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# HPV Vaccination and Cervical Cancer Prevention in Women

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This is to certify that the doctoral dissertation by

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Walden University
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Abstract

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MH, Clayton State University 2011

BS, Clayton State University 2013

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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## Abstract

Cervical cancer is the second most common cancer in women worldwide and is mainly caused by the human papillomavirus (HPV). The purpose of this study was to determine whether there was a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine compared to women who did not receive the vaccine, while considering demographic factors (race, ethnicity, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). This research study, guided by the social cognitive theory, consisted of secondary data analysis from the 2017 Behavioral Risk Factor Surveillance System for the females ages 18 to 60 who were diagnosed with cervical cancer as well as those who tested negative for cervical cancer. Females may or may not have received the HPV vaccine. Data were analyzed using binomial logistic regression analysis. Ethnicity was a significant predictor of cervical cancer diagnosis, $B$ = -1.93, OR = 0.15, $p < .001$, indicating that Hispanic individuals were 0.15 times as likely to have a diagnosis of cervical cancer. Based on the findings of this study, health care organizations may wish to raise awareness of cervical cancer among certain ethnic or racial groups. Furthermore, there could be a more proactive approach to cervical cancer prevention and detection. The potential positive social change that could result from this study is increased rate and timely administration of HPV vaccination for women, which may lead to lower death rates from cervical cancer.

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# Dedication

To my beautiful twins Kaylie and Kylie Simmons who faced many life-threatening complications after being born at only 24 weeks. This journey has been filled with heartaches and pain; however, through those trying times they continued to fight daily and have beat the odds. I am forever grateful for my miracles and the joy they bring to me daily. To my family and friends, I also thank you for your encouragement, support, and daily motivation.

## Acknowledgments

I would like to acknowledge everyone who played a role in my academic accomplishments, your motivation has been a great tribute of my success overall. I would like to specially thank Dr. Naser for the valuable guidance, insights, and suggestions provided to me on my research work. Also, thanks to all my committee members, each of whom were very patient and provided great advice and guidance throughout the research process. Thank you all for your unwavering support during this journey.

I also appreciate the support that all my family members and relatives provide to me while I was working on my research. Thanks to the almighty God!!! As my project wouldn't have seen the light of the day without blessings.

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# Chapter 1: Introduction to the Study

Cervical cancer is the second most common cancer in women worldwide and is mainly caused by the human papillomavirus (HPV; Fisher & Brundage, 2009; Hughes, 2009). Cervical cancer accounted for 9% (529,800) of the total new cancer cases worldwide and 8% (275,100) of the total cancer deaths among females in 2008 (Jemal et al., 2011). In the year 2017, 12,820 women in the United States were diagnosed with cervical cancer, and there were 4,210 deaths (American Society of Clinical Oncology [ASCO], 2018). Further, more than 85% of cervical cancer cases and deaths occur in developing countries. India, the second most populous county in the world, accounts for 27% (77,100) of the total cervical cancer deaths (ASCO, 2018). Preventive measures are needed and therefore the HPV vaccine is recommended for females between 13 and 60 years of age (Lindau et al., 2001).

In the state of Alabama, the incidence of and death rate for cervical cancer is among the highest in the United States (Miller, 2016). However, HPV vaccination in Alabama is currently not widely implemented in the state (Miller, 2016). It is important to determine a more accurate period when HPV vaccine should be administered particularly among teenage females. Literature about HPV vaccination and cervical cancer is abundant, but little research has been found about personal risk factors, factors affecting access to health care, and HPV vaccination in women based on demographic factors. The potential positive social change that could result from this study is increased rate and timely administration of HPV vaccination for women, which may lead to lower death rates (Centers for Disease Control and Prevention [CDC], 2017). In this chapter, I

will present information about the background for this study, purpose of this study, research questions, theoretical framework, nature of study, assumptions, limitations, and significance of this study.

## Background

Cervical cancer is a type of cancer that affects a woman's cervix, the lower portion of the uterus that connects it to the vagina ("Cervical Cancer," n.d.). Cervical cancer starts in the cells lining the cervix—the lower part of the uterus (womb; American Cancer Society, 2018). These cancer cells grow uncontrollably, forming a tumor that may spread to tissues around the cervix and may even break off and end up in other parts of the body (Garvit, 2012). But HPV vaccine and its timely administration plays a significant role in controlling the incidence of cervical cancer (Petry, 2014). HPV is one of the most common sexually transmitted infections (Williams et al., 2015). However, despite the availability of vaccines to prevent HPV, the U.S. vaccination rate falls below the 80% national objective.

Furthermore, previous research has reported the associations between HPV vaccine acceptability and parental characteristics, including sociodemographic factors, knowledge, perceived vaccine effectiveness, risk perceptions, and vaccine cost (Williams et al., 2015). Family history is beyond control when assessing the risks for cancer, but if the mother or sister of a patient has had cervical cancer, the likelihood of developing cancer increases by two to three times (American Cancer Society, 2018). Women who have a weak immune system due to HIV or taking immunosuppressive drugs can have a weaker immune system to fight off early cancer (Blake et al., 2015). Research shows that

patients who have chlamydia infection are at an increased risk for developing cancer of the cervix as well (Hirth et al., 2015). Therefore, the HPV vaccine is recommended for females between 13 and 60 years of age (Arbyn et al., 2015).

This study addressed possible demographic and personal risk factors for cervical cancer leading to higher death rates in certain racial groups of females (Tabatbhai et al., 2014). For example, in the state of Alabama, the death rate due to cervical cancer is higher in Black women as compared to White women (Miller, 2016). Research reveals that the incidence rate of cervical cancer is 10.1 in White females and 7.6 in Black females, whereas death rate due to cervical cancer is 3.4 in White females and 5.4 in Black females (rates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population)(CDC, 2017). This indicates that out of the women who are diagnosed with cervical cancer, approximately 71% of Black women succumb to cervical cancer, whereas for White women, it is only around 33%.

## Problem Statement

Cervical cancer is the third most diagnosed cancer and the fourth leading cause of cancer death in females worldwide (Miller, 2016), which has disproportionately affected certain racial groups (CDC, 2017). In 2017, 12,820 women in the United States were diagnosed with cervical cancer, and 4,210 died from the disease (ASCO, 2018). The rate of the diagnosis of cervical cancer in Alabama is much lower than the national survey's results, which could be attributed to several system barriers such as perceived lack of patient interest, insufficient reimbursement, and perceived parental hesitancy (Hastings et al., 2017).

In the past 40 years, the cases of cervical cancer and death rates have substantially subsided because of an increased number of women obtaining pap tests more frequently, which reveals cervical precancerous before it has extended its stage of cancer (CDC, 2017). But research has suggested that the HPV vaccine provision in community pharmacies is low. Of pharmacies providing vaccinations, only 11.7% had the HPV vaccine in their inventory (Hastings et al., 2017). As 68.1% of pharmacists reported that they do not plan to offer or continue offering the vaccine in the next year. Thus, future research should demonstrate successful HPV vaccine services in community pharmacies and outline strategies to overcome system barriers and parental hesitancy (Hastings et al., 2017). The study was conducted to address possible risk factors in reference to cervical cancer vaccination programs.

## Purpose of the Study

The purpose of this study was to determine whether there was a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine compared to women who did not receive the vaccine, considering demographic factors (race, ethnicity, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). An additional purpose of this study was to determine whether there was a significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received and the presence sexual activity.

## Research Questions and Hypotheses

Research Question 1: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care)?

$H_0$1: There is no statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care).

$H_1$1: There is a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care).

Research Question 2: Is there statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use)?

$H_0$2: There is no statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use).

$H_1$2: There is a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use).

Research Question 3: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity?

$H_0$3: There is no statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity.

$H_1$3: There is a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on race, the number of HPV shots received, and the presence of sexual activity.

## Theoretical Framework

The theory that guided the study was social cognitive theory. Social cognitive theory provides a framework for understanding, predicting, and changing human behavior (Ryan, 2012). The theory identifies human behavior as an interaction of personal factors, behavior, and the environment (Bandura, 1989). Social cognitive theory was helpful for understanding and predicting both individual and group behavior and identifying methods in which behavior can be modified or changed. The theory helped

explain the pattern of change in human behavior regarding administration of HPV vaccine during adolescence. The constructs used to measure the theory are divided into dependent and independent constructs. The dependent constructs are learning and change in behavior that would be measured in terms of incidence of cervical cancer; independent constructs are personal factors (initiation of sexual activity, ethnicity, and lifestyle), behavior (socioeconomic status), and environment (geographic location). The dependent constructs of the theory depend on and respond to independent constructs of the theory. This theory was chosen to provide an explanation incidence of cervical cancer as an interaction of personal factors (initiation of sexual activity), behavior (lifestyle), and environment (socioeconomic status; Bandura, 1989). A more detailed discussion of social cognitive theory will be provided in Chapter 2.

## Nature of Study

This research study used a quantitative research methodology, which was the most appropriate because it emphasizes objective measurements and numerical/statistical data for accurate explanation of a phenomenon. This study consisted of secondary data analysis from the 2017 Behavioral Risk Factor Surveillance System (BRFSS). Selected data from females between the ages of 18 to 60 who had been diagnosed with cervical cancer as well as females who tested negative for cervical cancer was reviewed. The independent variables were race, ethnicity, level of education, household income, type of healthcare coverage, delay in receiving medical care, sexual orientation, cigarette use, diet, type of contraception use, number of HPV shots received, and the presence of sexual

activity. The dependent variable of the study was the diagnosis of cervical cancer. The data collected were analyzed using binomial logistic regression analyses.

## Definitions

*Human papillomavirus (HPV):* HPV is a viral infection that is passed between people through skin-to-skin contact. Each HPV virus in this large group is given a number that is called its HPV type (CDC, 2016). There are more than 100 varieties of HPV, 40 of which are passed through sexual contact and can affect the genitals, mouth, or throat (NCI Dictionary, n.d.).

*Sexually active:* Sexual activity in this study refers to sexual touching, oral sex, anal sex, or vaginal sex (signalhealth, n.d.).

*Socioeconomic status:* Socioeconomic status is a theoretical construct encompassing individual, household, and/or community access to resources. It is commonly conceptualized as a combination of economic, social, and work status, measured by income or wealth, education, and occupation, respectively (Psaki et al., 2014).

## Assumptions

The assumptions of this research study were that participants were truthful in the information that they provided for dataset and that the variables that were used in this study were available in the dataset. It was also assumed that the sample represents the population and that the variables were measurable. It was also assumed that inclusion and exclusion criteria of the study are appropriate (Hartas, 2010). Another assumption was that the diagnosis of cervical cancer had been confirmed by a licensed physician. Finally,

the assumption was that information collected from the dataset is accurate; however, there is the possibility that a piece of information was not correctly recorded due to human error.

## Scope and Delimitations

This study was limited to women between 18 to 60 years of age and only to females to make the study feasible, because I focused on the disparity between women of different races regarding the diagnosis and mortality rate of cervical cancer. The threats to validity included internal validity threats, external validity threats, construct validity threats, and statistical conclusion validity threats. A threat to internal validity could arise from the previous experiences of the participants that could influence the results. A threat to external validity could be that the results of the study may not be generalizable to a larger population of women in the United States, as the information is limited to a smaller sample size. Statistical conclusion validity threats might arise if the conclusion of the research study is influenced by the Type-I error rates during data collection.

The theories that were considered but not used included the self-efficacy theory and the health belief model. The self-efficacy theory is based on the belief that some people have the capability to produce the effect (Bandura, 1977). That is, it addresses the power and ability to perform the courses of actions needed to manage situations. This theory was not used because it was impossible to exclude outcome considerations from efficacy expectations. The health belief model is based on following core beliefs based on perceptions, which include perceived susceptibility, perceived severity, perceived barriers, perceived benefits, perceived efficacy, perceived control, and perceived threat.

The theory also considers variables like demographic variables and predicts the probability of the studied individual to continue with the recommended health actions which may be preventive or curative by nature (Glanz et al., 2002). However, this model was not used as it does not account for a person's attitudes, beliefs, or other individual determinants that dictate a person's acceptance of a health behavior.

## Limitations

The major limitation of the study was that the data collected through a questionnaire may have been biased and the participants may not have answered accurately. As I used secondary data for my analysis, I was not able to address these limitations. Another major limitation is the progress in the HPV vaccine over the period when it was administered to the selected sample and the time of the research study. The gap between the time of the collected data and the timing of the research study has witnessed technological changes that might impact the validity of the research. In order to address this limitation, I used the most recent available data relevant to my study.

## Significance

The results of this quantitative study uniquely addressed the necessity for administration of HPV vaccine in the women regardless of their age, ethnicity, and economic status. The study results may enlighten individuals, the community, and society about cervical cancer prevention from the perspective of women who suffered from the disease. The potential positive social change that could result from this study is increased rate and timely administration of HPV vaccination for women to decrease the incidence of cervical cancer of women and lower the death rate due to cervical cancer. This

research could also promote positive social change and advance knowledge by raising awareness about the significance of HPV and the advantages of HPV vaccine in preventing cervical cancer in women. The study may encourage routine administration of HPV vaccine during adolescence as a professional practice in the United States to prevent cervical cancer.

## Summary

This quantitative study consisted of secondary data analysis from the 2017 BRFSS for females 18 to 60 years of age to determine whether a statistically significant relationship existed between demographic and personal risk factors, HPV vaccination, and cervical cancer throughout the United States. In Chapter 2, I provide my literature search strategy, theoretical framework, and provide an overview of the current literature on my research topic.

# Chapter 2: Literature Review

The prevalence and rise in the new cases of cervical cancer is witnessed in the developing areas (Petry, 2014), and the rate of cervical cancer has increased worldwide despite vaccine availability (Guglielmo et al., 2014). The purpose of this study was to determine whether there was a statistically significant difference in the diagnosis of cervical cancer between women who did and did not receive the HPV vaccine based on demographic factors (race, ethnicity, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). I also examined whether there was a significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received and the presence or absence of sexual activity.

Chapter 2 will present information about the literature search strategy, the theoretical framework, and a review of the literature related to cervical cancer, the HPV vaccine, the incidence rate and death rate among women due to cervical cancer, the factors associated with cervical cancer, and the preventive measures required to control morbidity and mortality rates of cervical cancer as well as previous similar studies and methodology used.

## Literature Search Strategy

Literature was searched using Google along with the Walden Library Health Sciences Research databases. Information was retrieved by searching through PubMed, ProQuest, Google Scholar, Science Direct, and included peer reviewed journals,

encyclopedias, scholarly articles, and books. The search terms that were used included *cervical cancer and HPV, HPV vaccine, cervical cancer incidence in Alabama, death rate in Alabama, HPV vaccine benefits and effectiveness, cervical cancer in teenage girls, resistance towards HPV vaccine, socioeconomic status and cervical cancer, cervical cancer and ethnicity*, *social cognitive theory, quantitative research methodology, binomial logistic regression, G-Power,* and *sample size*.

The literature was searched from the year 2009 to current year. Every keyword searched resulted in 150 to 200 results. All articles were peer reviewed. However, not all the articles retrieved by the search were full text. For some of the articles, only the abstract was available, but only full-text articles were used for the literature review. The numbers for full-text articles after narrowing the inquiry reduced considerably. The numbers of results also declined considerably when researched using Google Scholar.

The reference list of the articles and research studies selected provided additional articles and resources. Several sources and the information from the Health Information National Trends Survey was also relied on and included as per the relevance to my topic. Some sources that provided significant information from older publications were also included. Several journals exclusively for women's health and related to cancer were included as they provided unique and significant information. The magazines and opinion surveys available through Google were also considered for obtaining more relevant information and to keep searching for more reliable information.

## Theoretical Foundation

The social cognitive theory served as the theoretical framework for this research. The theory originated from Albert Bandura (Bandura, 1989). The unique feature of the social cognitive theory is the emphasis on social influence and its emphasis on external and internal social reinforcement (Bandura, 1989). This theory takes into consideration the unique way in which individuals acquire and maintain behavior while also considering the social environment in which individuals perform the behavior (LaMorte, 2016). The theory also considers a person's past experiences which factor into whether behavioral action will occur (Ryan, 2012). These past experiences influence reinforcements, expectations, and expectancies, all which shape whether a person will engage in a specific behavior and the reasons why a person engages in that behavior (LaMorte, 2016). For example, social cognitive theory can help explain how people adapt healthier habits and reduce unhealthy habits (Bandura, 2004, p. 146).

The purpose of social cognitive theory is to explain how people regulate their behavior through control and reinforcement to achieve goal-directed behavior that can be maintained over time (LaMorte, 2016). The theory identifies human behavior as an interaction of personal factors, behavior, and the environment (Bandura, 1989). The six constructs of the social cognitive theory are reciprocal determinism, behavioral capability, observational learning, reinforcements, expectations, and self-efficacy (Bandura, 1989). Reciprocal determinism refers to the dynamic and reciprocal interaction of person (individual with a set of learned experiences), environment (external social context), and behavior (responses to stimuli to achieve goals) (Bandura, 1989). Thus, all

three factors—environment, behavior, and personal factors—interact and influence each other. This construct relates to my study as the change in behavior (i.e., the dependent variable incidence of cervical cancer) could be observed based on the environment (i.e., the independent variable administration of HPV vaccine) as well as personal factors (i.e., the covariates of race, ethnicity, socioeconomic status).

Behavioral capability refers to a person's actual ability to perform a behavior through essential knowledge and skills (Bandura, 1989). This construct requires providing adequate knowledge and skills for desirable behavioral changes. This construct relates to my study as knowledge and skill (i.e., awareness and accessibility of HPV vaccine) would result in change of behavior (i.e., more people opting for HPV vaccination).

Observational learning asserts that people can witness and observe a behavior conducted by others and then reproduce those actions (Bandura, 1989). For example, witnessing the benefits of HPV vaccination can lead to more receiving the vaccine. Similarly, reinforcements refer to the internal or external responses to a person's behavior that affect the likelihood of continuing or discontinuing the behavior (Bandura, 1989). This construct is applicable to the people in helping them continue with the behavior (dosages of HPV vaccination) based on their internal and external responses.

Expectations refer to the anticipated consequences of a person's behavior. Outcome expectations can be health-related or not health-related. People anticipate the consequences of their actions before engaging in the behavior, and these anticipated consequences can influence successful completion of the behavior (Bandura. 1989). Here

expectation refers to the successful prevention from cervical cancer before engaging in the behavior (administration of HPV vaccine).

Finally, self-efficacy refers to the level of a person's confidence in his or her ability to successfully perform a behavior (Bandura, 1989). This construct refers to the mental strength of the individuals before they engage in a behavior (e.g., HPV vaccination). Social cognitive theory is helpful for understanding and predicting both individual and group behavior and identifying methods in which behavior can be modified or changed. This theory can help in understanding the pattern of change in human behavior regarding administration of HPV vaccine during adolescence. This theory is the most appropriate for my research study because it helped identify the incidence of cervical cancer as an interaction of personal factors (initiation of sexual activity), behavior (lifestyle), and environment (geographic location, socioeconomic status).

In previous research, social cognitive theory has been used to explain health behavior like exercise as well as self-management of chronic disease. Allen (2004) examined the literature on diabetes research using social cognitive theory to determine its predictive ability in explaining exercise behavior and to identify key interventions that enhance exercise initiation and maintenance. In correlational studies, a significant relationship was found between self-efficacy and exercise behavior. The predictive ability of outcome expectancies for exercise behavior demonstrated mixed results. However, self-efficacy was predictive of exercise initiation and maintenance over a period.

Additionally, Sell et al. (2006) reviewed literature and demonstrated several gaps in the literature regarding use of social support in self-management, impact of moral disengagement, and studies specifically targeting older adults. The integrative review explicated two areas related to the theory in need of further research. First, social support has not been thoroughly explored as a mechanism for enhancing self-management interventions. Second, moral disengagement was not identified as a focus within chronic disease research raising the question about the impact of moral disengagement on long-term adherence and behavior change.

## Literature Review Related to Key Concepts

### Cervical Cancer Overview

Cervical cancer is a type of cancer that affects a woman's cervix, which is mainly caused by HPV, a sexually transmitted disease transferred through intercourse with someone that has been previously affected ("Cervical Cancer," n.d.). Because it is acquired through sex, it is mostly contracted around the time of sexual maturity when a female's immune system defenses are at their lowest. When infected, a woman's immune system in some cases can fight off the disease and stop it before it develops into cervical cancer (Gravitt, 2012). But in 60% of cases, a woman cannot fight off the disease and cervical cancer precursor lesions are formed (Gravitt, 2012). These lesions cause some of the affected epithelial cells on the woman's uterus to transform into cancer cells and then a tumor, which may spread to tissues around the cervix and may even break off and end up in other parts of the body ("Cervical Cancer," n.d.).

Early cervical cancer has no manifestation in women and can go unnoticed until it is too late. But when the disease progresses far enough, there are a few signs that women should be aware of to recognize cervical cancer (Gravitt, 2012). One of the signs is blood or discharge from the vagina during or after sex, between menstrual cycles, or after menopause. This discharge may be thick, watery, and have a distinguishable foul odor. Another sign is experiencing pain in the pelvic region during intercourse ("Cervical Cancer," n.d.). These signs should be noted and followed up by a health care professional.

The controllable risk factors associated with cervical cancer also need to be made clear to patients to decrease the odds of getting the disease. Smoking can cause a person to be two times more likely of getting cervical cancer (Gravitt, 2012). The chemicals that come from smoking are carried throughout the bloodstream and can be found in the cervical mucus of those who smoke, and smoking causes the immune system to become less effective in fighting off HPV. A diet with low amounts of fruits and vegetables and being overweight can also increase the probability of developing cancer of the cervix (Gravitt, 2012).

Family history is out of the control of anyone looking at the risks for cancer, but if the mother or sister of a patient has had cervical cancer, the likelihood of developing cancer increases by two to three times (American Cancer Society, 2018). The daughters of a mother who took diethylstilbestrol during pregnancy to prevent a miscarriage are at an increased risk for cancer of the cervix. Another medication that can increase the risk includes birth control pills. The long-term use of birth control pills places a patient at an

increased risk during use, but when the medication is stopped, the risk goes back to before the use began.

Other factors that increase risk of cervical cancer are related to pregnancy, having a weak immune system or chlamydia, taking birth control, and level of income. Having three or more full term pregnancies places a woman at a higher risk for cancer. Additionally, a full-term pregnancy at an age younger than 17 years old increases the risk for cervical cancer to two times more likely when compared to women who waited until 25 years old or order to have children (Blake et al., 2015). Further, women who have a weak immune system due to HIV or taking immunosuppressive drugs can cause the body to have a weaker immune system to fight off early cancer (Blake et al., 2015). Research also shows that patients who have chlamydia infection are at an increased risk for developing cervical cancer, which they might not be aware of until a pap smear (Hirth et al., 2015). Gynecologists have also reported that low-income individuals are at more risk for having cancer due to not being able to early detect some of the risk factors (Wong & Do, 2012). Teaching patients the risk factors for cervical cancer allows them to change the things that can be altered and be aware of the factors that cannot be changed to make sure they get examined regularly for cancer of the cervix.

Further, research has revealed that Black women in the United States are dying from cervical cancer at a rate 77% higher than previously thought, whereas White women are dying at a rate 47% higher (Cancer Vaccine Week, 2017). Alabama has the highest cervical cancer death rate in the United States, and Black women are almost twice as likely to die of the disease as White women (roughly 5.2 Black women for every 2.7

White women). This disparity is significant because cervical cancer is preventable and treatable with adequate gynecological care and early screenings, which generally lead to a 93% 5-year survival rate. But delayed treatment worsens those chances, and across the Black Belt, institutionalized racism leaves women neglected by the state's crumbling social infrastructure (Chen, 2018). In Alabama, women are dying from the disease at rates that are higher than in any other state in the United States. Nationwide, Black women are more likely to die from this disease than women from any other racial or ethnic group (Chen, 2018).

Cervical cancer can be prevented to a significant extent if screening is done proactively (Guglielmo et al., 2014). The HPV vaccine and its timely administration also play a significant role in controlling the incidence of cervical cancer (Petry, 2014). But there is a link between the attitude toward cervical cancer prevention and the abnormalities caused by cervical cancer. There was an examination done to verify whether women with a history of cervical abnormalities expect reactions to cervical cancer. The measurement was related to the proficiencies of cervical abnormalities that elaborate politics, outlooks, and actions that are associated with cervical cancer prevention. The report showed that these women were more positive of observations of pap testing and HPV vaccination than women who had obtained normal pap testing results (The Association Between Cervical Abnormalites and Attitudes Toward Cervial Cancer Prevention, n.d.). Pap tests were perceived as being more effective at reducing the chance of developing cervical cancer in women if vaccination took place. Intent to vaccinate their daughters against HPV were highest among women who had cervical

cancer, women who had hysterectomies, and women who were treated for precancerous lesions (each $p < 0.05$). That is, HPV vaccination was favored by the women who had already suffered cervical cancer abnormalities compared to healthy women.

In terms of prevention, research has also evaluated the efficiency of HPV vaccines. Two distinct vaccines were evaluated, Gardasil a quadrivalent vaccine containing virus-like particles of types 6, 11, 16 and 18 and Cervarix, a bivalent vaccine containing virus-like particles of types 16 and 18 (Schiller et al., 2012). Both vaccines exhibited excellent safety and immunogenicity profiles. The vaccines also demonstrated remarkably high and similar efficacy against the vaccine-targeted types for a range of cervical endpoints from persistent infection to cervical intraepithelial neoplasia grade 3 (CIN3) in women naïve to the corresponding type at the time of vaccination. However, protection from incident infection or disease from non-vaccine types was restricted, and the vaccines had no effect on prevalent infection or disease.

## Sociocultural Factors and Cervical Cancer

Cervical cancer offers an example of how sociocultural factors such as gender, ethnicity/race, class, and attitudes toward sexuality converge to shape the risk and experience of cancer among women.

### *Race and Ethnicity*

Race refers to the categorization of human beings into several groups based on their physical traits, ethnicity, or genetics such as color of skin (Templeton, 2013). Analyzed trends in imposing cervical cancer prevalence in relation to 35-year period reveals that the death rate due to cervical cancer is higher among Black women as

compared to White women in Alabama though the incidence rate of cervical cancer is higher in White women (Cervical cancer overview, 2012). Perceived susceptibility to cervical cancer in Hispanic women seems to be influenced more importantly by the current or past perception of HPV/STI exposure, and by having a relative with cancer (Garcés-Palacio & Scarinci, 2012).

A gap was identified about the awareness and knowledge of HPV and HPV vaccine by race and ethnicity (Blake et al., 2015). Women living in rural areas and of lower socioeconomic status lead in cervical cancer mortality rate as compared to the women from urban areas. Further, the death rate due to cervical cancer is higher among Black and Hispanic women as compared to non-Hispanic White women. The gap existed not only in awareness and in knowledge about HPV and HPV vaccine, but also in obesity level and cancer screenings (Jacqueline et al., 2015).

The evaluation of 4,992 women for Pap testing suggested that White women with a higher household income reported a Pap test with 95% confidence interval as compared to Black women and other White women with lower household income (Jacqueline et al., 2015). Research also suggested that insurance coverage also played a crucial role for cancer screenings for both Black and White women (Madadi et al., 2014). Research has shown that less than 64.1 percent of low-income populations, specifically African American and Hispanic women, undergo cervical cancer screenings (Hirth et al., 2015). This leads to a higher incidence rate of HPV in these specific populations. Data suggested that 11.5 percent of African American and 14.2 percent of Hispanic women have a diagnosis of cervical cancer (Hirth et al., 2015). This value is greatly elevated from 8.8

percent of the general population (Hirth et al., 2015). Some of the suspected factors for this data include socioeconomic factors, lack of a stable form of healthcare, being uninsured, not feeling that they are at risk for cervical cancer, and different beliefs regarding the occurrence and treatment of cancer (Ackerson & Gretebeck, 2007).

***Socioeconomic Status***

Socioeconomic status is the social standing or class of an individual or group (Lai et al., 2013). It is often measured as a combination of education, income and occupation. The awareness about the HPV vaccine and its administration depends upon the education and income of the individual (Ramirez et al., 2013). Socioeconomic status could be a barrier in prevention of cervical cancer as the awareness about the adequate measures of vaccination is not provided in the ethnic group. The most important aspect being education as it impacts the awareness as well as understanding of the people regarding the vaccination (D'Orazio et al., 2014).

Women living in rural areas and of lower socioeconomic status lead in cervical cancer mortality rate as compared to the women from urban areas (Kontos et al., 2012). Further, the death rate due to cervical cancer is higher among African American and Hispanic women as compared to non-Hispanic White women (Kontos et al., 2012). Socioeconomic status influences education level as well as the capacity to seek insurance coverage. Women with lower socioeconomic status tend to receive lower level of education and have lower insurance coverage, which in turn, results in lack of cancer screenings and vaccination (Kontos et al., 2012). The U.S. Census Bureau reports an increased poverty rate of approximately 25 percent among African American and

Hispanic individuals (Semega et al., 2017). This far exceeds the 8.6 percent poverty rate for non-Hispanic White individuals (Semega et al., 2017). For the 41 percent of this population that is uninsured, the costs of cervical cancer screenings may not be affordable for them (Semega et al., 2017).

Along with the cost burden, many women in this population have misconceptions about what the diagnosis of cervical cancer could mean to them (Ramirez et al., 2013). When asked what they believe about cancer, Hispanic and African American women responded with saying that "cutting into cancer can make it spread," that "the treatment of cancer is worse that the disease," and that "there is very little a person can do to reduce their risk of cancer". Others also stated that if they are not participating in "risk-taking sexual activities" than there is no need to get screened (Ramirez et al., 2013).

Research indicated that the most basic reason these women chose not to get screened is because their healthcare provider did not explicitly recommend it to them (Ackerson & Gretebeck, 2007). This highlights the necessity for the medical personnel to reach into these communities and provide patient teaching as well and encouragement to get screened.

***Location of Residence***

Geography influences the incidence of cervical cancer based on the awareness and availability of the vaccines in the region (Anhang et al., 2011). It is realized that women in rural areas exhibit higher mortality rates due to cervical cancer as compared to the women living in urban areas. This is also because women in rural areas have low

accessibility of information and knowledge about HPV vaccine and associated cervical cancer (Anhang et al., 2011).

***Sexual Lifestyle***

Sexual lifestyle refers to the initiation of sexual activity, number of sexual partners, and the usage of contraceptives (Finer & Phiblin, 2013). These all influence the incidence of cervical cancer among women. Initiation of sexual activity at a very early age increases the risk of HPV infection (Finer & Phiblin, 2013). In addition, unprotected sex with multiple partners increases the possibility of HPV infection (Finer & Phiblin, 2013). The usage of contraceptive pills for longer duration also increases the possibility of HPV infection among the females (Ramirez et al., 2013).

***Attitude Toward Vaccination***

Vaccination is a recognized tool by the medical community for prevention of particular diseases and for promotion of public health. However, there are individuals who doubt the benefits and the needs of the vaccination; and consciously decide not to be vaccinated. This practice of discarding vaccination is also termed as vaccine hesitancy, which soon is transformed into vaccine refusal (Arbyn et al., 2015)). Hesitancy is not clear rejection, but the resistance towards vaccination which later combine with lack of awareness about vaccine benefits results in a decision to not get vaccinated.

The attitude towards vaccination, in general, largely depends upon awareness about the vaccine benefits. The attitude of ‘hesitancy’ can be changed towards desire of being vaccinated by adequate communication between the target population and the providers of the vaccine. The attitude towards vaccine is also impacted with experiences

of kith and kin (Arbyn et al., 2015). That is, ‘hesitancy’ changes to rejection if vaccine goes ineffective for anyone in the family or friends.

The acceptance of HPV vaccination for teenage girls also depends upon parental beliefs about cancer and their trust in health information. It was found that parents were more likely to accept the vaccine if they perceived a higher risk of getting cancer themselves and if they had a higher level of trust in health information from medical authorities. Perceived severity of cancer and fatalistic beliefs about cancer prevention did not predict vaccine acceptance (Nan et al., 2014). It is vital that parents understand the benefits of HPV vaccine and accept the same for their daughters well in time in order to reap the best benefits and enhanced effectiveness of the vaccination against fatal cervical cancer.

Research suggests, however, that many women do not regularly attend routine cervical screenings due to both knowledge deficit, as well as fear of results; as many as 38% of women are not seeking cervical screenings due to the latter reasoning (Petry, 2014). This is a big concern to many medical professionals because detection time and survival rate are very positively correlated. A key role of nursing care is to reduce this anxiety and fear by providing support and care for each patient as needed (Nan et al., 2014).

In addition to keeping women informed and at ease, education regarding cervical cancer and HPV vaccination should be provided to both genders on the importance of sexual health and particularly, wearing condoms during intercourse (Blake et al., 2015). HPV infection has been recognized as the main risk factor in the development of cancer.

Condoms can reduce the rates of HPV infections along with immunizing young females (Blake et al., 2015).

**Cervical Cancer Screening and Treatment**

HPV is a highly prevalent, sexually transmitted infection that causes cervical cancer and contributes towards increasing rates of mortality and morbidity. HPV is primarily responsible for both high grade and low-grade cervical lesions. HPV types that are the most common HPV types found in cervical cancer are HPV 16 and 18 and are responsible for approximately 70% of these cancers (Petry, 2014). On the other hand, low-risk HPV types, the most common of which are HPV 6 and 11, cause genital warts, low-grade cervical lesions, and recurrent respiratory papillomatosis, but they do not cause cervical or other HPV-related cancers (Guglielmo et al., 2014).

The most common way that cervical cancer is found is through a Pap smear performed by a gynecologist or other healthcare professional (Ashok et al., 2012). However, there is a possibility of a false positive and false negative result for a Pap smear test. A false-positive test result indicates that one has a high-risk type of HPV when one really does not. A false-negative test result means one really does have an HPV infection, but the test indicates that one does not have any infection (Mayo Clinic, 2018). The problem of false positives and false negatives can be minimized by avoiding intercourse, douching, or using any vaginal medicines or spermicidal foams, creams, or jellies for two days before the test (Reboji et al., 2013).

According to the American Cancer Society (2012), women should begin cervical cancer screenings when they turn 21 or 3 years after beginning sexual intercourse,

whichever comes first. This is to detect any changes that occur during the early disease process. After age 30, women can begin having pap smears every 3 years and they can be discontinued altogether after the age of 70 if the screenings have been normal for the last 10 years. These guidelines do not seem to be commonly adhered to according to the CDC's research that 60% of women diagnosed with cancer have never gotten a pap smear before or have not had one in 5 years (Arbyn et al., 2015). In the case of abnormal cells, being found from the Pap smear another test will be done that is called a colposcopy (Ashok et al., 2012).

A colposcopy involves the use of a colposcopy, which is a magnifying lens device that is used on the outside of the cervix to see it clearly (Ashok et al., 2012). After looking through the colposcopy, a biopsy may need to be performed to further examine abnormal cells in the cervix. A biopsy is a procedure where some tissue from the cervix is removed for further testing. Biopsies are done to be certain if what looks to be abnormal is indeed cancer. In addition, a cystoscopy, proctoscopy, and an exam under anesthesia may be done through the insertion of a lighted tube to view other regions of the systems to see where the cancer has spread (Ashok et al., 2012).

There are many methods to screening a patient that has been suspected to have cancer of the cervix. Treatment options can then be determined through the patient and healthcare physician working together to develop a plan of action to fight the cancer. Considering pre-cancers and invasive cancers, cryosurgery or laser surgery may be the treatment chosen. Cryosurgery involves a metal probe that has been cooled with liquid nitrogen to be placed in vagina and cervix to freeze any of the abnormal cells (Miller,

2016). Laser surgery is also performed by burning off pre-cancers and removing small pieces of tissue for biopsy (Ramirez et al., 2013).

Cervical cancer that has reached stage I, can be treated, or found using a technique called conization (D'Orazio et al., 2014). Conization involves the removal of a cone shaped piece of tissue from the cervix using a surgical or laser knife (D'Orazio et al., 2014). This is the procedure of choice for women who still want to have children. In stage I or II of cervical cancer a hysterectomy may be performed (D'Orazio et al., 2014). A hysterectomy can be radical or simple, depending on the patient's specific cancer (D'Orazio et al., 2014).

A simple hysterectomy includes the removal of the cervix and uterus, while a radical hysterectomy removes more than the simple hysterectomy (D'Orazio et al., 2014). It also removes the tissues next to the uterus and the upper part of the vagina next to the cervix. A radical hysterectomy can include the removal of the ovaries, fallopian tubes, and lymph nodes as well. A radical hysterectomy is performed more in early-stage II cancers (D'Orazio et al., 2014). A trachelectomy is a procedure done in the treatment of cervical cancer but is a method that allows young women to still can give birth. The uterus is left behind during this surgery and the cervix and upper part of vagina are removed (D'Orazio et al., 2014).

The risks associated with cancer coming back in this procedure are low but creates a higher risk for miscarriages than seen in healthy women (Hawkins et al., 2010). Another treatment option for the more severe cases of cervical cancer involves the use of radiation or chemotherapy treatments. Radiation therapy is used to kill any cancer cells

and hopes to shrink any tumors (Ramirez et al., 2013). Radiation is a medical care that uses high-energy rays like an x-ray to kill the cancer cells. Radiation for cervical cancer is almost always used alongside with chemotherapy drugs. The chemotherapy drugs that a doctor prescribes can be taken PO or through an IV, and once in the bloodstream it will circulate throughout the body (Blake et al., 2015).

Chemotherapy and radiation given together can improve the chances of survival for the patient (Blake et al., 2015). Medical care can help and may also cure cases of cervical cancer. However, it is always better to prevent the incidence of cervical cancer and HPV infection. In the context of cervical cancer, it is important that nurses consistently educate their patients, particularly by promoting cervical screenings and encouraging young women to receive HPV vaccinations (Petry, 2014).

**HPV Vaccination**

HPV infection is most common in young, sexually active populations, and it is estimated that three fourths of adults will be infected with HPV during their lifetime (Guglielmo et al., 2014). To control cervical cancer morbidity and mortality rates, it is paramount that awareness and knowledge about HPV and HPV vaccine should increase. The increased knowledge of benefits of HPV vaccination should also be able to transform into willingness to accept the vaccination. The suboptimal acceptance of HPV vaccination is a worrying cause of concern (Deanna et al., 2012). Earlier, there was no effective vaccine to reduce the risk of HPV acquisition. Now, two types of HPV vaccines- quadrivalent and bivalent are available to protect against both high-risk and low-risk HPV infections (Guglielmo et al., 2014). The vaccination against HPV is

promising and can reduce HPV-associated morbidity and mortality, if adequately implemented.

It is important to study cervical cancer diagnosis and to determine the accurate time when HPV vaccine should be administered among teenage females in order to enhance the effectiveness of HPV vaccine. Preventive measures are needed and therefore, HPV vaccine is recommended for females between 13 and 60 years of age (Blake et al., 2015). The acceptance of HPV vaccine is impacted by several factors. Research indicates Lai et. al (2013) found that HPV knowledge level was high among US women, but it was not associated with the willingness to vaccinate their daughters against HPV. Further, it was also found that the white women displayed higher willingness to accept HPV vaccination as compared to Black women.

An increased vaccination rate for HPV could result in reduction of HPV infection and incidence of cervical cancer (Jacqueline et al., 2015). There are two vaccines for HPV, Gardasil and Cervarix (Ortiz et al., 2012). These vaccines tend to prevent infections by high-risk HPV types, which cause most cervical cancers (Ortiz et al., 2012). Gardasil was approved in 2006, and protects against HPV types 6, 11, 16, and 18; Cervarix was approved in 2009, and protects against HPV types 16 and 18 (Ortiz et al., 2012). It is important for the HPV vaccination to be administered and all 3 doses are completed on time for the vaccine to be effective (Ortiz et al., 2012).

***Timing of Vaccination, Adolescence vs Post Adolescence***

The timing of HPV vaccination is crucial in prevention of the incidence of cervical cancer. Optimally, the HPV vaccine should be administered before sexual

initiation (Deanna et al., 2012). The systematic review and meta-analysis to evaluate the efficacy and safety of HPV vaccines in preventing cervical intraepithelial neoplasia grades 2 and 3 (CIN2 and CIN3), adenocarcinoma in situ (CIN2+) and cervical cancer suggested that the vaccines currently available are effective, safe, and capable of preventing CIN2+ lesions (Rey-Ares et al., 2012). The public health benefits of the vaccine and cost effectiveness have been validated in multiple studies (White, 2014). For female patients, the cervical cancer prevention with vaccine administration remains superior to cervical cancer screening programs employing Papanicolaou smears alone (Holman et al., 2014).

The CDC recommended schedule is for routine HPV vaccination at ages 11 and 12, with catch-up vaccination up to age 26 for females (Markowitz et al., 2014). Guidelines recommend that age-eligible women with past exposure to HPV should still be vaccinated. Little is known about how primary care providers (PCPs) use sexual history and HPV and Pap tests in their HPV vaccine recommendations (Deanna et al., 2012). A healthcare provider's recommendation is the strongest known predictor of initiation and completion the 3-dose HPV vaccine series (Dorell et al., 2012, Kessels et al., 2012).

***Availability and Accessibility to Vaccination***

This is a major concern as the availability and accessibility of HPV vaccination is important to control the incidence of cervical cancer. This depends upon the geographical location and socioeconomic status of the people (D'Orazio et al., 2014). It is important to create high level awareness about the benefits of the vaccination and to make it available

and accessible for every woman. The rate of contraction has increased despite vaccine availability (Jacqueline et al., 2015).

Research reveals that a huge gap exists about awareness and knowledge about HPV vaccine by sex, education, income, race/ethnicity, geographic area, and other important sociodemographic characteristics (Blake et al., 2015). This gap in awareness also leads to the difference in mortality and morbidity rates caused due to HPV infection. Women living in rural areas and of lower socioeconomic status lead in cervical cancer mortality rate as compared to the women from urban areas (Ramirez et al., 2013). Further, the death rate due to cervical cancer is higher among African American and Hispanic women as compared to non-Hispanic White women (Ramirez et al., 2013).

**Previous Studies and Methodology Used**

Jassim et al. (2018) explored the knowledge, attitudes, and practices of women attending primary care health centers for cervical cancer screening among women visiting primary health care centers in Bahrain. In this cross-sectional quantitative study, 300 women were taken as a sample. A validated tool comprised of 45 items to collect data through face-to-face interviews between December 2015 and February 2016. The participants demonstrated a wide range of knowledge and attitudes towards cervical cancer screening. However, the majority demonstrated positive attitudes towards the HPV vaccine (Jassim et al., 2018).

Assoumou et al. (2015) conducted a quantitative study to assess the awareness and knowledge about cervical cancer, Pap smear testing and its use and HPV among women living in Libreville, Gabon. A total of 452 women aged 16 years and older were

recruited from different town locations. Logistic regression analysis was used to identify the effect of demographic characteristics on the level of knowledge about cervical cancer, Pap smear testing and HPV. Odds ratio and 95% confidence intervals were used to identify the strength of association. This study demonstrates a very low level of knowledge about cervical cancer, Pap smear testing and HPV in a sample of Gabonese women. There is a critical need for Gabonese women to be informed about cervical cancer and the Pap smear test to improve the use of this preventive method (Assoumou et al., 2015).

Daley et al. (2013) initiated a quantitative study to examine Pap smear knowledge among three high-risk populations at different points in time. The study employed frequencies and logistic regression to examine associations between demographic factors and accurate knowledge of Pap smear testing within three separate HPV psychosocial studies. The three studies were conducted - (1) HPV-positive women (prevaccine population in 2005-2006, $n$ = 154, mean age 23.5), (2) college women (postvaccine population in 2008, $n$ = 276, mean age 18.9), and (3) minority college women (postvaccine population in 2011, $n$ = 711, mean age 23.3) (Daley et al., 2013). Knowledge about the purpose of the Pap smear remains low. Findings underscore the significant need for clear and consistent messages among high-risk women regarding the prevention of cervical cancer and other reproductive health conditions (Daley et al., 2013).

Al-Shaikh et al. (2014) assessed the level of knowledge regarding cervical cancer and the acceptance of the human papilloma virus (HPV) vaccine among Saudi female

students in health colleges through a study. Approximately 1400 students from Health Colleges at Princess Nora Bint Abdul Rahman University, Riyadh, Saudi Arabia were conveniently selected as a sample for cross-sectional quantitative study. A self-administrated questionnaire was distributed to all participants. Data collected included socio-demographic data, knowledge of cervical cancer risk factors and clinical presentation, Pap smear, and HPV vaccine acceptance. Vaccine acceptance is influenced by its price; approximately 80% of students thought that an affordable vaccine price should not exceed 300 Saudi Riyals. Perceived barriers to the vaccine were fear of injections and vaccine side effects (Al-Shaikh et al., 2014). A lack of knowledge and misinformation exists regarding cervical cancer, Pap smear, and HPV as a major risk factor for cancer of the cervix.

## Summary and Conclusion

Research indicates that there is a difference in the awareness and knowledge about HPV vaccine by sex, education, income, race/ethnicity, geographic area, and other sociodemographic characteristics. It is important to target populations that are still unaware about the benefits of HPV vaccine. Women of lower socioeconomic status and of races such as African American, Hispanic, and Black.  need adequate knowledge about HPV vaccine and associated cervical cancer morbidity and mortality. Women living in rural areas and of lower socioeconomic status lead the cervical cancer mortality rate as compared to the women from urban areas. Further, the death rate due to cervical cancer is higher among African American and Hispanic women as compared to non-Hispanic White women. The race, level of household income, education, as well as insurance

coverage impacts the vaccination and cancer screenings among women. HPV vaccine is effective if it is administered at an early age before a woman is infected with the virus. However, if the vaccine is administered after the woman is already infected, then it would not result in positive effect. In addition, there are several types of HPV vaccines and they need to be administered taking other parameters of the women in consideration. Providers may also be recommending the vaccine to women who may receive little benefit from the vaccine. Provider and system-level efforts to improve guideline-consistent practices are needed. Chapter 3 will provide description of the research methods that will be used to conduct this study and include data collection, data analysis, and ethical considerations.

# Chapter 3: Research Method

The purpose of this study was to determine whether there was statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine compared to women who did not receive the vaccine, considering demographic factors (race, ethnicity, county of residence, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). An additional purpose of this study was to determine whether there was a significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received and the presence or absence of sexual activity. Chapter 3 includes information about the research design, methodology, data collection, data analysis, threats to validity, and ethical considerations for this study.

## Research Design and Rationale

A quasi-experimental (non-equivalent group design) for this quantitative study was selected because it allowed me to assign numerical values to the variables and manipulate and analyze a larger dataset. Additionally, it helped me to draw cause–effect inferences. These designs often use intact groups that are similar to an extent so that they are fairly compared, though the groups may not be comparable, and it is unlikely that the two groups are similar if they were assigned through a random lottery (The Use and Interpretation of Quasi-Experimental Studies in Medical Informatics, n.d.)Because it is often likely that the groups are not equivalent (as in this study), there are two groups that

are similar in several ways but are non-equivalent, which allows fair comparison between the two groups. There were no anticipated time or resource constraints in the conduct of this study.

For this study, the independent variables were race, ethnicity, county of residence, level of education, household income, type of healthcare coverage, delay in receiving medical care, sexual orientation, cigarette use, diet, type of contraception use, vaccine administration, number of HPV shots received, and the presence of sexual activity. The dependent variable of the study was the diagnosis of HPV. The research questions and hypotheses for this study are:

Research Question 1: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care)?

$H_0$1: There is no statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care).

$H_1$1: There is a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors

affecting access to healthcare (type of healthcare coverage, delay in receiving medical care).

Research Question 2: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use)?

$H_0$2: There is no statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use).

$H_1$2: There is a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use).

Research Question 3: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity?

$H_0$2: There is no statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity.

$H_1$2: There is a statistically significant difference in the diagnosis of cervical cancer in Remove women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity.

# Methodology

## Population

In 2015, in the United States there were 2,123 females were diagnosed with cervical cancer, which is 8.5 per 100,000 (Alabama Statewide Cancer Registry, n.d.). I used data from secondary data analysis from the 2017 BRFSS for females between the ages of 18 and 60 who had been diagnosed with cervical cancer.

## Sampling and Sampling Procedures

Based on the research questions and hypotheses, stratified sampling strategy was the most appropriate choice for this research study. Specifically, proportional random stratified sampling was done by race, which uniformly divided the population into different homogenous groups (Frankfort-Nachmias & Nachmias, 2008). Stratified sampling strategy ensured that all the groups are uniformly represented. The sample was females between 18 to 60 years of age with or without a cervical cancer diagnosis in the United States.

The application used to compute sample size was G*Power version 3.1.9.2. Sample size was calculated using effect size, alpha level, and power level. An alpha level of 0.05 and a power of 80% was used. Effect size (moderate) provided a higher chance to detect a difference between the groups. These parameters were used as these are the most feasible levels to avoid Type 1 and Type II errors. Based on these parameters, the sample size was 568 females based on the G* power analysis.

## Data Collection

Secondary data from the 2017 BRFSS was used to select the population that met my inclusion criteria. This is a publicly available dataset, which I accessed after obtaining institutional review board (IRB) approval from Walden University (approval #10-04-19-0470159). For this secondary data analysis, data were de-identified. Data de-identification prevents a connection between the information and an individual's identity (Clinical and Intervention Setting, n.d.)The data are stored in a password protected laptop and will be destroyed after 5 years. The federal regulations allow for IRBs to exempt research using archival data when certain conditions exist, including removing a participant's identity from the data (Institutional Review Board, 2018, para. 1).

## Operationalization of Variables

Table 1 provides specific information for each of the study variables.

Table 1

*Study Variables*

| Variable name | Variable type | Survey question # | Data codes |
|---|---|---|---|
| Diagnosis of Cervical Cancer | DV, Nominal | 6.7, 13.3 | 1 = Yes<br>2 = No<br>7 = Don't know / Not sure |
| HPV Vaccination | IV, Nominal | 19.1 | 1 = Yes<br>2 = No<br>3 = Doctor refused when asked<br>7 = Don't know / Not sure<br>9 = Refused |
| Number of HPV Shots | IV, Nominal | 19.2 | _ _ Number of shots<br>0 3 = All shots<br>77 = Don't know / Not sure |
| Race | IV, Nominal | 8.4 | 10 = White<br>20 = Black or African American<br>30 =American Indian or Alaska Native<br>40 = Asian<br>41 = Asian Indian<br>42 = Chinese<br>43 = Filipino<br>44 = Japanese<br>45 = Korean<br>46 = Vietnamese<br>47 = Other Asian<br>50 = Pacific Islander<br>51 = Native Hawaiian<br>52 = Guamanian or Chamorro<br>53 = Samoan |
| Ethnicity | IV, Nominal | 8.3 | 1 = Mexican, Mexican American, Chicano/a<br>2 = Puerto Rican<br>3 = Cuban<br>4 = Another Hispanic, Latino/a, or Spanish origin |
| Level of Education | IV, Nominal | 8.7 | 1 = Never attended school or only attended kindergarten<br>2 = Grades 1 through 8 (Elementary)<br>3 = Grades 9 through 11 (Some high school)<br>4 = Grade 12 or GED (High school graduate)<br>5 = College 1 year to 3 years (Some college or technical school)<br>6 = College 4 years or more (College graduate) |
| Household Income | IV, Nominal | 8.17 | 04 = Less than $25,000 ($20,000 to less than $25,000)<br>03 = Less than $20,000 ($15,000 to less than $20,000)<br>02 = Less than $15,000 ($10,000 to less than $15,000)<br>01 = Less than $10,000<br>05 = Less than $35,000 ($25,000 to less than $35,000)<br>06 = Less than $50,000 ($35,000 to less than $50,000)<br>07 = Less than $75,000 ($50,000 to less than $75,000)<br>08 = $75,000 or more |

*(table continues)*

| Variable name | Variable type | Survey question # | Data codes |
|---|---|---|---|
| Type of healthcare coverage | IV, Nominal | 10.2 | 01 = A plan purchased through an employer or union (includes plans purchased through another person's employer)<br>02 = A plan that you or another family member buys on your own<br>03 = Medicare<br>04 = Medicaid or other state program<br>05 TRICARE (formerly CHAMPUS), VA, or Military<br>06 = Alaska Native, Indian Health Service, Tribal Health Services,<br>07 = Some other source, or<br>08 = None (no coverage) |
| Delay in Medical Care | IV, Nominal | 10.3 | 1 = You couldn't get through on the telephone.<br>2 = You couldn't get an appointment soon enough.<br>3 = Once you got there, you had to wait too long to see the doctor.<br>4 = The (clinic/doctor's) office wasn't open when you got there.<br>5 = You didn't have transportation. |
| Cigarette Use | IV, Nominal | 9.2 | 1 = Every day<br>2 = Some days<br>3 = Not at all<br>7 = Don't know / Not sure<br>9 = Refused |
| Type of Contraception | IV, Nominal | 17.1 | 01 = Female sterilization (e.g., Tubal ligation, Essure, Adiana)<br>02 = Male sterilization (vasectomy)<br>03 = Contraceptive implant (e.g., Implanon)<br>04 = Levonorgestrel (LNG) or hormonal IUD (e.g., Mirena)<br>05 = Copper-bearing IUD (e.g., ParaGard)<br>06 = IUD, type unknown<br>07 = Shots (e.g., Depo-Provera)<br>08 = Birth control pills, any kind<br>09 = Contraceptive patch (e.g., Ortho Evra)<br>10 = Contraceptive ring (e.g., NuvaRing)<br>11 Male condoms<br>12 = Diaphragm, cervical cap, sponge<br>13 Female condoms<br>14 = Not having sex at certain times (rhythm or natural family planning)<br>15 = Withdrawal (or pulling out)<br>16 = Foam, jelly, film, or cream<br>17 = Emergency contraception (morning after pill)<br>18 = Other method |
| Sexual Activity | IV, Nominal | 17.1 | 1 = Yes<br>2,3 = No |
| Sexual Orientation | IV, Nominal | 27.1 | 1 = Straight<br>2 = Lesbian or gay<br>3 = Bisexual |

*(table continues)*

| Variable name | Variable type | Survey question # | Data codes |
|---|---|---|---|
| Diet | IV, Nominal | 12.1, 12.3, 12.4, 12.612.1 | Not including juices, how often did you eat fruit? (times per day, week, or month)<br>1_ _ Days<br>2_ _ Weeks<br>3_ _ Months<br>888 = Never<br>777 = Don't Know<br>999 = Refused |
| | | 12.3 | How often did you eat a green leafy or lettuce salad, with or without other vegetables?<br>1_ _ Days<br>2_ _ Weeks<br>3_ _ Months<br>888 = Never<br>777 = Don't Know<br>999 = Refused |
| | | 12.6 | Not including lettuce salads and potatoes, how often did you eat other vegetables?<br>1_ _ Days<br>2_ _ Weeks<br>3_ _ Months<br>888 Never<br>777 = Don't Know<br>999 = Refused |
| | | 12.4 | How often did you eat any kind of fried potatoes, including french fries, home fries, or hash browns?<br>1_ _ Days<br>2_ _ Weeks<br>3_ _ Months<br>888 = Never<br>777 = Don't Know |

*Note.* IV = independent Variable, DV = dependent variable

## Data Analysis

The data was collected for all the independent variables-race, ethnicity, level of education, household income, type of healthcare coverage, delay in receiving medical care, sexual orientation, cigarette use, diet, type of contraception use, number of HPV shots received, and the presence of sexual activity. Descriptive data analysis was performed to determine frequencies and percentages for the independent variables. Binomial logistic regression analysis was used to analyze data from this study. Regression analysis is used primarily to analyze variability and provide prediction. It predicts the value of a dependent (response) variable based on the value of at least one independent (explanatory) variable (Laerd Statistics, 2018). It will be helpful to analyze the effect of the independent variables on the dependent variable (Daniel, 2010).

There are assumptions of binomial logistic regression that need to be met in order to generate a valid result. To run binomial logistic regression, it is assumed that the dependent variable is measured on a dichotomous scale; there is more than one independent variable (either continuous or categorical), observations are independent of each other, independent variables should not be in terms with multicollinearity, and linear relationship between independent variables and log odds (Laerd Statistics, 2018).

A correlation matrix is used to determine multicollinear relationships between independent variables. If there is multicollinearity between any two predictor variables, then the correlation coefficient between these two variables will be near to unity. Considering the situation, when two variables strongly correlate with each other or if they are measuring the same thing, then the problem of multicollinearity exists. Then, the

remedy is to drop one of the predictor variables to lessen the multicollinearity. Otherwise, the confidence interval of coefficients becomes wide, statistics tends to be exceedingly small, and it becomes difficult to reject the null hypothesis. If it is impossible to drop the concerned variable, then alternative methods of estimation like ridge regression or principal component regression would be utilized. Multicollinearity was assessed using variance inflation factors (VIFs).

Ridge regression gives an alternative estimator (k) that has a smaller total mean square error value. The value of k can be estimated by looking at the ridge trace plot from one approach. Ridge trace plot is a plot of parameter estimates vs k where k usually lies in the interval of [0,1]. The principal component regression approach combats multicollinearity by using less than the full set of principal components in the model. To obtain the principal components estimators, assume that the regressors are arranged in order of decreasing eigenvalues, $\lambda 1 \geq \lambda 2 \ldots\ldots \geq \lambda p > 0$. In principal components regression, the principal components corresponding to near zero eigenvalues are removed from the analysis and least squares applied to the remaining components. However, all VIF values were below 10, indicating that multicollinearity was not a concern (see Table 4, Table 8, and Table 11). I had planned to use ridge regression, but this was not adopted as the VIF values were below 10.

SPSS version 21 was used to analyze data for this study. Records with missing data were not included in the analysis. Data from this study were analyzed to answer the following research questions:

Research Question 1: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care)?

$H_0$1: There is no statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care).

$H_1$1: There is a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care).

Binomial logistic regression analysis was conducted to answer research question one considering the diagnosis of cervical cancer as the dependent dichotomous variable and race, ethnicity, level of education, household income, type of healthcare coverage, and delay in receiving medical care as independent variables. The null hypothesis was rejected if a $p$ value $< 0.05$ was observed.

Research Question 2: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine

considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use)?

$H_0$2: There is no statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use).

$H_1$2: There is a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use).

Research Question 3: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received and the presence of sexual activity?

$H_0$3: There is no statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received and the presence of sexual activity.

$H_1$3: There is a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity.

Binomial logistic regression analysis was conducted to answer research question two considering the diagnosis of cervical cancer as the dependent dichotomous variable and the number of HPV shots received, and the presence of sexual activity as independent variables. The null hypothesis was rejected if a $p$ value $< 0.05$ was observed.

## Threats to Validity

There are three types of validity associated with measurement. They are construct validity, empirical validity, and content validity (Creswell, 2009). A design is valid when it meets the validity with evidence. The validity of the research design is concerned with the intervention of factors that stimulate dependent variables. The validity of the research design can be easily established if the research design is generalizable and can be easily applied to real world situations. The factors outside of the experiment tend to assess internal and external validity of the research design.

The study was associated with internal validity threats. The external validity threats were not of concern as the study was carried out using secondary data. However, study would not be generalized for external environment with larger population. The internal validity threats arose from the previous experiences of the participants that may impact the behavior of the participants and influence the result. The threats to statistical conclusion validity were addressed by using a $p$ value of $< .05$ to determine statistical significance.

Reliability of a research design refers to the ability of the study to be trustworthy over a period. The reliability of this study could be ensured by using adequate scholarly resources as literature review. The reliability of the research design could also be ensured by assessing the gaps in the literature and by identifying the reason for this gap with the prevailing trends. The research study could address the gaps and should also consider the current scenario and expected future trends.

## Ethical Procedures

Before conducting my research, approval from the Institutional Review Board (IRB) at Walden University was obtained (IRB# 10-04-19-0470159). Approval through written agreements that would provide access to data was obtained. Consent was not required as secondary data was used. Data was de-identified and anonymous. The data collected is stored in a password protected laptop. The data is accessible only by myself and will destroy the data by deleting from my laptop after 5 years from the end of my research study.

## Summary

This research study used quantitative research methodology and consisted of secondary data analysis from the 2017 BRFSS. I analyzed data about cervical cancer diagnosis, HPV vaccination, demographics, and personal risk factors for cervical cancer in females, ages 18-60. Chapter 4 will provide the results of the data analysis.

# Chapter 4: Results

The purpose of this study was to determine whether there was a statistically significant difference in cervical cancer diagnosis between women who received the HPV vaccine and those who did not, with consideration for demographic factors (race, ethnicity, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). I also examined whether there was a difference in cervical cancer diagnosis in women who received the HPV vaccine based on the number of HPV shots received and the presence of sexual activity. Chapter 4 includes information about data collection and results of statistical analysis.

## Data Collection

For this study, secondary data from the 2017 BRFSS were analyzed. Because there were no data available for cervical cancer diagnosis or HPV vaccination for the cases in Alabama, I analyzed data from all females in the 2017 dataset. The independent variables were race, ethnicity, level of education, household income, type of healthcare coverage, delay in receiving medical care, sexual orientation, cigarette use, diet, type of contraception use, number of HPV shots received, and the presence of sexual activity. The dependent variable of the study was the diagnosis of cervical cancer.

There was a total of 251,007 female cases in the dataset. Table 2 displays descriptive statistics for the demographic variables in this sample. Most women in the sample identified as White ($n$ = 203,237, 81.0%) and not Hispanic ($n$ = 228,267, 90.9%).

The largest proportion of women had earned a college degree or higher (*n* = 92,050, 36.7%). The largest proportion of women had an income level of $75,000 per year or more (*n* = 59,486, 23.7%).

Table 2

*Frequencies and Percentages for Demographic Variables*

| Variable | Frequency | Percent |
|---|---|---|
| Race | | |
| White | 203,237 | 81.0 |
| Black or African American | 23,731 | 9.5 |
| American Indian or Alaskan Native | 5,763 | 2.3 |
| Asian | 5,230 | 2.1 |
| Hawaiian or Pacific Islander | 1,662 | 0.7 |
| Other | 5,013 | 2.0 |
| No preferred race | 792 | 0.3 |
| Do not know | 2,206 | 0.9 |
| Missing | 3,373 | 1.3 |
| | | |
| Ethnicity | | |
| Hispanic | 20,534 | 8.2 |
| Not Hispanic | 228,267 | 90.9 |
| Missing | 2,206 | 0.9 |
| | | |
| Education level | | |
| Never attended | 322 | 0.1 |
| Elementary | 5,663 | 2.3 |
| Some high school | 11,973 | 4.8 |
| High school | 67,114 | 26.7 |
| Some college | 72,965 | 29.1 |
| College graduate | 92,050 | 36.7 |
| Missing | 920 | 0.4 |
| | | |
| Income level | | |
| Less than $10,000 | 11,647 | 4.6 |
| Less than $15,000 | 12,256 | 4.9 |
| Less than $20,000 | 17,182 | 6.8 |
| Less than $25,000 | 20,447 | 8.1 |
| Less than $35,000 | 22,909 | 9.1 |
| Less than $50,000 | 28,603 | 11.4 |
| Less than $75,000 | 31,201 | 12.4 |
| $75,000 or more | 59,486 | 23.7 |
| Do not know | 21,909 | 8.7 |
| Missing | 25,367 | 10.1 |

# Results

## Research Question 1

Research Question 1: Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering demographic factors (race, ethnicity, level of education, household income) and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care)? Table 3 displays descriptive statistics for the variables included in Research Question 1. Less than 1% of women in the sample had a cervical cancer diagnosis and had received the HPV vaccine. Additionally, approximately 90% of the sample had no data available for type of healthcare coverage or delay in medical care. After list wise exclusion of cases missing data for these variables, no cases with cervical cancer diagnoses remained. Therefore, to conduct the analysis for Research Question 1, the variables for type of healthcare coverage and delay in receiving medical care were omitted from the analysis.

Table 3

*Frequencies and Percentages for Cervical Cancer Diagnosis, HPV Vaccination, Healthcare Coverage, and Delay in Medical Care*

| Variable | Frequency | Percent |
|---|---|---|
| Cervical cancer diagnosis | | |
| No | 250,754 | 99.9 |
| Yes | 253 | 0.1 |
| | | |
| Received HPV vaccine | | |
| No | 249,905 | 99.6 |
| Yes | 1,102 | 0.4 |
| | | |
| Primary health insurance coverage | | |
| Employer plan | 8,704 | 3.5 |
| Own plan | 2,555 | 1 |
| Medicare | 8,350 | 3.3 |
| Medicaid or state program | 2,134 | 0.9 |
| TRICARE VA or Military | 414 | 0.2 |
| Indian Health Service | 29 | 0 |
| Other | 825 | 0.3 |
| None | 24 | 0 |
| Do not know | 231 | 0.1 |
| Missing | 227,741 | 90.7 |
| | | |
| Delayed getting medical care | | |
| Could not get through on phone | 328 | 0.1 |
| Could not get appointment | 1,753 | 0.7 |
| Doctor wait was too long | 784 | 0.3 |
| Doctor office was not open | 189 | 0.1 |
| No transportation | 1,201 | 0.5 |
| Other | 1,273 | 0.5 |
| Do not know | 138 | 0.1 |
| No delay | 19,847 | 7.9 |
| Missing | 225,494 | 89.8 |

Additionally, a binary logistic regression was conducted to address this question, with the dependent variable being cervical cancer diagnosis. Before interpreting the results of the regression, multicollinearity was assessed using VIFs. All VIF values were below 10, indicating that multicollinearity was not a concern (see Table 4).

Table 4

*Variance Inflation Factors for Research Question 1*

| Variable | VIF |
|---|---|
| HPV vaccine | 1.00 |
| Race | 1.25 |
| Ethnicity | 1.22 |
| Education | 1.29 |
| Income | 1.27 |

The result for the overall binary logistic regression model was significant, $\chi^2(22) = 142.21$, $p < .001$, suggesting that collectively the independent variables significantly predicted cervical cancer diagnosis. The Cox and Snell $R^2$ and Nagelkerke $R^2$ were .001 and .039, respectively, indicating the predictors accounted for 0.10 – 3.90% of the variance in cervical cancer diagnosis. Receiving the HPV vaccine was a significant predictor of cervical cancer diagnosis, $B = 1.17$, OR = 3.23, $p = .044$, indicating that, after controlling for the demographic variables, women who received the HPV vaccine, were 3.23 times more likely to have a diagnosis of cervical cancer. Because there was a significant difference in cervical cancer diagnosis between women who received and did not receive the HPV vaccine, the null hypothesis was rejected. Table 5 presents the regression coefficients for the binary logistic regressle 5

*Binary Logistic Regression Predicting Cervical Cancer Diagnosis (Research Question 1)*

| Variable | *B* | *SE* | $\chi^2$ | *p* | *OR* |
|---|---|---|---|---|---|
| (Intercept) | -6.62 | 0.80 | 68.12 | < .001 | |
| HPV vaccine | 1.17 | 0.58 | 4.04 | .044 | 3.23 |
| Race: White | -0.84 | 0.75 | 1.23 | .266 | 0.43 |
| Race: Black or African American | -1.99 | 0.82 | 5.96 | .015 | 0.14 |
| Race: American Indian or Alaskan Native | -0.00 | 0.79 | 0.00 | 1.000 | 1.00 |
| Race: Asian | -2.41 | 1.25 | 3.69 | .055 | 0.09 |
| Race: Hawaiian or Pacific Islander | -13.64 | 264.29 | 0.00 | .959 | 0.00 |
| Race: Other | -0.97 | 1.00 | 0.94 | .332 | 0.38 |
| Race: No preferred race | -0.64 | 1.25 | 0.26 | .611 | 0.53 |
| Ethnicity: Hispanic | -1.93 | 0.50 | 14.95 | < .001 | 0.15 |
| Education: Never attended | -11.70 | 609.50 | 0.00 | .985 | 0.00 |
| Education: Elementary | 0.84 | 0.40 | 4.29 | .038 | 2.31 |
| Education: Some high school | -0.07 | 0.36 | 0.04 | .837 | 0.93 |
| Education: High school | 0.42 | 0.19 | 4.75 | .029 | 1.53 |
| Education: Some college | 0.51 | 0.19 | 7.50 | .006 | 1.66 |
| Income: Less than $10,000 | 1.24 | 0.33 | 14.31 | < .001 | 3.47 |
| Income: Less than $15,000 | 1.14 | 0.32 | 12.37 | < .001 | 3.13 |
| Income: Less than $20,000 | 0.85 | 0.32 | 6.90 | .009 | 2.33 |
| Income: Less than $25,000 | 0.86 | 0.31 | 7.71 | .005 | 2.37 |
| Income: Less than $35,000 | 0.43 | 0.33 | 1.72 | .190 | 1.54 |
| Income: Less than $50,000 | 0.52 | 0.31 | 2.80 | .094 | 1.69 |
| Income: Less than $75,000 | 0.11 | 0.33 | 0.11 | .744 | 1.11 |
| Income: $75,000 or more | -0.34 | 0.33 | 1.04 | .308 | 0.71 |

The Black category of race was a significant predictor of cervical cancer diagnosis, $B$ = -1.99, OR = 0.14, $p$ = .015, indicating that Black or African American individuals were 0.14 times as likely to have a diagnosis of cervical cancer. Ethnicity was a significant predictor of cervical cancer diagnosis, $B$ = -1.93, OR = 0.15, $p < .001$, indicating that Hispanic individuals were 0.15 times as likely to have a diagnosis of cervical cancer. The elementary, high school, and some college categories of education were significant predictors of cervical cancer diagnosis ($p$-values < .05), indicating that individuals with elementary, high school, or some college levels of education were more likely to have a diagnosis of cervical cancer. The income categories less than $25,000 were significant predictors of cervical cancer diagnosis ($p$-values < .05), indicating that individuals with income levels less than $25,000 were more likely to have a diagnosis of cervical cancer.

**Research Question 2**

Is there a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine considering personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use)? The independent variables for Research Question 2 included HPV vaccination, sexual orientation, cigarette use, diet (calculated daily servings of fruit, greens, other vegetables, and fried potatoes), and type of contraception use. The dependent variable was diagnosis of cervical cancer. Tables 6 and 7 display descriptive statistics for the variables included in Research Question 2.

Table 6

*Frequencies and Percentages for Sexual Orientation, Cigarette Use, and Type of Contraception*

| Variable | Frequency | Percent |
|---|---|---|
| Sexual orientation | | |
| Do not know | 1,251 | 0.50 |
| Straight | 106,595 | 42.47 |
| Lesbian or gay | 1,330 | 0.53 |
| Bisexual | 2,303 | 0.92 |
| Other | 559 | 0.22 |
| Missing | 138,969 | 55.36 |
| Cigarette use | | |
| Every day | 23,046 | 9.18 |
| Never smoked | 147,974 | 58.95 |
| Not at all | 60,448 | 24.08 |
| Some days | 9,567 | 3.81 |
| Missing | 9,972 | 3.97 |
| Type of contraception | | |
| Do not know | 94 | 0.04 |
| None or NA | 23,945 | 9.54 |
| Female sterilization | 1,953 | 0.78 |
| Male sterilization | 1,870 | 0.74 |
| Implant | 816 | 0.33 |
| LNG or IUD | 795 | 0.32 |
| Copper bearing IUD | 466 | 0.19 |
| Other IUD | 1,839 | 0.73 |
| Shots | 446 | 0.18 |
| Pills | 5,017 | 2.00 |
| Patch | 101 | 0.04 |
| Ring | 191 | 0.08 |
| Male condoms | 5,148 | 2.05 |
| Diaphragm | 47 | 0.02 |
| Female condoms | 121 | 0.05 |
| Rhythm or natural | 117 | 0.05 |
| Withdrawal | 427 | 0.17 |
| Foam jelly film or cream | 29 | 0.01 |
| Emergency contraception | 37 | 0.01 |
| Other | 638 | 0.25 |
| Missing | 206,910 | 82.43 |

Table 7

*Means and Standard Deviations for Diet Variables (Calculated Daily Servings)*

| Variable | *M* | *SD* |
|---|---|---|
| Fruit | 1.25 | 1.78 |
| Greens | 0.65 | 1.35 |
| Other vegetables | 1.10 | 2.12 |
| Fried potatoes | 0.17 | 0.39 |

A binary logistic regression was conducted to address this question, with the dependent variable being cervical cancer diagnosis. Before interpreting the results of the regression, multicollinearity was assessed using VIFs. All VIF values were below 10, indicating that multicollinearity was not a problem (see Table 8).

Table 8

*Variance Inflation Factors for Research Question 2*

| Variable | VIF |
|---|---|
| HPV vaccine | 1.03 |
| Sexual orientation | 1.03 |
| Cigarette use | 1.11 |
| Fruit | 3.90 |
| Greens | 1.02 |
| Other vegetables | 3.85 |
| Fried potatoes | 1.03 |
| Contraception | 1.06 |

The result for the overall binary logistic regression model was significant, $\chi^2(31) = 52.42$, $p = .009$, suggesting that collectively the independent variables significantly predicted cervical cancer diagnosis. The Cox and Snell $R^2$ and Nagelkerke $R^2$ were .002 and .138, respectively, indicating the model accounted for 0.20 – 13.80% of the variance

in cervical cancer diagnosis. Receiving the HPV vaccine was a significant predictor of cervical cancer diagnosis, $B = 2.00$, OR = 7.40, $p = .002$, indicating that, after controlling for the personal risk factors, women who received the HPV vaccine, were 7.40 times more likely to have a diagnosis of cervical cancer. Because there was a significant difference in cervical cancer diagnosis between women who received and did not receive the HPV vaccine, the null hypothesis was rejected. Table 9 presents the regression coefficients for the binary logistic regression.

Table 9

*Binary Logistic Regression Predicting Cervical Cancer Diagnosis (Research Question 2)*

| Variable | *B* | *SE* | $\chi^2$ | *p* | *OR* |
|---|---|---|---|---|---|
| (Intercept) | -35.28 | 6770.79 | 0.00 | .996 | |
| HPV vaccine | 2.00 | 0.63 | 9.98 | .002 | 7.40 |
| Orientation: Straight | 14.68 | 2809.52 | 0.00 | .996 | $2.38 \times 10^6$ |
| Orientation: Lesbian or gay | -1.13 | 3544.68 | 0.00 | 1.000 | 0.32 |
| Orientation: Bisexual | 15.82 | 2809.52 | 0.00 | .996 | $7.44 \times 10^6$ |
| Orientation: Other | -0.61 | 4765.54 | 0.00 | 1.000 | 0.54 |
| Cigarettes: Never smoked | -2.54 | 0.55 | 21.32 | < .001 | 0.08 |
| Cigarettes: Not at all | -1.33 | 0.59 | 5.12 | .024 | 0.26 |
| Cigarettes: Some days | -0.63 | 0.66 | 0.93 | .334 | 0.53 |
| Fruit | 0.11 | 0.10 | 1.22 | .269 | 1.12 |
| Greens | -0.27 | 0.40 | 0.46 | .500 | 0.77 |
| Other vegetables | -0.04 | 0.11 | 0.13 | .721 | 0.96 |
| Fried potatoes | -0.98 | 0.95 | 1.05 | .305 | 0.38 |
| Contraception: None or NA | 15.23 | 6160.37 | 0.00 | .998 | $4.11 \times 10^6$ |
| Contraception: Female sterilization | 16.29 | 6160.37 | 0.00 | .998 | $1.19 \times 10^7$ |
| Contraception: Male sterilization | 15.47 | 6160.37 | 0.00 | .998 | $5.22 \times 10^6$ |
| Contraception: Implant | -0.41 | 6453.94 | 0.00 | 1.000 | 0.66 |
| Contraception: LNG or IUD | -0.39 | 6542.14 | 0.00 | 1.000 | 0.67 |
| Contraception: Copper bearing IUD | -0.25 | 6724.47 | 0.00 | 1.000 | 0.78 |
| Contraception: Other IUD | -0.29 | 6319.41 | 0.00 | 1.000 | 0.75 |
| Contraception: Shots | -0.68 | 6734.43 | 0.00 | 1.000 | 0.51 |
| Contraception: Pills | 14.84 | 6160.37 | 0.00 | .998 | $2.79 \times 10^6$ |
| Contraception: Patch | -0.31 | 8251.77 | 0.00 | 1.000 | 0.74 |
| Contraception: Ring | -0.27 | 7370.15 | 0.00 | 1.000 | 0.76 |
| Contraception: Male condoms | 14.77 | 6160.37 | 0.00 | .998 | $2.60 \times 10^6$ |
| Contraception: Diaphragm | -0.07 | 13024.04 | 0.00 | 1.000 | 0.93 |
| Contraception: Female condoms | -0.40 | 8493.15 | 0.00 | 1.000 | 0.67 |
| Contraception: Rhythm or natural | -0.15 | 8452.18 | 0.00 | 1.000 | 0.86 |
| Contraception: Withdrawal | -0.59 | 6742.15 | 0.00 | 1.000 | 0.56 |
| Contraception: Foam jelly film or cream | -1.69 | 12147.21 | 0.00 | 1.000 | 0.18 |
| Contraception: Emergency contraception | 0.04 | 11213.87 | 0.00 | 1.000 | 1.05 |
| Contraception: Other | -0.27 | 6556.26 | 0.00 | 1.000 | 0.76 |

The “never smoked” and “not at all” categories of cigarette use were significant predictors of cervical cancer diagnosis ($p$-values < .05), indicating that individuals who smoked never or not at all were less likely to have a diagnosis of cervical cancer.

**Research Question 3**

Is there a statistically difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, and the presence of sexual activity? The independent variables for Research Question 3 included the number of HPV shots received, and the presence of sexual activity. The dependent variable was diagnosis of cervical cancer. Table 10 displays descriptive statistics for the variables included in Research Question 3.

Table 10

*Frequencies and Percentages for HPV Shots and Sexual Activity*

| Variable | Frequency | Percent |
|---|---|---|
| Number of HPV shots | | |
| Do not know | 159 | 0.06 |
| 1 | 234 | 0.09 |
| 2 | 175 | 0.07 |
| All shots | 529 | 0.21 |
| Missing | 249,910 | 99.56 |
| Sexually active | | |
| Yes | 40,781 | 16.25 |
| No | 4,167 | 1.66 |
| Missing | 206,059 | 82.09 |

A binary logistic regression was conducted to address this question, with the dependent variable being cervical cancer diagnosis. Only women who had received the HPV vaccine were included in this analysis. Before interpreting the results of the

regression, multicollinearity was assessed using VIFs. All VIF values were below 10 (1.00 for race, HPV shots, and sexual activity), indicating that multicollinearity was not a problem.

The result for the overall binary logistic regression model was not significant, $\chi^2(11) = 5.85$, $p = .883$, suggesting that collectively the independent variables did not significantly predict cervical cancer diagnosis. The Cox and Snell $R^2$ and Nagelkerke $R^2$ were .009 and .155, respectively, indicating the predictors accounted for 0.90 – 15.50% of the variance in cervical cancer diagnosis. Because no predictors were significant, the null hypothesis was not rejected. Table 11 presents the regression coefficients for the binary logistic regression.

Table 11

*Binary Logistic Regression Predicting Cervical Cancer Diagnosis (Research Question 3)*

| Variable | *B* | *SE* | $\chi^2$ | *p* | *OR* |
|---|---|---|---|---|---|
| (Intercept) | -36.43 | 10387.27 | 0.00 | .997 | 0.00 |
| Race: White | 14.93 | 9438.04 | 0.00 | .999 | 3047555.36 |
| Race: Black or African American | 15.33 | 9438.04 | 0.00 | .999 | 4527623.96 |
| Race: American Indian or Alaskan Native | -0.26 | 15285.13 | 0.00 | 1.000 | 0.77 |
| Race: Asian | -0.97 | 12558.00 | 0.00 | 1.000 | 0.38 |
| Race: Hawaiian or Pacific Islander | 15.22 | 25162.93 | 0.00 | 1.000 | 4071007.96 |
| Race: Other | -0.63 | 19209.57 | 0.00 | 1.000 | 0.53 |
| Race: No preferred race | -1.29 | 41286.21 | 0.00 | 1.000 | 0.28 |
| Shots: 1 | -0.01 | 5295.46 | 0.00 | 1.000 | 0.99 |
| Shots: 2 | 0.04 | 5730.43 | 0.00 | 1.000 | 1.04 |
| Shots: All | 16.52 | 4338.06 | 0.00 | .997 | 14876606.39 |
| Sexual activity: No | 1.22 | 1.24 | 0.97 | .325 | 3.39 |

## Summary

Three binary logistics regression analyses were conducted to answer the research questions. The results for Research Question 1 showed that there was a significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine after controlling for demographic factors; the null hypothesis was rejected. The results for Research Question 2 showed that there was a significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine after controlling for personal risk factors; the null hypothesis was rejected. The results for Research Question 3 showed that there were no differences in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received, or the presence of sexual activity; the null hypothesis was not rejected. Chapter 5 will contain a discussion of results, limitations, and recommendations for future research.

# Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to determine if there was a statistically significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine as compared to women who did not receive the vaccine, with the consideration of demographic factors (race, ethnicity, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). In addition, I also examined if there was a difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV vaccines received and the presence of sexual activity.

Cervical cancer has been the third most diagnosed cancer and the fourth leading cause of cancer death in females worldwide (Miller, 2016). In 2017, 12,820 women in the United States were diagnosed with cervical cancer and 4,210 deaths from the disease occurred (ASCO, 2018). However, a decreased amount of research has been identified about personal risk factors for cervical cancer, factors affecting access to health care, and HPV vaccination in women based on demographic factors. It is also important to determine the accurate time when HPV vaccine should be administered among teenage females to enhance the effectiveness of HPV vaccine. In this study, I intended to address the gap in the literature regarding the underlying causes of higher death rates in certain racial groups of females due to cervical cancer. I examined whether there was a difference in cancer diagnosis between those who did and did not receive the HPV vaccine based on demographic factors (race, ethnicity, level of education, household

income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care). I also examined number of HPV vaccines and sexual activity. For this quantitative study, I conducted secondary data analysis from the 2017 BRFSS. Data were selected from females between the ages of 18 to 60, who have been diagnosed with cervical cancer, as well as females who tested negative for cervical cancer.

The results of this study showed that there was a significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine after controlling for demographic factors and a significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine after controlling for personal risk factors. The findings also showed that there was no significant difference in the diagnosis of cervical cancer in women who received the HPV vaccine based on the number of HPV shots received or the presence of sexual activity. In this chapter, I will provide an interpretation of the findings, limitations of the study, recommendations, and implications.

## Interpretation of the Findings

The significant findings from this study suggest that patients should inquire about their health care coverage to receive the HPV vaccine. Approximately 90% of the sample had no data available for the type of healthcare coverage or delay in medical care. Considering list wise exclusion of cases missing data for these variables, no cases with cervical cancer diagnoses remained.

Additionally, the significant findings from this study suggest that Black women should see their oncologist for reliable cervical cancer diagnosis. The Black category of race was a significant predictor of cervical cancer diagnosis, $B$ = -1.99, OR = 0.14, $p$ = .015, indicating that Black or African American individuals were 0.14 times as likely to have a diagnosis of cervical cancer. Ethnicity was also a significant predictor of cervical cancer diagnosis, $B$ = -1.93, OR = 0.15, $p < .001$, indicating that Hispanic individuals were 0.15 times as likely to have a diagnosis of cervical cancer. Regarding other demographic factors, the elementary, high school, and some college categories of education were significant predictors of cervical cancer diagnosis ($p < .05$), indicating that individuals with these levels of education were more likely to have a diagnosis of cervical cancer. The income categories less than $25,000 were significant predictors of cervical cancer diagnosis ($p < .05$), indicating that individuals with income levels less than $25,000 were more likely to have a diagnosis of cervical cancer. If income is less than $25,000 annually, this would not be sufficient to cover medical procedures.

Additionally, the results revealed that the HPV vaccine should be provided because there was a significant difference in cervical cancer diagnosis between women who received and did not receive the HPV vaccine. Receiving the HPV vaccine was a significant predictor of cervical cancer diagnosis, $B$ = 2.00, OR = 7.40, $p$ = .002, indicating that, after controlling for the personal risk factors, women who received the HPV vaccine were 7.40 times more likely to have a diagnosis of cervical cancer.

The study addressed the gap in the literature by identifying possible demographic and personal risk factors for cervical cancer leading to higher death rates in certain racial

groups of females (Tabatbhai et al., 2014). Additionally, the social cognitive theory helped explain the pattern of change in human behavior regarding administration of HPV vaccine during adolescence. The dependent constructs of the theory are learning and change in behavior, which can be measured in terms of incidence of cervical cancer; independent constructs are personal factors (initiation of sexual activity, ethnicity, and lifestyle), behavior (socioeconomic status), and environment (geographic location). The dependent constructs of the theory depend on and responds to independent constructs of the theory. Thus, this theory helped to explain the incidence of cervical cancer as an interaction of personal factors (initiation of sexual activity), behavior (lifestyle), and environment (geographic location, socioeconomic status; Bandura, 1989).

## Limitations of the Study

The major limitation of the study was that the data collected through a questionnaire may be biased and the patients may not have provided correct information. As I used secondary data for my analysis, I was not able to address these limitations. The progress in the HPV vaccine over the period when it was administered to the selected sample and the time of the research study is another major limitation. The gap between the time of the collected data and the timing of the research study has witnessed technological changes that might affect the validity of the research. To address this limitation, I used the most recent available data relevant to my research study.

## Recommendations

As no research has been found about HPV vaccination in women living in Alabama, a recommendation for future research would be to conduct a quantitative study

on women from Alabama to provide confirmation of consistency of the findings in reference to the difference in the diagnosis of cervical cancer in women who received the HPV vaccine compared to women who did not receive the vaccine. Demographic factors (race ethnicity, county of residence, level of education, household income), personal risk factors (sexual orientation, cigarette use, diet, and type of contraception use), and factors affecting access to healthcare (type of healthcare coverage, delay in receiving medical care) should be considered in this recommendation.

Additionally, implementing a qualitative study with a phenomenological approach could help determine how women should schedule cervical examinations with their physicians. These objectives can proceed to address and close the gap in literature about HPV vaccination and cervical cancer because of lack of research that has been stipulated in reference to personal risk factors, factors affecting access to health care, and HPV vaccination in women based on demographic factors.

## Implications of Findings

The findings of the study were generally aligned with the literature of the topic of the study. These results indicate a reflection on the demographic and personal risk factors for cervical cancer in a certain group of females. The results also provide insight on a perspective of education, income, health care coverage, receiving medical care. These results may inform the structure of patient care, which could provide individuals with guidance throughout the process of treatment if cervical cancer is detected. The potential positive social change that could result from this study is increased rate and timely administration of HPV vaccination for women, which may lead to decreased death rates

from cervical cancer. The results of this study can also raise awareness in education for families, organizations, and the society. These objectives can encourage the public to take advantage of their health by regularly visiting their healthcare providers annually to ensure that they are in proper health. Women should consult with their physician for reliable testing to confirm a diagnosis of HPV and vaccines. If there is a situation when health care cost is unaffordable, patients can seek nonprofit organizations for their health care necessaries. Enough health care coverage should be provided in the process of receiving treatment because this plays a major role in the quality of health care treatment received.

## Summary and Conclusion

This research study used a quantitative research methodology and consisted of secondary data analysis from the 2017 BRFSS for females ages 18 to 60 diagnosed with cervical cancer as well as those who tested negative for cervical cancer. Females may or may not have received the HPV vaccine. Results of this study revealed that there was a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine after controlling for demographic factors and a statistically significant difference in the diagnosis of cervical cancer in women who received and did not receive the HPV vaccine after controlling for personal risk factors. Based on the findings of this study, health care organizations may wish to raise awareness of cervical cancer among certain racial groups. Furthermore, because of the increased rates of cervical cancer in certain racial groups, there should be a more proactive approach to cervical cancer prevention and detection.

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