one-third (32.4%) of women ages 30-64 years reported having a Pap test within the past 5 years with the proportion of women in their 30s (43.1%) being higher compared to women 40 years of age and older (22.3%-31.6%; American Cancer Society, 2017). Other statistical data suggests that women (aged 25 to 65) who have not graduated from high school (69.9%) have a lower prevalence of Pap testing as compared to women, of the same age group, who are college graduates (88.6%). Uninsured women (aged 21 to 64 years; 60.8%) also have a lower prevalence of Pap testing as compared to those who are insured (84.4%; American Cancer Society, 2017).

If cervical cancer is found early, it is one of the most successfully treated cancers (American Cancer Society, 2018; Tabatabai et. al, 2014). The cervical cancer death rate in the United States declined more than 50% between 1988 and 2018 (American Cancer

Society, 2018). Although data shows that cervical cancer death rates in the United States have declined, research has shown that there are psychosocial barriers that cause women not to participate in cervical cancer screenings. Doctor-patient relationship is quite significant in determining if a woman participates in cervical cancer screening (Bukowska-Durawa & Luszczynska, 2014; Jia et al, 2013; Manickavasagam et al., 2014). If trust has not been built and the woman does not feel comfortable with discussing their current medical state along with having the comfort of knowing that procedures will be performed with care, the woman is less apt to participate in cervical cancer screenings. Bukowska-Durawa and Luszczynska (2014) conducted a systematic review of 48 original studies that revealed that psychosocial barriers could be placed into three categories: personal, emotional, and social.

Personal psychosocial barriers relate to time management. For the participants of the 48 original studies that were included in Bukowska-Durawa and Luszyzynska (2014) systematic review, time management was inclusive of participants who had the tendency to procrastinate and participants who let uncontrollable factors, like weather, determine their participation in cervical cancer screening (rain or extreme temperatures has the potential to increase cancellations). Additionally, for participants who led hectic schedules having to find time to participate in a preventative exam could be perceived as a less than effective use of time.

Emotional barriers to cervical cancer screening suggest that the idea of finding disease served as a hindrance to Pap testing (Bukowska-Durawa & Luszyzynska, 2014). Through this systematic review it could be generalized that women were not only

uncomfortable with the potential of disease, but for those who were aware that disease was present the idea of disease progressing beyond the point of successful treatment made those women less likely to participate in Pap testing. Other emotional barriers to Pap testing were associated with women being shameful and embarrassed. The exam requires the most intimate part of the body (the vagina) to be examined, touched, and prodded with medical tools. Nearly 12% of the women from the 48 studies that Bukowska-Durawa & Luszyzynska (2014) reviewed associated shame with Pap testing, 9.3% felt embarrassment, 9.3% lacked a sense of comfort with exam. Followed by 4.7% who felt pain during previous Pap test, 4.7% who were uncomfortable with touching of an intimate area during the exam, and 4.7% who were nervous during the exam (Bukowska-Durawa & Luszyzynska, 2014).

The psychosocial barriers that contribute to some women not participating in Pap testing (cervical cancer exams) has been researched. Sociodemographic variables, which can be perceived as factors such as race, age, educational level, and healthcare coverage (insured or not insured) has been explored and documented. Findings of the exploration of these sociodemographic variables show that Pap testing among African American women (compared to non-Hispanic White women), women with no health insurance and women with fewer years of education remain low at 85%, 61%, and 70% respectively (Chen et al., 2012; Gibson et al., 2019).

As was previously stated, cervical cancer rates in the United States have declined by more than 50% between 1988 and 2018 (American Cancer Society, 2018; Gibson et al., 2019). Overall, cervical cancer incidence rate has decreased from 17.2 to 7.6 (per

100,000 women) and the mortality rate has decreased from 5.6 to 2.3 (per 100,000 women; Gibson et al., 2019; Siegel et al., 2018). However, the CDC reported that women in Mississippi develop cervical cancer at a rate of 10.4 for every 100,000 women in Mississippi, the highest rate among the 50 states (CDC, 2017).

Furthermore, Mississippi has the second highest obesity rate in the nation (Robert Wood Foundation, 2018). Despite continued focus from guiding goals and objectives of national health promotional efforts of Healthy People and Mississippi State Health Department, Mississippi's adult obesity rate is currently 37.3%, up from 23.7% in 2000 and from 15% in 1990 (Robert Wood Foundation, 2018). Poverty levels in Mississippi are substantial; in 2013 median household income in Mississippi was $40,000 compared to the national median household income of $56,000 (Uproot Mississippi, 2016). From 2011 to 2013, 17.3% of Mississippians lacked health insurance. Disparities in access to healthcare among different races is also a barrier, 20% of African American residents and 38% of Latino residents lack healthcare, compared to 15% of White residents of Mississippi (Uproot Mississippi, 2016). The looming problem is obesity rates are high, income levels are below the national average, and cancer rates (inclusive of cervical cancer rates) are the highest among people who reside in Mississippi in comparison to people who reside in other states in the United States. In addition, women in Mississippi are dying at an alarming rate from cervical cancer (at a rate of 3.3 per 100,000), only second to the state of Alabama (at a rate of 3.8 per 100,000; CDC, 2017).

My research study addresses the gap in literature by identifying the rate at which obese women who reside in Mississippi participate in Pap testing in comparison to

nonobese women who reside in Mississippi and the rate at which these two groups of women (obese and nonobese) get cervical cancer. Complex and interrelated factors contribute to the risk of developing cancer and to the observed disparities in cancer incidence and death among racial, ethnic, and underserved groups (Healthy People.gov, 2020). The lack of healthcare coverage and low socioeconomic status (SES) has been found to be the leading factors that increase an individual's risk of developing cancer (Healthy People.gov, 2020). It was further postulated in Healthy People 2020 objectives that SES is most often based on a person's: income, education level, occupation, social status in the community, and geographic location. Therefore, to grasp an understanding of the rate of cervical cancer among obese women and nonobese women who reside in Mississippi the question of perceived barriers to cervical cancer screening comes into question. The second problem then becomes are their perceived barriers such as race, age, education level, income, or healthcare coverage that influence the probability, partially or wholly, of cervical cancer screening among the two groups (obese and nonobese women in Mississippi).

The purpose of this study is to compare the rate of cervical cancer screening between obese and nonobese women who reside in Mississippi as a means of testing the hypothesis that obesity is a barrier to screening within this population. A secondary purpose is to assess the impact of race, age, education level, and healthcare coverage (insured or not insured) on cervical cancer screening on the relationship between obese and nonobese women who reside in Mississippi. I decided the most appropriate

conceptual framework for this research study, and the framework that would align the research, is a model that is grounded in healthcare use.

In this chapter the problem statement and the purpose of the study are reintroduced. Additionally, I synthesize current literature on the significance of the problem. Other sections of Chapter 2 include the literature search strategy, the conceptual model of the study, and the literature related to key variables and concepts. The variables are Mississippi, cervical cancer screening – Pap testing, obesity, race/ethnicity (predisposing factor), age (predisposing factor), education (predisposing factor), healthcare coverage (need factor) and income (enabling factors). Finally, this chapter ends with a summary and conclusion, including the transition to Chapter 3.

For this research I examined articles at the Walden University Library and expanded to PubMed, Journal of the American Medical Association (JAMA), National Center for Biotechnology Information (NCBI), and SAGE Journals for studies related to cervical cancer screening. Databases searched included Dissertations, Abstracts, and PsycINFO. Google Scholar and the World Wide Web search engine were used to conduct searches on relevant peer-reviewed articles. During this search I used the following keywords and phrases: *cervical cancer, cervical cancer screening, cervical cancer screening guidelines, obesity, obesity and cervical cancer screening, race and cervical cancer screening, age and cervical cancer screening, Mississippi demographics, cervical cancer screening in Mississippi, Mississippi and cervical cancer, theoretical frameworks, Andersen's Health belief model.* During the search, the focus was on articles from 2014 – 2020.

I conducted a search on governmental and organization websites to obtain relevant data needed for this research review. A search was also conducted to obtain the appropriate conceptual model applicable to this study. The decision was made to use the theoretical model relevant to healthcare use because it encompassed the variables within this research. This theoretical model will be discussed in this chapter as well as in Chapter 3, when the research design is discussed.

Theoretical Framework

It is important to understand that healthcare use is multifaceted. Healthcare is used to prevent disease, essentially maintain the health of the individual in whom the service is rendered, and treat disease, in some cases curing the disease (Andersen, 1968). An individual's utilization of healthcare services is dependent upon a person's perceived need for healthcare services. An individual's need for healthcare services could be due to an immediate need, life or death, an emergency, or from an impending medical situation that has persisted for some time and the severity of the symptoms has caused an individual to seek medical attention. Also, an individual's need for healthcare services could be sought after for preventative purposes. In short, healthcare use is the point in the healthcare system where the patients' needs intersect with the professional system (Babitsch, Gohl, & von Lengerke, 2012). Andersen's behavioral model, theoretical framework, is used to discover situations that either facilitate or impede utilization of healthcare services (Umanitoba, n.d.). Andersen (1968) sought to understand an individual's motivation around usage of healthcare services. While formalizing, the reasons behind healthcare use. Andersen posited three characteristics of an individual's

access to and use of healthcare services: predisposing, enabling, and need. Each of these three characteristics has subcomponents with variables with relatable variables that are measured and analyzed (Andersen, 1968).

Predisposing pertains to innate qualities and behaviors that are relevant depending upon the influences of an individual's culture and experiences (Aday & Andersen, 1974; Andersen, 1968; Babitsch et al., 2012; Umanitoba, n.d.). This factor deals with an individual's propensity to utilize health services even before onset of an illness (Aday & Andersen, 1974). According to Adday and Andersen (1974), demographic factors of predisposing are age and gender. These are biologic factors that relate to the need for health services (Andersen, 1995 as cited by Hulka and Wheat, 1985). Social factors are consistent with social structures that determine an individual's social and economic place within society (Andersen, 1995). The social factors that help define placement are education, occupation, ethnicity, social network, social interactions, and culture. Placement within society is not only key component of social structure but it also determines how well individuals cope with presenting problems and how individuals corral the needed resources to address the problem (Andersen, 1995). Health beliefs are the attitudes, values, and knowledge that people have toward and concerning the healthcare system (Andersen, 1995). Health beliefs can be considered as the explanation of how people find the means to health resources, decide it is necessary to use these resources, and ultimately use the health resources (Andersen, 1995).

Enabling factors focus on the logistical aspects of obtaining care (Andersen, 1995). Who, when, and where are questions that people ask themselves when seeking

healthcare services. Who addresses the doctor that will be attending to the impending health need; when is the availability of the doctor (how far out will one have to schedule an appointment); and where suggests the proximity of the doctor's office to an individual's dwelling or place of employment. Therefore, health personnel and facilities must be a feasible distance from where individuals live and work. The above logistical queries are factors of community. Community pertains to available health personnel and facilities and the wait time spent in facilities to see the doctor (Andersen, 1995). Another enabling factor includes personal/family, which addresses the means and know how to access health services, the income, health insurance, a regular source of care, travel, extent and source of care (Babitsch et al., 2012; Umanitoba, n.d.). Possible additions to these factors are genetic predispositions and psychological characteristics (Umanitoba, n.d.).

Need factors are the immediate cause of health service use. Health problems and how individuals perceive a need to seek health services to address these problems are paramount (Andersen, 1995). The basis for this factor and this health model is to consider how people view their own general health and functional state (Andersen, 1995). How do people experience, tolerate, and address symptoms of physical pain, illness, and worries; how do people measure if the health concern is important enough to seek professional medical help?

The behavioral model of health services use, also referred to as Andersen behavioral model and sociobehavioral model, has changed considerably, and evolved since its inception. The model has been refined to include measures that will distinguish

if an individual has a consistent source of care and how often that source is utilized and the individual's satisfaction with the practitioner issuing the health services (Derose et al., 2011). Additionally, environmental factors, health outcomes, and health behaviors have been added to broaden the scope to bring further understanding to an individual's use of healthcare services (Derose et al., 2011). Equality within the healthcare system, efficiency of the healthcare services rendered, effectiveness, and health and well-being have been incorporated into the model (Derose et al., 2011). The importance of variables at the neighborhood and community level and factors that are specific to vulnerable populations, such as the homeless, rural populations, immigrants, and African American women, are factors at the individual level that influence behavior in seeking care (Derose et al., 2011).

Andersen's model has been used in numerous studies investigating the use of healthcare services (Babitsch et al., 2012). Babitsch et.al. suggests that while Andersen's model has been used in numerous studies the diseases that were studied varied. The studies that employed Andersen's model as a theoretical framework utilized variables that were suitable to the diseases being studied. This suggests that Andersen model is adaptable and can be applied to differing settings allowing for variables to be distinguished as either predisposing factor, enabling factor, and/or need factor (Azfredrick, 2016).

Andersen's model has evolved from its original version developed in 1968. Modifications of the behavioral model have come because of critiques from others. Goldsmith (as cited by Lo and Fulda, 2008) established that access was not defined in

Andersen's model. Because of this critique, Andersen defined access using multidimensional terms and categorizing access based upon predisposing, enabling, and need factors (Lo and Fulda, 2008). Potential access refers to the existence of resources that is measured by age, education, and knowledge that people have concerning healthcare – enabling factors (Lo and Fulda, 2008). Realized access is the use of health services. Equitable access is dependent on demographic characteristics and need factor, while inequitable access consists of social structure and health beliefs as described in predisposing factors and enabling resources (Andersen, 1995).

Babitsch et al. (2012) conducted a systematic review of studies that employed Andersen's model dated between 1998 and 2011. From this study, Babitsch et al. deduced that Andersen's model proved complex, yet researchers did not convey this complexity in the production and presentation of results. Additionally, in most of the studies researchers utilized a small set of key variables with varying indicators (Babitsch et al., 2012). This commonality was found mostly among predisposing and enabling factors.

Many researchers have used Andersen behavioral model in their work that examines the utilization of health services to determine the outcome of various health problems. Azfredrick (2016) suggests that the adaptability of the model to various health settings and the inclusion of an array of variables is what make the model a strong foundation to build research studies. Although Babitsch et al. (2012) found that many scholars use a small set of key variables in their research, the Andersen behavioral model offers a range of independent variables in which researchers can choose. In this study I

focus on predisposing factors (age, education, occupation, and ethnicity) and enabling factors (income, health insurance, and obesity). Obesity is proxy for an enabling factor that might facilitate or impeded access to healthcare, to ascertain if any of these factors influence cervical cancer screening in women in Mississippi.

Andersen's behavioral model can be applied to studies involving access and use of health services to vulnerable populations. Vulnerable populations in this study were defined as members of the LGBTQ (Lesbian, Gay, Bisexual, Transgender, Queer or Questioning) community, rural populations, and immigrants. In examining the usage of Andersen's behavioral model this approach was taken because cervical cancer and cervical cancer screening is not just specific to one geographical region or one specific group of individuals. Cervical cancer is a global issue that makes the need for cervical cancer screening extremely important in the fight against cervical cancer.

Hirschfield et al. (2016) explored the association between the three factors – predisposing (vulnerable) factors, need factors, and enabling factors and the risk and protective factors for hypertension among United States men who sleep with men. This investigation involved a hierarchical logistic regression analysis of data from 7,454 U.S. men who sleep with men. Hirschfield et al. (2016) noted that Andersen's model revealed factors that may be driving disparities in hypertension among men sleeping with men. Some of the factors include need factors (i.e., comorbid and mental health conditions) and several enabling factors (Hirschfield et al., 2016). The enabling factors were having a primary care provider and residing in South Atlantic and South-Central regions of the United States were associated with higher odds of a hypertension diagnosis, while self-

pay or no insurance were associated with lower odds of a hypertension diagnosis (Hirschfield et al., 2016). Decker et al. (2013) and Smolen et al. (2014) (as cited by Hirschfield et al., 2016) deduced that individuals with public insurance might perceive themselves as having a need for medical care compared to uninsured individuals. Alternatively, uninsured adults may differ from adults with private and public insurance in terms of exercise, diet, attitudes toward health and healthcare, and mandated health screenings (Cogan, 2011; Smolen et al., 2014).

Greene et al. (2018) used Andersen's behavioral model to guide the selection of variables used in the study to examine the association between pregnancy history and cervical cancer screening in a diverse sample of sexual minority women. Predisposing, enabling, and need factors were examined to determine their influences on cervical cancer screenings. The predisposing factors in this study were age and sexual orientation. Women between the ages of 21-45 were examined and women who identified as lesbian, gay, bisexual, or transgender were examined (Greene et al., 2018). Enabling factors were type of healthcare facility and support from family while need factors were the impending need for healthcare services because of just giving birth. The sample population comprised of 430 women (Greene et al., 2018). The analysis provided evidence that sexual minority women who have been pregnant are more likely to receive Pap testing and that multiple sociodemographic factors are more likely to impact screening in this population (Greene et al., 2018).

Jia et al. (2013) used a cross sectional survey of women to determine their knowledge about cervical cancer and screening, demographic characteristics, and the

barriers to screening. A total of 5,929 from three towns in Wufeng County within China took part in a cross-sectional design study (Jia et al., 2013). The researchers based this study on Andersen's behavioral model using predisposing factors such as education, culture, age, attitudes, and knowledge the participants had regarding the healthcare system along. Enabling factors including income, the ability to access healthcare services, and income to evaluate factors affecting the willingness to undergo cervical cancer screenings were used. It was revealed through Jia et al's., (2013) study that women who were younger (women 45 years of age or younger), had lower income, positive family history of cancer, secondary or higher levels of education, higher levels of knowledge and fewer barriers to screening were more willing to participate in cervical cancer screenings than women without these characteristics.

Andersen's behavioral model was used to determine which of the three factors (predisposing, enabling, and/or need) attributed to the lack of cervical cancer screening participation among Ghanaian women (Williams, 2014). After examination of the responses from the participants of the study, lack of cervical cancer screening was associated with lack of knowledge regarding cervical cancer and cervical cancer screening (Williams, 2014).

Chawla et al. (2014) examined patterns of cervical, breast cancer screening among Asian American women in California, and evaluated their screening trends over time. Data was used from California Health Interview Survey for the years of 2001, 2003, 2005, 2007, and 2009 (Chawla et al., 2014). In this study the predisposing, enabling, and need factors based on Andersen's behavioral model were employed (Chawla et al., 2014).

Multivariate analyses indicated that Pap testing rates did not significantly change over time (77.9% in 2001 vs 81.2% in 2007). Chawla et al. (2014) postulates that sociodemographic and healthcare access (predisposing and enabling factors) had varied effects on cervical cancer screening, with education and insurance coverage significantly predicting screening for certain groups.

Maharjan and Tuladhar (2018) conducted a cross sectional interview-based study among 200 patients at a tertiary care hospital at Lalitpur Metropolitan city in Nepal. The researchers wanted to assess the knowledge and awareness of patients regarding screening methods of cervical cancer, its prevention, and early detection (Maharjan & Tuladhar, 2018). Predisposing factor, education, played an important role in the knowledge and understanding of cervical cancer screening. Among the participants, 76.5% or 153 women were literate, and 23.5% or 47 women were illiterate; only 41% had heard about Pap testing and only 1% had heard about other methods of screening test like visual inspection with acetic acid (Maharjan & Tuladhar, 2018). Additionally, only 7% had heard of HPV vaccination, only 22.5% had done Pap smear once, and 67% did not know the risk factor of cervical cancer (Maharjan & Tuladhar, 2018).

It has been noted that various factors influence healthcare use among women. Lin (2008), Selvin (2003), and Hewitt and Breen (2004) as cited by (Bussiere et al., 2014) indicated that socio-demographic factors, health and healthcare use play a role in how obese women with mobility limitations use preventative healthcare services. The socio-demographic variables, predisposing factors, were education, age, employment status, and marital status. Participants consisted of 8,133 women from the French National

Health and Disability Survey – Household Section, 2008, between the ages of 20-65 (Bussiere et al., 2014). The predisposing factors, which were conceptualized as level of education, marital status, and employment status, were significantly associated with screening use. Women with lower level of education and those who were not married, and unemployed, were less likely to receive a Pap test within the last 3 years (Bussiere et al., 2014).

I applied the following constructs of Andersen's behavioral model: predisposing factors (race/ethnicity, age, and education), enabling factor (healthcare coverage and income), and need factor (cervical cancer screening – Pap testing). Perceived need for cervical cancer screening is defined as participation in Pap testing. I also employed the following variables: obesity (independent variable), cervical cancer screening – Pap testing (dependent variable), and race/ethnicity, age, education, healthcare coverage and income (moderator variables). These variables are presented after the discussion of Mississippi demographics.

Mississippi Populace

Mississippi is ranked 32nd in the United States in terms of population with a total estimated population of 2.98 million people as of 2017, which is slightly up from the 2010 census of 2,967,297 (World Population View, 2018). The city of Jackson, which is the state capital, is the most populous city in Mississippi with 168,838 people (World Population View, 2018). No other city within Mississippi has a population as large as Jackson, the second most populous city is Gulf Port with 71,856 inhabitants, and the third most populous city is South Haven with a population of 52,589 inhabitants (World

Population View, 2018). There is a total of 299 municipalities across the city of Mississippi. Municipalities are designated as cities, towns, or villages (World Population View, 2018). For a population to be given the distinction as a city there must be 2,000 people or more who inhabit that area. Following the rule of having 2,000 or more inhabitants to be defined as a city, the U.S. Census Bureau (as cited by Cubit, 2019) states that Mississippi has 124 cities.

Demographics

The median age of Mississippi's population is 36.7 years of age with 51.5% (1,537,503) being female and 48.5% (1,448,717) being male (World Population View, 2019). Mississippi is a racially diverse state with majority of the state comprising of White women and men. White people account for 59% of the populace or 1,755,471 people, African Americans account for 37.5% or 1,122,576, people having two or more races account for 1.2% or 37,929, Asians account for 1% or 28,859, other races (inclusive of Hispanics) account for 9% or 27,530, American Indian and Alaska Native account for .4% or 13,258, and Native Hawaiian and other Pacific Islander account for less than .1% or 597 people (World Population View, 2019).

Although Mississippi is a racially diverse state, the largest percent of inhabitants are White, but Whites are the least likely to be impoverished. The rate of White people living below the poverty level is 13.5%, which is 216,267 people (World Population View, 2019). African Americans are the racial group that is most likely to be impoverished. Nearly 34% or 364,893 African Americans live below poverty level (World Population View, 2019). What is important to note is that female poverty rate is

23.52%, while male poverty rate is 19.22% (World Population View, 2019). Female 25-34 are the largest demographic living in poverty, followed by female 35-44, and then female 18-24 (Data USA, 2019). It is important to note the disparity between female and male poverty rate because of the correlation between income and poverty levels. Those with lesser or no income are more likely to be impoverished. It can be deduced that if income is lesser and a person is below the poverty level, they are less likely to have health insurance.

Education

Educational attainment is a predisposing factor that has an influence on income earnings. The 2010 US Census Bureau (as cited by World Population View, 2019) reported that there was 49,816 Mississippi women, over the age of 25, who have less than a 9th grade education. Mississippi women, over the age of 25, who did not graduate high school, but has attended some grades between 9th and 12th was 103,095 (World Population View, 2019). High school Mississippi women graduates, over age of 25, were 295,042. Women, over the age of 25, who reside in Mississippi that have had some higher education (college), obtained an associate's degree, a bachelor's degree, or a graduate degree are as follows: 237,946 women, 108,725 women, 146,159 women, and 91,202 women respectively (World Population View, 2019).

As it relates to race and educational attainment, the highest rate of high school graduates and highest rate of obtaining a bachelor's degree, was among people who were categorized as Islander, which was 97.35% (high school graduate) and 39.9% (bachelor's degree; World Population View, 2019). High school graduation rate and bachelor's

degree rate of Whites were 25% and 87.29% respectively (World Population View, 2019). African Americans graduation rate for high school was 77.91% and those who earned a bachelor's degree was 14.86% (World Population View, 2019). Individuals who identified as multiple race high school graduation rates were 85.11% and 26.07% obtained a bachelor's degree; Asians respective high school graduation and bachelor's degree rates were 82.3% and 39.9% (World Population View, 2019). Hispanic (63.41%) and Native Americans (71.89) had some of the lowest high school graduation rates and the lowest rates for obtaining a bachelor's degree – Hispanics (13.7%) and Native Americans (10.48%).

Income Earnings

The economy of Mississippi employs 1.17 million people (Data USA, 2019). In 2016, the median household income was $41,754, which is less than the U.S. annual median income (Data USA, 2019). Males in Mississippi have a higher average income that is 1.45 times higher than the average income of females; the average income for females was $36,845 (Data USA, 2019). Data retrieved from 2010 U.S. Census (as cited by World Population View, 2019) shows that the higher the educational attainment the higher the income. Females who had less than a high school education earned an annual income of $15,662. Females who were high school graduates earned an annual income of $20,838, while those who had some college earned $25,359 annually (World Population View, 2019). College graduates (obtained bachelor's degrees) and females who obtained graduate degrees earnings were $36,248 and $47,124 respectively (World Population View, 2019).

In 2016, the highest paid race/ethnicity of Mississippi workers was White (Data USA, 2019). These workers were paid 124 times more than the second highest salary of any race/ethnicity, which were Native American workers (Data USA, 2019).

Health Insurance Coverage

Nearly 11% of women ages 19 to 64, which is approximately 10.6 million women, were uninsured in 2017, a decline from a rate of 19% in 2013 (Kaiser Family Foundation [KFF], 2019). Women who are uninsured have inadequate access to healthcare services, lower standard of care when they are in the health system and poorer health outcomes (KFF, 2019). Compared to women who are insured, uninsured women have lower use of important preventative services such as Pap tests, mammograms, and timely blood pressure checks and are less likely to have a regular doctor (KFF, 2019). Women who fall within the lower income or below poverty level, women of color, and immigrant women are more likely to be uninsured (KFF, 2019).

The 2010 US Census (as cited by National Women's Law Center & State Partners, 2013) statistical data shows that approximately 181,000 Mississippi women were uninsured. The numbers are even higher for women of color. In Mississippi, 25.7% of African American women and 25.7% of Hispanic women were uninsured compared to 15.4% of White women (National Women's Law Center & State Partners, 2013.). For Mississippians, the age group most likely to have health insurance was 6-17, this is for both men and women (Data USA, 2019).

Obesity Epidemic

Obesity is defined as weight that is higher than what is considered a healthy weight for a given height (CDC, 2017). Body mass index or BMI is used as the screening tool for overweight or obesity. Body mass index is measured using a person's weight in kilograms divided by the square of height in meters (CDC, 2017). A high BMI can be an indicator of high body fatness. BMI criteria are as follows: BMI less than 18.5 is underweight; 18.5 to <25 is normal weight; 25 to <30 is overweight; 30 or higher is obese (CDC, 2017). Obesity is subdivided into categories: Class 1 is BMI of 30 to <35; Class 2 is BMI of 35 to <40; Class 3 is BMI of 40 or higher which is defined as extreme or severe obesity (CDC, 2017). BMI does not measure body fat directly, but it is one of the commonly used measures for overweight and obesity.

Mitchell and Shaw (2015) postulate that the rising number of obese and overweight individuals has become a worldwide epidemic of obesity, with more than 35% of adults considered to be overweight or obese. Overweight and obesity are the fifth leading cause of death in the world, accounting for nearly 3.4 million deaths annually (Smith & Smith, 2016). CDC (2017) define adult overweight and obesity as a weight that is higher than what is considered as healthy weight for a given height. Body mass index (BMI) is a screening tool used for overweight and obesity. Calculations for BMI and how BMI is categorized will be discussed in the Methods chapter.

Mississippi has the second highest adult obesity rate in the U.S., with West Virginia being the state with the highest adult obesity rate (Robert Wood Johnson Foundation, 2018). In 2017, Mississippi's obesity rate was 37.3%, up from 23.7% in

2000, and from 15.0% in 1990 (Robert Wood Johnson Foundation, 2018). Mississippians between the ages of 45-64 (male and female) had the highest obesity rate in 2017 with 42.4% being obese (Robert Wood Johnson Foundation, 2018). African Americans who resided in Mississippi in 2017 had the highest obesity rate at 45.5% with their White and Hispanic counterparts having obesity rates at 32.1% and 29.2% respectively (Robert Wood Johnson Foundation, 2018). Mississippi women obesity rate is 38.8% that is about 3.1% higher than their male counterparts of 35.7% (Robert Wood Johnson Foundation, 2018).

Obesity disproportionately affects racial and ethnic minorities as well as people at lower income and educational levels (Budd & Peterson, 2014). Women are more likely to be obese than their male counterparts, this has far reaching effects on women's reproductive health (Mitchell & Shaw, 2015). The etiology of obesity is overly complex encompassing genetic, environmental, physiologic, cultural, political, and socioeconomic factors (Mitchell & Shaw, 2015). For the sake of this study, the cultural, environmental, and socioeconomic factors of obesity were the focus.

Obesity and Race

The Census Bureau defines race as a person's self-identification with one or more social group, which means a person can report as White, Black or African American, Asian, American Indian, Alaska Native, Native Hawaiian, Other Pacific Islander, or Some Other Race (United States Census Bureau, 2017). I want to note that Hispanic was not one of the categories in which an individual can self-identify. The United States Census Bureau (2017) suggests that ethnicity determines whether a person is of Hispanic

origin or not. For this reason, ethnicity is broken out in two categories, which are Hispanic or Latino and Not Hispanic or Latino. Hispanics may report as any race.

Although the overall prevalence of obesity in the U.S. is not increasing, racial and ethnic minorities continue to struggle with rising obesity rates (Imes & Burke, 2014). Knox-Kazimierczuk and associates (2017) examined the relationship between race and body mass index through the constructs of racial identity (racial salience, racial centrality, and racial regard). Research was conducted to understand the intentions and motivations behind marginalized groups. Winant as cited by (Knox-Kazimierczuk et al., 2017) suggests that the concept of race symbolizes the sociopolitical and economic struggle enacted against specific groups of people.

For the study, Knox-Kazimierczuk et al. (2017) employed data from the National Survey of American Life Self-Administered Questionnaire (NSAL-SAQ) 2001-2003. The researchers noted that although the data set was approximately 13 years old at the time of usage it was the most comprehensive study on noninstitutionalized African Americans to date. Two thousand one hundred African American females served as study participants. The development of measures for this study focuses on established sociocultural determinants of African American female obesity (Knox-Kazimerczuk et al., 2017). Participants ranged in age from 18 to 92 years; the mean age was 42.72, participants had an average BMI of 29.66. Approximately 57% or 1,203 of the participants' household income were less than $25,000 annually (Knox-Kazimerczuk et al., 2017). Greater than half of the participants (63.7%, 1,337) had a high school education or less (Knox-Kazimerczuk et al., 2017). Racial salience was the concept of

determining racial identification (were participants identifying as Black, American, or both) – the variable importance of being Black or American was recoded as a dichotomous variable (no=0, yes=1; Knox-Kazimierczuk et al., 2017). Racial centrality was assessed through questions that determined if their beliefs were more centralized around the beliefs and feelings of upper class or working class. The responses were based on a 4-point Likert-type scale (*very close* = 4, *fairly close* = 3, *not too close* = 2, *not at all close* = 1). Racial regard was derived through adjectives describing African Americans, words such as lazy, intelligent, violent, hardworking, and gives up easily were used (Knox-Kazimierczuk et al., 2017). Responses were measured based on a 4-point Likert type scale (*very true* = 4, *somewhat true* = 3, *a little true* = 2, *not true at all* = 1). A 5-point Likert type scale was also used to assess how African American's felt that people within their own race treated them as well as how White people treated them.

Results from statistical testing indicate that racial salience was predictive of BMI. The overall results for the racial salience model were significant. Placing importance on not being African American was not predictive of BMI. Statistically significant relationships were not found with racial centrality. However, results showed statistically significant relationships between several racial regard constructs (belief that African Americans are lazy, give up easily, are violent). Participants from the research who identified with the constructs were associated with a higher BMI (Knox- Kazimierczuk et al., 2017). Other constructs that had an association with higher BMI among the participants were White and African Americans treating the respondent badly due to the shade of their skin. What was significant about this study that would relate to my research

study is the concept of centrality among African Americans. Centrality has been associated with healthier diets and more positive health habits. This construct correlates with predisposing factors within Andersen's behavioral model.

Wong et al. (2018) examined the relationship between neighborhood environments and obesity by race/ethnicity. Neighborhood characteristics have been associated with obesity, so researchers sought to examine the relationship between soda consumption and weight status (measured as BMI and obesity status). The main independent variables were measures of three neighborhood environments: social (social cohesion and safety), sociodemographic (neighborhood socioeconomic status, educational attainment, percent Asian, percent Hispanic, and percent African American), and built environments (consisting of number of grocery stores, convenience stores, fast food restaurants, and gyms in the neighborhood; Wong et al., 2018). The researchers hypothesized that neighborhoods with high social support, high neighborhood socioeconomic status, and protective built environment characteristics would be associated with positive outcomes for all groups (Carroll-Scott et al., 2013; Feng et al., 2010; Powell-Wiley et al., 2014 as cited by Wong et al., 2018). Wong et al. (2018) further hypothesized that people who lived among others from the same ethnic group would be associated with better obesity outcomes among neighborhood Asians and Hispanics since ethnic enclaves have previously been associated with better diet for these populations. Ethnic enclaves are environments that allow the cultural influences to thrive, which means that ethnic groups would be more apt to consume food that are indigenous to their culture instead of fast food. However, it was hypothesized that neighborhood

African Americans would not have the same outcome. African Americans who live among other Africa Americans is associated with worse outcomes because of institutional racism against African Americans in the form of redlining (Wong et al., 2018). The process of redlining has led to highly segregated, mostly urban neighborhoods that have been associated with negative health outcomes.

The study sample included 62,396 participants over the age of 18. The individual level and social environment data of the participants was obtained from the 2011-2013 California Health Interview Survey (Wong et al., 2018). Neighborhood sociodemographic, social, and built environments were represented by three sets of variables. Variables that represent the sociodemographic environment were median household income, educational attainment (percent with a high school degree or less), and racial/ethnic composition (percent Hispanic, African American, and Asian). Wong et al. (2018) found that a greater number of neighborhood sociodemographic, social, and built environment characteristics were associated with soda consumption and weight status for neighborhood Whites compared to other races. The environmental characteristics were associated with soda consumption and weight status in the other race/ethnicity groups (Wong et al., 2018). Lower neighborhood educational attainment was associated with higher soda consumption and weight status in all race/ethnicity groups.

Like Wong et al. (2014), Lew et al. (2018) employed sociodemographic variables such as race/ethnic groups and education, along with age and income. Lew et al. (2018) wanted to assess the weighted prevalence and odds ratio of obesity, prediabetes, and

diabetes by female sexual orientation. Researchers completed a secondary analysis of the 2014-2015 Behavioral Risk Factor Surveillance System (BRFSS) from 28 states, which included 136,878 subjects. Analysis of BRFSS revealed that with race/ethnic groups combined, lesbian and bisexual women, in comparison to straight (heterosexual) women, had an increased likelihood of obesity when controlling for age, income, and education (Lew et al., 2018). Compared with their non-Hispanic White counterparts, Hispanic lesbian women had increased odds for obesity and diabetes while non-Hispanic African American bisexual women had a greater likelihood for obesity. Non-Hispanic White women had an increased likelihood for obesity relative to their straight, ethnic/racial counterparts (Lew et al., 2018).

Obesity and Age

More than one-third of adults and 17% of youth in the United States are obese (Ogden et al., 2014). The prevalence of obesity stayed constant between 2003 - 2004 and 2009 – 2010; however, obesity remains to be a growing issue both domestically and internationally (Ogden et al., 2014). Though Ogden et al. (2014) examines the prevalence (indicator of how widespread a disease is) of obesity and my research is based around the rate (the occurrence of new cases) at which women develop cervical cancer based upon cervical cancer screening (comparing the screening of obese women to nonobese women), the research study conducted by Ogden et al. (2014) provides adequate data regarding the relationship between obesity and age.

Researchers used the 2011-2012 National Health and Examination Survey, which is a cross-sectional probability sample of the United States noninstitutionalized

population consisting of both interview and examination components (Ogden et al., 2014). An analysis of the adult aged respondents (20 years and older) was conducted. Obesity was defined as a BMI greater than or equal to 30. Obesity was further divided into grade 1 (BMI 30-34), grade 2 (BMI 35-39), and grade 3 (BMI ≥ 40). Overweight in adults was defined as BMI greater than or equal to 25 but less than 30. Ogden et al. (2014) tested the prevalence of obesity among male and female survey respondents using 2-sided *t* tests. To test for race/Hispanic origin and age differences in 2011-2012, the null hypothesis of no race/ethnic or age difference was first tested with an analysis or variance. If the hypothesis was rejected, tests for differences between any two subgroups were conducted with *t* tests (Ogden et al., 2014).

Of the 9,120 respondents in the NHANES 2011-2012, survey 5,181were adults aged 20 years and older (Ogden et al., 2014). Age-adjusted and crude prevalence estimates of overweight and obesity among adults by sex, age, and race/Hispanic origin estimates indicate that more than two-thirds of adults were either overweight or obese, 34.9% were obese, and 6.4% were extremely obese (Grade 3 obesity) in 2011-2012. Grade 3 obesity was more prevalent in women than men (Ogden et al., 2014). The prevalence of obesity was highest among the middle age group, individuals between 40 and 59, compared with 20-39-year aged individuals and adults aged 60 years and over.

Hales and associates (2018) also conducted a study that analyzed the trends in obesity prevalence among U.S. youth and adults. The years the researchers analyzed were 2007-2008 and 2015-2016 to determine recent changes. Just as Ogden et al. (2014), Hales et. al. (2018) gathered data from the National Health and Nutrition Examination Survey

(NHANES). Both groups of researchers sought to analyze the prevalence of obesity among age groups during different time periods, while accessing the different variables that could affect obesity rates, such as race and education. Among adults aged 20 years and older obesity was defined as BMI of 30 or more and severe obesity was defined as a BMI of 40 or more. Prevalence and 95% confidence intervals of obesity and severe obesity were estimated overall and stratified by sex and age (2-5, 6-11. 12-19, 20-39, 40-59, and ≥ 60 years).

The results of the statistical data from testing shows that the age-standardized prevalence of obesity among adults increased from 33.7% (95% CI, 31.5%-36.1%) in 2007-2008 to 39.6% (95% CI, 36.1%-43.1%) in 2015-2016 (P = 001). Prevalence increased among women, and in adults aged 40 to 59 years and 60 years or older. In adults who were categorized as severely obese, the age-standardized prevalence of obesity increased from 5.7% (95% CI, 4.9%-6.7%) in 2007-2008 to 7.7% (95% CI, 6.6%-8.9%) in 2015-2016 (P=0.001). The prevalence of obesity increased in severely obese men and women adults aged 20 to 39 years and 40-59 years. Hales et al. (2018) and Ogden et al. (2014) sought to examine the prevalence of obesity among different age groups. In both studies, the results of statistical testing showed that the prevalence of obesity and severe obesity persisted among adults.

The prevalence of obesity is increasing globally and because of the global rise of obesity, the current and the future burden of cancers related to obesity are rising (Arnold et al., 2016). According to Arnold et al. (2016) obesity is not only affecting the occurrence of cancer, but it is also affecting the prognosis among cancer survivors. For

this study, the question for women in Mississippi, who are dying at an alarming rate from cervical cancer, is how many of these women are obese and of the obese women how many participate in cervical cancer screenings, like Pap testing?

Cervical Cancer Screening

Cervical cancer screening is a medical examination that is an essential part of a woman's health routine. The primary goal of cervical cancer screening is to identify and remove precancerous lesions caused by HPV to prevent invasive cancers from developing (NIH, n.d.). The secondary goal of cervical cancer screening is to find cervical cancer at an early stage, in which most cases at an early stage the cancer is treatable (NIH, n.d.). The National Institute of Health further postulates that routine cervical cancer screening has been shown to greatly reduce both the number of cervical cancer cases and cervical cancer deaths.

For many years, the Papanicolaou test, also called the Pap test or Pap smear, was the only method used for cytology-based screening (NIH, n.d.). Cytology-based screening refers to the study of cells removed from the cervix using a microscope (NIH, n.d.). During the Pap test cells are removed from the cervix using a small medical tool. Under the microscope, the cells removed from the cervix are checked for cervical cancer or cell changes that may lead to cervical cancer. Through Pap testing inflammation and other infections can also be found.

However, with the emergence of the ability to test for the human papillomavirus (HPV) cervical cancer screening now includes three approaches: HPV testing which looks for high risk HPV within cervical cells; Pap testing, which checks for cell changes;

Pap/HPV cotesting (NIH, n.d.). Pap/HPV cotesting consists of checking a sample cell for high-risk HPV types and cervical cell changes. The peer-reviewed articles synthesized in the upcoming sections will identify what approach to cervical cancer screening was used, HPV testing, Pap testing, or Pap/HPV cotesting.

Cervical Cancer Screening and Age

According to the American Cancer Society (ACS; 2018) and the U.S. Preventative Screening Task Force (USPSTF; as cited by Monnat, 2014) it is recommended that women participate in Pap testing every 3 years from the ages of 21-65. However, some studies include women who are 18 years of age and older (Monnat et al., 2014; Sabatino et al., 2015). For this study I used women between the ages of 21-65 because ACS and USPSTF recommend that women aged 21 participate in Pap testing every 3 years. Secondly, women between the ages of 21 and 65 were utilized because educational attainment was one of the independent variables in this study. The age of 21 is more empirically sound under the presumption that most women have at least completed high school and for those who have continued to higher education has either completed undergraduate studies or are close to completion.

Cervical Cancer Screenings in the United States

Cervical cancer screening is one of the greatest cancer prevention achievements (Bernard et al., 2014; Sabatino et al., 2015). After the integration and the widespread usage of the Papanicolaou (Pap) test in the United States in the 1950s, cervical cancer incidence and mortality have decreased dramatically (Bernard et al., 2014). The Pap test

now includes the use of the human papillomavirus (HPV) test that is used to detect infection of high-risk HPV types (Bernard et al., 2014; NIH, n.d.).

Despite evidence that cervical cancer screening saves lives, the incidence and death rates remain substantial, especially among populations with limited access to healthcare (Bernard et al., 2014; Sabatino et al., 2015). Cervical cancer screening declined from 2010 to 2013 (Sabatino et al., 2015). Cervical cancer screenings have been stagnant among certain populations even after improvements to testing. The inconsistencies in testing and the staggering rate in which women in Mississippi develop cervical cancer has led lead federal agencies such as the CDC and Agency for Healthcare Research and Quality to develop objectives to reduce or eliminate illness such as cervical cancer. The objectives formulated by such agencies have become the foundation for the cervical cancer objectives listed in Healthy People 2020. The cervical cancer objectives include increasing screening rates to a target of 93%, reducing cervical cancer incidence rate to 7.1 per 100,000 women, and reducing cervical cancer death rate to 2.2 per 100,000 women.

Cervical Cancer Screening, Race, and Socioeconomic Status

Research consistently demonstrates how predisposing factors (race, age, education) and enabling factors (healthcare coverage) are crucial for Pap test utilization (Monnat, 2014). Monnat states that while income and educational attainment are essential enabling factors to Pap utilization, both of which will be discussed in further detail, race/ethnicity are not so exact. Literature has shown to be conflicting regarding which race/ethnicity has a higher utilization rate of Pap testing. Some research suggests that

Black and Hispanic women continue to have lower rates of cervical cancer screening than White women (Monnat, 2014). Consideration must be taken in that for the studies where Black and Hispanic women have lower rates of cervical cancer screening the samples utilized within these studies have been limited to certain states or regions, Medicare beneficiaries, or HMO enrollees (Monnat, 2014). Conversely, other research has demonstrated that screening rates among Black and Hispanic women are now equal to or higher than rates among White women (Monnat, 2014).

Monnat (2014) suggests that the findings of social science research consistently infer that individuals at higher levels of socioeconomic status enjoy better health than those at lower socioeconomic levels. According to Link and Phelan (as cited in Monnat, 2014), socioeconomic status is a "fundamental cause" of health disparities because it influences access to and use of health promoting resources. A higher socioeconomic status is usually coupled with higher income, and in some cases a higher educational attainment. Hayward et al. (as cited in Monnat, 2014) suggests that not only does race differentially channel groups into positions of social advantage, but race could possibly transform the meaning of socioeconomic status. For example, the income that is used to purchase screening services or cover the co-pays of screening services may have lower benefits for racial minorities compared with their White peers because of perceived or actual racial discrimination in the quality of care (Monnat, 2014). Simply stated, although minority women with higher income levels might have the money needed to either pay for the screening exam or to pay the co-pay for the screening exam, they might not find it beneficial to participate. Either because they perceive that because of the color of their

skin they will receive less than stellar service by healthcare providers or because they have firsthand experienced discrimination in a healthcare setting by healthcare providers.

Monnat (2014) assessed the socioeconomic status gradient for odds of receiving preventative cancer screenings (mammogram and Pap test) among White, Black, Hispanic, and Asian Women living in the United States. Three years (2006, 2008, 2010) of nationally representative data from the BRFSS were used. These three years were specifically chosen because these were the years the cancer screening questions were used by all states (Monnat, 2014). Women between the ages of 25-65 who had not undergone hysterectomy were analyzed. Monnat (2014) findings were consistent with previous studies that found that Pap testing continued to be less likely among lower income women than among higher income women. It was also found that Black and Hispanic women have higher odds of reported screenings than White women (Monnat, 2014). In addressing the main objective of this study, which was testing the applicability of the socioeconomic status diminishing return to Pap test utilization, it was found that relative to White women, women of color did not experience as pronounced increases in the likelihood of receiving Pap test with rising levels of income and education attainment.

Jacobs et al. (2014) notes that cervical cancer screening has been documented in African American, Hispanic, and Asian populations. The researchers further postulate that perceived discrimination may contribute to this disparity (Jacobs et al., 2014). The researchers sought to understand the relationship between perceived everyday racial/ethnic discrimination along with other discrimination and the effects of discrimination on cervical cancer screening in a multiethnic population of women (Jacobs

et al., 2014). Three thousand two hundred fifty-eight women who participated in the Study of Women's Health across the Nation (SWAN) were analyzed. SWAN is a multiethnic/racial, longitudinal cohort study of the natural history of the menopausal transition conducted in seven U. S. sites (Jacobs et al., 2014). Jacobs et al. (2014) showed that African American women reported the highest percentage of racial discrimination (35%), followed by Chinese (20%), Hispanic (12%), Japanese (11%), and non-Hispanic White women (3%). The researcher's results suggest perceived discrimination is an important issue across racial/ethnic groups and are negatively associated with cervical cancer screening participatory rates (Jacobs et al., 2014).

Cervical Cancer Screening, Education, & Healthcare Coverage

Research consistently demonstrates that household income and educational attainment are crucial factors in preventative testing such as Pap tests. Research shows that women at higher levels of income and education are likely to use their financial and knowledge-based resources to obtain timely screening than their peers at lower levels of socioeconomic status (Monnat, 2014). Mirowsky and Ross (as cited in Monnat, 2014) deduce that educational attainment provides individuals with the knowledge set, skills, and ability to make better-informed health choices. Monnat findings added to the previous research; educational attainment increased the likelihood of having a recent Pap test for White, Black, and Hispanic women; white women had more of a substantial increase than other groups for obtaining a Pap test from lowest to highest household income and educational attainment. Asian women had the lowest rates of recent Pap test use among the highest household income groups (Monnat, 2014). Asian women reporting

a recent Pap test was lower among college educated Asians compared with Asian women with only a high school diploma. This differed from other races and is a phenomenon that Monnat referred to as the diminishing returns or paradoxical returns perspective. Diminishing returns or paradoxical returns perspective is when one variable increases, but the output as the result of the increase of this variable begins to decrease. This was exemplified through the rates of Pap testing among Asian women decreasing as the education attainment of Asian women increased.

Various factors can influence participation of Pap tests; however, one of the most important factors is having healthcare insurance and access to a regular healthcare provider. For the sake of my study healthcare insurance (insured or not insured) will be observed and not access to a healthcare provider. Benard et al. (2014) suggests that financial and nonfinancial barriers might explain some disparities in screening in cervical cancer screening percentages with health insurance being one of the financial barriers that has a bearing on whether a woman participates in cervical cancer screening. However, to the contrary, the researchers found that of the women who had not been screened in adherence with the recommended screening interval the percentage was higher among those who had insurance and a regular healthcare provider (Benard et al., 2014). Of the 8.2 million women who had been screened in the past 5 years, 69% had insurance and a regular healthcare provider, 9.6% had insurance but no regular healthcare provider, 9.8% had no insurance but had a regular healthcare provider, and 10.7% had neither healthcare insurance nor a regular healthcare provider (Benard et al., 2014).

To remedy the absenteeism of women from preventative health screenings such as Pap testing, the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides free or low-cost preventative testing(Benard et al., 2014 and Tangka et al., 2015). This program is implemented through cooperative agreements between the CDC and 67 grantees representing health departments in all 50 states, the District of Columbia, 5 US territories, and 11 American Indian and Alaska Native tribes or tribal organizations (Tangka et al., 2015). The grantees then establish subcontracts with healthcare providers across the states to deliver screening services (Tangka et al., 2015). These providers include a diverse group of local health providers such as local health departments, Federally Qualified Health Centers, community health centers, American Indian Health Service clinics, hospital, and other healthcare systems (Tangka et al., 2015).

Therefore, women aged 18-64, who are considered low-income (incomes 250% of the federal poverty level), uninsured, and/or underinsured (insurance does not cover preventative services or a high deductible or co-payment for cervical cancer screening), who have not had a hysterectomy, are provided with either free or low-cost mammograms (breast examinations) and Pap test through NBCCEDP (Benard et al., 2014 and Tangka et al., 2015). Tangka et al. (2015) estimated that between 2010-2012, 705,970 women aged 18-64 years, which is 6.5% (705,970 of 9.8 million) of the eligible population, received NBCCEDP funded Pap tests. Women aged 40-64 accounted for an estimated 16.5% of the eligible population; six hundred twenty-three thousand six hundred three women or 22.6% participated in Pap tests provided through NBCCEDP

(Tangka et al., 2015). For women who fell within the age range of 18-39, which represented an estimated 1.2% of the eligible population, 83,660 or 2.3% women participated in Pap tests (Tangka et al., 2015). The researchers also estimated that the NBCCEDP screened 7.3% of eligible Hispanic women, 6.5% of eligible non-Hispanic Black women, and 9.7% of eligible non-Hispanic White women. The focus of this study was to describe the extent of the nation's only organized screening program provision of cervical cancer screening services to underserved women in the United States over time.

Conclusion

In Chapter 2, I presented a literature review on cervical cancer rates of women in Mississippi, cervical cancer screening rates, and some of the barriers to cervical cancer screening. Cervical cancer was once the leading cause of cancer death for women in the U.S. (Monnat, 2014). The significant decline in cervical cancer mortality over the past 40 years is attributable to more women participating in regular Pap testing (regularity refers to the recommended scheduling of Pap testing; Monnat, 2014). The significance of Pap testing is that it offers early detection of cervical cancer when successful treatment of the disease is more favorable (American Cancer Society, 2018). However, for women in Mississippi, cervical cancer rates are the highest among the 50 states (CDC, 2017). Women in Mississippi develop cervical cancer at a rate of 10.4 for every 100,000 women (CDC, 2017).

To get more women to participate in preventative health screenings such as the Pap test, organizations such as the NBCCEDP through partnerships with the CDC and health departments in all 50 states, offer Pap testing (Bernard et al., 2014 and Tangka et

al., 2015). Pap testing is provided at either a reduced cost or no cost (Bernard et al., 2014 and Tangka et al., 2015). Despite the availability of Pap testing to those who are considered low-income, under insured, or not insured Mississippi women develop cervical cancer at a higher rate than women who reside in the other 50 states. Scholars who have examined the underuse of cervical cancer screenings have focused on a woman's economic status, educational attainment, race, and health insurance status (insured or not insured), but none examined if Pap testing differs among obese women and nonobese women who reside in Mississippi and the association of race, age, educational level, and healthcare coverage. This study filled this gap. The knowledge obtained from this study will be used to improve the understanding on why the underuse of cervical cancer screening still exists.

Chapter 3: Research Method

Introduction

HPV is present in all cases of cervical cancer; labeled as the necessary cause and the most prevalent risk factor, researchers found that in every case of cervical cancer HPV DNA was present (Beavis & Levison, 2016; CDC, 2015; Dasari et al., 2015). Cervical cancer, which kills about 4,000 American women every year, is almost entirely preventable (Haelle, 2015). HPV DNA can be detected using the Pap test. It is through the Pap test that HPV DNA can be found as well as precancerous cells can be found. The American Cancer Society suggests that women between the ages of 21 to 65, who have not undergone hysterectomies, should follow the recommended guidelines for Pap testing. Once the leading cause of cancer death for women in the U.S., cervical cancer rates have declined significantly since the advent of the Pap test (Haelle, 2015). However, despite the decline of cervical cancer death rates in the U.S., Mississippi women are developing cervical cancer at a higher rate than their counterparts in the other 50 states (CDC, 2017). Another risk factor for cervical cancer is obesity (Mississippi State Department of Health, 2019). Mississippi has the second highest obesity rate in the United States (Robert Wood Foundation, 2018). The guiding goals and promotional efforts of Healthy People and the Mississippi State Health department has worked to address cervical cancer rates in Mississippi women. Mississippi women still develop cervical cancer at a higher rate compared to women in the other 50 states and Mississippi women are still more obese, only second to Alabama. Scholars have not examined if there is a disparity at the rate in which obese women and nonobese women who reside in

Mississippi participate in Pap testing. Given the increased rate at which Mississippi women develop cervical cancer, with Pap testing being the preventative screening that detects the disease, and the obesity epidemic in Mississippi, determining the degree of association between Pap testing and obesity will widen the scope of the problem. The purpose of this study was to compare the rate of cervical cancer screening between obese and nonobese women who reside in Mississippi as a means of testing the hypothesis that obesity is a barrier to screening within this population. A secondary purpose is to assess the impact of race, age, educational level, and healthcare coverage (insured or not insured) on cervical cancer screening on the relationship between obese and nonobese women who reside in Mississippi.

The first section of Chapter 3 consists of a list of the study variables and the research questions and hypotheses. The research design and rationale are explored, and I provide an explanation for the use of secondary analysis of the quantitative survey design. The research sample, process of selecting the sample and the variables, and the procedures for data collection associated with the study is discussed. Also, data analysis, threats to validity, and a summary of the chapter are described.

Study Variables

For this study, the dependent variable was cervical cancer screening via presence of Pap testing. Obesity was the independent variable. Race/ethnicity and age were moderating variables and education, healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured), and income were mediating variables.

Figure 1

Dependent and Independent Variables

Variable Type	Variable Name	Variable Configuration	Level of Measurement
Dependent Variable	Cervical Cancer Screening (Pap test) (HADPAP2) How long has it been since the last Pap test (LASTPAP2)	Yes or no Range: Measurement included months and years – within the last 12 months; within past two years; within the past three years; within the past five years	Nominal Variable
Independent Variable	Obesity (WEIGHT2/HEIGHT3)	Weight in pounds, height in feet and inches * Weight and height used to calculate BMI to determine obesity level	Nominal Variable
Covariate	Race/Ethnicity Are you Hispanic or Spanish Origin? (HSPANC3) Which one of the following would you say is your race? (MRACE1)	Yes or No White; Black or African American; American Indian or Alaska Native; Asian; Pacific Islander	Nominal Variable
Covariate	Age (AGE)	Measured in years	Nominal Variable
Covariate	Education (EDUCA)	Measured by highest grade or year completed: Elementary (K-8th grade); High School (9th – 11th); High School Graduate (Grade 12 or GED); Some College (1-3 years of college or technical school); College Graduate (4 years or more)	Nominal Variable
Covariate	Healthcare Coverage *Health Insurance; prepaid plans (HMO); government plans (Medicare, Indian Health Service) (HLTHPLN1)	Yes or No	Nominal Variable
Covariate	Income (INCOME2)	Range: Less than $10,000; $10,000-$14,999; $15,000 - $19,999; $20,000 - $24,999; $25,000 - $34,999; $35,000 - $49,999; $50,000 - $74,999; $75,000 or more	Nominal Variable

Research Design and Rationale

This research was a secondary data analysis of the 2015 – 2017 BRFSS (Behavioral Risk Factor Surveillance System). BRFSS is the nation's premier system of health-related telephone surveys that collect state data about U.S. residents as it relates to their health-related risk behaviors, chronic health conditions, and use of preventative services (CDC, 2019). Noted as being the largest continuously conducted health survey systems in the world, BRFSS completes more than 400,000 adult interviews each year (CDC, 2019). The BRFSS questionnaire is designed by a working group of BRFSS state coordinators and CDC staff; approval is received by all state coordinators (CDC, 2019). The questionnaire currently has three parts, which are: (a) the core components, (b) optional modules, (c) state-added questions (CDC, 2019).

The core component of the questionnaire consists of three parts, the first being the fixed core. The fixed core is a generic set of questions asked by all states that includes questions regarding demographic characteristics and health behavioral questions such tobacco use and seatbelt use (CDC, 2019). The second portion of the core component is the rotating core which is made up of two distinct sets of questions addressing different topics, each asked in alternating years by all states (CDC, 2019). Subsequently, in the year the rotating core topics are not used, they are supported as optional modules. The emerging core, the third part of the core component of the questionnaire, is a set of up to five questions that are added to focus on emerging issues (CDC, 2019). The emerging core questions are not permanent questions, they are part of the core for 1 year and are

evaluated during that year or shortly after the year concludes to determine their potential value in future surveys (CDC, 2019).

In this secondary data analysis, a quantitative design was employed to analyze data pertaining to these variables: obesity (independent variable), cervical cancer screening (Pap test; dependent variable), and race/ethnicity (moderator variable), age (moderator variable), education (mediator variable), healthcare coverage (mediator variable), and income (mediator variable).

I chose this design to statistically quantify if there is an association between obesity and Pap test participation in women between the ages 21 and 65 who reside in Mississippi and to quantify if there is an association between perceived barriers (race, age, education, healthcare coverage, and income) and cervical cancer screening in Mississippi women aged 21 to 65. The quantitative design was also chosen because of the cost-effectiveness and ease of accessibility to the dataset. Additionally, I did not have the resources to collect the data in a timely manner. The CDC oversees the BRFSS survey which is conducted by state health department employees.

Definition of Key Study Variables

Pap testing history was defined using BRFSS survey question of "How long has it been since you had your last Pap test?" Responses of 5 years or less would be defined as having participated in cervical cancer screening. Another question that defined Pap testing history from the BRFSS survey was "Have you ever had an HPV test?" The response is either yes or no. This question is pertinent to defining cervical cancer screening as it relates to respondents who are over the age of 30 years. The American

Cancer Society recommended guidelines suggest that women aged 30 years and over receive the HPV/Pap test every 5 years and women who only receive the Pap test should be screened every 3 years (American Cancer Society as cited by Smith et al., 2018). The rationale behind using these questions opposed to other questions on the BRFSS survey such as "Have you ever had a Pap test" which resulted in a yes, no, don't know/not sure, or refused response is that the response does not give insight into the individual's Pap testing history.

I defined obesity through computation of the female respondents, between the age of 21 and 65 who reside in Mississippi, height (measured in meters) and weight (measured in kilograms). Through this computation body mass index (BMI) was derived. The CDC's BMI criteria was used to determine obesity. BMI criteria for obesity are subdivided into categories: Class 1 is BMI of 30 to <35; Class 2 is BMI of 35 to <40; Class 3 is BMI of 40 or higher which is defined as extreme or severe obesity (CDC, 2017).

This study was a secondary analysis conducted on the 2015 – 2017 BRFSS surveys using questions that were derived from data that applied to Andersen's behavioral model of healthcare use. According to Andersen, an individual's access to and use of healthcare services is a function of three characteristics: predisposing factors, enabling factors, and need factors (Andersen, 1995). The questions derived are pertinent to the predisposing factors consisting of race/ethnicity, age, and education; enabling factors, health insurance; and need factors which relates to the need for medical regimen which is cervical cancer screening for this study. The questions on these variables can be

recognized from the categorization of data based on survey questions from the 2015 – 2017 BRFSS.

The purpose of this study is to determine if obesity as the independent (predictor) variable has any association with cervical cancer screening rates, like Pap testing rates (dependent variable) among Mississippi women between the ages of 21 and 65. This relationship was discovered by exploring factors that could possibly impact access and usage of cervical cancer screenings. These factors (race/ethnicity, age, education, income, and healthcare coverage) were obtained through the analysis of data presented in the BRFSS survey. The quantitative design was the most appropriate methodology for this research in that it allowed me to test my hypotheses. I determined if there is an association and the degree of association between the independent and the dependent variable between the years of 2015 – 2017. The 2015, 2016, and 2017 BRFSS surveys were used due to it being more recent and to having a greater span of data to analyze. The survey continued to evolve and one of the enhancements was the methodology incorporated cellular telephone use (CDC, 2014). The addition of cellular telephones maintains representativeness, coverage, and validity of the BRFSS data (CDC, 2014). The weighting method of raking or iterative proportional fitting was also employed in 2011. In addition to race/ethnicity, age, and gender, raking allows for the use of other demographic variables to be included in weighting such as education (CDC, 2014). Therefore, the 2017 BRFSS survey employed all the enhancements as well as addressed the issues needed to conduct this study.

Population

The data used for this study were obtained from the 2015, 2016, and 2017 BRFSS. The BRFSS survey is conducted annually at the state level by state health department employees or designees of the state health department (CDC, 2019). The goal of this survey is to provide health departments, public health officials, and policymakers with behavioral information, when combined with mortality and morbidity statistics, that informs public health officials as they establish health related policies and priorities as well as address and access strategies to promote good health (CDC, 2019). The BRFSS goal is to support at least 4,000 interviews per state each year. The frequency of Mississippi participants in the 2017 BRFSS is 5,076.

Procedures for Recruitment, Participation, and Data Collection

The BRFSS uses a survey methodology that involved representatives from the states obtaining samples of telephone numbers from the CDC (CDC, 2019). Those representatives then review their sampling methodology with a state statistician and the CDC to ensure data collection procedures are in place to follow the methodology (CDC, 2019). BRFSS uses two samples, one for landline telephones and one for cellular telephones. The inclusion of cellular telephones began in 2011 due to increased usage of cellular phones by most households (CDC, 2019). Since landline telephones are often shared among persons living within a residence, household sampling is used in the landline sample (CDC, 2019). Household sampling requires interviewers to collect information on the number of adults living within a residence and then select randomly from all eligible adults (CDC, 2019). Cellular telephone respondents are weighted as

single adult households (CDC, 2019). Disproportionate stratified sampling (DDS) draws telephone numbers from two lists, listed telephone numbers and not listed telephone numbers; cellular telephone sample is randomly generated from a sampling frame of confirmed cellular area code and prefix combinations (CDC, 2019). The BRFSS samples landline telephone numbers based on sub-state geographic regions. Regional sampling is used to target data collection to geographic subpopulations such as residents within a public health district (CDC, 2019).

Sample Size and Power

For this study G*power 3.1.9.2 (Faul et al., 2013) was used to calculate the power needed to detect the likelihood of a statistically significant relationship between obesity (obese and nonobese women), race/ethnicity, age, education, insurance coverage, and income on the participation of Pap testing of women between the ages of 21 and 65 who reside in Mississippi. Compromised power analysis was used which involves calculating the power and implied alpha, given the sample size, beta/alpha ratio, and effect size. All statistical data was based on weighted data. For this study, the power analysis, a subset (n = 852) was used for the sample size. An odds ratio of 1.47 was used in this power analysis. The odds ratio was calculated from a previous study (Monnat, 2014). Therefore, for this study I made the decision to use a sample size of 852.

Procedures for Gaining Access to the Dataset

The dataset used for this study were the 2015 – 2017 BRFSS. These data were open to the public and can be accessed through the CDC 2017 BRFSS Survey Data and Documentation page located at

https://www.cdc.gov/brfss/annual_data/annual_2017.html. The 2015 - 2017 BRFSS public use data files were available in SAS Transport Format. This format can be exported into SPSS or STATA. For this research study I exported the SAS Transport Format into SPSS.

Permission to Gain Access to the Data

I sent an email sent to cdcinfo@cdc.gov to ensure I was able to gain access. Although the dataset is for public consumption, I wanted to ensure that there were no permissive actions that had been overlooked. A stipulation for using open access datasets provided by the CDC is found Section 308 (d) of the Public Health Service Act: Data collected by the CDC may be used only for health statistical reporting and analysis (CDC, 2015).

Instrumentation

The instruments used for the BRFSS survey is questionnaires. The questionnaire is comprised of an annual standard core, a biannual rotating core, optional modules, and state-added questions (CDC, 2014). Standard core questions are questions that are included every year and must be asked by all states (CDC, 2014). Each year the core questions are constructed to gather data on emerging or late breaking health issues (CDC, 2014). After one year, these questions are reviewed to determine if they are discontinued or incorporated into the fixed core, rotating, or optional modules.

Rotating core questions are asked by all states on every other year rotation (CDC, 2014). Optional module questions relate more to the issues of the state. These questions are a set of standardized questions on various topics that each state may select and

include in its questionnaire (CDC, 2014). Once these questions have been selected, the module must be used in its entirety and asked of all eligible respondents; if an optional module is modified in anyway those questions will be deemed as state added questions (CDC, 2014). To achieve a wide range of data states may opt to "split" samples that include only selected modules (CDC, 2014). Therefore, some modules may appear only on versions of questionnaires (CDC, 2014). For example, if the questionnaire adopted by a state is too long to ensure respondent cooperation, different modules may be separated among respondents to include more modules (CDC, 2014).

State added questions allow for state department of health representatives to gather data on additional topics related to their specific health priorities using extra questions they choose to add to their questionnaire (CDC, 2014). It is important to note that all questions included in the BRFSS are cognitively tested prior to inclusion in the questionnaire (CDC, 2014). The exact wording of the questions in the BRFSS are determined at the annual BRFSS meeting in March where BRFSS state coordinators vote to adopt questions submitted by CDC programs (CDC, 2014). The BRFSS Working Group, which is a governing group of BRFSS state coordinators, may add questions on emerging issues (CDC, 2014). After the meeting, representatives from the CDC design core components, optional modules, and data processing layouts while taking into consideration state priorities, potential funding, and any other practicalities (CDC, 2014). The new BRFSS materials for the next surveillance year are then disseminated to the states in which the survey may go through another change because the states have the option to add their own questions that they have designed or acquired.

The BRFSS survey goes through a statistical process called weighting. This process attempts to remove bias in the sample (CDC, 2014). The BRFSS weighting process includes two steps: design weighting and iterative proportional fitting, also known as raking (CDC, 2014). Raking does not require demographic data for small geographic areas; therefore, more demographic variables, variables that were not used prior to 2011, can be used (CDC, 2014). In addition to sex, age, race, ethnicity, and region, telephone ownership, education, marital status, and home ownership were added (CDC, 2014). As a researcher using the study, more demographic variables are available to correct any imbalances between the survey and the population (Pew Research Center, 2018).

Each telephone number used within BRFSS was assigned a disposition code to indicate the result of a call. The disposition codes reflect three dispositions of calls, either the call was completed, the telephone number was to a household that was eligible to be included in an interview, but the interview was not completed, or a telephone number was ineligible or could not have its eligibility determined (CDC, 2014). The final disposition rates are then used to calculate response rates, cooperation rates, and refusal rates (CDC, 2014).

Finally, states submit data to CDC for final cleaning, weighting, the production of analysis datasets, and other technical assistance (BRFSS-RegInfo, 2018). Computer assisted telephone interviewing (CATI) programming is provided by the CDC to states to convert the BRFSS questionnaire into a CATI interface from which interviewers will read and record answers to each question (BRFSS-RegInfo, 2018). States run edit

checking programs against the data and submit to the CDC on a monthly/quarterly basis (BRFSS-RegInfo, 2018). To access the validity and reliability of the BRFSS survey Pierannunzi, Hu, and Balluz (2013) completed a systematic review of different health risk behaviors that BRFSS targets. Overall findings indicated that BRFSS prevalence rates were comparable to other national surveys which rely on self-report. The differences that were noted were discovered in the mode of administration. Surveys that consisted of a face-to-face interview were less like the BRFSS survey along with surveys that utilized physical measures (Pierannunzi et al., 2013).

Operationalization

This study involved conducting a secondary analysis using only a portion of the questionnaires that were applicable to this research study. The survey questions selected for this review were operationalized to the constructs of Andersen's Behavioral Model.

Measures

A secondary analysis of data from the BRFSS survey database was tested to determine which group of women, obese women or nonobese women, between the ages of 21 and 65, who reside in Mississippi, had a higher cervical cancer screening, through Pap testing, participation rate. The BRFSS routinely surveys adults age 18 years and older in each state. Respondents are asked questions regarding health-related risk behaviors, chronic health conditions, and use of preventative services (CDC, 2019). For my secondary analysis, women between the ages of 21 and 65 were included. For the three years of the BRFSS questionnaire that are used, 2015, 2016, and 2017, there were

16,246 respondents from the state of Mississippi. However, of the 16,246 respondents I am unsure how many women are between the desired age of 21 and 65.

The BRFSS survey monitored health behaviors and various other constructs that were selected for inclusion in this study. Those constructs align with Andersen's Behavioral Model. The factors that influence the use of health services based upon Andersen's behavioral model are predisposing factors, enabling factors, and need factors. For this study, the predisposing factors were race/ethnicity, age, and education; enabling factors were health insurance and income; and need factor was the need for medical regimen which was cervical cancer screening. The details of each construct, questions, and responses are discussed.

Predisposing Factors

Predisposing factors are used to define the sociocultural characteristics of individuals that exist prior to their illness. For this study, predisposing factors illuminate how likely an individual is to receive health services based on their race/ethnicity, age, and education. These factors were represented by the following questions from the 2015 to 2017 BRFSS surveys:

- Which one of these groups would you say best represents your race?
- What is your age?
- What is the highest grade or year of school you completed?

The responses to race/ethnicity, age, and highest grade or year of school, which is synonymous to education, for multiple years 2015-2017, will help to generate prevalence estimates of cervical cancer screening among Mississippi women between the ages of 21

and 65. The response to race/ethnicity, age, and education will determine if either of these covariates had an influence on the rate of cervical cancer screening among obese and nonobese women, between the ages of 21 and 65 who live in Mississippi.

Enabling Factors

Enabling factors referred to the logistical aspects of obtaining care. These were factors such as income and health insurance, that would lead or detract an individual from engaging in healthcare services. The represented questions from the BRFSS survey were the following:

- What is your annual income from all sources?
- Do you have any kind of healthcare coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service?

These questions were used to determine if the female respondent either had insurance or not (yes or no). The responses to these questions were used to answer research questions one and two.

Perceived Need Factor

Need factor refers to an individual's responsiveness to preventative healthcare services and the perceived need for healthcare use such as cervical cancer screening. Cervical cancer screening participation was defined using the listed question below:

- Have you ever had a Pap test?
- How long has it been since your last Pap test?

Those who answered yes to having had a Pap test and the time since the last Pap test was within the last five years was considered to be a participant of cervical cancer screening. For those who responded as having had a Pap test, but the time frame of the last Pap test was more than 5 years ago, or they do not remember when they participated in their last Pap test were considered as being nonparticipants of cervical cancer screening.

No treatment intervention was involved in this study. The focus was on the analysis of secondary data obtained from BRFSS survey, based on a nonexperimental survey of the randomly selected nationwide population. The analysis will be limited to women between the ages of 21 and 65 who reside in Mississippi. The trend of cervical cancer screening through Pap testing is compared across the years of 2015-2017 to ascertain if there is a difference in the rate in which obese and nonobese women participate in cervical cancer screening controlling for race/ethnicity, age, education, income, and healthcare coverage.

Statistical Data Analysis

SPSS (Statistical Package for Social Sciences) was used to generate prevalence estimates of Pap testing among obese and nonobese women, between the ages of 21 and 65, who reside in Mississippi from 2015 to 2017. Logistic regression analyses was used to calculate prevalence, prevalence ratios (PRs), and 95% confidence intervals (95% *Ci*s) for each independent variable to assess the association with participation in Pap testing. The multivariable analyses was controlled for all significant study variables ($p<0.05$) to calculate adjusted prevalence ratios (APRs).

Research Question 1

RQ1: Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income?

$H_0$1: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

H_a1: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

Logistic regression was used to assess the extent to which obese women and nonobese women in Mississippi participate in cervical cancer screening. Cervical cancer screening – dependent variable (Pap testing) was operationalized as a nominal variable; screened for cervical cancer (having participated in cervical cancer screening within the past five years) was coded as 1 and never screened for cervical cancer was coded as 0. Obesity – independent variable, was operationalized as a nominal variable; obese was coded as 1 and nonobese was coded as 0. Race – covariate, was operationalized as a nominal variable; White (non-Hispanic) was coded as 1, Black (non-Hispanic) was coded as 2, Asian (non-Hispanic) was coded as 3, American Indian/Alaskan Native (non-Hispanic) was coded as 4, Hispanic was coded as 5, and other race (non-Hispanic) was coded as 6. Age – covariate, was operationalized as a nominal variable; women between

the ages of 21 and 44 were coded as 1 and women between the ages of 45 and 65 were coded as 2. Education – covariate, was operationalized as a nominal variable; Some high school coded as 1, high school graduate or GED coded as 2, some college coded as 3, and college graduate coded as 4. Income – covariate, was operationalized as a nominal variable; less than $25,000 coded as 0, $25,000 to $34,999 coded as 1, $35,000 to $49,999 coded as 2, $50,000 to $74,999 coded as 3, and $75,000 or more coded as 4.

Research Question 2

RQ2: Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

$H_0$2: The rate of cervical cancer screening among obese women in Mississippi is not higher than the same rate among nonobese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

H_a2: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured).

Cervical cancer screening – dependent variable (Pap testing) was operationalized as a nominal variable; screened for cervical cancer (having participated in cervical cancer screening within the past five years) was coded as 1 and never screened for cervical

cancer was coded as 0. Obesity – independent variable, was operationalized as a nominal variable; obese was coded as 1and nonobese was coded as 0. Health insurance – covariate, status was operationalized as a nominal variable; insurance coverage was coded as 1 and no insurance was coded as 0.

For both research questions the data were analyzed in three stages. The first stage was descriptive analysis to describe the data and find patterns in the data. For the second stage bivariate analysis was conducted to establish the association between cervical cancer screening and insurance coverage. Bivariate analyses were conducted to establish the association between obese women and cervical cancer screening, as well as nonobese women and cervical cancer screening. These associations were assessed using chi square tests of association. In addition to chi square tests, Cramer's V statistics was calculated to measure the strength of the relationship between cervical cancer screening and insurance coverage; obese women and cervical cancer screening; nonobese women and cervical cancer screening. For the third stage, multiple logistic regression modeling was used to assess the association between cervical cancer screening and health insurance coverage adjusting for obesity (either obese or nonobese).

Stepwise regression was used to fit the regression model. Variables were added to the model using forward selection. Forward selection starts with no predictors in the model, only the constant, and sequentially all the other variables of interest are added (the independent variables and covariates). The significance of the model was assessed by the independent variables as represented by χ 2 coefficient. The Nagelkerke R^2 was used to assess the variability on the dependent variable that was accounted for the independent

variable. The significance of the independent variable was assessed using Wald Chi-squared test. The probability healthcare insurance coverage affected cervical cancer screening among obese and nonobese women was determined by odds ratio and was interpreted as follows: An odds ratio value greater than 1.0 indicated an increased chance of cervical cancer screening and an odds ratio value less than 1.0 indicated a decreased chance of cervical cancer screening.

Assessment of Each Research Question

The relationship between the dependent variable, Pap testing, and the independent variable, obesity, including covariates such as race/ethnicity, age, education, healthcare coverage, and income were evaluated. Logistic regression analyses were used to calculate prevalence, probability (PRs), at the 95% confidence interval (CIs) for each independent variable to assess the significant statistical association with participation in Pap testing. For the multivariable analyses control, all significant study variables required a value of (p<0.05) to calculate the APRs.

Justification

Logistic regression analyses were used to calculate prevalence, PRs, and 95% *CI* for each independent variable to assess the association of Pap testing and women who reside in Mississippi. This study is a multivariable analyses for which there will be a control of all significant study variables (p<0.05) to calculate the adjusted prevalence ratios (APRs). Prevalence ratios (PRs) based on multivariate regression analyses were used for the hypotheses testing to isolate the association between the outcome variable, dependent variable, Pap testing, and the independent study variables which include

characteristics (i.e., race/ethnicity, age, education, healthcare coverage) of the study population. Multivariate regression was used to relate multiple independent variables to a single dependent variable. Using the multivariate regression on the BRFSS surveys from 2015-2017 the analytical results can be used to test the null hypothesis for each research question generalizable to the population of Mississippi women between the ages of 21 and 65.

Logistic regression models are predictive analyses used to describe data and to explain the relationship between one dependent binary or dichotomous variable and one or more nominal, ordinal, interval, or ratio-level independent variables (Alexopoulos, 2010; Statistic Solutions, 2019). For multiple regression analysis, wherein there was one dependent variable and multiple independent variables, there are four assumptions. The first assumption is that variables have normal distribution (normality; Osborne & Waters, 2002). The second assumption is that the relationship between the dependent and independent variable are linear in nature (linearity; Osborne & Waters, 2002). The third assumption is homoscedasticity, the variance of errors is the same across all levels of the independent variables (Osborne & Waters, 2002). This was the most appropriate model of analysis for this study because it allowed for the examination of multiple independent variables with adjustment of their regression coefficients for possible confounding effects between variables (Schneider et al., 2010).

Threats to Validity

The research conducted was nonexperimental and employed the use of BRFSS surveys 2015-2017. There were threats to validity in the measurement; for internal

validity, the threats may include selection and measurement bias. The BRFSS was designed by researchers at CDC and health officials in health departments in each of the states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands (CDC, 2013). The population surveyed was randomly selected. Response rates, cooperation rates, and refusal rates for BRFSS are calculated using standards set by the American Association for Public Opinion Research (AAPOR; CDC, 2017). Based on the AAOPR guidelines, response rate calculations include assumptions of eligibility among potential respondents or households that are not interviewed (CDC, 2017). While changes in the geographic distribution of cellular numbers by telephone companies and the portability of landline telephone numbers are likely to make it more difficult than in the past to ascertain which telephone are out-of-sample and which telephone numbers represent likely households the BRFSS has achieved a cellular telephone response rate that compares favorably with other similar surveys (CDC, 2017). The external validity threat could result if the results of the study were generalized to the entire population of Mississippi women between the ages of 21 and 65. Concerning to this study was also construct validity. It was important to know if the questions asked in the BRFSS survey were valid and reliable to apply them to the constructs of Anderson's behavioral model.

The BRFSS survey questions were constructed to be reliable and valid through the following processes (CDC, 2013):

- CDC researchers and health department representatives from all states, District of Colombia, Puerto Rico, and US Virgin Islands formulate questions on the BRFSS survey.

- In 2011 the cellular telephone inclusion was added, which means that inclusive of land line cellular telephone numbers were also used to contact respondents (CDC, 2013 &2017).
- In 2011 the approach changed for the BRFSS survey, but to accommodate the changes to the survey the methodology changed as well; new weighting procedure called raking was employed to accommodate the inclusion of the new weighting variable (CDC, 2017).
- In 2013, cellular telephone stratification is conducted by BRFSS (CDC, 2013).
- All states ask the core questions without modification – interviewers are all trained and follow the same protocol (CDC, 2013).
- Systematic, unobtrusive electronic monitoring is a routine part of monthly survey procedures for all interviewers; states also have the option to utilize callback verification procedures to ensure data quality (CDC, 2013).
- Unless electronic monitoring of interviewers is being routinely conducted, a 5% random sample of each month's interviews must be called back to verify selected responses for quality insurance (CDC, 2013).
- New questions are integrated into the survey annually to address looming health issues (CDC, 2013).
- Web and mail versions of the BRFSS questionnaire were administered to potential respondents drawn from the standard BRFSS telephone sampling frame and reverse-matched to identify valid mailing addresses (CDC, n.d.).

- Address-based sampling (ABS) is utilized in conjunction with random-digital-dial (RDD0. The mail survey approach achieved higher response rates in low-response-rate states than RDD (CDC, n.d.).
- DDS draws telephone numbers from two strata (lists), either high density or medium density to yield residential telephone numbers (CDC, n.d.).
- Telephone numbers in the highest strata are sampled at the highest rate. The rate at which each stratum is sampled is called sample ratio. For BRFSS the landline sampling ratio for high to medium density is 1:1.5 (CDC, n.d.).
- Before sampling begins disproportionate stratified sampling (DSS) was used for landline sampling. DSS design attempts to find a way of differentiating between a high-density stratum and a medium density stratum before sampling begins (CDC, n.d.).
- Cellular telephone respondents are randomly selected with each having equal probability of selection. States complete approximately 20% of their completed interviews with respondents on cell phones (CDC, n.d.).
- The BRFSS goal is to support at least 4,000 interviews per state each year.

For this study, the inclusion criteria for participants were women who reside in Mississippi between the age of 21 and 65 who had not undergone a hysterectomy that were respondents of the 2015-2017 BRFSS surveys. Predisposing factors (race/ethnicity, age, education), enabling factors (income and insurance coverage), and need factor (cervical cancer screening – Pap testing) was measured. All the questions for these constructs were categorized under race/ethnicity, age, education (predisposing factors),

income and insurance coverage (enabling factors), and cervical cancer screening (need factor). The questions and measurement instruments for the BRFSS survey was validated to be reliable.

Ethical Procedures

Permission to use the BRFSS surveys 2015-2017 was sought through CDC info. Although the BRFSS survey data sets were available for public use, the CDC info team was still informed that this research was being conducted.

Treatment of Human Subjects

For this research study, human participants were not accessed. The secondary data were collected during the BRFSS surveys from 2015-2017. According to the Office of the Associate Director for Science (OADS) all research involving human participants that is conducted or supported by CDC must comply with the HHS Policy for Protection of Human Research Subjects (CDC, 2017). Furthermore, a stipulation for using open access datasets provided by the CDC is in Section 308 (d) of the Public Health Service Act: Data collected by the CDC may be used only for health statistical reporting and analysis (CDC, 2015). The CDC employees and state health department workers ensured that the identity of the data subjects was not disclosed by omitting direct identifiers and any characteristics that might lead to identification. The data was used only for health statistical reporting and analysis after the approval of the institutional review board (IRB) at Walden University.

Ethical Concerns

This study was conducted using secondary data therefore there were no ethical concerns to note. No contact with subjects and no intervention activities were included. Before the collection of data, approval was obtained through Walden University IRB (IRB Approval # 01-10-20-0339154).

Treatment of Data

The data were handled in a professional manner. Data were stored on my personal laptop in which only me, as the researcher, could access.

Summary

This research was a quantitative study consisting of statistical analysis of secondary data from the BRFSS surveys from 2015-2017. The BRFSS survey was developed in collaboration between CDC and public health departments in each of the states to derive data from the questionnaire to provide health departments, public health officials, and policymakers with behavioral information that, when combined with mortality and morbidity statistics, inform public health officials as they establish health-related policies and priorities as well as address and assess strategies to promote good health (CDC, 2013). The aim was to determine if there was a relationship or association, and the level of relationship, between obese and nonobese Mississippi women between the ages of 21 and 65 and cervical cancer screening – Pap testing. The results of this study will help to fill the gap in literature. None of the studies I reviewed examined if obesity had an impact on cervical cancer screening of women who reside in Mississippi. Andersen's behavioral model was the conceptual framework that applied to this research.

In Chapter 3, I describe the research study, research questions, research hypotheses, and secondary data analyses. The research questions were formulated before searching suitable datasets. This chapter provides information on the data collection, target population, and effect size. Extensive information was provided on the BRFSS dataset regarding the sampling of respondents, participation, data collection, and the method for gaining access to the data. Instrumentation, operationalization of constructs, data analysis plan, threats to validity, and ethical procedures were all addressed. In Chapter 4, I will discuss the collection of data and results of the study.

Chapter 4: Results

Introduction

The purpose of this study is to compare the rate of cervical cancer screening between obese and nonobese women who reside in Mississippi as a means of testing the hypothesis that obesity is a barrier to screening within this population. A secondary purpose is to assess the impact of race, age, education level, income, and healthcare coverage (insured or not insured) on cervical cancer screening on the relationship between obese and nonobese women who reside in Mississippi. The following research questions and hypotheses were derived:

RQ1: Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income?

$H_0$1: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

H_a1: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

RQ2: Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically

significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

$H_0$2: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

H_a2: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured).

In this chapter, I provide a brief description of discrepancies found in data collection, resulting in changes to the plan presented in the methodology. This chapter will also consist of the descriptive characteristics of the sample, the results of the analyses conducted to answer each research question, and a summary of the overall findings.

Survey Response Rates

The 2018 Behavioral Risk Surveillance System (BRFSS) median response rate of 49.9% was representative of all states, territories, and Washington, DC. For the state of Mississippi, the response rate of 56.2% was representative of landline and cellular telephone numbers sampled (CDC, 2019). Response rates for BRFSS were calculated using standards set by the American Association for Public Opinion Research (AAPOR) Response Rate Formula #4 (CDC, 2019). The response rate is the number of respondents

who completed the survey as a proportion of all eligible and likely-eligible people (CDC, 2019).

Representativeness of the Sample

According to the CDC (2019), the increasing percentage of households abandoning their landline telephones for cellular telephones has significantly eroded the population coverage provided by landline telephone levels to pre-1970s levels. By using a dual-frame survey including landline telephones and cellular telephones, the validity, data quality, and representativeness of BRFSS data was improved (CDC, 2019). In 2011, a new weighting methodology, iterative proportional fitting or raking, was employed replacing the post stratification method to weigh BRFSS data (CDC, 2019). Raking allows incorporation of cellular telephone survey data and permits the introduction of additional demographic distinctions (e.g., education level, marital status, own/rent) in addition to age-race/ethnicity-gender that improves the degree and extent to which the BRFSS sample accurately reflects the sociodemographic make-up of an individual state (CDC, 2019).

Discrepancies in Data Collection

Upon accessing BRFSS survey for the years 2015–2017, I found that none of those years could be used for analyses. BRFSS survey 2015 had the question in the codebook, “Have you ever had a Pap test” as it was a part of the Breast and Cervical Cancer Screening Section. However, for the state of Mississippi the data was missing; there were no responses. Subsequently, there was also no data for Mississippi respondents, for the question “How long has it been since you had your last Pap test” for

the 2015 survey. BRFSS survey 2016 had no data for the state of Mississippi regarding Pap tests as well. The BRFSS survey 2017 did not contain the Breast and Cervical Cancer Screening Section; therefore, no questions regarding screenings for breast or cervix were asked. Because of these discrepancies in data availability, I analyzed data for Mississippi women, between the ages of 21 and 65, in the 2018 BRFSS dataset.

Results

Descriptive Characteristics of the Study Sample

The 2018 BRFSS data file used for this study comprised data from adults and children from the United States and selected U.S. territories. The sample comprised of 3,484 Mississippi women between the ages of 21 and 65. Table 1 displays descriptive statistics for the demographic variables in this sample. Of the Mississippi women within the sample, most were between the ages of 45 and 65 (n = 1,383, 39.7%), the other segmented group of the sample represented Mississippi women between the ages of 21 and 44 (n = 924, 26.5%). Most women in the sample identified as White (Non-Hispanic; n = 1,991, 57.1%) and Black (Non-Hispanic; n = 1,368, 39.3%). The largest portion of Mississippi women were High School Graduates or had earned their General Education Degree (GED; n = 1,065, 30.6%). The largest portion of Mississippi women had an income level less than $25,000 per year ($n$ = 1,251, 35.9%). Most Mississippi women reported having some form of healthcare coverage (health insurance, prepaid plans such as HMOs, government plans such as Medicare, or Indian Health Service; n = 3,077, 88.3%). Of the 3,484 Mississippi women within the sample, most were active participants of Pap testing (n = 2,318, 66.5%). The largest portion of women were nonobese (n =

1,807, 51.9%) with the remainder of women within the sample falling within the Obese I (*n* = 681, 19.5%), Obese II (*n* = 397, 11.4%), Obese III (*n* = 342, 9.8%).

Table 1

Frequencies and Percentages for Descriptive Variables

Variable	Frequency	Percent
Age		
21 – 44	924	26.5
45 – 65	1,383	39.7
Missing	1,177	33.8
Race		
White (Non-Hispanic)	1,991	57.1
Black (Non-Hispanic)	1,368	39.3
Asian (Non-Hispanic)	4	0.1
American Indian/Alaska Native (Non-Hispanic)	23	0.7
Hispanic	23	0.7
Other (Non-Hispanic)	15	0.4
Missing	60	1.7
Education level		
Some high school	320	9.2
High school graduate or GED	1,065	30.6
Some college	1,024	29.4
College graduate	956	27.4
Missing	119	3.4
Income level		
Less than $25,000	1,251	35.9
$25,000 - $34,999	343	9.8
$35,000 - $49,999	368	10.6
$50,000 - $74,999	303	8.7
$75,000 or more	485	13.9
Missing	734	21.1
Healthcare coverage	3,077	88.3
Yes	402	11.5
No	5	0.1
Missing		
	701	20.1
Cervical cancer screening (Participate in Pap testing)	2,318	66.5
Pap test 5 or more years ago (does not participate in Pap testing)		
Pap test within past year to pass 5 years (does participate in Pap testing)	465	13.3
Missing	1,807	51.9
	681	19.5
Nonobese Obese	397	11.4
Nonobese	342	9.8
Obese I	257	7.4
Obese II		
Obese III		
Missing		

Bivariate Analysis

Results of the Pearson's chi-square test identified there was no statistically significant difference in the age (age groups 21-44 and 45-65) of nonobese and obese women who participated in Pap testing, Age Group 21-44 (χ^2 (3, n = 1,980) = 1.455, $p > .05$ (see Table 2) and Age Group 45-65 (χ^2 (3, n = 1,980) = 5.621, $p > .05$; see Table 2). For women between the ages of 21 and 44, who were not obese, 44.7% did not participate in Pap testing, while 17% of women within the same age category classified as Obese III did not participate in Pap testing. Women between the ages of 21 and 44, who were not obese, 52.4% participated in pap testing, while 13.1% of women within the same age category, classified as Obese III, participated in Pap testing. For women between the ages of 45 and 65, who were not obese, 43.8% did not participate in Pap testing, while 17.3% of women within the same age category, classified as Obese III, did not participate in Pap testing. As for women between the ages of 45 and 65, who were not obese, 50.1% participated in Pap testing, while women within the same age category, but classified as Obese III, 12.5% participated in Pap testing. These results suggest that nonobese women between the ages of 21 and 44 were not more likely to participate in Pap testing in comparison to obese women between the ages of 21 and 44. Results also suggest that nonobese women between the ages of 45 and 65 were not more likely to participate in Pap testing in comparison to obese women between the ages of 45 and 65. Furthermore, the association between age (age group 21-44) and Pap testing was weak (Cramer's V =

.042). The association between age (age group 45-65) and Pap testing was also weak, (Cramer's $V = .070$).

Table 2

Contingency Table for Age Category and Pap Testing Among Nonobese and Obese Women

		Classification of BMI				
Variable	Category	Nonobese	Obese I	Obese II	Obese III	Total
Ages 21-44	1	21	12	6	8	47
	2	44.7%	25.5%	12.8%	12%	100%
	3	402	162	107	101	772
	4	52.1%	21.0%	13.9%	13.1%	100%
Ages 45-65	1	109	55	42	43	249
	2	43.8%	22.1%	16.9%	17.3%	100%
	3	457	208	133	114	912
	4	50.1%	22.8%	14.6%	12.5%	100%
	Total	989	437	288	266	1980

Note: Category 1= Participate in Pap Testing – No (Pap test within last 5 years); Category 2 = % of those who do not participate in Pap testing; Category 3 = Participate in Pap Testing – Yes (Pap test within the last year to 5 years); Category 4 = % of those who participate in Pap testing

Table 3 shows that White (Non-Hispanic), nonobese women were not more likely to participate in Pap testing in comparison to Black (Non-Hispanic), nonobese women. Other races (Asian, American Indian/Alaska Native, Hispanic, and other races) were not compared due to the low sample size. Within the sample, two respondents were Asian, 17 respondents were American Indian/Alaska Native, 19 Hispanic respondents, and 9 categorized as Other Race. Results of the Pearson's chi-square test identified there was no statistically significant difference in the race, White (Non-Hispanic) and Black (Non-Hispanic), of nonobese and obese women who participate in Pap testing, White (Non-

Hispanic) women (χ^2 (3, n = 2,800) = 2.548, p > .05 see Table 3) and Black (Non-Hispanic) women (χ^2 (3, n = 2,800) = 1.379, p > .05 see Table 3). The association between race (White and Non-Hispanic) and Pap testing was weak (Cramer's V = .040). The association between race (Black and Non-Hispanic) and Pap testing was also weak, (Cramer's V = .035).

Table 3

Contingency Table for Race and Pap Testing Among Nonobese and Obese Women

		Classification of BMI				
Variable	Category	Nonobese	Obese I	Obese II	Obese III	Total
White (non-Hispanic)	1	305	88	52	39	484
	2	63%	18.2%	10.7%	8.1%	100%
	3	739	222	106	73	1140
	4	64.8%	19.5%	9.3%	6.4%	100%
Black (non-Hispanic)	1	73	39	24	30	166
	2	44.0%	23.5%	14.5%	18.1%	100%
	3	405	234	170	154	963
	4	42.1%	24.3%	17.7%	16.0%	100%
Asian (non-Hispanic	3		2			2
	4		100%			100%
American Indian/Alaska Native (non-Hispanic)	1	1	3	0	1	5
	2	20%	60%	0%	20%	100%
	3	5	3	4	0	12
	4	41.7%	25.0%	33.3%	0.0%	100%
Hispanic	1	3	1	0	0	4
	2	75%	25%	0%	0%	100%
	3	7	5	1	2	15
	4	46.7%	33.3%	6.7%	13.3%	100%
Other race (non-Hispanic)	1	4	0		0	4
	2	100%	0%		0%	100%
	3	2	1		2	5
	4	40%	20%		40%	100%

Note: Category 1= Participate in Pap Testing – No (Pap test within last 5 years); Category 2 = % of those who do not participate in Pap testing; Category 3 = Participate in Pap Testing – Yes (Pap test within the last year to 5 years); Category 4 = % of those who participate in Pap testing

A chi-square test of association was conducted to assess the relationship between the education level of Mississippi women and Pap test participation. Results of the Pearson chi-square test indicated there was no statistically significant difference in the percentage of women who completed some high school and participation in Pap testing, χ^2 (3, n = 2,755) = 3.270, p >.05). Results of the Pearson chi-square test also indicated there was not a statistically significant difference in the percentage of women who completed High School or earned a GED, χ^2 (3, n = 2,755) = 6.156, p >.05) or women who completed some college, χ^2 (3, n = 2,755) = 4.453, p >.05). For women who completed college, the Pearson's chi-square test indicated there was not a statistically significant difference in their participation in Pap testing, χ^2 (3, n = 2,755) = 2.786, p >.05). These results suggest that the educational level of a Mississippi woman is not significantly associated with her participation in Pap testing. Furthermore, the association between educational level and participation in Pap testing was small, Cramer's V = .117 for some high school, Cramer's V = .086 for high school graduate or GED, Cramer's V = .073 for some college, Cramer's V = .058 for college graduate (see Table 4).

Table 4

Contingency Table for Education and Pap Testing Among Nonobese and Obese Women

		Classification of BMI				
Variable	Category	Nonobese	Obese I	Obese II	Obese III	Total
Some High School	1	45	14	9	8	76
	2	59.2%	18.4%	11.8%	10.5%	100%
	3	76	34	25	26	161
	4	47.2%	21.1%	15.5%	16.1%	100%
HS Graduate or GED	1	138	46	25	30	239
	2	57.7%	19.2%	10.5%	12.6%	100%
	3	299	146	87	71	603
	4	49.6%	24.2%	14.4%	11.8%	100%
Some College	1	114	37	22	15	188
	2	60.6%	19.7%	11.7%	8.0%	100%
	3	345	152	87	75	659
	4	52.4%	23.1%	13.2%	11.4%	100%
College Graduate	1	77	22	18	16	133
	2	57.9%	16.5%	13.5%	12%	100%
	3	430	130	78	58	696
	4	61.2%	18.3%	11.6%	8.9%	100%
	Total	1,524	581	351	299	2,755

Note: Category 1= Participate in Pap Testing – No (Pap test within last 5 years); Category 2 = % of those who do not participate in Pap testing; Category 3 = Participate in Pap Testing – Yes (Pap test within the last year to 5 years); Category 4 = % of those who participate in Pap testing

Results of the Pearson's chi-square test identified statistically significant differences in the number of women who participate in Pap testing by income level less than $25,000 annually, $\chi^2(3, n = 2,372) = 13.910$, $p < .05$ (see Table 5). This result suggested that women (nonobese and obese) who earned more than $25,000 in annual income were more likely to participate in Pap testing than women (nonobese and obese) who earned less than $25,000 annual income. However, the association between annual income less than $25,000 annually and Pap testing was low, (Cramer's $V = .115$).

Table 5

Contingency Table for Income and Pap Testing Among Nonobese and Obese Women

			Classification of BMI			
Variable	Category	Nonobese	Obese I	Obese II	Obese III	Total
Less than 25,000	1	150	52	32	32	266
	2	56.4%	19.5%	12%	12%	100%
	3	341	198	122	128	789
	4	43.2%	25.1%	15.5%	16.2%	100%
25,000 to 34,999	1	44	11	9	4	68
	2	64.7%	16.2%	13.2%	5.9%	100%
	3	125	40	36	30	231
	4	54.1%	17.3%	15.6%	13.0%	100%
35,000 to 49,999	1	40	11	5	5	61
	2	65.6%	18.0%	8.2%	8.2%	100%
	3	138	56	43	24	261
	4	52.9%	21.5%	16.5%	9.2%	100%
50,000 to 74,999	1	34	14	11	6	65
	2	52.3%	21.5%	16.9%	9.2%	100%
	3	120	43	28	14	205
	4	58.5%	21.0%	13.7%	6.8%	100%
75,000 or more	1	33	13	8	6	60
	2	55.0%	21.7%	13.3%	10.0%	100%
	3	246	70	31	19	366
	4	67.2%	19.1%	8.5%	5.2%	100%
	Total	1271	508	325	268	2,372

Note: Category 1= Participate in Pap Testing – No (Pap test within last 5 years); Category 2 = % of those who do not participate in Pap testing; Category 3 = Participate in Pap Testing – Yes (Pap test within the last year to 5 years); Category 4 = % of those who participate in Pap testing

For health insurance coverage, the Pearson's chi-square test identified there was no statistically significant difference in a Mississippi woman (nonobese or obese) having insurance coverage and participation in Pap testing, (women with insurance coverage) χ^2 (3, n = 2,838) = 4.205, $p > .05$ and (women without insurance coverage) χ^2 (3, n = 2,838) = 1.932, $p > .05$; see Table 6). These results suggest that nonobese and obese women with insurance were not more likely to participate in Pap testing in comparison to nonobese and obese women without insurance. The association between having insurance coverage and participation in Pap testing was weak, Cramer's $V = .041$. The association between women who did not have insurance coverage and participation in Pap testing was also weak, Cramer's $V = .076$.

Table 6

Contingency Table for Health Insurance Coverage and Pap Testing Among Nonobese and Obese Women

			Classification of BMI			
Variable	Category	Nonobese	Obese I	Obese II	Obese III	Total
Health Insurance						
Yes	1	349	110	70	58	587
	2	59.5%	18.7%	11.9%	9.9%	100%
	3	1054	422	247	192	1915
	4	55%	22%	12.9%	10.0%	100%
No	1	40	21	9	12	82
	2	48.8%	25.6%	11.0%	14.6%	100%
	3	125	49	36	44	254
	4	49.2%	19.3%	14.2%	17.3%	100%
	Total	1568	602	362	306	2838

Note: Category 1= Participate in Pap Testing – No (Pap test within last 5 years); Category 2 = % of those who do not participate in Pap testing; Category 3 = Participate in Pap Testing – Yes (Pap test within the last year to 5 years); Category 4 = % of those who participate in Pap testing

Research Question 1 and Hypotheses

RQ1: Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income?

$H_0$1: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

H_a1: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for age, race/ethnicity, education, and income.

Cervical cancer screening (Pap testing), obesity levels (nonobese and obese women), and the covariates of age, race/ethnicity, education, and income were all included in the final regression model. The regression results showed that the addition of age, race/ethnicity, and education level significantly improved the fit between the final model and the data, χ^2 (df = 12, n = 3,484) = 5.807, $p < .05$. The inclusion of obesity levels (nonobese and obese), age, race/ethnicity, education, and income were all included in the final model explained between 9.8% (Cox & Snell R^2) and 17.3% (Nagelkerke R^2) of the variance in participation in cervical cancer screening (Pap testing), and the final model correctly classified 85.1% of the cases.

Table 7 is a summary of the logistic regression coefficient beta (B), the Wald statistics, the odds ratio, and its 95% confidence interval (CI). Based on Wald statistics, the independent variable of obesity levels (nonobese and obese) and the covariates of age (categories of 21-44 and 45-65), race, education level, and income level were associated with participation in cervical cancer screening (p <.05). After controlling for obesity levels (nonobese and obese), age (categories of 21-44 and 45-65), race, educational level, and income level in the final model, Mississippi women who were categorized as Class I obese (BMI of 29.95-34.94) were 2.097 more likely to participate in cervical cancer screening (B = .741, p <.05; OR = 2.097, 95% CI [1.401, 3.139]) compared to Mississippi women who were categorized as Class III obese (BMI of 40+). Women who were

categorized as Class II obese (BMI of 34.95-39.99) were 1.543 more likely to participate in cervical cancer screening (B = .434, p <.05; OR = 1.543, 95% CI [.994, 2.395]) compared to Mississippi women who were categorized as Class III obese (BMI of 40+). Mississippi women who were between the ages of 21 and 44 were .215 less likely to participate in cervical cancer screening (B = -1.538, p <.05; OR = .215, 95% CI [.152, .304]) compared to Mississippi women who were between the ages of 45 and 65. White Mississippi women were 3.591 more likely to participate in cervical cancer screening (B = 1.278, p <.05; OR = 3.591, 95% CI [2.622, 4.916]) compared to Black Mississippi women. Mississippi women who did not complete high school were .540 less likely to participate in cervical cancer screening (B = -.616, p <.05; OR = .540, 95% CI [.328, .888]) compared to Mississippi women who were college graduates and Mississippi women who graduated from high school or earned a GED were .631 less likely to participate in cervical cancer screening (B = -.460, p <.05; OR = .631, 95% CI [.440, .996]) compared to Mississippi women who were college graduates. As income decreases, the odds of participating in cervical cancer screening decreased by .613 (B = -4.90, p <.05; OR = .613, 95% CI [.429, .875]). Therefore, I rejected the null hypothesis in favor of the alternative hypothesis that there is a statistically significant association between cervical cancer screening in nonobese Mississippi women and obese Mississippi women after controlling for age, race/ethnicity, education, and income.

Table 7

Logistic Regression Results for Pap Testing Based on Obesity Level

							95% CI	
	B	*S.E.*	Wald	*df*	Sig.	*Exp(B)*	Lower	Upper
Class I Obese	.741	.206	12.965	1	.000	2.097	1.401	3.139
Class II Obese	.434	.224	3.743	1	.053	1.543	.994	2.395
Age Category (21-44)	-1.538	.177	75.282	1	.000	.215	.152	.304
Race (White Non-Hispanic)	1.278	.160	63.548	1	.000	3.591	2.622	4.916
Some High School	-.616	.254	5.893	1	.015	.540	.328	.888
High School Grad/GED	-.460	.184	6.216	1	.013	.631	.440	.906
Income Less Than $25,000	-.490	.182	7.259	1	.007	.613	.429	.875

To expand on the cervical cancer screening model, a stepwise multiple logistic regression using forward selection was conducted to assess the significance of the relationship between the obesity level of Mississippi women and participation in cervical cancer screening. The regression results showed that the age (categories 21-44 and 45-65), race/ethnicity, educational levels, and income levels improved the fit between the final model and the data, $\chi^2(df = 12, n = 3{,}484) = 5.807$, $p < .05$. The inclusion of age, race/ethnicity, education, and income in the final model explained between 9.7% (Cox & Snell R^2) and 17.1% (Nagelkerke R^2) of the variance in participation in cervical cancer screening, and the final model correctly classified 85.1% of the cases.

Table 8 is a summary of logistic regression coefficients (*B*), the Wald statistics, the odds ratio, and its 95% CI. Based on Wald's statistics, age, race/ethnicity, education, and income were significantly associated with Mississippi women participating in cervical cancer screening, $p < .05$. After controlling for age, race/ethnicity, education, and income, obesity level significantly decreased the odds of Mississippi woman participation in cervical cancer screening.

Compared to Mississippi women who were not obese, Class I (29.95 – 34.94 BMI) obese women, were 2.1 times more likely to not participate in cervical cancer screening (*B* = .751, $p < .05$; *OR* = 2.120, 95% CI [1.417, 3.170]). Class II (34.95 - 39.99 BMI) obese Mississippi women were 1.5 times more likely to not participate in cervical cancer screening (*B* = .436, $p < .05$, *OR* = 1.547, 95% CI [.997, 2.399]). Furthermore, Mississippi women between the ages of 21 and 44 were 4.6 times more likely to not participate in cervical cancer screening (*B* = 1.532, $p < .05$, *OR* = 4.624, 95% CI [3.271, 6.540]). Black Mississippi woman odds of participating in cervical cancer screening were decreased by .28, (*B* = -1.279, $p < .05$, *OR* = .278, 95% CI [.204, .380]). The lower the education level, some high school (*B* = .550, $p < .05$, *OR* = 1.733, 95% CI [1.097, 2.736]) and high school graduate or GED (*B* = .401, $p < .05$, *OR* = 1.493, 95% CI [1.100, 2.027]), the odds of not participating in cervical cancer screening increased by 1.7 and 1.5, respectively. As income increases, the odds of not participating in cervical cancer screening increased by 1.6, (*B* = .472, $p < .05$, *OR* = 1.604, 95% CI [.529, 1.381]). These results provided further evidence of the rejection of the null hypothesis in favor of the alternative hypothesis.

Table 8

Logistic Regression Results for Participation in Pap Testing Based on Obesity Level, Age, Race, Education, and Income

Variable	*B*	*S.E.*	Wald	*df*	Sig.	*Exp(B)*	95% CI	
							Upper	Lower
Class I Obese	.751	.205	13.379	1	.000	2.120	1.417	3.170
Class II Obese	.436	.224	3.787	1	.052	1.547	.997	2.399
Class II Obese	.284	.243	1.368	1	.242	1.329	.825	2.139
Age 45 – 65	1.532	.177	75.110	1	.000	4.625	3.271	6.540
Race Black	-1.279	.159	64.827	1	.000	.278	.204	.380
Some High School	.550	.233	5.562	1	.018	1.733	1.097	2.736
High School Grad or GED	.401	.156	6.623	1	.010	1.493	1.100	2.027
Income Less Than $25,000	.472	.152	9.651	1	.002	1.604	1.191	2.161

Research Question 2 and Hypotheses

RQ2: Is the rate of cervical cancer screening among nonobese women in Mississippi higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

$H_0$2: The rate of cervical cancer screening among nonobese women in Mississippi is not higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured)?

H_a2: The rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage (insured – prepaid plans such as HMO's, government plans such as Medicare or uninsured).

For this research question a stepwise multiple logistic regression using forward selection to assess the significance of the relationship between healthcare coverage and participation in cervical cancer screening among nonobese and obese Mississippi women. The covariates age, race/ethnicity, and income included in the final regression model were significantly ($p \leq .05$) associated with participation in cervical cancer screening. The independent variable, education level, was a variable that was not in the equation. The regression results showed that the addition of healthcare coverage, age, race/ethnicity, and income to the model significantly support the fit between the final model and the data χ^2 (df = 13, n = 3,484) = 5.824, p <.05. The addition of healthcare coverage, along with age, race/ethnicity, and income to the final model explained between 5.3% (Cox & Snell R^2) and 9.3% (Nagelkerke R^2) of the variance in participation in cervical cancer screening and 85% of the cases in the final model were correctly classified.

Table 9 is a summary of the logistic regression coefficients beta (B), the Wald statistics, the odds ratio, and 95% CI. Based on Wald's statistics age, race/ethnicity, educational level, income, and healthcare coverage were significantly associated with cervical cancer screening. After controlling for age, race/ethnicity, educational level, income, healthcare coverage, that is whether the respondent had insurance (B = -1.093, p

< .05; *OR* = .335, 95% CI [.237, .474]) decreased the odds of not participating in cervical cancer screening. Compared to Mississippi women who were not obese, Class I (29.95 – 34.94 BMI) obese women, were 2.4 times more likely to not participate in cervical cancer screening (*B* = .865, *p* < .05; *OR* = 2.374, 95% CI [1.582, 3.563]). Class II (34.95 - 39.99 BMI) obese Mississippi women were 1.6 times more likely to not participate in cervical cancer screening (*B* = .471, *p* < .05, *OR* = 1.602, 95% CI [1.031, 2.489]). Mississippi women between the ages of 21 and 44 were 5.9 times more likely to not participate in cervical cancer screening (*B* = 1.799, *p* < .05, *OR* = 5.922, 95% CI [4.120, 8.512]). A Black Mississippi woman's odd of participating in cervical cancer screening were decreased by .28, (*B* = -1.293, *p* < .05, *OR* = .275, 95% CI [.200, .377]). As income increases, the odds of not participating in cervical cancer screening increased by 1.5, (*B* = .409, *p* < .05, *OR* = 1.505, 95% CI [1.118, 2.024]). Therefore, I rejected the null hypothesis in favor of the alternative hypothesis that the rate of cervical cancer screening among nonobese women in Mississippi is higher than the same rate among obese women in Mississippi to a statistically significant degree, after controlling for healthcare coverage.

Table 9

Logistic Regression Results for Participation in Pap Testing Based on Obesity Level, Age, Race, Income, and Insurance Coverage

Variable	*B*	*S.E.*	Wald	*df*	Sig.	*Exp(B)*	95%CI	
							Upper	Lower
Class I Obese	.865	.201	17.248	1	.000	2.374	1.582	3.563
Class II Obese	.471	.225	4.400	1	.036	1.602	1.031	2.488
Age 45-65	1.779	.185	92.293	1	.000	5.922	4.120	8.512
Race Black	1.293	.161	64.143	1	.000	.275	.200	.377
Income Less Than 25,000	.409	.151	7.288	1	.007	1.505	1.118	2.024
Insured Healthcare Coverage	1.093	.177	38.119	1	.007	.335	.237	.474

Summary

In this chapter, data from the 2018 Behavioral Risk Surveillance System were evaluated to determine the extent to which obesity levels influence the likelihood of Mississippi women participating in cervical cancer screening. I presented the results of the data analyses conducted to answer the two research questions. The sample comprised data from 3,484 Mississippi women. The key findings of the analyses were that after controlling for race, age, educational level, and income level a statistically significant relationship was found among obesity level and participation in cervical cancer screening. Mississippi women who were categorized as Obese I and Obese II were more likely to not participate in cervical cancer screening (Pap testing) in comparison to their nonobese counterparts. After controlling for age, race/ethnicity, educational level,

income, healthcare coverage, insured or not insured, not having insurance decreased the odds of a Mississippi woman participating in cervical cancer screening. Based on the results, for both research questions, the null hypothesis was rejected.

Included in Chapter 5 is my interpretation of the findings of this study based on publish research. Chapter 5 will also include a discussion of the limitations of the study, implications for positive social change, a detailed description of recommendations for future studies, and a conclusion to complete the chapter.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The participation in cervical cancer screening, via Pap testing, has decreased the number of new cases of cervical cancer as well as the number of deaths in cervical cancer in women within the United States (CDC, 2018). For a little over 30 years, between 1988 and 2018, cervical cancer rates in the United States have declined by more than 50% and the overall cervical cancer incidence rates have decreased from 17.2 to 7.6 (per 100,000 women; American Cancer Society, 2018; Gibson et al., 2019; Siegel et al., 2018). The mortality rate has decreased from 5.6 to 2.3 (per 100,000 women; Gibson et al., 2019; Siegel et al., 2018). The decline in cervical cancer incidence rates and mortality rates is largely due to the participation of women in Pap testing (CDC, 2018). Early detection of precancerous or cancerous cells on the cervix can be lifesaving. However, with the strides made in decreasing cervical cancer incidence and mortality rates, cervical cancer remains a public health concern in the United States and for the state of Mississippi where cervical cancer rates are the highest among the 50 states (CDC, 2017). Not only are cervical cancer rates high, but obesity rates in Mississippi are the second highest in the United States (Robert Wood Foundation, 2018). These high obesity rates could be related to the high cervical cancer incidence and mortality rates of women in Mississippi. In this observational study, I evaluated the extent to which obesity, race/ethnicity, age, education, income, and healthcare coverage affect the rate of Pap testing among Mississippi women. Anderson's behavioral model served as the theoretical framework of the study. The understanding gained from this study can be used to guide the

development of strategies to decrease cervical cancer incidence and mortality rates among Mississippi women.

In this study, I evaluated data from the 2018 Behavioral Risk Surveillance System (BRFSS) to determine the extent to which obese and nonobese Mississippi women participate in cervical cancer screening and to assess the impact of race/ethnicity, age, education, income, and healthcare coverage (insured or not insured) on cervical cancer screening rates. The results of Pearson's chi-square tests showed that there was no statistically significant difference in the age (21-44 and 45-65) of nonobese and obese Mississippi women who participate in cervical cancer screening via Pap testing. Likewise, there was no statistically significant difference in the race, White (Non-Hispanic) and Black (Non-Hispanic), of nonobese and obese Mississippi women who participate in Pap testing. There was no statistically significant difference in the educational level (some high school, high school graduate, some college, college graduate) of nonobese and obese Mississippi women who participate in Pap testing. As for income, the results of the Pearson's chi-square test showed that completion of Pap tests by both nonobese and obese Mississippi women was significantly associated with income level less than $25,000, suggesting that Mississippi women who earned more than $25,000 in annual income were more likely to participate in Pap testing than women (nonobese and obese) who earned less than $25,000 in annual income. For health insurance coverage, the results of the Pearson's chi-square test identified there was no statistically significant difference in a Mississippi woman (nonobese or obese) having insurance coverage and participation in Pap testing.

Further analyses using stepwise multiple logistic regression showed that after controlling for age, race/ethnicity, education, and income there is a statistically significant association between Pap testing in nonobese Mississippi women and obese Mississippi women. Additionally, when controlling for insurance coverage, there is a statistically significant association between Pap testing in nonobese Mississippi women and obese Mississippi women.

Interpretation of Findings

For women, predisposing factors of age, race, income, education and enabling factors of income and insurance coverage, are crucial determinants of Pap test utilization (Monnat, 2014). Likewise, obesity, a predisposing factor, plays a role in Pap test utilization. In the current study, the obesity level of Mississippi women, in addition to age, race, income, education, and insurance coverage influenced participation in cervical cancer screening. Results of the multiple logistic regression showed that as obesity levels (Obesity I, Obesity II, and Obesity III) increased, the likelihood of participating in cervical cancer screening decreased. Nonobese Mississippi women were more likely to participate in cervical cancer screening compared to obese Mississippi women. Inferring that the more obese a woman is, the likelihood of that woman not participating in cervical cancer screening increases. This result coincides with Friedman et al. (2012) findings that obese women receive cervical cancer screenings less frequently than their counterparts of normal weight.

Results of the multiple logistic regression showed there was an association between age of a woman and participation in cervical cancer screening. Mississippi

women between the ages of 45 and 65 were more likely to participate in cervical cancer screening, in comparison to Mississippi women between the ages of 21 and 44. This result contradicted data retrieved from the 2015 National Health Interview Survey (NHIS) stating that women in their 30s were more likely to participate in Pap testing compared to women in their 40s. Furthermore, Jia et al. (2013) revealed that women who were younger, women 45 years of age or younger, were more willing to participate in cervical cancer screening.

Literature has shown to be conflicting regarding which race/ethnicity has a higher utilization rate of Pap testing. Monnat (2014) suggests that some research states that, in comparison to White women, Black and Hispanic women have lower rates of cervical cancer screening. To the contrary, Monnat (2014) analyzes other research with results that demonstrate that screening rates among Black and Hispanic are now equal to or higher than rates among White women. The results of this study supported Monnat's (2014) former finding; in comparison to White nonobese Mississippi women, Black obese Mississippi women were less likely to participate in cervical cancer screening. The difference in association between race and cervical cancer screening for this study could be due to sample size. In this study, other races/ethnicities were not analyzed, including Hispanics, due to the low sample size. Little to no representation of different races/ethnicities – Asian, American Indian/Alaska Native, Hispanic, and other races – could undermine the impact of race/ethnicity on cervical cancer screening, or Pap testing.

Data retrieved from the 2010 United States Census Bureau shows that education attainment and income are in tandem (World Population View, 2019). The higher the

educational attainment, the higher the income level. As it relates to cervical cancer screening, research demonstrates that women that have higher levels of education and higher levels of income are likely to use their knowledge-based resources and financial resources to obtain timely cervical cancer screening (Monnat, 2014). Results of the multiple logistic regression shows the lower the educational attainment, the lower the participation rate of both nonobese and obese Mississippi women in Pap testing. Participation in Pap testing was in accordance with educational attainment for both non-obese and obese Mississippi women; however, results of this study showed that nonobese women with a lower educational attainment still participated in Pap testing at a higher rate than obese women. This commensurate the findings of Maharjan and Tuladhar (2018), which showed that education played an important role in the knowledge and awareness of cervical cancer prevention and early detection. In like manner, results of the multiple logistic regression showed the lower the income level of nonobese and obese Mississippi women, the lower the participation rate in Pap testing. Nonobese Mississippi women of a lower income still participated in cervical cancer screenings at a higher rate than their obese counterparts.

Bernard et al. (2014) presents contradicting results regarding health insurance as a barrier to cervical cancer screening. In the study it is suggested that a woman having health insurance is one of the financial barriers that has a bearing on a woman participating in cervical cancer screening (Bernard et al., 2014). However, in this same study, researchers found that women who did not adhere to the recommended Pap testing interval were women who had insurance and a healthcare provider (Benard et al., 2014).

The results of my study confirm the former of the results from Benard et al. (2014) study, that a lack of insurance coverage is a financial barrier that has a negative bearing on a Mississippi woman's participation in Pap testing.

The theoretical framework that guided this research study was Andersen's behavioral model. This model posits that predisposing, enabling, and need factors characteristics influences an individual's access and use of health services, in this case, participation in cervical cancer screening via Pap testing (Aday & Andersen, 1974; Andersen, 1968; Babitsch et al., 2012; Umanitoba, n.d.). Factors evaluated in this study showed that obesity level, age, race/ethnicity, educational level (i.e., predisposing factors), income (i.e., enabling factor), and health insurance coverage (i.e., need factor)– insured or uninsured, influenced the likelihood of Mississippi women participating in cervical cancer screening (predisposing factor).

Limitations of the Study

Secondary data from the 2018 Behavioral Risk Surveillance Survey (BRFSS) was used for this research study. As a result, the evaluations documented in this survey were restricted to questions asked in the survey, were limited to variables in the BRFSS data set, and responses were self-reported. The most critical limitation of the study was that upon accessing BRFSS survey for years 2015 – 2017 it was found that none of those years could be used for analyses. BRFSS survey 2015 had the question in the codebook, "Have you ever had a Pap test", it was a part of the Breast and Cervical Cancer Screening Section. However, for the state of Mississippi the data was missing; there were no responses. Subsequently, there was no data for Mississippi respondents, for the question

"How long has it been since you had your last Pap test" for the 2015 survey. BRFSS survey 2016 had no data for the state of Mississippi. BRFSS survey 2017 did not contain the Breast and Cervical Cancer Screening Section; therefore, no questions regarding screenings for breast or cervix were asked.

Therefore, the data set that had responses to the pertinent questions for this study, the 2018 BRFSS data set, was used. There was a small sample size for the race variable, which rendered races other than Black and White to be excluded. The analyses described in this study used weighted data, so it is possible that the significance of the associations reported was overestimated. Missing data can limit the validity of secondary data sources and this should be taken into consideration when interpreting the data.

Recommendations for Future Studies

I evaluated nonobese and obese Mississippi women and their participation in cervical cancer screening, via Pap testing, to test the hypothesis that obesity is a barrier to cervical cancer screening (Pap testing). I also evaluated the impact of age, race/ethnicity, education level, income, and insurance coverage on cervical cancer screening on nonobese and obese women who reside in Mississippi. Given the low sample size of other race/ethnicity for Mississippi women within the 2018 BRFSS data set, more research may be needed to solely evaluate the impact of race/ethnicity on cervical cancer screening.

Furthermore, research has shown that the sociodemographic variable, healthcare coverage, affects women's participation in cervical cancer screening (Gibson et al., 2019). If women are not insured or underinsured, they are less likely to participate in

cervical cancer screening compared to a woman that is insured (Gibson et al., 2019). However, in the study conducted by Benard et.al. (2014), there were conflicting findings; of the women who had not been screened in adherence with the recommended screening interval, the percentage was higher among those who had insurance and a regular healthcare provider. In light of this conflicting finding, further research is needed to clarify or reduce any ambiguity surrounding the contradicting finding.

Implications for Positive Social Change

Improving the participation of Mississippi women in cervical cancer screening and addressing barriers that hinder these women from participating in cervical cancer screening has several implications for positive social change. The World Health Organization (WHO) is working on the definition of a threshold under which cervical cancer will no longer be a public health concern (WHO, 2018). For the WHO to achieve this goal, it is important that a state like Mississippi, that has the highest cervical cancer rate among the 50 states, decrease their rate of cervical cancer diagnosis. One way of decreasing cervical cancer diagnosis is early detection of precancerous lesions which can be detected through cervical cancer screening (NIH, n.d.).

In understanding the impact that obesity, age, race/ethnicity, education level, income, and insurance coverage has on cervical cancer screening it is important to formulate policies to increase the use of cervical cancer screening, via Pap testing. It would be important to expand on efforts of the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) which provides free or low-cost health screenings, such as Pap testing, to women (Tongka et al., 2015). Women who are low-income, uninsured,

or underinsured would be given the opportunity to participate in routine cervical cancer screenings; this has the potential to increase testing and possibly decrease rates of cervical cancer.

Furthermore, public health workers, program developers, and researchers could work together to decrease rates of obesity in Mississippi women. Obesity disproportionately affects racial and ethnic minorities as well as people at lower income and educational levels (Budd & Peterson, 2014). In addition to offering free to low-cost preventative testing, healthcare providers and other partners could provide wellness checks in which issues such as obesity can be addressed.

Conclusion

Women are still dying from cervical cancer. Even with preventative screenings such as the Pap testing, women are still suffering from the ravaging effects of cervical cancer. According to the World Cancer Research Fund and the American Institute for Cancer Research (2020), cervical cancer is the fourth most commonly occurring cancer in women. For women in Mississippi, these effects are paramount. The CDC reported that women in Mississippi have the highest rate of cervical cancer among the 50 states (CDC, 2017). Not only are cervical cancer rates the highest, but obesity rates are high as well in the state of Mississippi, only second to the state of Alabama (Robert Wood Johnson Foundation, 2018). In the United States, there is a higher risk among obese women of developing cervical cancer (Clarke et al., 2018).

Preventative practices such as cervical cancer screenings, via Pap testing, has two goals: (a) the primary goal is to identify and remove precancerous lesions caused by HPV

to prevent invasive cancers from developing; (b) secondary goal is to find cervical cancer at an early age in which the cancer is still at a treatable state (NIH, n.d.). Despite the possibility of early detection that cervical cancer screening provides, participation in Pap testing is low (Chang et al., 2016). To optimize participation in Pap testing the barriers that hinder women from participation must be addressed. Researchers have identified age, education, income, and employment status along with obesity as some of the barriers or perceived risk factors to Pap testing (Chang et al., 2016; Clarke et al., 2018).

In this study, based on the research conducted by Chang et.al. and Clarke et.al. I made the decision to use the following covariates – age, race/ethnicity, educational level, income, and healthcare coverage to determine if any of these factors are barriers to Mississippi women participating in cervical cancer screening. The independent variable obesity level (nonobese and obese) and the covariates age (21-44 and 45-65), race/ethnicity, education level, and income were all associated with cervical cancer screening among Mississippi women. After controlling for obesity levels (nonobese and obese), age, race/ethnicity, education, and income level in the final model, Mississippi women who were categorized as Class I obese (BMI of 29.95 – 34.94) were more likely to participate in cervical cancer screening, compared to Mississippi women who were categorized as Class III obese (BMI of 40+). These results suggest that the more obese a Mississippi woman is the less likely she is to participate in cervical cancer screening. Furthermore, Black Mississippi women who were between the ages of 21 and 44 were less likely to participate in recommended interval cervical cancer screening; Mississippi women who did not complete high school were less likely to participate in cervical

cancer screening compared to Mississippi women who completed high school and higher levels of education as income decreased the odds of participating in Pap testing decreased for Mississippi women. After controlling for healthcare coverage along with the other variables, results showed that healthcare coverage was associated with cervical cancer screening; women who were not insured were less likely to participate in cervical cancer screening. It has become clear from this research and other studies that increasing cervical cancer screening participation among Mississippi women is dependent upon addressing sociodemographic, socioeconomic, and sociocultural barriers that prohibit them from participation. Once these barriers have been addressed, cervical cancer screening participation could possibly increase, thereby decreasing the rates of cervical cancer among women in Mississippi.

References

AAFP Foundation. (2019). *Screening for cervical cancer: Recommendation Statement.* https://www.aafp.org/afp/2019/0215/od1.html

Aday, L., & Andersen, R. (1974). A framework for the study of access to medical care. *Health Services Research, 9*(3), 208 – 220.

Agorastos, T., Chatzistamatiou, K., Katsamagkas, T., Koliopoulous, G., Daponte, A., Constantinidis, T., & the HERMES study group. (2015). Primary screening for cervical cancer based on high-risk human papillomavirus (HPV) detection and HPV 16 and HPV 18 genotyping, in comparison to cytology. *PLOS ONE, 10(3): e0119755.* https://doi.org/10.1371/journal/pone.0119755

Aimagambetova, G., & Azizan, A. (2018). Epidemiology of HPV infection and HPV-related cancers in Kazakhstan: A review. *Asian Pacific Journal of Cancer Prevention, 19*(5), 1175 – 1180. https://doi.org/10.22034/APJCP.2018.19.5.1175

Akinlotan, M., Bolin, J., Helduser, J., Ojinnaka, C., Lichorad, A., & McClellan, D. (2017). Cervical cancer screening barriers and risk factor knowledge among uninsured women. *Journal of Community Health, 42*(4), 770-778. https://doi.org/10.1007/s10900-017-0316-9

Alexopoulos, E.C. (2010). Introduction to multivariate regression analysis. *Hippokratia, 14*(Suppl 1), 23-28. American Cancer Society. (2017). *Cancer Prevention & Early Detection Facts & Figures.* https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/cancer-prevention-and-early-detection-

facts-and-figures/cancer-prevention-and-early-detection-facts-and-figures-2017.pdf

American Cancer Society. (2020). *Key Statistics for Cervical Cancer.* https://www.cancer.org/cancer/cervical-cancer/about/key-statistics.html

American Cancer Society. (2020). *The American Cancer Society Guidelines for the Prevention and Early Detection of Cervical Cancer.* https://www.cancer.org/cancer/cervical-cancer/detection-diagnosis-staging/cervical-cancer-screening-guidelines.html

Andersen, R. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36*(1), 1-10.

Arain, A. (2015). Three doses to finish: A review on completion of human papillomavirus (HPV) vaccination amongst females aged 12 to 17 years. *Journal of Community Medicine & Health Education, 5*(352). https://doi.org/10.4172/2161-0711.1000352

Arnold, M., Leitzmann, M., Freisling, H., Bray, F., Romieu, I., Renehan, A., & Soerjomataram, I. (2016). Obesity and cancer: An update of the global impact. *Cancer Epidemiology, 41,* 8 – 15. https://doi.org/10.1016/j.canep.2016.01.003

Azfredrick, E. (2016). Using Andersen's model of health service utilization to examine use of services by adolescent girls in South – Eastern Nigeria. *International Journal of Adolescence and Youth, 21*(4), 523 – 529. https://doi.org/10.1080/02673843.2015.1124790

Babitsch, B., Gohl, D., & von Lengerke, T. (2012). Re-revisiting Andersen's behavioral

model of health services use: A systematic review of studies from 1998 – 2011. *Psycho-Social Medicine, 9*, Doc 11. https://doi.org/ 10.3205/psm000089

Beavis, A. & Levinson, K. (2016). Preventing cervical cancer in United States: Barriers and resolutions for HPV vaccination. *Frontiers of Oncology, 6*(19). https://doi.org/10.3389/fonc.2016.00019

Bernard, V., Thomas, C., King, J., Massetti, G., Doria-Rose, V., Saraiya, M., & Centers for Disease Control and Prevention. (2014). Vital signs: Cervical cancer incidence, mortality, and screening – United States, 2007-2012. *Morbidity and Mortality Weekly Report, 63*(4), 1004-1009. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm63e1105a1.htm

Budd, G., & Peterson, J. (2014). CE: The obesity epidemic, part 1: Understanding the origins. *The American Journal of Nursing*, *114*(12), 40 – 48. https://doi.org/10.1097/01.NAJ.0000457410.8396

Bukowska – Durawa, A. & Luszczynska, A. (2014). Cervical cancer screening and psychosocial barriers perceived by patients. A systematic review. *Contemporary Oncology (Pozan, Poland)*, *18*(3), 153 – 159. https://doi.org/10.5114/wo.2014.43158

Bussiere, C., Sicsic, J., & Pelletier-Fleury, N. (2014). The effects of obesity and mobility disability in access to breast and cervical cancer screening in France: Results from the National Health and Disability Survey. *PLoS One, 9*(8), e104901. doi:10.1371/journal.pone.0104901

Carroll-Scott, A., Gilstad-Hayden, K., Rosenthal, L., Peters, S., McCaslin, C., Joyce, R., & Ickovics, R. (2013). Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: The role of built, socioeconomic, and social environments. *Social Science & Medicine (1982), 95,* 106 – 114. doi:10.1016/j.socscimed.2013.04.003

Centers for Disease Control and Prevention. (2019). *Behavioral Risk Factor Surveillance System.* https://www.cdc.gov/brfss/index.html

Centers for Disease Control and Prevention. (2014) *Behavioral Risk Factor Surveillance System: About the Behavioral Risk Factor Surveillance System (BRFSS).* https://www.cdc.gov/brfss/about/about_brfss.htm

Centers for Disease Control and Prevention. (2013). Behavioral Risk Factor Surveillance System: BRFSS 2013 Survey Data and Documentation. https://www.cdc.gov/brfss/annual_data/annual_2013.html

Centers for Disease Control and Prevention. (2014). *Behavioral Risk Factor Surveillance System: BRFSS Today.* https://www.cdc.gov/brfss/about/brfss_today.htm

Centers for Disease Control and Prevention. (2020). *Cervical Cancer Statistics.* https://www.cdc.gov/cancer/cervical/statistics/index.htm

Centers for Disease Control and Prevention. (2019). *Cervical Cancer: What Should I Know about Screening.* https://www.cdc.gov/cancer/cervical/basic_info/screening.htm

Centers for Disease Control and Prevention. (2017). *Defining Adult Overweight and*

Obesity. https://www.cdc.gov/obesity/adult/defining.html

Centers for Disease Control and Prevention. (2019). *HPV Diseases and Cancers.* https://www.cdc.gov/hpv/parents/cancer.html

Centers for Disease Control and Prevention. (2019). *Leading Causes of Deaths – Females - All Races and Origins - United States, 2017*. https://www.cdc.gov/women/lcod/2017/all-races-origins/index.htm

Centers for Disease Control and Prevention. (2017). *United States Cancer Statistics: Data Visualizations.* https://gis.cdc.gov/Cancer/USCS/DataViz.html

Chang, H., Myong, J., Byun, S., Lee, S., Lee, Y., Lee, H., Lee, K., Park, D., Kim, C., Hur, S., Park, J. & Park, T. (2017). Factors associated with participation in cervical cancer screening among young Koreans: A nationwide cross-sectional study. *BMJ open*, *7*(4), e013868. doi:10.1136/bmjopen-2016-01386

Chawla, N., Breen, N., Liu, B., Lee, R., & Kagawa-Singer, M. (2014). Asian American women in California: A pooled analysis of predictors for breast and cervical cancer screening. *American Journal of Public Health, 105*, e98 – e109. doi:10.2105/AJPH.2014.302250

Chen, H., Kessler, C., Mori, N., & Chauhan, S. (2012). Cervical cancer screening in the United States, 1993 – 2010: Characteristics of women who are never screened. *Journal of Women's Health (2002), 21*(11), 1132 – 1138. doi:10.1089/iwh.2011.3418

Clarke, M., Fetterman, B., Cheung, L., Wentzensen, N., Gage, J.C., Katki, H.A., Befano,

B., Demarco, M., Schussler, J., Kinney, W., Raine-Bennett, T., Lorey, T., Poitras, N., Castle, P., & Schiffman, M. (2018). Epidemiologic evidence that excess body weight increases risk of cervical cancer by decreased detection of precancer. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology, 36*(12), 1184-1191. doi:10.1200/JCO.2017.75.3442

Cogan, J. (2011). The Affordable Care Act's preventative services mandate: Breaking down the barriers to nationwide access to preventative services. *Journal of Law, Medicine & Ethics, 39*, 355 – 365. doi:10.1111/j.1748-720X.2011.00605.x

Cubit Planning. (2019). *Mississippi Cities by Population.* https://www.mississippi-demographics.com/cities_by_population

Dasari, S., Wudayagiri, R., & Valluru, L. Cervical cancer: Biomarkers for diagnosis and treatment. *Clin Chim Acta, 445*(7). doi:10.1016/j.cca.2015.03.005

Data USA (2019). Mississippi. https://datausa.io/profile/geo/mississippi

Decker, S., Kostova, D., Kenney, G., & Long, S. (2013). Health status, risk factors, and medical conditions among persons enrolled in Medicaid vs uninsured low-income adults potentially eligible for Medicaid under the Affordable Care Act. *JAMA, 309*(24), 2579 – 2586. doi:10.1001/jama.2013.7106

Derose, K., Gresenz, C., & Ringel, J. (2011). Understanding disparities in healthcare access – and reducing them – through a focus on public health. *Health Affairs, 30*(10). doi:10.1377/hlthaff.2011.0644

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2013). G*Power 3.1.2 [computer

software]. //www.psycho.uniduesseldrof.de/abteilungen/aap/gpowers3/download-and-register

Feng, J., Glass, T., Curriero, F., Stewart, W., & Schwartz, B. (2010). The built environment and obesity: A systematic review of the epidemiologic evidence. *Health & Place, 16*(2), 175 – 190. doi:10.1016/j.healthplace.2009.09.008

Friedman, A., Hemler, J., Rossetti, E., Clemow, L, & Ferrante, J. (2012). Obese women's barriers to mammography and pap smear: The possible role of personality. *PubMed Obesity 20*(8), 1611-1617

Gibson, E., Gage, J., Castle, P., & Scarinci, I. (2019). Perceived susceptibility to cervical cancer among African American women in the Mississippi Delta: Does adherence to screening matter? *Women's Health Issues: Official Publication of the Jacob's Institute of Women's Health,* 29(1), 38-47. doi:10.1016/j.whi.2018.09.006

Greene, M., Hughes, T., Hanlon, A. Huang, L., Sommers, M., & Meghani, S. (2018). Predicting cervical cancer screening among sexual minority women using Classification and Regression Tree analysis. *Preventative Medicine Reports, 13*, 153 – 159. doi:10.1016/j.pmedr.2018.11.007

Haelle, T. (2015). *The Great Success and Enduring Dilemma of Cervical Cancer Screening.* https://www.npr.org/sections/health-shots/2015/04/30/398872421/the-great-success-and-enduring-dilemma-of-cervical-cancer-screening

Hales, C., Fryar, C., Carroll, M. Freedman, D., & Ogden, C. (2018). Trends in obesity and severe obesity prevalence in US youth and adults by sex and age, 2007-2008 to 2015-2016. *JAMA, 319*(16), 1723-1725. doi:10.1001/jama.2018.3060

Healthcare.gov. (n.d.). *Health Coverage.* https://www.healthcare.gov/glossary/health-coverage/

Healthy People.gov. (2020). *Cancer.* https://www.healthypeople.gov/2020/topics-objectives/topic/cancer

Hirschfield, S., Downing, M., Horvath, K., Swartz, J., & Chiasson, M. (2016). Adapting Andersen's behavioral model of health service use to examine risk factors for hypertension among U.S. MSM. *American Journal of Men's Health, 12*(4), 788 – 797. doi:10.1177/155798831644402

Hobbs, M., Griffiths, C., Green, M., Jordan, H., Saunders, J., & McKenna, J. (2018). Associations between the combined physical activity environment, socioeconomic status, and obesity: A cross-sectional study. *Perspectives in Public Health, 138*(3), 169-172. doi:10.1177/1757913917748353

Hulka, B.S., & Wheat, J.R. (1985). Patterns of utilization: The patient perspective. *Medical Care, 23*(5), 438 – 460. Retrieved from: https://journals.lww.com/lww-medicalcare/Citation/1985/0500/Patterns_of_Utilization_The_Patient_Perspective.9.aspx

Imes, C., & Burke, L. (2014). The obesity epidemic: The United States as a cautionary tale for the rest of the world. *Current Epidemiology Reports, 1*(2), 82 – 88. doi:10.1007/s40471-014-0012-6

Jacobs, E., Rathouz, P., Karavolos, K., Everson-Rose, S., Janssen, I., Kravitz, H., Lewis, T. & Powell, H. (2014). Perceived discrimination is associated with reduced breast and cervical cancer screening: The Study of Women's Health Across the

Nation (SWAN). *Journal of Women's Health (2002), 23*(2), 138-145. doi:10.1089/jwh.2013.4328

Jia, Y., Li, S., Yang, R., Zhou, H., Xiang, Q., Hu, T., Zang, Q., Chin, Z., Ma, D. & Feng, L. (2013). Knowledge about cervical cancer and barriers of screening program among women in Wufeng County, a high-incidence region of cervical cancer in China. *PLoS One, 8*(7), e67005. doi:10.1371/journal.pone.0067005

Jin, J. (2018). Screening for cervical cancer. *JAMA.2018*, 320(7), 732-733. doi:10.1001/jama.2018.11365

KFF (Kaiser Family Foundation). (2019). *Women's Health Insurance Coverage.* https://www.kff.org/womens-health-policy/fact-sheet/womens-health-insurance-coverage-fact-sheet/

Knox-Kazimierczuk, F., Geller, K., Sellers, S., Taliaferro, B., & Smith-Shockley, M. (2018). African American women and obesity through the prism of race. *Health Education & Behavior: The Official Publication of the Society for Public Health Education, 45*(3), 371 – 380. doi:10.1177/1090198117721610

Leone, L., Allicock, M., Pignone, M., Johnson, L., Walsh, J. & Campbell, M. (2012). Cancer screening patterns by weight group and gender for urban African American church members. *Journal of Community Health, 37*(2), 299-306. doi:10.1007/s10900-011-9445-8

Lew, K., Dorsen, C., Melkus, G., & Maclean, M. (2018). Prevalence of obesity,

prediabetes, and diabetes in sexual minority women of diverse races/ethnicities: Findings from the 2014 – 2015 BRFSS Surveys. *The Diabetes Educator, 44*(4), 348 – 360. doi:10.1177/014572178776599

Lo, K., & Fulda, K.G. (2008). Impact of predisposing, enabling, and need factors in accessing preventative medical care among U.S. children: Results of national survey of children's health. *Osteopath Medical Primary Care, 2*(12). doi:10.1186/1750-4732-2-12

Maharjan, M., & Tuladhar, H. (2018). Awareness and knowledge about screening tests for cervical cancer in patient attending obstetrics and gynecology. Out patient department at a tertiary care hospital in Lalitpur. *Medical Journal of Shree Birendra Hospital, 17*(2), 12-18. doi:10.3126/mjsbh.v17i2.20019

Manickavasagm, E., Dai, H., & Griffith, J. (2014). HPV vaccine status and BMI correlation. *Obesity and Control Therapies, 1*(4). doi:10.15226/2374-8354/1/1/00104

Merriam-Webster.com. dictionary. Merriam-Webster. https://www.meriam-webster.com/dictionary/age

Mitchell, S., & Shaw, D. (2015). The worldwide epidemic of female obesity. *Best Practice & Research. Clinical Obstetrics & Gynecology, 29*(3), 289 – 299. doi:10.1016/j.bpobgyn.2014.10.002

Monnat, S. (2014). Race/ethnicity and the socioeconomic status gradient in women's cancer screening utilization: A case of diminishing returns? *Journal of Healthcare for the Poor and Underserved, 25*(1), 332-56. doi:10.1353/hpu.2014.0050

National Institute of Health (NIH) National Cancer Institute. (n.d). *HPV and Pap Testing.* https://www.cancer.gov/types/cervical/pap-hpv-testing-fact-sheet

National Women's Law Center & State Partner (2013). *State of Women: Improving Women's Health.* https://nwlc.org/sites/default/files/pdfs/aca-factsheets/mississippi_healthstateprofiles.pdf

Ogden, C., Carroll, M, Kit, B., & Flegal, K. (2014). Prevalence of childhood and adult obesity in the United states, 2011 – 2012. *JAMA, 311*(8), 806 -814. doi:10.1001/jama.2014.732

Osborne, J., & Waters, E. (2002). Four assumptions of multiple regression that researchers should always test. *Practical Assessment, Research, and Evaluation, 8*(2).

Pew Research Center. (2018). *How Different Weighting Methods Work.* https://www.pewresearch.org/methods/2018/01/26/how-different-weighting-methods-work/

Pierannunzi, C., Hu, S., & Balluz, L. (2013). A systematic review of publications assessing reliability and validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004-2011. *BMC Medical Research Methodology, 13*(49).

Powell-Wiley, T., Ayers, C., Agyemang, P., Leonard, T., Berrigan, D., Ballard-Barbash, R., Lian, M., Das, S. & Hoehner, C. (2014). Neighborhood-level socioeconomic deprivation predicts weight gain in a multi-ethnic population: Longitudinal data from the Dallas Hearth Study. *Preventative Medicine, 66,* 22 – 27. doi:10.1016/j.ypmed.2014.05.011

RegInfo.gov. (2018). *Behavioral Risk Factor Surveillance System*. www.reginfo.gov

Roncancio, A., Ward, K., Sanchez, I., Cano, M., Byrd, T., Vernon, S., Fernandez-Esquer,M., & Fernandez, M. (2015). Using the theory of planned behavior to understand cervical cancer screening among Latinas. *Health Education Behavior, 42*(5), 621-626. doi:10.1177/1091098115571364

Robert Wood Johnson Foundation. (2018). *The State of Obesity*. https://stateofobesity.org/states/ms/

Sabatino, S., White, M., Thompson, T., & Klabunde, C., & Centers for Disease Control and Prevention. (2015). Cancer screening test use – United States, 2013. *MMWR. Morbidity and Mortality Weekly Report, 64*(17), 46-8.

Schneider, A., Hommel, G., & Blettner, M. (2010). Linear regression analysis. *Dtsch Artzbel Int, 107*(44), 776-782. doi:10.3238/artzbel.2010.0776

Siegel, R., Miller, K., & Jemal, A. (2018). Cancer statistics, 2018. *American Cancer Society Journals,* 68(1), 7-30. doi:10.3332/caac.21442

Smith, R., Andrews, K., Fedewa, S., Manassarm-Baptiste, D., Saslow, D., Brawley, D., & Wender, R. (2018). Cancer screening in the United States, 2017: A review of current American Cancer Society guidelines and current issues in cancer screening. *CA Cancer Journal of Clinicians, 67*, 100-121. doi:10.3322/caac.21392

Smith, K., & Smith, M. (2016). Obesity statistics. *Primary Care, 43*(1), 121 – ix.

doi:10.1016/j.pop.2015.10.001

Smolen, J., Thorpe, R., Bowie, J., Gaskin, D., & LaVeist, T. (2014). Health insurance and chronic conditions in low-income urban whites. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 91*(4), 637 – 647. doi:10.1007/s11524-014-9875-6

Statistics Canada. (2019). *Educational Attainment of Person*. https://www23.statcan.gc.ca/imdb/p3Var.pl?Function=DEC&Id=85134

Tabatabatai, M., Kengwoung-Keumo, J., Eby, W., Bae, S., & Guemmegne, J. (2014). Disparities in cervical cancer mortality rates as determined by the longitudinal hyperboblastic mixed effects type II model. *PLoS One, 9*(9). doi:10.1371/journal.pone.0107242

Tangka, F., Howard, D., Royalty, J., Dalzell, L., Miller, J., O'Hara, B., Sabatino, S., Joseph, K., Kenney, K., Guy, G., & Hall, I. (2015). Cervical cancer screening of underserved women in the United States: Results from the National Breast and Cervical Cancer Early Detection Program, 1997-2012. *Cancer Causes & Control, 26,* 671-686. doi:10.1007/s10552-015-0524-5

Thaxton, L. & Waxman, A. (2015). Cervical cancer prevention: Immunization and screening 2015. *The Medical Clinics of North America,* 99(3), 469-477. doi:10.1016/j.mcna.2015.01.003

Umanitoba, C. n.d. *Andersen and Newman Framework of Health Services Utilization.* http://umanitoba.ca/faculties/health_sciences/medicine/units/chs/departmental_units/mchp/protocol/media/Andersen_and_Newman_Framework.pdf

United States Census Bureau. (2017). *About Race.* https://www.census.gov/topics/population/race/about.html

Uproot Mississippi. (2016). *Building a Healthier Mississippi from the Ground Up State Health Assessment and Improvement Plan.* https://uprootms.org/wp-content/uploads/2016/09/sha_ship_report_2016_smallest-1-1.pdf

Williams, M. (2014). A qualitative assessment of the social cultural factors that influence cervical cancer screening behaviors and the health communication preferences of women in Kumasi, Ghana. *Journal of Cancer Education, 29,* 555 – 562. doi:10.1007/s13187-014-0611-4

Wong, M., Chan, K., Jones-Smith, J., Calantuoni, E., Thorpe, R., & Bleich, S. (2018). The neighborhood environment and obesity: Understanding variation by race/ethnicity. *Preventative Medicine, 111,* 371 – 377.

World Health Organization. (2019). *Screening for Cervical Cancer.* https://www.who.int/cancer/detection/cervical_cancer_screening/en/

World Health Organization. (2018). *Sexual and Reproductive Health: WHO Leads the Way Towards Elimination of Cervical Cancer as a Public Health Concern.* https://www.who.int/reproductivehealth/cervical-cancer-public-health-concern/en/

World Population View. (2018). *Mississippi Population 2020.* https://worldpopulationreview.com/states/mississippi-population

World Population View. (2019). *Mississippi Population 2020.* https://worldpopulationreview.com/states/mississippi-population

Yao, J., Li, S., Yang, R., Zhou, H., Xiang, Q., & Feng, L. (2014). Knowledge about

cervical cancer and barriers of screening program among women in Wufeng County, a high-incidence region of cervical cancer in China. *PLoS One, 8*(7). doi:10.1371/journal.pone.0067005

Zhao, S., Yao, D., Chen, J., Ding, N., & Ren, F. (2015). MiR-20a promotes cervical cancer proliferation and metastasis in vitro and in vivo. *PLoS ONE* 10(3): e0120905. doi:10.1371/journal.pone.0120905