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Predictors of Cervical Cancer Screening Among Hispanic Women in Texas

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This is to certify that the doctoral study by

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Abstract

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MPH, Walden University, 2016

MBBS, Mysore University, 1997

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Hispanic women in Texas show higher cervical cancer incidence rates as compared to all women in the United States. The rate of cervical cancer in the United States has reduced mostly due to regular cervical cancer screening. However, high cervical cancer among Hispanics in Texas may reflect low cervical cancer screening. The purpose of this quantitative study was to examine the insurance status (independent variable) and cervical cancer screening (dependent variable) among low income Hispanic women, living in Texas Health Service Regions (HSRs), after controlling for age, marital status, and personal health care provider. The theoretical framework used in this study was the health belief model. Nine hundred and fifteen Hispanic women living in Texas HSRs, ages 21-65 years and who participated in Texas BRFSS 2015-2017, were the sample for this study. Univariate analysis was performed to obtain frequencies and percentages of all covariates. A Chi-square was conducted to determine if there was an association between any of the independent and the dependent variable and binomial logistic regression was used to answer the hypotheses. The findings from this study revealed no relationship with cervical cancer screening and the level of education. However, insurance status and income were statistically significant on receiving a Pap test among low income Hispanic women in Texas HSRs ($p<.001$, $OR=1.52$; $p<.001$, $OR= .39$, respectively) after controlling for age, marital status, and personal health care provider. This study can contribute to positive social change by helping public health stakeholders better understand and address unequal access to health care centers (especially, to cervical cancer screening programs) among the Hispanic Women in Texas HSRs.

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Section 1: Foundation of the Study and Literature Review

Introduction

According to the 2016 U.S. Census Bureau, 18% of the population of 57.5 million Americans is Hispanic or Latino (American Cancer Society [ACS], 2018). In 2018, there were 13,240 new cases of cervical cancer and 2,400 Hispanic women in the United States were estimated to be diagnosed with cervical cancer in 2018 (National Cancer Institute [NCI], 2018; ACS, 2018). In the past 40 years, the cervical cancer rate and the deaths from cervical cancer have decreased significantly due to the introduction of Pap test (Centers for Disease Control and Prevention [CDC], 2018). However, the cervical cancer incidence rate among Hispanic women in the United States remains higher (9.6) compared to non-Hispanic whites (7.1) and non-Hispanic blacks (9.2) (ACS, 2018). The incidence rate refers to the average annual rate per 100,000, with age adjusted to the 2000 U.S. standard population (ACS, 2018). The high cervical cancer incidence rate among Hispanic women partly reflects poor compliance with the Pap test. The high incidence rate may also be attributed to the fast-growing Hispanic population in the United States, lack of insurance, low income, lack of health care provider, poor health literacy, and lower cancer screening rates (Mann, Foley, Tanner, Sun, & Rhodes, 2015; Velasco-Mondragon, Jimenez, Palladino-Davis, Davis, & Escamilla-Cejudo, 2016). Mandating insurance coverage for inexpensive routine services like Pap tests can significantly increase utilization of cervical cancer screening (Bitler & Carpenter, 2017).

Currently, the Hispanic population in Texas is 18% of the U.S. population (ACS, 2018). The Hispanic population is the largest minority group in the U.S., which is rapidly

increasing in their population size and is projected to double in the next 4 decades (ACS, 2018). In Texas, 71% of women had a Pap smear in the past 3 years, and the incidence rate of cervical cancer was estimated to be 9 per 100,000 women (Texas Department of State Health Services [DSHS], 2016). The incidence of cervical cancer in Texas was 8.3per 100,000 population, as compared to the national average of 7.5 per 100,000 women (Akinlotan et al., 2017). However, within Texas, the invasive cervical cancer incidence rate (Age-Adjusted rate/100,000) remains high among Health Service Region (HSR) 1 (14.2), followed by HSR 2 (13.7) and HSR 5 (9.4) respectively (Texas DSHS, 2018). Healthy People 2020 goal is to reduce the invasive cervical cancer rate from 8.3 to 7.3 new cases per 100,000 females (Office of Disease Prevention and Health Promotion [ODPHP], 2019). Currently, the cervical cancer screening among Hispanic women in Texas is 72.2%, as compared to 78.8% of the U.S. population (United Health Foundation [UHF], 2019). Healthy People 2020 goal is to increase the proportion of women who receive a cervical cancer screening based on the most recent guidelines from 84.5% to 93% (ODPHP, 2019).

Level of education, income, and insurance status influences the uptake of cervical cancer screening among Hispanic women (Mann, Foley, Tanner, Sun, & Rhodes, 2015; Velasco-Mondragon, Jimenez, Palladino-Davis, Davis, & Escamilla-Cejudo, 2016). However, there is a gap in the literature regarding the influence of education level, income, and insurance status on cervical cancer screening among low income Hispanic women in Texas HSRs (Akinlotan et al., 2017). This study is unique as it involved analysis of the association between level of education, income, and insurance status on

cervical cancer screening (Pap test) among low income Hispanic women in Texas HSR 1. The association in the study was investigated after controlling factors for age, health care provider, and marital status. The study can help women understand the inequality to access health care center (specifically, to cervical cancer screening programs) among the Hispanic in Texas HSR 1. The study thereby can contribute to the positive social change within the community and other health service regions in Texas. Understanding how the predictors like income, level of education, and insurance status impacts cervical cancer screening can help health care providers and policymakers in designing programs that can increase the screening rate among Hispanic women in Texas. Increasing the cervical cancer screening rate can help in reducing the morbidity and mortality rates related to cervical cancer among Hispanic women in Texas HSR 1. The outcome of the study can help in developing theory-based cervical cancer education with culturally-sensitive language by lay health workers, and increase the cervical cancer screening rate within an underdeveloped setting and with participants who have low literacy levels.

In Section 1, I discussed the problem statement and purpose of the study, followed by the research questions and hypotheses, as well as the theoretical foundation and nature of the study. Next, the discussion focuses on a detailed literature search strategy and review of the literature, along with the definitions, assumptions, scope, and delimitations. Lastly, I focused on the significance of the study and the contributions to the positive social change and a summary of the literature.

Problem Statement

Cervical cancer ranks as the fourth most common type of cancer among women worldwide, with 570,000 new cases in 2018, representing 6.6% of all female cancers (World Health Organization [WHO], 2018). In the United States, the cervical cancer rate has been on the decline with the introduction of the Papanicolaou (Pap) smear and now ranks 14th in frequency (National Institutes of Health [NIH], 2018). However, Hispanic women in the United States show higher rates of cervical cancer than do non-Hispanic women (ACS, 2018; Moore de Peralta, Holaday, & Hadoto, 2017). According to the CDC (2018), in the United States, the incidence rate of cervical cancer (per 100,000 women per year) shows 9.4 among Hispanic women, compared to 8.6, 7.5, 6.4, and 6 respectively among Blacks, Whites, Americans Indians and Alaska Natives, and Asians and Pacific Islanders. The Hispanic population in Texas from 2012 to 2016 is 38.6%, which is 21.3% more than the national average of 17.3 % (NCI, 2018). Also, Hispanic women in Texas show the highest cervical cancer incidence rates of 11.9 per 100,000 women in 2015, compared to the U.S. average of 9.4 per 100,000 women for the same year (CDC, 2018). Within Texas, the invasive cervical cancer incidence rate (Age-Adjusted rate/100,000) remains high among HSR 1 (14.2), followed by HSR 2 (13.7) and HSR 5 (9.4) respectively (Texas DSHS, 2018). The high cervical cancer rate in Texas HSR 1 can be attributed to delayed diagnosis, inadequate patient follow-up, and late stage at presentation. Cervical cancer prevention by regular screening and early treatment of cervical cancer are highly cost-effective (WHO, 2019). As such, the high incidence rate

of cervical cancer in Texas HSR 1 is a public health concern and reflects the disparity in cervical cancer screening and treatment.

In Texas, Hispanics show low cervical cancer screening rates compared to non-Hispanic whites and blacks (Akinlotan, Weston, & Bolin, 2018). Boom et al. (2018) study showed that the cervical cancer incidence rate in the Texas–Mexico border region, which includes seven counties from the Rio Grande Valley and the Laredo area is 10.9–12.1 per 100,000, which is 25.0% higher than the rate for the entire state of Texas (9.2 per 100,000) and 55.4% higher than the U.S. rate (7.4 per 100,000). In Rio Grande Valley and the Laredo area, lack of knowledge, transportation, insurance, and scarcity of physicians contributed to the acceptance of cervical cancer screening and treatment (Boom et al., 2018). Insurance status, level of education, income, age, personal health care provider, and marital status influence uptake of Pap smear (Akinlotan et al., 2017; Lai et al., 2017; Musa et al., 2017). Studies in different counties in Texas shows that the marital status, household income, level of education, insurance status, race, and age acts as a barrier in cervical cancer screening (Akinlotan et al., 2018). Texas HSR 1 serves 41-county area in the Panhandle and South Plains (Texas DSHS, 2018). However, limited research has been done to know how the identified barriers impact cervical cancer screening among low income Hispanic women in Texas, HSR 1.

Hispanic/Latino migrant and seasonal farmworkers show low cervical cancer screening rate due to very low rates of health insurance coverage (Luque et al., 2017). As such, migrant status can act as a barrier in the uptake of Pap test. To develop effective health initiatives and a screening promotion program, it is essential to understand the

barrier in the cervical cancer screening (Li, Carlson, Villarreal, Meraz, & Pagan, 2017). Based on evidence in the literature, there is a literature gap related to what specific predictors contribute to cervical cancer screening uptake in Texas HSR 1, and whether it is due to income, insurance status, age, marital status, education, or personal health care provider. To establish an effective intervention the predictors of cervical cancer screening uptake among HSR 1 in Texas must first be determined. Responding to the gap in the literature, in this study I determined to what extent the high incidence of cervical cancer among low income Hispanic women in Texas HSR 1 may be due to their income, insurance status, or education.

Purpose of the Study

The purpose of this quantitative study was to examine the predictors of cervical cancer screening among low income Hispanic women in Texas HSR 1. In this study, I examined the association between cervical cancer screening and income (all levels), insurance status, education, age, health care provider, and marital status, which influences screening among low income Hispanic women in Texas HSR 1. I explored the impact of all income levels and focused more on low income impact on cervical cancer screening among Hispanic women. In the study, income, insurance status, and level of education represented the independent variables, and cervical cancer screening (Pap test) the dependent variable. Also, the age, marital status, and personal health care provider represented the covariates. Examining the predictors of geospatial areas with low cervical cancer screening helps policy-makers in developing programs and allocating resources on a more local level (Akinlotan et al., 2018). As such, in this study, I examined the extent

of predictors impacting cervical cancer screening in one region (HSR 1). Once the health care providers know the extent to which predictors like income, insurance status, and education impact cervical cancer screening, they can better design programs and initiatives that can increase screening rates and decrease cervical cancer incidence and mortality rates among low income Hispanic women in Texas HSR 1.

Research Questions and Hypotheses

The objective of this research study was to explore a statistically significant relationship between the level of education, income, and insurance status on cervical cancer screening (Pap test) among low income Hispanic women in Texas HSR 1. As such, the research questions and hypotheses are as follows:

Research Question 1 (RQ1): Is there a statistically significant relationship between insurance status (independent variable) and cervical cancer screening (dependent variable) among low income Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$1: There is no statistically significant relationship between the insurance status and cervical cancer screening among low income Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

H_a1: There is a statistically significant relationship between the insurance status and cervical cancer screening among low income Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

Research Question 2 (RQ2): Is there a statistically significant relationship between the level of education (independent variable) and cervical cancer screening (dependent variable) among the low income Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$2: There is no statistically significant relationship between the level of education and cervical cancer screening among low income Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

H_a2: There is a statistically significant relationship between the level of education and cervical cancer screening among low income Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

Research Question 3 (RQ3): Is there a statistically significant relationship between all level income (independent variable) and cervical cancer screening (dependent variable) among Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$3: There is no statistically significant relationship between all level income and cervical cancer screening among Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

H_a3: There is a statistically significant relationship between all level income and cervical cancer screening among Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

In the study, I first completed descriptive statistics. I then used binomial logistic regression (BLR) helped to analyze the relationship between Pap test and income, insurance status, level of education, age, marital status, and personal health care provider. BLRs was used to determine the significance of the results obtained and to decide whether to reject or retain the null hypothesis.

Theoretical Foundation for the Study

According to Grim and Hortz (2017), theories help in addressing the intrapersonal factors like knowledge, attitudes, beliefs, motivation, self-concept, and skills. Health belief model (HBM) constructs include perceived susceptibility, perceived severity, perceived benefits and barriers in engaging in a behavior, cues to action, and self-efficacy (Glanz, Rimer, & Viswanath, 2015). In my study, HBM factors like the perceived vulnerability to the health condition, perceived severity of the health threat, perceived benefits of performing the health behavior, and perceived costs and barriers of performing such action helped in determining factors involved in cervical cancer screening rates. Also, the constructs of HBM are well defined, making its use accessible and applicable (Glanz et al., 2015). As such, the theoretical framework of HBM grounded my study. HBM shows the action taken by individuals towards preventive or detecting disease strategies, and the influencing factors involved in their uptake (Ma et al., 2013). In my research, HBM revealed the impact of insurance status, income, and the level of education on cervical cancer screening among Hispanic women living in Texas HSR 1.

In the study, by using HBM, I assumed that women can adopt cancer preventive strategy by participating in cervical cancer screening, and gain more knowledge on

cervical cancer screening and cervical cancer if they (a) feel that cervical cancer can be avoided, (b) expect that regular cervical cancer screening can avert adverse health outcome (i.e., getting routine Pap smear can prevent late-stage cervical cancer), and (c) believe that they can accept the recommended health action (Pap smear) by speaking comfortably with healthcare providers.

Using HBM in the study, the perceived susceptibility (individual thinking that they would not get cervical cancer), and perceived severity (did not think cervical cancer is dangerous) can act as a central component of motivation, whereas, the perception of benefits (screening might detect and treat pre-cancerous lesions, and can prevent the onset of high-grade cancer), and barriers (income, insurance status, and education) determine women's intention towards screening (Pap test). Moore de Peralta et al. (2017) showed that women with higher self-efficacy are more likely to have obtained a Pap test every year during the last 3 years than women with lower self-efficacy. The study reveals that perceived self-efficacy and threats act as the strongest predictors of cervical cancer screening behavior among Hispanic women (Moore de Peralta et al., 2017; Moore de Peralta et al., 2015). In my study the perceived barrier (income, insurance, and education) of the HBM construct specifically helped in creating and assessing the research questions.

Nature of the Study

In my study, I used the quantitative research approach. The quantitative research approach involved secondary data analysis, wherein I used the dataset collected by a different research team for a different purpose (Statistics Solutions, 2017). My research

question revealed the impact of insurance, income, and level of education on cervical cancer screening. Poverty, low level of education, unemployment, and insurance status influence screening rates, which in turn contributes to a high cervical cancer rate among Hispanic women (Moore de Peralta et al., 2017). As such, variables in my quantitative study included cervical cancer screening, insurance status, income, level of education, age, marital status, and personal health care provider. The dependent variable represented cervical cancer screening in the form of Pap smear; and independent variables represented education, income, and insurance. Age, marital status, and personal health care provider represented the covariates in the study. As such, the quantitative approach helped in analyzing the problem statement related to cervical cancer which closely relates to cancer screening strategies among Hispanic women living in Texas HSR 1. Because all the variables represent health outcome compared to sociodemographic and payment factors, I used cross-sectional design and conducted secondary data analysis from the data available in the 2016-2017 Texas Behavioral Risk Factor Surveillance System (BRFSS).

Literature Search Strategy

The literature review includes a summary of my research on cervical cancer screening and the level of education, income, and impact of insurance status on screening among low income Hispanic women living in the Texas HSR 1. I obtained relevant literature by using search engines and databases at Walden University Library, Science Direct, ProQuest, Google Scholar, and PubMed. Electronic database searches in the Walden University library included CINAHL & MEDLINE Combined Search and

ProQuest Health & Medical Collection under Health Science databases. Databases accessed for the literature review also included: medical journals, nursing journals, and books recommended by Walden librarian. The literature search focused on articles published between the years 2014 and 2018, with older articles cited due to their relevance to this topic.

Types of literature reviewed included peer-reviewed journal articles as well as seminal literature. Additional information is included from the ACS, the CDC, World Health Organization, Texas Cancer Research Institute, and Prevention. The keywords and combinations used for searches include *cervical cancer; cervical cancer screening; cervical cancer screening, and Hispanic/Latinas; Cervical cancer and cervical cancer screening in Texas; cervical cancer screening and risk factors, Pap smear, health belief model, incidence; cervical cancer screening and insurance status; cervical cancer screening and level of education; income and cervical cancer screening.* To answer my research question, I reviewed the electronic peer-reviewed academic journals on education, income, insurance, age, marital status, and provider availability related to cervical cancer screening among low income Hispanic women living in Texas.

The Health Belief Model

My study focused on the predictors of cervical cancer screening among Hispanic women living in Texas HSR 1. The HBM has proved to be a useful theoretical model in assessing people's belief towards health behavior (screening) by using multiple constructs (Jones et al., 2014). HBM constructs include perceived susceptibility, perceived severity, perceived benefits and barriers in engaging in a behavior, cues to

action, and self-efficacy (Glanz et al., 2015). HBM plays a significant role in predicting behavior and in designing behavioral health intervention (Glanz et al., 2015). According to Sulat, Prabandari, Sanusi, Hapsari, and Santoso (2018), HBM uses the conceptual framework in behavioral health research, both for designing interventions and for predicting changes related to health behavior.

The HBM helps in determining the factors behind the nonparticipation in cervical cancer screening programs, and guides in designing culturally appropriate cervical cancer screening interventions (Moore de Peralta et al., 2015). To determine the factors involved in nonparticipation, the HBM use several constructs to predict people behavior on action towards preventing, detecting, or controlling illnesses (Glanz et al., 2015). Research reveals that the constructs of the HBM can be used individually or in combination to understand the health behaviors (Glanz et al., 2015). In my study the research questions are tied to the constructs of the HBM. How the constructs of the HBM could influence the uptake of cervical cancer screening, reduce mortality and morbidity rates associated with cervical cancer among Hispanic women in Texas HSR 1 are described below.

Perceived susceptibility to cervical cancer and cervical cancer screening. According to the HBM, women are more likely to accept cervical cancer screening (Pap test) recommendation only when they are susceptible to cervical cancer (Glanz et al., 2015). The perceived susceptibility (individual thinking that they would not get cervical cancer) acts as a central component of motivation (Moore de Peralta et al., 2015). Lai et al. (2017) observed that 58 years or older women, employed, and unmarried women showed a greater likelihood of developing cervical cancer compared to 35 years and

younger, married, and unemployed women. Non-U.S. born and healthy women were less likely to develop cervical cancer compared to U.S. born and unhealthy women (Lai et al., 2017). However, low perceived susceptibility to cervical cancer contributed to limited utilization of cervical cancer screening services (Hami, Ehlers, & van der Wal, 2014).

It is assumed that greater the perceived risk, greater the likelihood of engaging in behaviors that decreases the risk (Glanz et al., 2015). The perception that one is not at risk of cervical cancer contributes significantly for not obtaining a Pap smear test even when the services are freely provided (Camp et al., 2015; Hami et al., 2014). By analyzing the women awareness on cervical cancer susceptibility it is possible to strengthen the available information related to cervical cancer screening services (Hami et al., 2014). One of the aims of this study was to find out how far this assertion applies to Hispanic women living in Texas HSR 1. Exploring the importance of perceived susceptibility of cervical cancer can influence positive perception that helps in developing preventive measures and in decreasing mortality related to cervical cancer among Hispanics living in Texas HSR 1.

Perceived severity of cervical cancer and screening. According to the HBM, the perceived vulnerability to disease and disease severity combine to form 'threat,' which in turn can motivate action (Glanz et al., 2015). The key element of perceived severity refers to understanding the outcome of contracting cervical cancer or leaving it undiagnosed and untreated (Babazadeh et al., 2018). According to HBM, the perceived severity where the women did not think cervical cancer is dangerous can act as a motivation for not screening (Moore de Peralta et al., 2015). Perceived severity postulates

that an individual gets motivated to adopt a behavior when they consider the health problem in question is serious (Nancy Nien-Tsu et al., 2018). For example, if the Hispanic women living in Texas HSR 1 understand that cervical cancer is a serious disease, and is responsible for serious medical, social, and economic consequences, then they are more likely to participate in routine screening (Tadesse, 2015).

Although most Latino women consider cervical cancer as a serious disease, the belief that screening might result in removal of the uterus, discomfort, and stigma of having a sexually transmitted disease can influence them against testing (Madhivanan, Valderrama, Krupp, & Ibanez's, 2016). Mann, Foley, Tanner, Sun, and Rhodes (2015) showed that US Hispanics/Latinas women are less likely to change their perception that Pap test is uncomfortable and painful even though they have high rates of morbidity and mortality from cervical cancer. There is strong evidence that doctors' and health care providers' advice provides women with clear information on the seriousness of cancer, and initiates them in taking preventive measures such as screenings (Ashtarian, Mirzabeigi, Mahmoodi, & Khezeli, 2017).

Perceived Benefits for Cervical Cancer Screening. Perceived benefits reflect an individual's belief or opinion on a new behavior that helps in reducing the risks involved in getting a disease. Great motivation, high benefit perception, and less barrier perception can increase one's awareness of the benefits of the Pap test (Miri et al., 2018). Cervical cancer detected at an early stage helps in successful treatment. As such, an individual should show optimal beliefs that screening tests will detect cervical cancer at an early stage and believe in its potential benefits (Moore de Peralta et al., 2015). Risk perceptions

play a vital role in health decision-making, For example, Hispanic women in Texas HSR 1 should believe that routine screening can benefit them in detecting cervical cancer at an early stage and prevent the onset of cancer complications.

The result of a multiple regression on the predictors of women's intention to be screened showed that 73% of women obtained good perceived benefits of Pap smear and its influence on their health (Shirazi Zadeh Mehraban, Namdar, & Naghizadeh, 2018). Also, upgrading the perceived benefits can more likely change an individual's behavior (Shirazi Zadeh Mehraban et al., 2018). Findings from another study revealed that positive social interaction and emotional support had been associated with Pap test screening (Documet et al., 2015). Good social support relieves the stress associated with cancer screening and provides the resources that encourage screening behaviors (Documet et al., 2015). Rectifying the misconceptions of cervical cancer screening by continued education can help the Hispanic population in Texas HSR 1 to actively participate in cancer screening program (Lai et al., 2017).

Perceived Barrier to Cervical Cancer Screening. Latinas show cervical cancer at more advanced and less treatable stages (Moore de Peralta et al., 2015). Moore de Peralta et al. (2015) study explains that late diagnosis of cervical cancer among Latinas is due to multiple barriers like lack of health insurance, low-income, embarrassment, fear of finding cancer, and lack of doctor's recommendation. The perceived barrier to cervical cancer screening includes lack of knowledge, fear of cancer diagnosis, inappropriate beliefs and pain toward the procedure, lack of time, crowded health care centers, negative familial history, the absence of any symptoms, and cost of the procedure (Shirazi Zadeh

Mehraban et al., 2018). Higher the perceived barrier score the lower the tendency for Pap test (Shirazi Zadeh Mehraban et al., 2018).

Limited funding like inadequate insurance coverage acts a major structural barrier that restricts individual in accessing cervical cancer prevention services (Boom et al., 2018). Even when the free screening program can remove the structural barriers, low-income women fail to take the opportunity of screening (Akinlotan et al., 2017; Miri et al., 2018). A study thereby indicates that apart from structural barrier, patient related barrier like limited knowledge on accessing the healthcare system can also contribute to low cervical cancer screening rate (Akinlotan et al., 2017; Boom et al., 2018). Similarly, the cultural barrier for Hispanics to access cervical cancer screening includes fatalistic views about cancer predetermined by God, attribution to promiscuous sexual behaviors, and embarrassment of being examined by male physicians (Madhivanan et al., 2016). As such, studying the association between perceived barriers to cervical cancer screening can help in developing stronger information in initiating the uptake of screening services. Once the Hispanic women in Texas HSR1 get access to cancer screening services with limited barriers, there can be a reduction in new cervical cancer cases.

Cues to Action for Cervical Cancer Screening. Cues to action impacts behavior by influencing an individual's perception of susceptibility, severity, benefits, barriers, and self-efficacy (Moore de Peralta et al., 2015). For example, cultural values like belief and attitude impact one's health-seeking behavior and health care utilization. Thereby, cultural values can influences cervical cancer screening behavior among Hispanic women (Moore de Peralta et al., 2015). It is true that women will adopt a regular Pap test when

they are reminded by friends, family members, or health care workers. However, not all family member's involvement influences womens' healthcare decisions. Most of the time, mothers or other female relatives play a vital role in providing health care information, and in the decision to get screened (Madhivanan et al., 2016). To maximize Pap smears, the cues to action need to be culturally meaningful and sensitive to Hispanic women living in Texas HSR 1. For example, culturally meaningful cues to action can include utilization of educational messages in an appropriate language that Latina women can understand (Tung, Lu, Smith-Gagen, & Yan, 2016).

Small media materials combined with lay health workers are effective in delivering Pap test screening and in linking Hispanic women to health services in Texas (Fernandez et al., 2014). Small media material that motivates women towards screening can include videos and printed materials like letters, brochures, and newsletters (Fernandez et al., 2014). Bilingual community health workers not only provide health care information, but also determine financial resources and schedule appointments that help in improving the opportunities for women to undergo cancer screening (Akinlotan et al., 2017). A cross-sectional study by Shirazi Zadeh Mehraban et al. (2018) showed that the most beneficial cues to action involved televisions programs (56%), health care workers (51.3%) and doctors (50.8%), while websites and satellites showed 19.7% and 15%, respectively. Television programs includes information on the prevalence of cervical cancer, life threatening complications of the cancer, benefits of cervical cancer screening, and availability of screening facilities in the area of living (Shirazi Zadeh Mehraban et al., 2018). As such, to improve cervical cancer screening rate among

Hispanics in Texas HSR 1, the most widely accepted social media can be reinforced to broadcast health programs.

Self-Efficacy for Cervical Cancer Screening. Self-efficacy refers to the confidence in one's own ability in acting. Self-efficacy acts as a powerful predictor of disease prevention and detection behaviors (Majdfar et al., 2016). A Multivariate logistic regression in Majdfar et al. (2016) study showed that perceived barriers and poor self-efficacy are seen among women who never had Pap smear. The study was consistent with the findings from Moore de Peralta et al. (2015) study showing that women with higher self-efficacy are more likely to have obtained a Pap test every year during the last three years than women with lower self-efficacy.

Findings from the study conducted by Shirazi Zadeh Mehraban et al. (2018) showed that self-efficacy has a significant impact on Pap test behavior among women in Fasa, south of Iran. Among 200 participants in the study, 57.1% showed a good self-efficacy, and 52% of women had Pap smears test at least once in their lifetime. The educated participants showed higher knowledge and tendency to do Pap smear as compared to low-educated participants. A study conducted among Utah Latinas also reported a similar result (Lai et al., 2017).

Underserved Latinas show a lack of understanding of cervical cancer, risk factors, screening procedure, and prevention measures (Lai et al., 2017). As such, Latinas who perceive cervical cancer as not a threat to their health are less likely to keep up with regular Pap testing (Lai et al., 2017). However, cultural appropriateness helps in increasing the confidence of having a regular Pap smears (Tung et al., 2016). Also,

interpersonal factors like social relationships and social support influence health perceptions and trigger screening behaviors (Documet et al., 2015).

Cervical Cancer Screening

The cervical cancer rate in the United States has decreased from 2.8 to 2.3 deaths per 100 000 women from 2000 to 2015, due to widespread cervical cancer screening (Curry et al., 2018). Pap test or Pap smear is cytology based cervical cancer screening test that identifies precancerous lesions, which on removal prevents the development of invasive cancer (NCI, 2019). In 1928, George N. Papanicolaou developed a test called "Pap smear" wherein the cervical cells from females' uterine wall was taken and were examined under a microscope to detect cancerous cells or precancerous lesions (Pan American Health Organization [PAH0], 2015). NCI and the ACS supported and implemented Pap smear (PAHO, 2015). However, the effectiveness of Pap smears seen after conducting a study from 1947 to 1963 on more than 100,000 women (over 30 years of age). In the study, 468 women were diagnosed with invasive cancer, and 353 women with in-situ carcinomas (PAHO, 2015). Cervical cancer screening can be performed by regular conventional Pap smear (CPS) or Liquid Based Cytology (LBC) (Pankaj et al., 2018). Unsatisfactory smears were commonly reported by a conventional method (7.1%) than with liquid-based method (1.61%) (Pankaj et al., 2018). However, there were no differences seen in the detection of epithelial cell abnormalities using both the methods (Pankaj et al., 2018). Since, there is no significant difference in the final screening outcome and also the high cost associated with LBC, CPS remains a better option in a resource-poor setting (Sharma et al., 2016).

Epidemiology of Cervical Cancer among Hispanics

In the world, cervical cancer considers as the third common cancer and the fourth leading cause of cancer death among women (Elmajjaoui et al., 2016). In 2008, worldwide cervical cancer accounted to be 9% (529,800) of the new cancer cases and 8% (275,100) of cancer death among females (Elmajjaoui et al., 2016). According to Khan et al. (2016) study, Latin America and the Caribbean showed 14.6% of cervical cancer cases and 11.9% of cervical cancer deaths in the world. Cervical cancer remains to be frequent cancer among women in Africa and the disadvantaged population (Ginindza & Sartorius, 2018). In the United States, 9.5 per 100,000 Hispanics population are more likely to be diagnosed with cervical cancer compared to other ethnic population like African Americans (9.2), Asians and Pacific Islanders (6.0), and Whites (7.5) respectfully (ACS, 2019c; Khan et al., 2016). A study by Bodson, Warner, and Kepka (2016) also showed that the incidence of cervical cancer is 1.5 times more among Hispanic/Latino women compared to non-Hispanic/non-Latino White women. However, within the United States, the Southern region shows higher cervical cancer incidence (8.5 per 100,000) and death rate (2.7 per 100,000) (Akinlotan et al., 2018). In Texas, the incidence of cervical cancer estimated as 8.3 per 100,000 population, compared to the national average of 7.5 per 100,000 women (Akinlotan et al., 2017). Within Texas, the invasive cervical cancer incidence rate (Age-Adjusted rate/100,000) among Hispanics in Health Service Region (HSR) 1 estimates 14.2, followed by HSR 2 (13.7), and HSR 5 (9.4) respectively (Texas DSHS, 2018). Thereby, quantifying the cervical cancer screening rate within Texas HSR 1 can provide vital information for policy and decision makers to ascertain necessary

resources in preventing and managing cancer among risk population (Ginindza & Sartorius, 2018).

In the United States

Early diagnosis helps in improving the cervical cancer prognosis (Damiani et al., 2015). As such, regular screening of these cancers by Pap test can help in reducing the mortality from breast and cervical cancer (Damiani et al., 2015). Despite many screening services, cervical cancer remains to be the third most common gynecologic cancer in the United States, with an age-adjusted incidence rate of 7.8 per 100 000 and mortality rate of 2.3 per100 000 from 2007 to 2011 (Gomez, Guendelman, Harley, & Gomez, 2015). The 2008, CDC report showed that in the United States, 10.4 new cases of cervical cancer seen among every 100,000 Hispanic women, as compared to 6.5 new cases among White women during the same period (Moore de Peralta et al., 2015). According to the ACS (2019), in the United States, approximately 13,170 new cases of invasive cancer will be diagnosed among women, and around 4,250 women die from cervical cancer.

There is a decline in the incidence of cervical cancer rate by more than 50 percent, from 17.2 cases per 100,000 women in 1973 to 7.6 cases in 2013 (Akinlotan et al., 2017). Also, the mortality rates associated with cervical cancer shows a decline from 13.1 deaths per 100,000 women in 1950 to 2.3 deaths in 2014 (Akinlotan et al., 2017). However, the southern region in the United States show higher cervical cancer incidence (8.5 per 100,000), and death rate (2.7 per 100,000) compared to other regions (Akinlotan et al., 2017). Also, among the Hispanics/Latinos living in the United States, 35% represents immigrants, and 85% of them have limited English language proficiency, contributing to

low awareness and knowledge on cervical cancer (Bodson, Warner, & Kepka, 2016). The incidence rate of cervical cancer is higher among U.S. Hispanics compared to non-Hispanics (9.7 vs. 7.1 per 100,000 females) (Lai et al., 2017). As such, more research is essential to focus on the influence of health care knowledge, health care access, age, income, and insurance on cervical cancer among Hispanics/Latinos living in various regions of the United States (Bodson et al., 2016; Akinlotan et al., 2018).

In Texas and Health Service Regions

According to Texas Department of State Health Services (DSHS) (2016), 71% of women had Pap smear in the past three years, and the incidence rate of cervical cancer shows 9 per 100,000 women. Geographical locations influence the uptake of cervical cancer screening (Akinlotan et al., 2017). In Texas, rural women are less likely to be screened for cervical cancer compared to urban and suburban women due to the disparity in insurance status and access to health care facilities in rural areas (Akinlotan et al., 2017). Similarly, information obtained from 2014 to 2015 Texas Behavioral Risk Factor Surveillance System (BRFSS) shows 72.2% of women living in counties with a high Hispanic population received recent Pap test compared to 80.9% of women in counties with a low Hispanic population (*P*-value = 0.001) (Akinlotan et al., 2018). In Texas, the cervical cancer incidence rate is 8.3per 100,000 population in 2013, as compared to the national average of 7.5 per 100,000 women for the same year (Akinlotan et al., 2018).

Boom et al. (2018) study showed that the average age-adjusted cervical cancer incidence rate among the Texas–Mexico border consisting of seven counties was 10.9–12.1 per 100,000, which is 25.0% higher than the Texas statewide rate (9.2 per 100,000)

and 55.4% higher than the US rate (7.4 per 100,000). Also, the average age-adjusted mortality rate related to cervical cancer was 3.4–3.8 per 100,000, which is 28.6% higher than the entire Texas state (2.8 per 100,000) and 56.5% higher than the US rate (2.3 per 100,000) (Boom et al., 2018). For every 100,000 women, around three died from cervical cancer (Texas DSHS, 2016). However, within Texas, the invasive cervical cancer incidence rate (Age-Adjusted rate/100,000) remains high among Health Service Region (HSR) 1 (14.2), followed by HSR 2 (13.7), and HSR 5 (9.4) respectively (Texas Department of State Health Services, 2018). The high rate of cervical cancer within HSR 1 alerts the need for more research on predictors of cervical cancer among the Hispanics in Texas HSR 1.

Cervical Cancer Screening among Hispanics

The Pap test is a simple and easy screening test for cervical cancer. According to the American College of Obstetricians and Gynecologists (ACOG) (2017), cervical cancer screening helps in identifying low-grade and high-grade changes. Low-grade changes can be managed by frequent testing to see if the cells change back to normal; and high-grade changes treated by removing the abnormal cells (ACOG, 2017). As such, cervical cancer screening in the form of Pap test identifies pre-cancerous lesions at an early stage and helps in treating and preventing the late stage of cervical cancer (Moore de Peralta et al., 2015; Nancy Nien-Tsu et al., 2018). Older adults show less cervical cancer screening rate and are at higher risk for cancer (Cadet, Burke, Stewart, Howard, & Schonberg, 2017). However, Latinas have benefited less from the Pap test compared to other ethnic groups (Nancy Nien-Tsu et al., 2018). Structural and financial barriers like

lack of time and transportations, uninsured and underinsures hinders the uptake of cervical cancer screening (Nancy Nien-Tsu et al., 2018). Cultural and emotional factors influence the uptake of cervical cancer screening among older Hispanic women (Cader et al., 2017; Madhivanan et al., 2016). Cervical cancer screening can be effective only in the presence of a well-organized system available for follow-up and treatment (WHO, 2019).

In the United States

In the United States, Hispanic women are less likely to be screened for cervical cancer (Nancy Nien-Tsu et al., 2018). Valdovinos et al. (2016) study showed that perceived discrimination is the reason behind low adherence to cancer screening guidelines among US Hispanic/Latino adults. Discrimination triggers stress and hinders individual's self-control resources, which contribute to nonparticipation in healthy behaviors including cervical cancer screening (Valdovinos et al., 2016). Perceived discrimination measured using the Brief Perceived Ethnic Discrimination Questionnaire-Community Version showed that ethnic discrimination along with health insurances contributes to a high rate of late-stage cancer (Valdovinos et al., 2016). Similarly, Moore de Peralta et al. (2017), study showed that cues to action influence Hispanic's women participation in cervical cancer screening. As such, understanding the effect of perceived discrimination on adherence to cancer screening among Hispanic subgroups can help in designing a culturally appropriate intervention strategy that increases cervical cancer screening adherence (Valdovinos et al., 2016). According to Mojica, Flores, Ketchum, and Liang (2017), low level of education, immigration status, fear of knowing to have

cancer, limited English knowledge, and limited understanding of the U.S. health care system restrict Latinos' ability to access cancer screening services.

The prevalence rate of cervical cancer in the U.S. is 8 cases per 100,000, with a mortality rate of 2.4% (Moore de Peralta et al., 2017). But, the minority populations in the U.S. like African American, Hispanic, and Asian American women show reduced cervical cancer screening rate, and thus a higher incidence and mortality rates than white women (Nardi, Sandhu, & Selix, 2016). Screening rates showed lower for Asian women (70.5%), Hispanic and African American women (77% and 82.13%), compared to white women (82.7%) (Nardi et al., 2016). Miles-Richardson, Allen, Claridy, Booker, and Gerbi (2017) study showed that socio-demographic factors and region of residence acts as a predictor for cervical cancer screening among women aged 18 years and older in the United States. The study showed that Hispanic or Latino women living in the South Black Belt States in the US are less likely to be screened for cervical cancer compared to Non-Hispanic Black women and women residing in non-Black Belt states (Miles-Richardson, Allen, Claridy, Booker, & Gerbi, 2017). Latinas living in the Miami-Dade region showed poor knowledge of cervical cancer and cancer screening strategies (Madhivanan et al., 2016). A disparity in the cervical cancer incidence rate in different regions in the U.S. reflects differences in access to screening and treatment facilities (Moore de Peralta et al., 2017). Similarly, cervical cancer screening disparities exist within counties, and thus there is a need for more research on cervical cancer screening in different states and health service regions, like Texas HSR 1.

In Texas and Health Service Regions

Cancer screening reduces the risk of cervical, colon, and breast cancer (Mojica, Flores, Ketchum, & Liang, 2017). Healthy People 2020 goals are to increase the cervical cancer screening rate from 84.5% (baseline in 2008) to 93% (HealthyPeople.gov, 2019). However, cancer screening rates among Latinos remains to be lower (77%) than for non-Latino Whites (83%) and is below Healthy People 2020 goals (Mojica et al., 2017). Cervical Cancer-Free Texas and Cervical Cancer-Free America coalition, identified, developed, disseminated, and sustained evidence-based cervical cancer control programs throughout the state (Fernandez et al., 2014). The cervical cancer control programs include cervical cancer screening (Pap test) through a culturally competent program delivered by lay health workers (LHWs) to Hispanic women. However, according to 2016 BRFSS, cervical cancer screening among women aged 21 to 24 years in Texas is low (48.8%) compared to US (62%) (United Health Foundation [UHF], 2019). Cervical cancer screening among Hispanic women in Texas is 72.2%, as compared to 78.8% of the US population (UHF, 2019). Healthy People 2020 aims to increase the cervical cancer screening rate among women aged 21 to 65 years to 93 percent (UHF, 2019).

Hispanics in Texas show the lowest screening rates compared to non-Hispanic whites and blacks (Akinlotan, Weston, & Bolin, 2018). Racial composition across the health service regions or counties in Texas modifies the association between individual race and Pap testing (Akinlotan et al., 2018). Cancer screening and preventive programs among minority communities target blacks, and Hispanics living in such communities are likely to benefit more from such programs (Akinlotan et al., 2018). However, Boom et al.

(2018) study showed that Federally Qualified Health Center (FQHC) serving uninsured women in Texas-Mexico border performed only 8941(12.9%) Pap test among 69,139 women aged 21-64 years. A low rate of Pap test within different health service regions reflects systemic barrier like insufficient provider clinical capacity, the high cost of healthcare, and poor government funding sources (Boom et al., 2018). Identifying geospatial areas and distinguishing individual-level predictors of Pap testing in Texas HSR 1 help stakeholders in targeting specific sub-groups of the population with low screening rates (Akinlotan et al., 2018).

Literature Review Related to Key Variables and/or Concepts

Level of Education and Cervical Cancer Screening

Educational attainment level a vital health determinant considers being an important predictor of participation to cancer screening (Damiani et al., 2015). A Meta-analysis study on the association between the level of education and the adherence to cervical cancer screening by Pap-test showed that odds of having at least one Pap test over a three-year period are 96% higher for women with the highest level of education as compared with the lowest level (Damiani et al., 2015). Educated women show greater awareness on their risk, more interest, and knowledge on health issues and behaviors, and better access to information and resources related to health including adherence to cancer screening (Damiani et al., 2015). Similarly, lack of correct and up-to-date knowledge shows a negative impact on health-promoting behavior like cervical cancer screening (Damiani et al., 2015). A study conducted in Colombia revealed that the probability of having a Pap test depends on personal attributes, the area of residence, and prevalence of

no education in the neighborhood (Bermedo-Carrasco, Peña-Sánchez, Lepnurm, Szafron, & Waldner, 2015). Understanding the correlation between the level of education and adherence to cancer screening helps policymakers in the decision making processes to focus interventions on this disadvantaged group (Bermedo-Carrasco et al., 2016; Damiani et al., 2015).

The incidence of cervical cancer per 100,000 people for Hispanic women is 9.4 compared to 7.5 for whites, 6.4 for American Indian and Alaska natives, and 6.0 for Asian and Pacific Islander women (CDC, 2018). A higher level of education provides more knowledge on cervical cancer, screening, and the relationship between the two, and impacts the cervical cancer incidence and mortality (Acharya Pandey, & Karmacharya, 2017; Ebu, 2018). However, the level of education differs with age, sex, race and Hispanic origin, nativity, and disability status (Ryan & Bauman, 2016). According to the U.S. Census Bureau, Whites have the highest percentage of high school education (93%), Asians have the highest percentage of bachelor's or higher degree (54%), and Hispanic have the lowest percentage at every level from high school graduate (67%) to advanced degrees (5%) (Ryan & Bauman, 2016). Similarly, Moore de Peralta et al. (2015) study showed that Hispanic woman's perceived susceptibility to and severity of cervical cancer is associated with lack of knowledge on cervical cancer and screening strategies. Perceived susceptibility to cervical cancer increases with an increase in a woman's knowledge of cervical cancer screening (Moore de Peralta et al., 2015). Documet et al. (2015) study showed that 69.4% of women aged above 21 years, reported of having Pap

test in the past three years had less than high school diploma, compared to 77.7% and 89.0% of those with a high school diploma and some college degree, respectively.

Musa et al. (2017) study focused on the effect of education on cervical cancer and screening among women who are at risk for cervical cancer and provides recommendations towards screening for women on cervical cancer screening (CCS). By using the qualitative search strategy, the PICO (Problem or Population, Interventions, Comparison, and Outcome) framework helped the author in reviewing 3072 study reporting screening, among which 28 articles selected to be eligible for inclusion (Musa et al., 2017). This study showed that theory-based educational interventions significantly increased CCS rates (*OR*: 2.46, 95% *CI*: 1.88, 3.21). Also, this study showed that letters, appointment, and sending patient reminders significantly improve participation and CCS rates among the population at risk. Musa et al. (2017) study showed that theory-based cervical cancer educational interventions increase women's participation in cervical cancer screening programs, particularly when intervention targets communities with low literacy levels. However, the limitation of the study is that it did not collect secondary outcome data on the cost of cervical cancer screening tests, health insurance coverage and how these variables influence screening rates (Musa et al., 2017).

Level of education modifies the constructs in the HBM (Ebu, 2018). Education influences subjective perception of cancer screening (Ebu, 2018). Women at some level of education can use better maternal health care services compared to those without any formal education (Ebu, 2018). Women with a higher level of education were 3.16 times (95% *CI*, 1.42–7.02) more likely to have received cervical cancer screening than those

with no formal education (Ebu, 2018). Also, women with no form of education have poor access to health services, less likely of having cervical cancer screening, and experience a low quality of life (Ebu, 2018). As such, women with poor or no education are at high risk of contracting cervical cancer (Ebu, 2018). In the United States, the cervical cancer screening rate among women with less than high school education is 78.2%, high school graduates 79%, some college degree 84.8%, and college graduates 88.2% (UHF, 2019). Similarly, in Texas, the cervical cancer screening rate among women with less than high school education is 70.4%, high school graduates 74.8%, some college degree 85.4%, and college graduates 89.6% (UHF, 2019). However, reasons for Texas HSR 1 could be largely different, and thereby the level of education data from Texas HSR 1 should be specifically analyzed to determine its association with cervical cancer screening rate.

Income and Cervical Cancer Screening

Each year, cervical cancer contributes to the loss of 2.7 million years of life among women aged 25–64 years, with 89% of this loss seen in low-income countries, compared to 11% in high-income countries (Amimo, Moon, Magit, & Sacarlal, 2018). The probability of accessing cervical cancer screening services among women with primary school or lower level of education increases with increase in income ($P < 0.05$) (Amino et al., 2018). Low-income women without health insurance receive free Pap testing from health departments or providers such as Planned Parenthood (Lai et al., 2017). However, along with low income, socio-cultural, religious and structural barriers contribute to low cancer screening uptake (Islam et al., 2017). Apart from Low-income, lack of insurance, low health literacy, the high cost of care, and inability to miss work

prevent patients from accessing the cervical cancer screening and prevention services (Boom et al., 2018).

Women with higher levels of education and income are likely to have a Pap test compared to women with a lower level of education and income (Miles-Richardson et al., 2017). Low-income and ethnic minority women(Hispanics) in the U.S. show lower cervical cancer screening utilization, lower adherence to timely follow-up after an abnormal finding as compared to nonminority or higher-income population (Nonzee et al., 2015). Low-income women showed barriers to knowledge, perceptions of cancer, embarrassment, and prioritization of competing obligations that contributes to low screening rate (Nonzee et al., 2015). Participants with higher income levels and access to a regular source by care reported of having a Pap test every year during the last three years (Moore de Peralta et al., 2017). In Texas, timely Pap testing was low among women aged above 50 years, single women, and those with low education and income (<$25,000) (Akinlotan et al., 2018). Mojica et al. (2017) study showed that 94% of Latina women had an annual household income of <$30,000 which along with lack of insurance contributed to low cervical cancer screening rate. The rate of cervical cancer screening increases with increase in income (Akinlotan et al., 2018).

A study among Korean women from 2005 to 2015 showed greater income-related inequalities than education-related inequalities for both breast and cervical cancer screening (Choi et al., 2018). This greater inequalities in cervical cancer than in breast cancer relates to cervical cancer screening that involves women around 30 years are more likely to have lower income than women of other age groups (Choi et al., 2018).

However, a study on income-related inequality and determinants of inequality changes during the economic crisis is limited (María Merino-Ventosa, & Rosa, 2018). During a financial crisis, reduction of household income level along with a slight increase in the proportion of women without private health coverage negatively impact cervical cancer screening rate (María Merino-Ventosa, & Rosa, 2018). As of 2016, people in Texas below poverty level represented 16.7% as compared to the national rate of 15.1% (Cancer Prevention & Research Institute of Texas, 2019). In 2016, the median household income in Texas was $54,727 (Cancer Prevention & Research Institute of Texas, 2019). However, the association of income with the cervical cancer screening among Hispanic women in Texas HSR 1 is unknown, and thereby the need for research in this particular service providing region was essential.

Insurance Status and Cervical Cancer Screening

The usual source of care and improved cancer screening contributed primarily among insured populations (Lai et al., 2017; Mojica et al., 2017; Shoemaker & White, 2016). In 2015, Latina women between 19 to 64 years with no insurance represented 20% (Mojica et al., 2017). Uninsured women have greater access to no-cost cancer screening resources in the clinics, are eligible to the state's Breast and Cervical Cancer Services program, and have free access to breast and cervical cancer screening and diagnostic services (Mojica et al., 2017). Insured women, when using their health insurance need to face out of pocket costs (e.g., co-pays) which can act as a barrier in seeking care (Mojica et al., 2017). However, cancer screening rate differs within the diverse population of uninsured Hispanic women (Shoemaker & White, 2016). Poor cancer screening is

significant among recent immigrant, uninsured Hispanic groups including Puerto Rican, Central or South American, Cuban, Dominican, and others (Shoemaker & White, 2016). Cuban/Cuban American women who had the lowest Pap test represented women with either public insurance or no insurance (Shoemaker & White, 2016). Mexican women showed the lowest proportion of Pap test compared to other Hispanic subgroups secondary to poor access to health insurance (Shoemaker & White, 2016).

Sabik, Tarazi, Hochhalter, Dahman, and Bradley (2018) study showed that Medicaid eligibility expansions to nonelderly low-income adults ensure access to preventive care including cervical cancer screening. More than perceived ethnic discrimination, health insurance coverage closely associates with receiving breast, cervical, colorectal, or prostate cancer screening (Valdovinos et al., 2016). Cost or a lack of health insurance acts as a barrier to cervical cancer screening among underserved Latinas (Lai et al., 2017). In the U.S. Medicaid and Medicare is not accepted by 18% and 13% of the physician respectfully (Cancer Prevention & Research Institute of Texas, 2019). Similarly, Medicaid and Medicare acceptance among Texas physician is relatively low. In Texas, 35% of the physician does not accept Medicaid, and 20% Medicare (Cancer Prevention & Research Institute of Texas, 2019). Bitler and Carpenter (2017), a study on the insurance adopting mandatory cervical cancer screening showed 1.3% points of increase in cervical cancer screening rate in the past 2-years. Women with preexisting insurance benefit from new or revised insurance plans that cover routine Pap tests without cost-sharing (Bitler & Carpenter, 2017). As such, insurance mandates in all states

that require cervical cancer screening (Pap test) coverage can increase the uptake of screening rate (Bitler & Carpenter, 2017).

Low-income women in Texas had challenges in accessing cervical cancer screening when the state transited to state-only funding without any federal support for women's health services from Medicaid (Akinlotan et al., 2017). Akinlotan et al. (2017) study reveal the impact of low-income and un-insurance on low cervical cancer screening rate. The study population included uninsured women over 21 years with household incomes less than 250% of the federal poverty level, who were considered eligible for grant funding for screening. The quantitative study collected survey data from 433 women who received funds for cervical cancer screening over 33 months. Data in this study included information on demographics, knowledge of risk factors, and barriers to screening. Descriptive analysis revealed a significant relationship between educational attainment and knowledge of risk factors ($r = 0.1381$, $P < 0.01$) (Akinlotan et al., 2017). Multivariate analyses compared Whites and Hispanics, and showed increased odds of fear of finding cancer (*OR* 1.56, 95% *CI* 1.00-2.43), language barriers (*OR* 4.72, 95% *CI* 2.62–8.50), and presence of male physicians (*OR* 2.16, 95% *CI* 1.32–3.55) as barriers in screening (Akinlotan et al., 2017). Limitation of the study is that it does not involve the persons who came for testing in the study, which may reveal that the persons may have some knowledge towards screening or cancer prevention strategies. The second limitation is that only un-insured women with low level of education included in the study, and thereby the outcome cannot be generalized (Akinlotan et al., 2017).

Among the uninsured population in the United States, 34% represents the Latinas as compared to other racial/ethnic groups (Mojica et al., 2017). In Texas, the rate of Hispanics with age group 18 and older without insurance represents 34.7% as compared to either non-Hispanic whites (7.5%) or blacks (11.8%) (Cancer Prevention & Research Institute of Texas, 2019). Even when the rate of uninsured declined from 27% in 2007 to 16.6% in 2016, Texas continues to have the highest uninsured rate in the nation (Cancer Prevention & Research Institute of Texas, 2019). The rate of uninsured in Texas is twice as high as the national average of 8.8% (Cancer Prevention & Research Institute of Texas, 2019). However, the association between insurance status and cervical cancer screening may be different in Texas HSR 1, and thus its data needs to be analyzed.

Marital Status and Cervical Cancer Screening

Cervical cancer screening helps in better treatment and survival rate (Khan et al., 2016). Khan et al. (2016) study focused on the disparity seen with cervical cancer and survival time between White Hispanic (WH) and White non-Hispanic (WNH) women in the United States. The researcher used sampled cervical cancer cases from nine states in the United States from the Surveillance Epidemiology and End Results (SEER) database (Khan et al., 2016). The study showed a statistically significant differences between ethnicities and marital status ($p<0.001$) (Khan et al., 2016). The research showed a significant difference in marital status and survival time between WH and WNH. Wherein, 75% of WH and 35% of WNH women showed declining survival rates within the first 100 months of diagnosis, which reflects the quality of treatment Hispanic women received after cancer diagnosis by Pap test (Khan et al., 2016). The major limitation of

the study is the challenge in categorizing the complex Hispanic ethnicity (Khan et al., 2016). Also, the researcher did not include data from the states Texas and Florida, which have diverse Hispanic populations (Khan et al., 2016). In Texas HSR 1, the influence of marital status on Pap test may show different findings. Thereby, examining states individually like Texas and individual health service regions like HSR 1 can help in recognizing the disparity seen among Hispanics for Pap test within that specific geographic location.

Compared to single women who never have their Pap smear, married women are two times more likely of having had a Pap smear (95% *CI*: 1.13, 3.73) (Ncube, Bey, Knight, Bessler, & Jolly, 2015). Spousal support positively influences the uptake of cervical cancer screening (Ncube et al., 2015). There is a significant association between marital status and the utilization of breast, cervical, and colorectal cancer screening (Hanske et al., 2016). Unmarried women are more likely to avoid regular screening and present at late stage disease (Hanske et al., 2016). Among married individuals, spouses can play a vital role in influencing their partners' towards health-seeking behaviors, like setting up an appointment with a primary care physician (Hanske et al., 2016). The rate of cervical cancer screening among married women was higher (83.9%) compared to divorced/widowed/separated (75.1%) and never married women (78.7%, $p < 0.001$) (Hanske et al., 2016). The rate of cervical cancer screening among married women was five times more compared to those who were never married (Miles-Richardson et al., 2017). Women married with children have better knowledge of cervical cancer risk factors, and undergo regular screening and follow up compared to unmarried women

(Akinlotan et al., 2017). Munseok, Langabeer, Seo, and Langabeer (2018) study showed that among the married women, the relative odds of having a Pap test and having a prior hysterectomy were 1.17 times higher compared to unmarried women (*OR*, 1.17; 95% *CI*, 1.08 to 1.27).

Majdfar et al. (2016) study showed a positive correlation between duration of marriage and husband's education with Pap smear uptake ($P<0.01$). In univariate analysis, the study showed a significant association between Pap smear uptake and duration of marriage (*OR* = 5.7 for 5-14 years and *OR*=10.4 for more than 15) (Majdfar et al., 2016). In multivariate analysis, the significant associations persisted between Pap smear uptake and duration of marriage (*OR* = 5.9; 95% *CI*: 2.8, 12.2) (Majdfar et al., 2016). As such, Pap smear in married women can be considered as a positive health behavior and health promotion (Majdfar et al., 2016). Marital status plays a vital role in cervical cancer screening among Arab American women (Abbound et al., 2017). Arab Americans represent the growing ethnic minority in the United States, with a growth rate of more than 72% from 2000–2010 (Abbound et al., 2017). Arab women believe that for female premarital virginity and bodily privacy reflects respect, modesty, and good reputation, and Pap test can cause loss of virginity and an invasion of bodily privacy (Abbound et al., 2017). As such, Unmarried Arab women consider cervical cancer screening as unimportant and unnecessary before marriage (Abbound et al., 2017).

Marital status and language play an important role in the uptake of Pap test among the Hispanics (Akinlotan et al., 2017). Researchers found that single women reported insufficiency in the English language (*OR* 0.59, 95% *CI* 0.36–0.96) as a barrier to

screening compared to women who were married (Akinlotan et al., 2017). Women who are unmarried, having no children, and having lower socioeconomic position showed lower adherence to cervical cancer screening (Leinonen et al., 2017). In Texas, Married women, and those with a college degree showed higher screening rates (84.4% and 87.4%) compared to unmarried and less educated women (67.6% and 76.5%) (Akinlotan et al., 2018). However, research was essential to evaluate and synthesize the existing evidence on cervical cancer screening behaviors and the influence of marital status on these behaviors among Hispanic women in Texas HSR 1 to promote cervical cancer screening

Age and Cervical Cancer Screening

American Cancer Society recommends cervical cancer screening to begin at age 21, regardless of woman's onset of sexual activity (ACS, 2019; ACOG, 2017). Women aged 21 to 65, should have a Pap test once every three years. But, after age 30, the screening preferences include a Pap test combined with an HPV test every five years (ACS, 2019; ACOG, 2017; Moore de Peralta et al., 2015). However, women aged 65 years, who had a regular screening in the previous ten years, and showed no serious pre-cancers (like CIN2 or CIN3) in the last 20 years can stop from having cervical cancer screening (ACS, 2019; Denson & Keele, 2016). According to ACS (2019), no women of any age should be screened every year by any screening method. Cervical cancer screening should be restricted to women aged 18 years or older (Valdovinos et al., 2016). Younger women are more likely to obtain the unnecessary Pap test than older women, which reflects their misunderstandings or misconceptions about Pap tests and other

screening tests such as vaginal cancer screening (Munseok, Langabeer, Seo, & Langabeer, 2018).

In univariate analysis, Majdfar et al. (2016) study showed a significant association between the Pap smear uptake and the age group (*OR* =2.7 for 27-34 years and *OR*=7.4 for more than 35 years). Also, under multivariate analysis, the significant associations persisted between Pap smear uptake and age (*OR* = 3.9; 95% *CI*: 1.2, 12.9) (Majdfar et al., 2016). There is an association between cervical cancer screening at a particular age and stage-specific cervical cancer rate (Landy, Pesola, Castañón, & Sasieni, 2016). Regular screening among women aged 35–64 years, showed 67% (95% confidence interval (*CI*): 62–73%) reduction in stage 1A cancer, and a 95% (95% *CI*: 94–97%) reduction in stage 3 or worse cervical cancer (Landy et al., 2016). Among women who undergo regular screening, the crude mortality for 25.5–79 years can be half the current (95% *CI*: 0.48–0.52) but can be 3.6 (95% *CI*: 3.3–4.0) times higher in the absence of cervical screening (Landy et al., 2016). Pap smear uptake significantly associates with age group ($p = 0.004$) (Lai et al., 2017). In Utah, Latino women below 37 years showed overdue for Pap testing ($n = 28$, 96.6%) compared to other age groups (38–47 years: $n = 51$, 82.3%; 48–57 years: $n = 43$, 70.5%; ≥ 58 years: $n = 26$, 65%) (Lai et al., 2017).

There is a rise in the mortality rates from cervical cancer among women of reproductive age (Amimo et al., 2018). Miles-Richardson et al. (2017) study showed higher cervical cancer screening among women aged 45–64 and 65–74 years than those aged 18–44 years and 75 and older. In Akinlotan et al. (2017) study in Texas, women older than age 50 showed reduced odds of identifying fear of finding cancer (*OR* 0.54,

95% *CI* 0.32–0.93) as a barrier compared to women younger than 50. The high compliance for cervical cancer screening among younger women makes a diagnosis of cervical cancer easy at an early stage (Akinlotan et al., 2017). However, in Texas, over 95% of cancer deaths occur among individual 45 years or older (Cancer Prevention & Research Institute of Texas, 2019). The national goal is to increase the percentage of cervical cancer screening among women aged 21 to 65 years from 75% (2018 baseline) to 85% (2023 target) (Cancer Prevention & Research Institute of Texas, 2019).

Personal Health Care Provider and Cervical Cancer Screening

Poor access to primary care physicians or specialists impacts the adherence to cancer-related care including cervical cancer screening (Nonzee et al., 2015). Primary care physician can be considered as a personal health care provider since they can play a significant role in addressing most of the medical problems, including preventive services utilization, like cervical cancer screening (Roberto, Anita, & Vishwam, 2010). Having at least one personal health care provider can provide adequate cervical and breast cancer screening behavior (Roberto et al., 2010). In a multivariate analysis, presence of one personal health care provider have shown significant association with adequate cervical cancer screening behavior (odds ratio, 2.37; 95% *CI*, 2.08–2.70) and breast cancer screening behavior (odds ratio, 2.86; 95% *CI,* 2.54–3.24) (Roberto et al., 2010). However, the study showed that personal health care provider and health insurance have independent effects on cancer screening behavior and can be considered as an important predictor of adequate cervical and breast cancer screening (Roberto et al., 2010).

Having a male health care provider like the male general practitioner (GP), a foreign GP, and young GP showed higher non-adherence rates to cervical cancer screening (Leinonen et al., 2017). The role of a personal health care provider and the settings can influence the uptake of health screening behavior. Women who regularly visit their private physician are likely to receive recommendations on preventive health care issues including cervical cancer screening (Damiani et al., 2015; Maar et al., 2014). When personal health care providers educate their clients on the relation between the regular regiment of care, it motivates women to accept preventive services and remove the fears and embarrassment that women feel with cervical cancer screening procedure (Damiani et al., 2015). Abboud et al. (2017) study showed that Arab American women having a primary care provider increased the odds of receiving a Pap test compared to non-Arab (*OR* = 11.1, 95% *CI* [5, 24.4]). Also, lack of a healthcare provider's recommendations for a Pap test showed a decrease in the odds for receiving it (*OR* =0.26, 95% *CI* [0.12, 0.54]) (Abbound et al., 2017).

Health care provider played a vital role in analyzing the barriers and facilitators in cervical cancer screening among Vietnamese American Women (Nguyen-Truong et al., 2018). Health care providers provide education on cervical cancer screening and improve the capacity in providing culturally and linguistically appropriate care (Nguyen-Truong et al., 2018). Charitable and faith-based clinics which rely on foundations, grants, and private funding volunteer NPs, physician assistants (PAs), and physicians (MDs) towards acute and preventive care for their clients, including cervical cancer screening (Denson & Keele, 2016). Volunteer health care providers serving Hispanic women in faith-based

safety net clinics showed that volunteer nurse practitioners are more likely to document cervical cancer screening recommendations ($P < .01$) and perform screenings ($P < .01$) than volunteer physicians (Denson & Keele, 2016). However, Denson and Keele (2016) study limited to 2 faith-based clinics within a specific county, and cannot be generalizable to other populations of voluntary health care providers in different geographic locations like Texas HSR 1.

Akinlotan et al. (2018) study involving 47 of 254 Texas counties, and the sample representing all eleven Texas public health regions showed a significant variation in cervical cancer screening across Texas counties. Individual predictors of Pap screening in the study included age, marital status, routine physical visits, and income (Akinlotan et al., 2018). However, limitation of the study is that it did not include personal health care providers such as nurse practitioners, who also provide Pap testing (Akinlotan et al., 2018). Thereby, further research should consist of personal health care providers in the study, and analyze its effect on Pap test in a specific health service region, like Texas HSR 1.

Definitions

Cervical cancer: Refers to cancer that starts in the cells lining the cervix at the transformation zone; start as pre-cancerous lesions, and takes several years to change to cervical cancer (ACS, 2019b). Cervical cancer refers to a disease where malignant (cancer) cells develop in the cervix (National Cancer Institute [NCI], 2019). Treating all pre-cancerous lesions can prevent almost all cervical cancers (ACS, 2019b). Cervical

cancer ranks 14th among the common cancers affecting the U.S. women (National Institutes of Health [NIH], 2018).

Invasive cervical cancer: Cancer that spread from the surface of the cervix to deeper tissue in the cervix or other parts of the body (NIH, 2018).

Cervical cancer screening: Refers to the test for identifying signs of cervical cancer before a person develops any symptoms (NCI, 2019). Regular cervical cancer screening by Pap test has reduced the cervical cancer incidence and mortality rate by approximately 70% (Boom et al., 2018).

Papanicolaou [Pap] test: A screening test for diagnosing cervical cancer that identifies precancerous lesions before they become invasive cervical cancer (ACS, 2019b). Pap test used in detecting cancer and any changes that may lead to cancer (NCI, 2019). Mortality related to cervical cancer is low among women below 30 years and women of any age who have regular screenings with the Pap test (NCI, 2019).

Hispanic/ Latino: Person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race (U.S. Census Bureau, 2018). According to US Census Bureau 2016, 57.5 million Americans identified themselves as Hispanic or Latino (ACS, 2018).

Level of education: Refers to the highest level of education that an individual has completed (U.S. Census Bureau, 2016). According to the International Standard Classification of Education, levels of education refers to the group educational programs where each category of the program represent broad steps of educational progression

(International Bureau of Education, 2019). More advanced the program reflects higher the level of education (International Bureau of Education, 2019).

Income level: Individual earnings regularly received before paying for personal income taxes, social security, union dues, Medicare deductions, etc. (U.S. Census Bureau, 2016b). Income level is used to assess the economic status at any point in time in a city, state, region, or country such as the United States (U.S. Census Bureau, 2016b).

Insurance: Health insurance protects from unexpected, high medical costs; and helps in maintaining health and treating illnesses and accidents (HealthCare.gov, n.d.). Health insurance helps in providing free preventive care like vaccines, screenings, and some check-ups, even before the deductible is met (HealthCare.gov, n.d.).

Marital status: Marital status and marital history data provides information on marriage trends, and forecast future needs of programs on spousal benefits (U.S. Census Bureau, n.d.). Marital status reflects the outcome of policies and programs focusing on the well-being of families, including tax policies and financial assistance programs (U.S. Census Bureau, n.d.).

Age: Age data helps in planning and funding government programs that provide assistance or services for specific age groups (U.S. Census Bureau, n.d.). The U.S. Preventive Services Task Force (2018) recommends cervical cancer screening with Pap smear once every three years for all women aged 21 to 29 years. Women aged 30 to 65 years can have the cervical cancer screening with Pap smear alone once every three years or have combined Pap test and High-risk HPV test once every five years (The U.S. Preventive Services Task Force, 2018). Analyzing age with other factors like income,

level of education, and insurance can help in recognizing the discrimination in the society and the government programs (U.S. Census Bureau, n.d.).

Personal health care provider: It refers to health care providers who address almost all the medical problems, including the utilization of preventive services (Roberto et al., 2010). American Indians/Alaska Natives showing lower life expectancy and lower quality of life can reflect the low prevalence of having a personal doctor or health care provider (Adakai et al., 2018).

Assumptions

The study involved many assumptions. Firstly, I assumed that self-reported data provides valid and reliable information. Secondly, I assumed that the questionnaires used in the study are answered honestly without any bias. I assumed that the participant knowledge on cervical cancer screening varies based on their ethnicity, and interview participants could read and speak in English and Spanish. Finally, I assumed that low income Hispanic women in Texas HSR 1 will require more awareness and understanding of cervical cancer and screening strategies, and better access to health care facilities and cervical cancer screening.

Scope and Delimitations

In my study, I used a quantitative, cross-sectional study design. My study used Texas BRFSS cross-sectional data from 2016-2017, with inclusion criteria limited to Hispanic women aged between 21 and 65 years, and residing in Texas HSR 1. BRFSS dataset includes all the variables required in the study. Therefore, no other database was utilized. As I utilized BRFSS database for secondary data analysis in this study, there was

no primary data collection or contacts with any participants directly in the study. Since BRFSS is a population-based dataset and only Hispanic women in Texas was analyzed, the results cannot be generalized to the Hispanic population in the different state. The study participants may not have disclosed their personal information, and thereby the questionnaires may compromise the study's internal and external validity. Participants may have given the socially acceptable answers, rather than their actual perception, attitudes, and behaviors towards cervical cancer screening. Due to difficulty in translating certain questions from English to Spanish, some participants may not have answered all questions, thus posing a threat to internal and external validity. Threats to external validity can occur due to the voluntary participation of the study participants. My study was limited to a quantitative, cross-sectional design and there was not any control or comparison groups.

The Significance of the Study and Potential for Positive Social Change

Significance

In the U.S., despite the availability of screening facilities, the minority population including Hispanic women show a high cervical cancer rate. According to Li, Carlson, Villarreal, Meraz, and Pagon (2017), people's attitude towards cervical cancer prevention influences the promotion and acceptance of cervical cancer screening. Reviewing the factors contributing to cervical cancer screening rate can help in developing culturally tailored education and outreach programs that enhance cancer screening services. Improving the education standards and outreach program among low income Hispanic

women within the Health Service Region in Texas can increase the awareness of cervical cancer, and cancer screening.

This research will be an original contribution to the field as there are many research studies published exploring the barriers contributing to cervical cancer screening among Hispanics. But, none of the published contributions have explored the level of education, income, insurance status, age, marital status, and health care providers in the uptake of cervical cancer screening (Pap test) among low income Hispanic women in Texas HSR 1. Reducing the cervical cancer rate in Texas can help in reaching the Healthy People 2020 objective of Age-Adjusted Cervical cancer Incidence Rate from 9.2 to 7.2 (NCI, 2018).

Positive Social Change

An accessible, affordable, and good quality screening program can enhance the cancer screening rate and reduce the morbidity and mortality related to cervical cancer. My study can contribute to a positive social change within the Hispanic community in Texas. The study can help women understand the inequality to access health care center (specifically, to cervical cancer screening programs) among the Hispanic in Texas HSR 1, and the influence of education, insurance status, income, age, marital status, and personal health care provider have on cervical cancer screening. The study can help in increasing culturally appropriate screening interventions that can reduce inequality in cervical cancer screening, enhance early detection and treatment of pre-cancerous lesions, and decrease mortality and morbidity of the targeted population.

Summary

According to ACOG (2017), high-grade cervical cell changes takes almost 3-7 years to turn into cancer. However, cervical cancer screening plays an important role in recognizing early changes in the cervical cells that may lead to cancer later (ACOG, 2017). Despite the availability of cervical cancer screening facilities, cervical cancer persists in being a significant problem, in medically underserved communities (Boom et al., 2018). Significant disparities were seen in the uptake of cervical cancer screening among Hispanic women across Texas counties (Akinlotan et al., 2018). In Texas in 2015, new cases of Cervical Cancer were 1,247, among which 407 women died of Cervical Cancer (CDC, 2018). The cervical cancer incidence rates among Hispanic women in Texas was of 11.9 per 100,000 Women in 2015, compared to the United States average of 9.4 per 100,000 women for the same year (CDC, 2018). The HBM in the study provided additional measures in identifying the predictors responsible for cervical cancer screening and guided in improving and enhancing the uptake of cervical cancer screening rate. Analyzing the predictors of cervical cancer screening among low income Hispanics in Texas in specific health service regions (HSR 1) is an issue that needs a research. This study focused on the influence of level of education, income, insurance status, age, marital status, and health care providers on cervical cancer screening among Hispanic women in Texas HSR 1. Identifying additional predictors in cervical cancer screening among Hispanic women in Texas HSR 1 helped in continued improvement in the uptake of cervical cancer screening.

Conclusion

In conclusion, there was a gap in the literature for research exploring associations between level of education, income, insurance status, age, marital status, and health care providers on cervical cancer screening among low income Hispanic women in Texas HSR 1. Section 1 provided information on the purpose of the study, the nature of the study, the research question and hypothesis, and a detailed literature review with limitation, delimitation, and assumption. The section concluded with a description of the positive social change impact of the study. The subsequent section, Section 2, focused on research design and rationale, methodology, and threats to validity.

Section 2: Research Design and Data Collection

Introduction

The purpose of this study was to determine the predictors of cervical cancer screening among low income Hispanic women in Texas. The study assessed if there was an association between level of education, income, and insurance status on cervical cancer screening among Hispanic women in Texas HSR 1 after controlling for age, marital status, and personal health care provider. This section provided information on the research design and rationale; study population and sample, sample size, choice of instrumentation, its purpose, and how I operationalized the constructs. Lastly, the section described threats to validity and ethical procedures and closes by summarizing the pertinent details involved in the study.

Research Design and Rationale

The identified dependent variable in the study represented cervical cancer screening in the form of Pap smear. The independent variable represented education, income, and insurance. Age, marital status, and personal health care provider represent the co-variants in the study. I used a quantitative, cross-sectional study design from the secondary Texas BRFSS data collected during 2016 and 2017. Akinlotan et al.'s (2018) study used this type of study design to analyze individual and county level predictors on the use of cervical cancer screening tests such as Pap tests in Texas. The survey design in this study provided non-experimental, cross-sectional, quantitative information to determine the predictors of cervical cancer screening among low income Hispanic

women in Texas HSR 1. The advantages of using this BRFSS survey design included quick data collection turnaround, and its cost and time effectiveness.

Methodology

This section describes how the study was conducted. This section involves the description of the study population, sampling and sampling procedures used to collect data as described in secondary data materials. I also addressed the instrumentation and operationalization of constructs, threats to validity, and ethical procedures.

Population

The target population in this study included low income Hispanic women aged 21 to 65 years living in Texas HSR 1 from 2016-2017. This age group was selected based on the U.S. Preventive Task Force (USPTF) guidelines for cervical cancer screening by Pap smear. According to USPTF guidelines, women aged between 21 and 65 years should have a Pap test once every 3 years (Akinlotan et al. 2018; USPTF, 2018).

Sampling and Sampling Procedure

The Texas BRFSS survey included participants accurately representing all types of adults in Texas, regardless of health status (Texas DSHS, 2018b). Texas BRFSS initiated in 1987 represents a cross-sectional telephone survey that includes both landline and cellular phone respondents and administered under the direction of the CDC (Texas DSHS, 2018b). Apart from CDC general questionnaire, Texas adopted a core questionnaire, with optional modules, and state-added questions; all questions were set in English and Spanish language (Texas DSHS, 2018b). The sample for this research study included Hispanic women respondents from the Texas BRFSS survey 2016 and 2017

who were between the ages of 21-65 and lived in HSR 1. My rationale for this sample was because the questionnaire on cervical cancer screening (Pap test) was introduced in 2015, and Hispanic women in HSR 1 showed the highest incidence rate of invasive cervical cancer (Texas DSHS, 2018).

To ensure a representative sample, Texas BRFSS uses multistage cluster sampling, and a random digit dialing among non-institutionalized US citizens who are 18 years or older (Texas DSHS, 2018b). Weighting was used in the BRFSS survey to analyze the differences in the probability of selection, nonresponse bias, non-coverage, and overlapping sample frames (Akinlotan et al. 2018). The estimated response rate for the Texas BRFSS survey was 40% for 2017 and 36.7% for 2016 (CDC, 2018). The response rate refers to a complete or partial interview from the entire eligible sample (Akinlotan et al. 2018). Although lower than the national average response rates for BRFSS (44.9% in 2017 and 47.05% in 2016), the data can be considered appropriate for cross-sectional sampling (CDC, 2018). Since BRFSS operate under the direction of CDC, much of the questionnaires are standardized across all BRFSS surveys in the 50 states, three territories, and the District of Columbia, and helps to make comparisons among states and to the nation. To reduce the errors in prevalence estimates, BRFSS use weight trimming to reduce the value of extremely high weights and to increase the value of extremely low weights (Pickens, Pierannunzi, Garvin, & Town, 2018). Thereby, Texas BRFSS is considered the best sources of data for decision-making throughout DSHS and the public health community (Texas DSHS, 2018b)

Access to the data set. The BRFSS represents a national health-related telephone survey in collecting state data from U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services (CDC, 2018). Each year, the CDC provides free availability of BRFSS dataset online and a readme file (CDC, 2018). Since CDC indicates that HIPAA waiver is approved by IRB in the survey, researchers need not apply for institutional review board (IRB) review (CDC, 2015). However, to access the Texas data set (state data), it was essential to get permission from the Texas Department of State Health Services.

For the study purpose and to access the Texas data, I initially contacted the Texas Health Department. The Texas Health Department informed me that the survey questionnaire on cervical cancer screening takes place on even years, and the last updated questions were available in 2016 data file. The permissions for the use of Texas BRFSS data was strictly for health statistical reporting and analysis (CDC 2018; Texas DSHS, 2018b). To comply with permissions for the usage of the Texas BRFSS data, some of the criteria that users must follow includes:

- Use the data in these data files for statistical reporting and analysis only.
- Analyze the Texas BRFSS data with appropriate software that accounts for the complex sample survey design of the Texas BRFSS
- Use the appropriate weighting factor to get correct estimates
- If any personal identity is discovered in the data, to inform the Texas BRFSS Coordinator at the Texas DSHS of the incident, and safeguard or

delete the information that would identify an individual, as requested by the Texas DSHS

After getting the guidance from the Texas Health Department, I completed and mailed the 'Texas BRFSS Public Use Data File (PUDF) User Registration and Confidentiality Agreement' form provided online at Texas DSHS. Within a day I got the Texas BRFSS data set for 2014 to 2017. Each data set was provided with case sensitive password. Data files included a readme file, data user's guide, codebook, and SPSS output for conversion to SAS 9 and STATA 8. To obtain the data, I completed the steps shown in Figure 1:

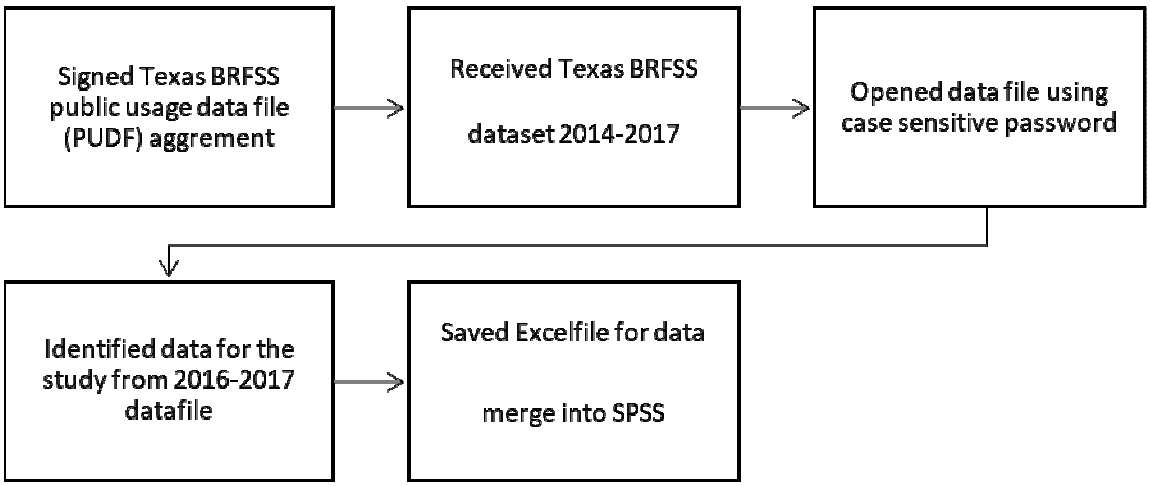

Figure 1: Accessing Texas BRFSS Data

Inclusion and exclusion criteria. Inclusion and exclusion criteria hinged on the ethnicity of the women in the study. Hispanic women living in Texas HSR 1 between the ages of 21 and 65 who had Pap smear in the past 3 years were included in this study. Non-Hispanic women and women residing in other health service regions were excluded from this study.

Sample size. From 2016-2017, a total of 3,515 females aged 21-65 years were selected for the Texas BRFSS survey on the cervical cancer-related questionnaire (Texas BRFSS 2016-2017 Data file). Of these, around 2,665 females completed the survey, and 75% (2064) accepted having a Pap test in the past three years. From the total sample, around 850 Hispanic women participated in the survey, among which 72.3% (635) estimated of having a Pap test in the past three years and were used in this study (n=635).

Justification for the effect size, alpha level, and power level. In a study, *P*-value informs the presence of effect, but will not reveal the size of the effect (Sullivan & Feinn, 2012). However, the substantive significance (effect size) and statistical significance (*P* value) play an important role in reporting and interpreting studies (Sullivan & Feinn, 2012). Since the study involves multistage, probability sampling design, and there was no similar study on the RQs under study, I used the medium effect size to allow for best external validity. According to Cohen, medium effect size is represented as d=0.5 (Sullivan & Feinn, 2012). I used an alpha level of .05 to reduce Type 1 error, and power level of .80 to reduce Type 2 error. Alpha level of 0.05 refers to 5% chance of incorrectly rejecting the null hypothesis, and the probability of a Type I error refers to the significance level (Statistical Solution, 2019). The effect size of 0.5 was obtained by analyzing the difference between the two population divided by the appropriate measure of variance (Leppink, O'Sullivan, & Winston, 2016). However, Type 2 error can be avoided by using a Statistical power. Statistical Power refers to the probability ($1-\beta$) of rejecting the null hypothesis when it is false, and this null hypothesis has to be rejected to avoid Type II error (Statistical Solution, 2019). In Statistical Power, the power level

informs the level or the chance of not making a Type II error. Power level 0.80 represents 80% chance of not making a Type II error (Statistical Solution, 2019). I planned to conduct a post hoc power analysis to evaluate the achieved statistical power, and the detail can be reviewed in Section 3.

Instrumentation and Operationalization of Constructs

The BRFSS acts as a major instrument in collecting uniform state-specific data related to health risk behaviors, chronic diseases and conditions, access to health care, and use of preventive health services related to the leading causes of death and disability in the United States (BRFSS, 2017; CDC, 2019). Since 2011, BRFSS landline telephone and cellular telephone-based surveys include self-reported responses, and without any proxy interviews (BRFSS, 2017). After the survey, each State data get transmitted to CDC for editing, processing, weighting, and analysis (BRFSS, 2017). Validity and reliability are the key indicators used to measure instruments. Reliability refers to the stability of findings, whereas validity refers to the truthfulness of findings (Haradhan Kumar Mohajan, 2017). Akinlotan et al. (2017) study showed that based on BRFSS data, the average screening rate for women ages 21 to 65 years was 82.6% across the United States in 2014 and 77.7% in Texas. From 2014-2015, the estimated response rate for the Texas BRFSS was 35.4% and 34.4% respectfully (Akinlotan et al., 2018). The validity and reliability testing of the BRFSS survey supports the use of the data (Akinlotan et al., 2018). As such, for a valid and reliable data, all public and private health department at the federal, state, and local levels depend on BRFSS to identify public health problems,

set priorities and goals, design policies and interventions, and to evaluate the program outcome (CDC, 2019; Texas DSHS, 2018b).

Apart from cancer screening, BRFSS plays an important role in monitoring the Healthy People 2020 Objectives for current smoking, obesity, high blood pressure, exercise, and physical activity, flu, and pneumonia vaccinations, cholesterol and seat belt usage (Texas DSHS, 2018b). In Texas BRFSS, the health department uses the landline telephone survey to collect data from a randomly selected adult in a household residing in Texas. By cellular telephone survey, Texas BRFSS collects data from adults who answer the cell phones and those residing in a private residence or college housings (BRFSS, 2017). Texas BRFSS acts as an important tool for decision-making throughout DSHS and the public health community (Texas DSHS, 2018b)

Operationalization

Each variable in this study was collected via 2016-2017 Texas BRFSS landline or cellular telephone survey, guided by the CDC (BRFSS, 2017). The sample sizes were too small when using one year of data, so multiple years of data were combined for analysis. My dependent variable in the study included cervical cancer screening (Pap test) and is defined by whether women aged 21-65 years had a Pap test within the past 3 years. This variable is categorical and dichotomous (“yes” or “no”). The independent variables in the study included the level of education, income, and insurance status. I defined the level of education by the highest level of education attained as a categorical variable, separated into the following categories: less than high school, high school graduate, some college, and college graduate. Income was categorized as follows: Less than $15,000; $15,000 to

<$25,000; and $25,000 to <$35,000; $35,000 to <$50,000. I explored the impact of all income levels, and focused more on low incomes (<$25,000). Insurance status was defined as the health insurance coverage for individual aged 18-64 and is a dichotomous variable ("Yes" or "No").

The covariates in this study included age, marital status, and personal health care provider. Age was categorized into the following groups: 21–44 and 45–65. Marital status was categorized as married and unmarried. The personal health care provider was defined as those who have one person as a personal doctor or health care provider. The personal health care provider was categorized as "Yes," only one; yes, more than one; no; don't know; and refused.

Research Questions and Hypotheses

The objective of this research study was to explore a statistically significant relationship between the level of education, income, and insurance status on cervical cancer screening (Pap test) among low income Hispanic women in Texas HSR 1. I used logistic regression to test the relationship between education, income, and insurance status and Pap test among Hispanic women in Texas HSR 1. Logistic regression was used to determine the significance of the results obtained and to decide whether to reject or retain the null hypothesis. The research questions and hypotheses are as follows:

Statistical Analysis for Research Question 1

RQ1: Is there a statistically significant relationship between insurance status (independent variable) and cervical cancer screening (dependent variable) among low

income Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$1: There is no statistically significant relationship between the insurance status and cervical cancer screening among low income Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

H_a1: There is a statistically significant relationship between the insurance status and cervical cancer screening among low income Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

Statistical Analysis for Research Question 2

RQ2: Is there a statistically significant relationship between the level of education (independent variable) and cervical cancer screening (dependent variable) among low income Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$2: There is no statistically significant relationship between the level of education and cervical cancer screening among low income Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

H_a2: There is a statistically significant relationship between the level of education and cervical cancer screening among low income Hispanic Women, living in

Texas HSR 1, after controlling for age, marital status, and personal health care provider.

Statistical Analysis for Research Question 3

RQ3: Is there a statistically significant relationship between all level income (independent variable) and cervical cancer screening (dependent variable) among Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$3: There is no statistically significant relationship between all level income and cervical cancer screening among Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

H_a3: There is a statistically significant relationship between all level income and cervical cancer screening among the Hispanic Women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider.

Data Analysis Plan

I performed univariate analysis to describe the population and understand the frequencies and percentages of all study variables. By conducting bivariate analysis, I determined if there is an association between any of the independent and the dependent variable. According to Statistics Solutions (2018), logistic regression analysis describes data and explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. Binomial logistic regression (BLR) is a predictive statistical analysis model used in a study when the dependent variable is dichotomous (binary). My research includes one dependent

variable, a binary variable (cervical cancer screening), and three independent variables (Insurance, income, & level of education). After obtaining the Chi-square analysis, the independent variables used in the logistic regression can help in identifying the predictor model for increasing cervical cancer screening. As such BLRs can be the best fit in the study to answer the hypotheses (reject or retain the null hypothesis).

I analyzed the collected data using SPSS version 21 and conducted all statistical tests with an alpha level of (α= .05) for statistical significance. The decision to reject or accept the null hypothesis depended on the *p*-value. If the *p*-value was less than or equal to the stated alpha level, reject the null hypothesis and accept the alternative hypothesis. If the *p*-value was greater than the stated alpha level, I retained the null hypothesis and reject the alternative hypothesis. I interpreted all confidence intervals and effect size to avoid a type one error and the strength of the relationship between the independent and dependent variables.

Threats to Validity

Validity reflects the accuracy of the study. Both internal and external threats to validity were specific in this study along with the dataset used. Internal validity in this study was reflected in the design and statistical analysis. External validity was shown in the usage of secondary data and questionnaires used for accuracy and completeness of the data, and alterations made with the data. Threats to external validity can occur due to the voluntary participation of the study participants. The study participants may not have disclosed their personal information, and thereby the questionnaires may compromise the study's internal and external validity.

The BRFSS included a core standardized questionnaire and provided a set of optional module questions for each state to adapt according to their needs (Ronaldo, Pierannunzi, Kristie, Kurt, & Machell, 2016). CDC do not provide any guidance to BRFSS data users on how to adjust the weights provided for each state sample when they aggregate the state samples (Ronaldo et al.,2016). As such, weighted distributions of the state samples do not adhere to national demographic distributions, and thereby more chance of introducing bias by data users (Ronaldo et al., 2016). Also, some participants in the BRFSS survey may not have answered all questions due to difficulty in translating certain questions from English to Spanish, thus posing a threat to internal and external validity. However, in this study, the values relevant to the variables are well documented in the Texas BRFSS 2016-2017 codebook, and missing data are reported to reduce any bias.

Once the state collects data, CDC provides technical assistance by weighting the data with a method called raking, guides in data cleaning and data-quality reporting, and finally release a data set for public use (Ronaldo et al.,2016). However, the cervical screening uptake data from Texas BRFSS study was based on self-reported information, and thereby cannot be validated. Also, the study involves cross-sectional survey information which helped in showing an association but not the causation. The findings from the study may not be generalizable to the U.S. population because the BRFSS survey design excludes persons residing in military installations, correctional institutions, long-term care facilities, and nursing homes (Pickens et al., 2018). Adults without telephone access were also excluded from the BRFSS (Pickens et al., 2018).

Ethical Procedures

Several steps were used to uphold the ethical procedure in this study. As a first step, to access Texas BRFSS data, I contacted the Texas health department, discussed on my research topic, and mentioned on the required data for the study. After getting detailed information from Texas health department via email, I completed, signed, and mailed the 'Texas BRFSS Public Use Data File User Registration and Confidentiality Agreement' form provided online at Texas Department of State Health Services (DSHS). Once I received the data files, I reviewed and saved it in my file (Password protected). BRFSS use standards set by the American Association of Public Opinion Research to calculate the response rates, cooperation rates, and refusal rates (BRFSS, 2017). The information about the respondents in this study was not a public access file, and I will not seek access to this private information. Thus the respondents will remain anonymous.

As a second step, I applied and received approval (IRB approval number 06-19-19-0426569) to conduct the study from Walden University Institutional Review Board (IRB). I did not access and work on the data used in the study until I received the approval. Handling the data act as a major ethical consideration, so its integrity was maintained. As such, I did not modify the original data by falsifying, altering, or modifying it in any way. I ensured that the data in this study are adequate and relevant. The data was assessed specifically for accuracy, collection methods, collection timeframe, content, and purpose. I maintained the ethical standards throughout my study process, thoroughly reported the findings, and clearly stated the statistical significance. I

avoided data fabrication, and informed the knowledge which was a primary goal of this research study.

To avoid the ethical breach, the Texas BRFSS 2016-2017 data used in this study was analyzed without disclosing personal information and identifiers. During the data analysis, if had identified personal information, I was to inform the Texas BRFSS Coordinator at the Texas DSHS of the incident who can resolve the breach in data or release of data. All data used in this study was saved on a personal flash drive and will be deleted completely from the corresponding device in a certain period as per Walden University IRB guidelines.

Summary

In summary, in Section 2, I discussed on research design (cross-sectional, quantitative), rationale and methodology of the study. In this study, the cross-sectional quantitative design analyzed the association between insurance status, income, and level of education on cervical cancer screening among Hispanic women in Texas HSR 1. The methodology section described the study population (Hispanic women living in Texas HSR 1) from Texas BRFSS 2016-2017, management of secondary data, sampling and sampling procedures, and instrumentation and operationalization of constructs. Instrumentation and operationalization of constructs revealed the dependent and independent variables, the data collection and management techniques, and the data analysis plan. Lastly, this section discussed threats to validity, ethical considerations, and dataset treatment post analysis. The next section, Section 3, reveals the results and findings of this study. Section 3 discusss how the data were collected and analyzed.

Section 3: Presentation of the Results and Findings

Introduction

The purpose of this quantitative study was to explore the association between cervical cancer screening (Pap test) and insurance status, level of education, and income among low-income Hispanic women in Texas HSRs. Section 3 includes results of statistical analysis on data collected from 2015-2017 Texas BRFSS. This section provides evidence of an association between the predictors and Pap test. Three research questions included in the study were:

RQ1: Is there an association between insurance status and cervical cancer screening among low-income Hispanic women in Texas HSR1 after controlling for age, marital status, and personal health care provider?

RQ2: Is there an association between level of education and cervical cancer screening among low-income Hispanic women in Texas HSR1 after controlling for age, marital status, and personal health care provider, and

RQ3: Is there an association between income and cervical cancer screening among Hispanic women in Texas HSR1 after controlling for age, marital status, and personal health care provider?

In this section, I described the timeframe and sample population, representative sample, and univariate descriptive analysis (frequency) of the sample. The subsection includes the results of chi-square tests for RQ1, RQ2, and RQ3, and binominal logistic regression model. The section concludes with a summary of the findings from the data analysis.

Data Collection of Secondary Data Set

The Behavioral Risk Factor Surveillance System (BRFSS) is the nation's health-related telephone surveys that collect behavioral health risk data at the state and local level (CDC, 2019). By collecting 400,000 adult interviews each year, BRFSS considers as the largest continuously conducted health survey system in the world (CDC, 2019). CDC directs and monitor BRFSS and ensures that all the questionnaire standardized across all BRFSS surveys in the 50 states, three territories, and the District of Columbia (Texas Health and Human Services [HSS], 2019). Initiated in 1987, a federally supported Texas BRFSS conducts landline and cellular telephone survey and collects data about Texas residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services (Texas HSS, 2019). Federal, state, and local health officials review BRFSS to identify public health issues, set priorities, goals, and to design policies and interventions (Texas HSS, 2019). As mentioned earlier, I planned to utilize 2016–2017 Texas BRFSS data to chi-square and binomial logistic regression analyses on Pap test, as identified by the research questions of this study.

Discrepancies

There were some discrepancies from the use of Texas BRFSS secondary data set. As mentioned earlier, I planned to analyze 2016 and 2017 Texas BRFSS dataset in my study. However, after reviewing the data, the questionnaire on Pap test was missing in 2017 dataset. To get an adequate sample, I included 2015, 2016, and 2017 Texas BRFSS datasets. Also, earlier, I planned to study sample from HSR 1. Upon review, the sample

size from HSR 1 was very minimal, so I planned to include all HSRs from Texas in my study.

Regarding the income category, to get a sufficient sample size, I had to consider <$50,000 as a low-income population. My revised research plan analyzed low-income Hispanic women in Texas HSRs. The combination of 2015-2017 gave me a sample size of 910, which was adequate to perform binomial logistic regression analysis.

My revised research questions are as follows:

RQ1: Is there a statistically significant relationship between insurance status (independent variable) and cervical cancer screening (dependent variable) among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider?

$H_0$1: There is no statistically significant relationship between the insurance status and cervical cancer screening among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider.

H_a1: There is a statistically significant relationship between the insurance status and cervical cancer screening among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider.

RQ2: Is there a statistically significant relationship between the level of education (independent variable) and cervical cancer screening (dependent variable) among the low

income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider?

$H_0$2: There is no statistically significant relationship between the level of education and cervical cancer screening among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider.

H_a2: There is a statistically significant relationship between the level of education and cervical cancer screening among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider.

RQ3: Is there a statistically significant relationship between all level income (independent variable) and cervical cancer screening (dependent variable) among Hispanic women, living in Texas HSR 1, after controlling for age, marital status, and personal health care provider?

$H_0$2: There is no statistically significant relationship between all level of income and cervical cancer screening among Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider.

H_a2: There is a statistically significant relationship between the all level of income and cervical cancer screening among Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider.

Time Frame and Response Rates

Texas health department uses landline and cellular phone to administer the BRFSS surveys continuously through the year (CDC, 2019). Cervical cancer screening is an even year question, though the Texas health department asked it in 2015 (Texas HHS, 2019). In 2017, Texas BRFSS conducted 6,461 landline interviews and 4,752 cell phone interviews, with a response rate of 40% (CDC, 2019). In 2016, there were 7,325 landline interviews and 3,491 cell phone interviews, with a response rate of 36.7% (CDC, 2019). Similarly, in 2015, there was 9,260 landline interviews and 4,727 cell phone interviews and a response rate of 34.4% (CDC, 2019). However, in my study, 915 Hispanic women responded in the BRFSS survey on Pap test questioner between 2015 and 2017.

Descriptive Demographics of the Sample

The sample population was 915 Hispanic women living Texas HSRs. All 915 women responded to questions regarding Pap test within the past 3 years. All women were between the ages of 21-65 years.

Representativeness of the Sample

According to the Texas BRFSS (Texas HSS, 2019), the sample for the survey is selected to be the representatives of the Texas population of all ages. To acquire data for evaluation and decision-making at the local level, DSHS Center for Health Statistics works with the Texas public health community to oversample their area in the statewide BRFSS (Texas HSS, 2019). The oversamples will be weighted to adjust for the probabilities of selection and a post-stratification weighting factor that fits for sex and age of that particular community (Texas HSS, 2019). However, according to the CDC

protocol for BRFSS data, estimates will not be presented for unweighted sample sizes less than 50 (CDC, 2019). Of the households selected between 2015 and 2017 for BRFSS, 915 low-income Hispanic women ages 21-65 formed the study sample

Univariate Analysis

Descriptive of the Sample Population

Tables 1 through 3 depict the sample sizes of Pap smear uptake, sample size of the Hispanic ethnic group and HSRs. Table 1 shows a total sample of 915 Hispanic respondents in the estimation area of Texas participated in the BRFSS survey between 2015 and 2017. Among 915, 866 from the HSRs responded to the survey questionnaire. However, 653 Hispanic females aged 21-65 years responded of having the Pap test within the past 3 years.

Table 1

Hispanic Ethnicity

	Frequency	Percent
Hispanic	915	100.0

Table 2

Texas Health Service Regions

		Frequency	Percent
	HSR 1	37	4.3
	HSR 2/3	88	10.2
	HSR 4/5 N	60	6.9
	HSR 6/5 S	88	10.2
	HSR 7	108	12.5
	HSR 8	60	6.9
	HSR 9/10	166	19.2
	HSR 11	259	29.9
	Total	866	100.0
Missing	System	49	
Total		915	

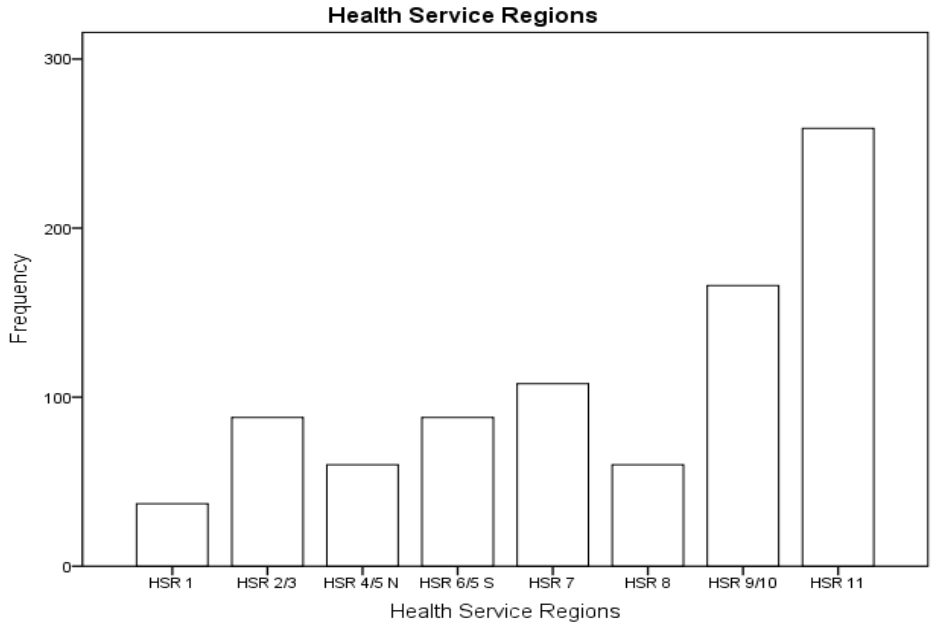

Figure 2. Bar chart showing differences in frequency with various HSR.

Table 3

Females Ages 21-65, With Intact Cervix, Who Have Had a Pap Test Within the Past 3 Years

	Frequency	Percent
Yes	653	71.4
No	262	28.6
Total	915	100.0

Descriptive (Univariate) Characteristics of the Sample Population

Tables 4 through 9 depict the sample sizes of the variables that were evaluated in the study. Fifty-one percent (51%) of females aged 18-64 had health insurance coverage. Nearly 16% (15.6%) had income less than $50,000. Forty-one percent (41.4%) had less than high school education, and nearly 13% (12.8%) were college graduate. Fifty-two percent (52.1%) had one person has a personal doctor or health care provider, and 45.4% had no personal doctor or health care provider. Fifteen percent (15%) of females included in the study were between 18 and 29, while 43.1% were between 45 and 64 years. Nearly 50% (49.8%) females were unmarried.

Table 4

Has Health Insurance Coverage - Ages 18-64

		Frequency	Percent
	Yes	456	51.0
	No	438	49.0
	Total	894	100.0
Missing	System	21	
Total		915	

Table 5

Income Categories

	Frequency	Percent
Less than $15,000	284	31.0
$15,000 to less than $25,000	358	39.1
$25,000 to less than $35,000	130	14.2
$35,000 to less than 50,000	143	15.6
Total	915	100.0

Table 6

Education Categories

	Frequency	Percent
Less than High School	379	41.4
High School Graduate	259	28.3
Some College	160	17.5
College Graduate	117	12.8
Total	915	100.0

Table 7

Do You Have One Person You Think of as Your Personal Doctor or Health Care Provider?

		Frequency	Percent
	Yes, only one	473	52.1
	Yes, more than one	22	2.4
	No	412	45.4
	Total	907	100.0
Missing	Don't have	6	
	Refused	2	
	Total	8	
Total		915	

Table 8

Age Group

	Frequency	Percent
18-29	137	15.0
30-44	365	39.9
45-64	394	43.1
65+	19	2.1
Total	915	100.0

Table 9

Marriage Categories

		Frequency	Percent
	Married	458	50.2
	Unmarried	454	49.8
	Total	912	100.0
Missing	System	3	
Total		915	

Bivariate Analysis

A bivariate analysis of chi-square of all respondents' five variables- insurance status, income, personal health care provider, age, and marital status revealed a significant association with Pap test. Level of education was found non-significant. The complete results of all cross-tabulation and Chi-square analysis is displayed in Table 10-27.

Tables 10 through 18 display the cross-tabulations for independent variables insurance status, level of education, and income by Pap test.

Table 10 shows the cross-tabulation the females in the sample who had Pap test within the past 3 years. 54% percent (54.2%) of the females who had Pap test had insurance coverage, and 43% females had no insurance coverage. Having Pap test was

significantly associated with insurance coverage among low income Hispanic women in Texas HSRs (X^2 =9.274, P=.002), which is shown in Table 11. This test is significant at 0.01 level and certainly below the common 0.05 threshold. Therefore we can reject the null hypothesis that there is no relationship between the two variables assuming that there is some sort of relationship between Pap test and insurance status. However, the strength of association between the variables is very weak (.102) as seen by Phi and Cramer's V measures on Table 12.

Table 10

*Cross-tabulation of Females Ages 21-65, with intact cervix, who have had a pap test within the past 3 years * Has health insurance coverage - ages 18-64*

		Has health insurance coverage		
		Yes	No	Total
Yes	*N*	346	292	638
	%	54.2%	45.8%	100.0%
No	*N*	110	146	256
	%	43.0%	57.0%	100.0%
Total	*N*	456	438	894
	%	51.0%	49.0%	100.0%

Table 11

Chi-Square Tests

	Value	*df*	*p*
Pearson Chi-Square	9.274[a]	1	.002
Continuity Correction[b]	8.829	1	.003
Likelihood Ratio	9.293	1	.002
Fisher's Exact Test			
Linear-by-Linear Association	9.264	1	.002
N of Valid Cases	894		

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 125.42.
Computed only for a 2x2 table.

Table 12

Symmetric Measures

		Value
Nominal by Nominal	Phi	.102
	Cramer's V	.102
N of Valid Cases		894

Table 13 shows that 41% percent (41.3%) of the females who had Pap test had less than high school education, 28% (27.9%) high school graduate, 17% (16.8%) some college, and 14% (13.9%) college graduate. 42% (41.6%) of the females who had no Pap smear had less than high school graduate, 30% (29.7%) high school graduate,

19%(19.1%) some college and 10 (9.9%) college graduate. Having Pap test was not significantly associated with level of education among low income Hispanic women in Texas HSRs (X^2=3.045, *P*=.385), which is shown in Table 14. Since, *p*-value is more than the common 0.05 threshold we can tell that there is no statistically significant association between the level of education and Pap test. Therefore, we accept the null hypothesis that there is no relationship between the two variables.

Table 13

*Cross-tabulation of Females Ages 21-65, With Intact Cervix, Who Have Had a Pap Test Within the Past 3 Years * Education Categories*

		Less than High School	High School Graduate	Some College	College Graduate	
Yes	*N*	270	182	110	91	653
	%	41.3%	27.9%	16.8%	13.9%	100.0%
No	*N*	109	77	50	26	262
	%	41.6%	29.4%	19.1%	9.9%	100.0%
Total	*N*	379	259	160	117	915

Table 14

Chi-Square Tests

	Value	*df*	*p*
Pearson Chi-Square	3.045[a]	3	.385
Likelihood Ratio	3.157	3	.368
Linear-by-Linear Association	.619	1	.431
N of Valid Cases	915		

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 33.50.

Table 15

Symmetric Measures

		Value
Nominal by Nominal	Phi	.058
	Cramer's V	.058
N of Valid Cases		915

Table 16 shows that nearly 28% (27.7%) of the females who had Pap test had income less than $15,000, 39% (38.6%) had an income between $15,000 to $25,000, 17% (16.5%) had an income between $25,000 to $35,000, and 17% (17,2%) had an income of $35,000 to less than $50,000. Also, females who had no Pap test had nearly 39% (39.3%) income less than $15,000, 41% (40.5%) had an income between 15,000 to $25,000, 8.4% had an income between $25,000 to $35,000, and 11.8% had an income of $35,000 to less than $50,000. Having Pap test was significantly associated with income levels among Hispanic women in Texas HSRs (X^2 =20.375, P=.000), which is shown in Table 17. Therefore we can reject the null hypothesis that there is no relationship between the two variables assuming that there is some sort of relationship between Pap test and income levels. However, the strength of association between the variables is very weak (.149) as seen by Phi and Cramer's V measures on Table 18.

Table 16

*Cross-tabulation of Females Ages 21-65, With Intact Cervix, Who Have Had a Pap Test Within the Past 3 Years * Income Categories*

		Less than $15,000	$15,000 to less than $25,000	$25,000 to less than $35,000	$35,000 to less than 50,000	
Yes	*N*	181	252	108	112	653
	%	27.7%	38.6%	16.5%	17.2%	100.0%
No	*N*	103	106	22	31	262
	%	39.3%	40.5%	8.4%	11.8%	100.0%
Total	*N*	284	358	130	143	915
	%	31.0%	39.1%	14.2%	15.6%	100.0%

Table 17

Chi-Square Tests

	Value	*df*	*p*
Pearson Chi-Square	20.375[a]	3	.000
Likelihood Ratio	21.156	3	.000
Linear-by-Linear Association	16.308	1	.000
N of Valid Cases	915		

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 37.22.

Table 18

Symmetric Measures

		Value
Nominal by Nominal	Phi	.149
	Cramer's V	.149
N of Valid Cases		915

Tables 19 through 26 display the cross tabulation of control variables (personal health care provider, age group, and marriage category) to Pap test.

Table 19 shows that nearly 56% (55.7%) of the females who had Pap test had nearly one personal health care provider, 3% (2.9%)) more than one, and 41% (41.3%) no personal health care provider. 43% (43.3%) of the females who had no Pap test had one personal health care provider, 1% (1.1%) more than one, and 56% (55.6%) with no personal health care provider. Having Pap test was significantly associated with personal health care provider among Hispanic women in Texas HSRs (X^2 =16.521, P=.000), which is shown in Table 20. Therefore we can reject the null hypothesis that there is no relationship between the two variables assuming that there is some sort of relationship between Pap test and personal health care provider. However, the strength of association between the variables is very weak (.134) as seen by Phi and Cramer's V measures on Table 21

Table 19

*Cross-tabulation of Females Ages 21-65, With Intact Cervix, Who Have Had a Pap Test Within the Past 3 Years * Do you have one person you think of as your personal doctor or health care provider?*

		Yes, More Than One	Yes, Only One	No	
Yes	*N*	360	19	267	646
	%	55.7%	2.9%	41.3%	100.0%
No	*N*	113	3	145	261
	%	43.3%	1.1%	55.6%	100.0%
Total	*N*	473	22	412	907
	%	52.1%	2.4%	45.4%	100.0%

Table 20

Chi-Square Tests

	Value	*df*	*p*
Pearson Chi-Square	16.250[a]	2	.000
Likelihood Ratio	16.521	2	.000
Linear-by-Linear Association	13.586	1	.000
N of Valid Cases	907		

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.33.

Table 21

Symmetric Measures

		Value
Nominal by Nominal	Phi	.134
	Cramer's V	.134
N of Valid Cases		907

Table 22 shows that nearly 14% (13.6%) of the females who had Pap test were in age group of 18-29, 43% (42.7%) were between 30-44 years, 42% (41.5%) were between 45-64 years, and 2% were (2.1%) above 65 years. 18 %(18,3%) of the females who had no Pap test were between the age group of 18-29, 33% (32.8%) were between 30-44 years, 47% (46.9%) were between 45-64 years, and 2% (1.9%) were above 65 years. Having Pap test was significantly associated with age group among Hispanic women in Texas HSRs (X^2 =8.681, P=.034), which is shown in Table 23. Therefore we can reject the null hypothesis that there is no relationship between the two variables assuming that there is some sort of relationship between Pap test and age group. However, the strength of association between the variables is very weak (.097) as seen by Phi and Cramer's V measures on Table 24.

Table 22

*Cross-tabulation of Females Ages 21-65, With Intact Cervix, Who Have Had a Pap Test Within the Past 3 Years * Age Group*

		18-29	30-44	45-64	65+	
Yes	*N*	89	279	271	14	653
	%	13.6%	42.7%	41.5%	2.1%	100.0%
No	*N*	48	86	123	5	262
	%	18.3%	32.8%	46.9%	1.9%	100.0%
Total	*N*	137	365	394	19	915
	%	15.0%	39.9%	43.1%	2.1%	100.0%

Table 23

Chi-Square Tests

	Value	*df*	*p*
Pearson Chi-Square	8.681[a]	3	.034
Likelihood Ratio	8.736	3	.033
Linear-by-Linear Association	.003	1	.959
N of Valid Cases	915		

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.44.

Table 24

Symmetric Measures

		Value
Nominal by Nominal	Phi	.097
	Cramer's V	.097
N of Valid Cases		915

Table 25 shows that 53% of the females who had Pap test were married, and 47% were unmarried. 43% (43.3%) of the females who had no Pap test were married and 57% (56.7%) were unmarried. Having Pap test was significantly associated with marital status among low income Hispanic women in Texas HSRs (X^2 =7.012, P=.008), which is shown

in Table 26. Therefore I can reject the null hypothesis that there is no relationship between the two variables assuming that there is some sort of relationship between Pap test and marital status. However, the strength of association between the variables is very weak (.008) as seen by Phi and Cramer's V measures on Table 27.

Table 25

*Cross-tabulation of Females Ages 21-65, With Intact Cervix, Who Have Had a Pap Test Within the Past 3 Years * Marriage Categories*

		Married	Unmarried	
Yes	*N*	345	306	651
	%	53.0%	47.0%	100.0%
No	*N*	113	148	261
	%	43.3%	56.7%	100.0%
Total	*N*	458	454	912
	%	50.2%	49.8%	100.0%

Table 26

Chi-Square Tests

	Value	*df*	*p*
Pearson Chi-Square	7.012[a]	1	.008
Continuity Correction[b]	6.630	1	.010
Likelihood Ratio	7.028	1	.008
Fisher's Exact Test			
Linear-by-Linear Association	7.005	1	.008
N of Valid Cases	912		

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 129.93. b. Computed only for a 2x2 table.

Table 27

Symmetric Measures

		Value
Nominal by Nominal	Phi	.088
	Cramer's V	.088
N of Valid Cases		912

Binomial Logistic Regression Analysis

Binomial logistic regression was performed separately for each one of the three independent variables with three control variables simultaneously to analyze the predictors for the uptake of Pap test among low income Hispanic women in Texas HSRs. The main goal of the binary logistic regression analysis was to determine the role of several predictors in explaining the dichotomous outcome (yes or no Pap test). The independent variables were insurance status, level of education, and income. Control variables includes personal health care provider, age, and marital status. The complete results of all BLRs is displayed in Table 28-42.

Results Research Question 1

Table 28-32 displays the BLR for Pap test and insurance status with control variables, and provides results for RQ1.

Table 28

Dependent Variable Encoding

Original Value	Internal Value
Yes	0
No	1

Table 29

Categorical Variables Codings

			Parameter coding	
		Frequency	(1)	(2)
Do you have one person you think of as your personal doctor or health care provider?	yes, more than one	457	.000	.000
	Yes, Only one	21	1.000	.000
	NO	407	.000	1.000
Age group	18-29	137	.000	.000
	30-44	360	1.000	.000
	45-64	388	.000	1.000
Marriage Categories	Married	443	.000	
	Unmarried	442	1.000	
Has health insurance coverage - ages 18-64	Yes	451	.000	
	No	434	1.000	

Table 30

Model Summary

Step	-2 Log likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	1023.913[a]	.043	.062

Note. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 31

Hosmer and Lemeshow Test

Step	Chi-square	*df*	*p*
1	5.752	7	.569

Table 32

Variables in the Equation

		B	S.E.	Wald	*df*	*p*	*OR*	95% C.I.for *OR* Lower	Upper
Step 1[a]	Has health insurance coverage - ages 18-64(1)	.421	.164	6.618	1	.010	1.523	1.105	2.098
	Do you have one person you think of as your personal doctor or health care provider?			10.036	2	.007			
	Do you have one person you think of as your personal doctor or health care provider?(1)	-.578	.640	.816	1	.366	.561	.160	1.966
	Do you have one person you think of as your personal doctor or health care provider?(2)	.477	.164	8.471	1	.004	1.611	1.168	2.221
	Age group			12.442	2	.002			
	Age group(1)	-.547	.224	5.957	1	.015	.579	.373	.898
	Age group(2)	.033	.218	.023	1	.879	1.034	.675	1.584
	Marriage Categories (1)	.368	.154	5.746	1	.017	1.445	1.069	1.953
	Constant	-1.340	.240	31.148	1	.000	.262		

Note. Variable(s) entered on step 1: Has health insurance coverage - ages 18-64, Do you have one person you think of as your personal doctor or health care provider?, Age group, Marriage Categories .

Is there a statistically significant relationship between insurance status (independent variable) and Pap test (dependent variable) among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider?

A binary logistic regression analysis was conducted to analyze if insurance status, personal health care provider, age, and marital status predicts uptake of Pap test (Table 28-32). The outcome of interest was Pap test. The predictor variables were insurance status (IV), and personal health care provider, age, and marital status (control variables). Reference category for the study is selected from the categorical variables codings (Table 29). From the categorical variable coding table, persons with more than one personal health care provider, age group18-29, married group, and persons with health insurance is selected as a reference category in the analysis. The Hosmer-Lemeshow goodness-of-fit (Table 31) was not significant (p>.05) indicating the model has good fit. Additionally, the -2Log likelihood=1023.913 and the Nagelkerke *R* Square =.062. The model (Table 32) shows that the persons without health insurance, ages 18-64 were 52.3% more likely not to have Pap test compared to those with health insurance (reference category). Persons without personal health care provider (group 2) were 61.1% more likely not to receive Pap test compared to persons who had more than one personal health care provider. Persons of age group 1 (30-44) were 42.1% less likely not to receive Pap test compared to those of reference group (18-29). Also, persons who are not married (marriage category 1) were 44.5% more likely not be screened by Pap test compared to those who are married (reference category).

Regression analysis for insurance status had significant results. Wald=6.618, p<.001, *OR*=1.52, suggests that persons without health insurance are more likely of not to have Pap test in comparison to persons with health insurance. Regression analysis for personal health care provider, age, and marital status was significant. Wald=8.471,

$p<.001$, $OR=1.61$ suggests that persons without health care provider are more likely not to have the Pap test in comparison to persons with more than one personal health care provider. Wald=5.957, $p<.001$, $OR=.58$ suggests that person of age group 30-44 are more likely not to receive Pap test compared to persons with age group 18-29. Wald=5.746, $p<.001$, $OR=1.45$ suggests that persons who are not married are more likely not to receive Pap test compared to persons who are married.

Results Research Question 2

Table 33-37 displays the BLR for Pap test and level of education with control variables, and provides results for RQ2.

Table 33

Dependent Variable Encoding

Original Value	Internal Value
Yes	0
No	1

Table 34

Categorical Variables Codings

			Parameter coding		
		Frequency	(1)	(2)	(3)
Education Categories	Less than High School	373	.000	.000	.000
	High School Graduate	255	1.000	.000	.000
	Some College	159	.000	1.000	.000
	College Graduate	117	.000	.000	1.000
Age group	18-29	137	.000	.000	.000
	30-44	360	1.000	.000	.000
	45-64	388	.000	1.000	.000
	65+	19	.000	.000	1.000
Do you have one person you think of as your personal doctor or health care provider?	Yes, More than one	473	.000	.000	
	Yes, Only one	22	1.000	.000	
	No	409	.000	1.000	
Marriage Categories	Married	452	.000		
	Unmarried	452	1.000		

Table 35

Model Summary

Step	-2 Log likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	1049.057[a]	.039	.055

Note. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 36

Hosmer and Lemeshow Test

Step	Chi-square	*df*	*p*
1	3.676	8	.885

Table 37

Variables in the Equation

		B	S.E.	Wald	*df*	*p*	*OR*	95% C.I.for *OR* Lower	Upper
Step 1[a]	Education Categories			2.587	3	.460			
	Education Categories(1)	.025	.184	.019	1	.891	1.026	.715	1.471
	Education Categories(2)	.102	.216	.224	1	.636	1.107	.726	1.689
	Education Categories(3)	-.339	.257	1.739	1	.187	.713	.431	1.179
	Do you have one person you think of as your personal doctor or health care provider?			16.790	2	.000			
	Do you have one person you think of as your personal doctor or health care provider?(1)	-.633	.636	.991	1	.320	.531	.153	1.846
	Do you have one person you think of as your personal doctor or health care provider?(2)	.602	.157	14.621	1	.000	1.825	1.341	2.484
	Age group			10.555	3	.014			
	Age group(1)	-.508	.225	5.091	1	.024	.602	.387	.935
	Age group(2)	.015	.220	.004	1	.947	1.015	.659	1.562
	Age group(3)	-.110	.566	.038	1	.846	.896	.296	2.715
	Marriage Categories (1)	.338	.152	4.924	1	.026	1.402	1.040	1.889
	Constant	-1.159	.261	19.764	1	.000	.314		

Note. a. Variable(s) entered on step 1: Education Categories, Do you have one person you think of as your personal doctor or health care provider? Age group, Marriage Categories.

Is there a statistically significant relationship between level of education (independent variable) and Pap test (dependent variable) among low income Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider?

A binary logistic regression analysis was conducted to analyze if level of education, personal health care provider, age, and marital status predicts uptake of Pap test (Table 33-37). The outcome of interest was Pap test. The predictor variables were level of education (IV), and personal health care provider, age, and marital status (control variables). Reference category for the study is selected from the categorical variables codings (Table 34). From the categorical variable coding table, persons with less than high school education, persons with more than one personal health care provider, age group18-29, and married group are selected as a reference category in the analysis. The Hosmer-Lemeshow goodness-of-fit (Table 36) was not significant ($p>.05$) indicating the model has good fit. Additionally, the -2 Log likelihood=1049.057 and the Nagelkerke *R* Square =.055. The model (Table 37) shows no significance with any of the educational category to those with reference category. Persons with no personal health care provider (group 2) were 82.5% more likely not to receive Pap test compared to persons who had more than one personal health care provider. Persons of age group 1 (30-44) were 39.8% less likely not to receive Pap test compared to those of reference group (18-29). Also, persons who are not married (marriage category 1) were 40.2% more likely not be screened by Pap test compared to those who are married (reference category).

Regression analysis for level of education had not significant results. Regression analysis for personal health care provider, age, and marital status was significant. Wald=14.621, $p<.001$, *OR*=1.83 suggests that persons without health care provider are more likely not to have the Pap test in comparison to persons with more than one personal health care provider. Wald=5.091, $p<.001$, *OR*=.60 suggests that person of age

group 30-44 are less likely not to receive Pap test compared to persons with age group 18-29. Wald=4.924, $p<.001$, $OR=1.40$ suggests that persons who are not married are more likely not to receive Pap test compared to persons who are married.

Results Research Question 3

Table 38-42 displays the BLR for Pap test and level of education with control variables, and provides results for RQ3.

Table 38

Dependent Variable Encoding

Original Value	Internal Value
Yes	0
No	1

Table 39

Categorical Variables Codings

			Parameter coding		
		Frequency	(1)	(2)	(3)
Income Categories	Less than $15,000	280	.000	.000	.000
	$15,000 to less than $25,000	353	1.000	.000	.000
	$25,000 to less than $35,000	129	.000	1.000	.000
	$35,000 to less than 50,000	142	.000	.000	1.000
Age group	18-29	137	.000	.000	.000
	30-44	360	1.000	.000	.000
	45-64	388	.000	1.000	.000
	65+	19	.000	.000	1.000
Do you have one person you think of as your personal doctor or health care provider?	Yes, More than one	473	.000	.000	
	Yes, Only one	22	1.000	.000	
	No	409	.000	1.000	
Marriage Categories	Married	452	.000		
	Unmarried	452	1.000		

Table 40

Model Summary

Step	-2 Log likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	1035.977[a]	.053	.075

Note. a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 41

Hosmer and Lemeshow Test

Step	Chi-square	*df*	*p*
1	3.168	8	.923

Table 42

Variables in the Equation

		B	S.E.	Wald	*df*	*p*	*OR*	95% C.I.for *OR* Lower	Upper
Step 1[a]	Income Categories			14.803	3	.002			
	Income Categories(1)	-.240	.175	1.884	1	.170	.786	.558	1.108
	Income Categories(2)	-.946	.271	12.170	1	.000	.388	.228	.661
	Income Categories(3)	-.614	.251	5.970	1	.015	.541	.331	.886
	Do you have one person you think of as your personal doctor or health care provider?			14.688	2	.001			
	Do you have one person you think of as your personal doctor or health care provider?(1)	-.802	.637	1.584	1	.208	.448	.129	1.564
	Do you have one person you think of as your personal doctor or health care provider?(2)	.543	.158	11.811	1	.001	1.721	1.263	2.346
	Age group			9.902	3	.019			
	Age group(1)	-.529	.225	5.527	1	.019	.589	.379	.916
	Age group(2)	-.032	.219	.021	1	.884	.969	.631	1.488
	Age group(3)	-.213	.570	.139	1	.709	.808	.265	2.469
	Marriage Categories (1)	.220	.156	1.971	1	.160	1.246	.917	1.693
	Constant	-.751	.268	7.840	1	.005	.472		

Note. Variable(s) entered on step 1: Income Categories, Do you have one person you think of as your personal doctor or health care provider? Age group, Marriage Categories.

Is there a statistically significant relationship between income level (independent variable) and Pap test (dependent variable) among Hispanic women, living in Texas HSRs, after controlling for age, marital status, and personal health care provider?

A binary logistic regression analysis was conducted to analyze if income, personal health care provider, age, and marital status predicts uptake of Pap test (Table 38-42). The outcome of interest was Pap test. The predictor variables were income level (IV), and personal health care provider, age, and marital status (control variables). Reference

category for the study is selected from the categorical variables codings (Table 39). From the categorical variable coding table, persons with income less than $15,000, persons with more than one personal health care provider, age group18-29, and married group are selected as a reference category in the analysis. The Hosmer-Lemeshow goodness-of-fit (Table 41) was not significant (p>.05) indicating the model has good fit. Additionally, the -2Log likelihood=1035.977 and the Nagelkerke R Square =.075. The model (Table 32) shows that persons with income category 2 ($25,000 to less than $35,000), and category 3 ($35,000 to less than $50,000) were 61.2% and 45.9% less likely not to receive Pap test compared to reference category respectively. Persons without personal health care provider (group 2) were 72.1% more likely not to receive Pap test compared to persons who had more than one personal health care provider. Persons of age group 1 (30-44) were 41.1% less likely not to receive Pap test compared to those of reference group (18-29). Also, persons who are not married (marriage category 1) were 24.6% more likely not be screened by Pap test compared to those who are married (reference category).

Regression analysis for income status had significant results. Wald=12.170, p<.001, OR= .39 suggests that persons with income between $25,000 to less than $35,000 were less likely not to have Pap test compared to persons with income less than $15,000. Wald=5.970, p<.001, OR= .51 suggests that persons with income between $35,000 to less than $50,000 were less likely not to have Pap test compared to persons with income less than $15,000.Regression analysis for personal health care provider, age, and marital status was significant. Wald=11.811, p<.001, OR=1.72 suggests that persons without health care provider are more likely not to have the Pap test in comparison to

persons with more than one personal health care provider. Wald=5.527, $p<.001$, $OR=.58$ suggests that person of age group 30-44 are less likely not to receive Pap test compared to persons with age group 18-29. Wald=1.971, $p<.001$, $OR=1.24$ suggests that persons who are not married are more likely not to receive Pap test compared to persons who are married.

Summary

In conclusion, there was no association between level of education and cervical cancer screening (Pap test) among low income Hispanic women living in Texas HSRs after controlling for age, marital status, and personal health care provider. However, there was a statistically significant association between insurance status and income on Pap test among Hispanic women in Texas HSRs (Wald=6.618, $p<.001$, $OR=1.52$; Wald=12.170, $p<.001$, $OR= .39$, respectively). Section 4 provides an overview of the interpretations, limitations, recommendations, and conclusions that are relevant to this doctoral study. Section 4 also provides the comparison of findings to relevant literature.

Section 4: Application to Professional and Implications for Social Change

Introduction

The purpose of this quantitative study was to analyze the relationship between cervical cancer screening and insurance status, level of education, and income among low-income Hispanic women in Texas HSRs. Overall there was no association between the level of education and cervical cancer screening (Pap test) among low-income Hispanic women living in Texas HSRs after controlling for age, marital status, and personal health care provider. However, there was a statistically significant association between insurance status and income on Pap test among Hispanic women in Texas HSRs. This section includes an interpretation of the findings, limitations of the study, recommendations for further research, and implications for professional practice towards positive social change.

Interpretation of the Findings

The analyses of Texas BRFSS (2015-2017) data indicated no significant associations between the level of education and Pap test. However, Texas BRFSS (2015-2017) data showed a significant association between Pap test and insurance status, income, and the covariates (age, marital status, and personal health care provider). In the following subsection, I compared the findings to the literature and discuss the significant results.

Findings to Literature

Level of education. Documet et al. (2015) analyzed the association between the level of education and the Pap test. The authors showed that women with less than high

school diploma reported having a lower Pap test (69.4%), compared to those with a high school diploma (77.7%) and some college degree (89 %). Interventions that activate social support networks can increase cervical cancer screening uptake among women with low educational attainment (Documet et al., 2015). Musa et al. (2017) study focused on the effect of education on cervical cancer and screening among women who are at risk for cervical cancer. The authors concluded that theory-based cervical cancer educational interventions increase women's participation in cervical cancer screening programs, especially in communities with low literacy levels (Musa et al., 2017). Ebu (2018) conducted a descriptive cross-sectional study to determine the socio-demographic factors influencing the uptake of cervical cancer screening. The author showed that the education of women of all ages as a priority helps in adopting appropriate health behaviors and engaging in cervical cancer screening. My research disconfirms the overall association of educational level and cervical cancer screening uptake found in these earlier studies. Based on these contradictory findings in the literature, combined with my result of a nonsignificant association of educational level and Pap test uptake, I recommend further research can provide better knowledge on the role of the level of education as a predictor of Pap test uptake.

Insurance status. Holden, Chen, and Dagher (2015) used 2004–2011 Medical Expenditure Panel Survey data to analyze the use of USPSTF-recommended preventive services among uninsured adult. The study concluded that uninsured adults received preventive services far below Healthy People 2020 targets. However, uninsured African American and Hispanic populations utilized preventive services far better than uninsured

Whites (Holden, Chen & Dagher, 2015). Bitler and Carpenter (2017) used BRFSS to evaluate the effects of state insurance mandates requiring insurance coverage for Pap tests. The authors concluded that by mandating generous insurance coverage for even inexpensive services like Pap test can significantly increase uptake. Bhandari and Li (2019) study focused on analyzing the impact of the Affordable Care Act's (ACA) elimination of cost-sharing and the utilization of cancer screenings. The study involved 2009 (pre-ACA period) and 2011–2014 (post-ACA period) data and showed that in 2014 (as compared to 2009), privately-insured women reported 2% (0.98 (0.97–0.99) reduction in utilizing Pap tests (Bhandari & Li, 2019). Authors showed that Hispanic women with Medicare-only insurance had a 92% ($p < 0.05$) rise in receipt of Pap tests in 2011 compared to 2009 (Bhandari & Li, 2019). Greater awareness of zero cost-sharing policy can help in increasing the uptake of cancer screenings (Bhandari & Li, 2019).

For this study, I did not address racial disparity in the uptake of Pap test. However, this study showed that persons without health insurance are more likely not to have a Pap test in comparison to persons with health insurance (Wald=8.471, $p<.001$, $OR=1.61$). These study results suggest that health insurance plays a major role in Pap test and cervical cancer prevention. This is vital due to the fact that many study results showed that insured women like private insurance or Medicare are more likely to be involved in the uptake of Pap test compared to uninsured women (Bitler & Carpenter, 2017; Bhandari & Li, 2019). The associations in the study persisted even after including control variables of age, marital status, and personal healthcare provider availability.

Income. Lai et al. (2017) study aimed to explore the factors and barriers associated with Pap testing. The authors reported that cost or a lack of health insurance persist as barriers to Pap testing. Miles-Richardson et al. (2017) study used 2012 BRFSS data to analyze the factors associated with cervical cancer screening among women 18 years of age and older in the United States. The authors showed that women with more than a high school education and having a higher income increases the participation in cervical cancer screening. Akinlotan, Weston, & Bolin, (2018) used 2014- 2015 Texas BRFSS data to assess the influences of individual and country-level predictors of a Pap test in the past three years. The authors concluded that there are significant disparities in the uptake of cervical cancer screening across Texas counties. The odds of timely Pap testing were lower among women with income less than $25,000 (Akinlotan, Weston, & Bolin, 2018). Socio-economic disparities and obstetric-gynecologic physicians in a county contribute to the predictors of these disparities (Akinlotan et al., 2018). In this study, Wald=12.170, $p<.001$, $OR= .39$ suggests that persons with income between $25,000 to less than $35,000 were less likely not to have Pap test compared to persons with income less than $15,000. The associations persisted even after including control variables of age, marital status, and personal healthcare provider availability.

Age. Age was a statistically significant factor in the current study. The study showed that women between 30-44 years were 42.1% less likely not to receive a Pap test compared to women of 18-29 years. These study results reveals that middle aged women were less likely to be aware of and knowledgeable of the screening test and had lower Pap test compared to women of younger age group. As such, the study suggests that

younger women need to be targeted for cervical cancer screening. Also, the association in the study persisted even after including the level of education, insurance status, and income measures in the study. Regular cervical cancer screening and follow up among younger women makes the diagnosis of cervical cancer easy at an early stage (Akinlotan et al., 2017). However, over 95% of cancer deaths in Texas, occur among individual 45 years or older (Cancer Prevention & Research Institute of Texas, 2019). Several studies also showed that age was statistically significant, $p < .05$, regardless of racial/ethnic group. Miles-Richardson et al. (2017) study from 2012 BRFSS data focused on analyzing the factors associated with cervical cancer screening among women above 18 years of age in the United States. After adjusting all sociodemographic variables study showed that women between 45–64 years of age (*AOR*: 2.56; 95 % *CI* 2.42–2.71) and 65–74 years of age (*AOR*: 1.55; 95 % *CI* 1.45–1.66) had a pap test than those aged 18–44 years and 75 and older. The authors concluded that socio-demographic factors and region of residence act as the predictors of cervical cancer screening. Women of reproductive age show high mortality rates from cervical cancer (Amimo et al., 2018).

Marital status. Khan et al. (2016) study used sampled cervical cancer cases from nine states in the United States from the Surveillance Epidemiology and End Results (SEER) database. The authors showed statistically significant differences between ethnicities and marital status ($p<0.001$) with cervical cancer cases (Khan et al., 2016). Ncube et al. (2015) study showed that married women are two times more likely to have a Pap smear (95% *CI*: 1.13, 3.73) compared to unmarried. Also, spouse support positively impacts the uptake of cervical cancer screening.

Similarly, Hanske et al. (2016) study showed a significant association between marital status and the utilization of cervical cancer screening. As compared to other studies, my research also showed a statistically significant relationship between marital status and cervical cancer screening. In my research, the results, Wald=5,746, $p<.001$, $OR=.58$ suggests that unmarried are more likely not to receive a Pap test compared to married women. These study results showed that there will be a positive correlation between marital status and compliance with cervical cancer screening guidelines among women in Texas HSRs. In Texas, Married women, showed higher screening rates (84.4%) compared to unmarried (67.6%) (Akinlotan et al., 2018). Women who are unmarried, having no children, and having lower socioeconomic position showed lower adherence to cervical cancer screening (Leinonen et al., 2017). The association in the study persisted even after including the level of education, insurance status, and income variables in the study.

Personal health care provider. Abboud et al. (2017) study used multiple articles to determine cervical cancer screening behaviors and factors influencing these behaviors among Arab American women. The authors showed that lack of a healthcare provider's recommendations decreases the odds for receiving Pap test (*OR* =0.26, 95% *CI* [0.12, 0.54]) (Abbound et al., 2017). Personal health care providers educate their clients on regular health care regimes, motivates women to accept preventive services like cervical cancer screening procedure (Damiani et al., 2015). Nguyen-Truong et al.'s (2018) study showed that personal health care providers educate clients on cervical cancer screening and provides culturally and linguistically appropriate care. Compared to all other reviews,

my study also showed a significant relationship between personal health care provider and cervical cancer screening among low-income Hispanic women in Texas HSRs. In my study, the results Wald=8.471, $p<.001$, $OR=1.61$ indicates persons without healthcare provider are more likely not to have the Pap test as compared to persons with more than one personal health care provider.

Analyzing and Interpreting the Findings in Theory Context

Cervical cancer rates are disproportionately high among Hispanic women (Moore de Peralta et al., 2017). Based on the HBM, the cues influences Hispanic women to undergo cervical cancer screening (Moore de Peralta et al., 2017; Moore de Peralta et al., 2015). HBM constructs include perceived susceptibility to doctor visits and cervical cancer screening; perceived severity of the threat of cervical cancer mortality, regardless of early detection; and perceived benefits of early-stage cervical cancer detection and treatment. Perceived barriers include age, no personal doctor, not having health insurance. Self-efficacy involves one's belief in accessing cervical cancer screening; and cues to action, which consists of influence to get cervical cancer screening.

The variables used in the study have proven to be statistically significant align with the HBM constructs. Perceived benefits about the cervical cancer screening the most important predictors in the uptake of Pap test was a vital part of this research. Women who perceive benefits from Pap test will engage in regular screening than those who do not see the benefit from screening (Karimy, Azarpira, & Araban, 2017). Perceived susceptibility like age, marital status, income, insurance status, and availability of personal health care provider motivates people towards health screening behavior

including Pap test. The regression analysis in the study revealed that there is a statistically significant relationship between insurance status and income on cervical cancer screening among low-income Hispanic women in Texas HSRs. According to Moore de Peralta et al.'s (2017) age, marital status, income, and availability of regular care are significant variables that influence women perceptions about cervical cancer and Pap test screening behaviors. Place of residence influence a resident's engagement towards healthy practices, like cervical cancer screening (Akinlotan et al., 2018).

Women with perceived barriers like no personal health care provider, no insurance, less knowledge, unmarried, and low income are less likely to be screened for cervical cancer. Women with low income and lower level of education are less likely to be screened or follow up on abnormal Pap smear results (Akinlotan et al., 2017). There is a decline in the new cervical cancer rate from 14.8 to 6.4 per 100,000 persons from 1975 to 2013 (Nardi, Sandu, & Selix, 2016). The decrease in cervical cancer rate each year is due to increase in the uptake of Pap test (Nardi et al., 2016). However, women's belief on the benefits of Pap test can only help in increasing their participation in the screening programs. As such, HBM constructs helped in assessing the factors such as increased susceptibility and perceived benefits of the Pap test and to identify barriers to Pap test and to develop interventions in reducing the barriers.

Limitations of the Study

Secondary data creates boundaries, as the data collected initially were not for this research. The BRFSS survey uses a disproportionate stratified sample (DSS) design for landline telephone samples and random sample design for the cellular telephone survey

of noninstitutionalized adults 18 years of age or older (CDC, 2016). The BRFSS survey excludes individuals in institutions such as hospitals, those who are a ward of the state, and those who do not have landline or cellular phone. Excluding these individuals may have affected the outcome of the study and my interpretation of the findings. Also, the data used in this study was secondary data obtained as a part of the 2015-2017 BRFSS survey in Texas. The results of this study cannot be generalized as the sample population represents low-income Hispanic women from Texas HSRs and not representative of the entire U.S. Hispanic population. Using self-reported data may have also posed a limitation to my study. BRFSS data includes self-reported data and limited by the inability to verify the data. Unscreened women tend to over-report of having Pap test, but screened women accurately report their screening. For example, women might have reported pelvic examinations to cervical cancer screening test (Van Dyne et al., 2019). Self-reported information in a survey may be less accurate than those from physical measurements (CDC, 2016). Another limitation is that Pap test recommendations which follow current USPSTF guidelines recommending Pap test on all women between 21 to 65 years of age once every three years.

Recommendations

My current secondary data analysis focused on low-income Hispanic women living in Texas HSRs who had access to landline and cell phone. Findings from this research study indicated that further research should be carried out in understanding the relationship between providers and education on women who have no landline or cell phone facilities. These outreach and education efforts can assist with increased

knowledge and awareness on cervical cancer and the importance of regular Pap test and follow up among Hispanic women in Texas HSRs. Additionally, recommendation focus on further research using cervical cancer screening instrument grounded in the HBM constructs to analyze the relationship between the predictors of cervical cancer screening. Also, consideration can focus on the in-depth interview and focus group discussions on assessing participants' response qualitatively.

Lastly, a study with mixed methods, qualitative and quantitative examining the same variables can provide in-depth information that can further advance the goals of this research. In the long run, this type of study can help in improving the Pap test and follow up and can reduce the morbidity and mortality rates related to cervical cancer among Hispanic women in Texas HSRs. While the current study included the analysis of covariates analyzed in previous studies, there may be additional variables for further investigation. I recommend on developing awareness on cervical cancer screening through cultural and linguistical educational programs and materials. Appropriate instructional materials help health care providers in enhancing the uptake of Pap test among the Hispanic women in Texas.

Implications for Professional Practice and Social Change

My study examined modifying factors of the HBM and analyzed the variables influencing the Pap test. Determining the extent of provider on cervical cancer screening in Texas HSRs could help in improving compliance with Pap test and further decrease the possibility of cervical cancer rate.

Professional Practice

In respect to professional practice, the findings of this study can help in developing and testing strategies that help in improving the uptake of cervical cancer screening across Hispanics in Texas. The findings from this study can help in developing or enhancing culturally-sensitive educational programs for all Hispanic women living in Texas. The study results can contribute the health care professionals and health care providers in conversations with a Hispanic population related to routine Pap test and cervical cancer prevention. The study findings can be used as a foundation for future study on cervical cancer screening uptake that can help in increasing in the uptake of Pap test among Hispanic women in Texas.

Analyzing the relationship between patient and the perceived barriers towards cervical cancer screening that could have prevented low Pap test in Texas can help the researchers and public health providers in developing appropriate interventions. The study outcome from this research can help in developing programs and interventions that can deliver recommendation and relationship building among patients and health care professionals. Also, the study results can enhance the provider's knowledge on the importance of predictors in improving Pap test uptake within their patient populations. Culturally and linguistically appropriate educational materials help the health care providers to improve the Pap test uptake where insurance status and income are not essential criteria.

Positive Social Change

Positive social change can be achieved by bringing changes in the public health system and by bridging the gap between the research, policy, and practice. The findings from this study can help the researchers in addressing how low rate of cervical cancer screening contributes to high cervical cancer rate among Hispanic women in Texas. Addressing the barriers in screening by health care providers can make the Hispanic women become proactive towards timely cervical cancer screening, and reduce negative health screening behavior. Currently, the cervical cancer services program is funding clinics across the state to provide good quality, low-cost and accessible cervical cancer screening and diagnostic services to women (Texas HSS, 2019). However, cervical cancer rate among Hispanic women in Texas remains high. As such, the findings from this study can help to redesign, supplement, or enhance cervical cancer screening programs that can ultimately reduce overall morbidity and mortality from cervical cancer in Texas.

The evidence from this research could help in improving the uptake of Pap test and follow up and can aim in increasing the Pap test coverage to meet the Healthy People 2020 goals. Given the high prevalence of cervical cancer and mortality related to cervical cancer among Hispanics, this study raises concerns on the need for improvement in the uptake of Pap test among Hispanics in Texas. Encouraging Hispanic women to form social support groups can help in a free discussion on cervical cancer and cervical cancer screening as any other health issues. Social support groups can help in developing positive social interaction, provide necessary resources and emotional support, and

impacts positive cervical cancer screening behavior. Targeted public health education in partnership with different community organizations can help in reaching the target population and improve the uptake in the Pap test. As such, this study can contribute to positive social change within the community and the public health profession.

Conclusion

The primary purpose of this quantitative study was to analyze the relationship between the level of education, insurance status, and income on cervical cancer screening among low-income Hispanic women in Texas HSRs. Binomial regression analysis revealed no relationship with cervical cancer screening and the level of education. However, insurance status and income were statistically significant, after controlling for age, marital status, and personal health care provider. Pap test in diagnosing early cancer changes and subsequent cervical cancers should remain a public health priority. Further research can help in enhancing the gap in the uptake of Pap test among the Hispanic population in Texas.

More research on this topic is essential to bring political and practical recommendations in increasing the uptake of Pap test and to reduce the cervical cancer rate among Hispanic women. Each year Healthy People's goal is to increase the rate of Pap test uptake and to reduce the cervical cancer rate. With the availability of low-cost, simple screening like Pap test, it is possible to detect cervical cancer at an early stage, provide early treatment, and reduce mortality related to cervical cancer. However, disparities in the use of cancer screening services in Texas reflects many inadequacies in the health care system. Racial disparity in prevalence and mortality related to cervical

cancer is a serious issue that needs special attention, especially among Hispanic women in Texas HSRs. Public health education on cervical cancer screening and interventions in improving the knowledge of cervical cancer among Hispanic women is essential for a positive social change regarding this population group.

References

Abboud, S., De Penning, E., Brawner, B. M., Menon, U., Glanz, K., & Sommers, M. S. (2017). Cervical cancer screening among Arab women in the United States: An integrative review. *Oncology Nursing Forum*, *44*(1), E20–E33. doi: 10.1188/17.ONF.E20-E33

Acharya Pandey, R., & Karmacharya, E. (2017). Cervical cancer screening behavior and associated factors among women of Ugrachandi Nala, Kavre, Nepal. *European Journal of Medical Research*, *22*(1), 32. doi:10.1186/s40001-017-0274-9

Adakai, M., Aseret-Manygoats, T., Allison, M., Sandoval-Rosario, M., Fang Xu, Greenlund, K. J., … Xu, F. (2018). Health disparities among American Indians/Alaska Natives - Arizona, 2017. *MMWR: Morbidity & Mortality Weekly Report*, *67*(47), 1314–1318. Retrieved from https://www.cdc.gov/mmwr/volumes/67/wr/mm6747a4.htm

Akinlotan, M. A., Weston, C., & Bolin, J. N. (2018). Individual- and county-level predictors of cervical cancer screening: A multi-level analysis. *Public Health*, *160*, 116–124. doi: 10.1016/j.puhe.2018.03.026

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

American Cancer Society. (2019). Cervical Cancer Prevention and Early Detection. Retrieved from https://www.cancer.org/cancer/cervical-cancer/prevention-and-early-detection/cervical-cancer-screening-guidelines.html

American Cancer Society. (2019b). What Is Cervical Cancer? Retrieved from https://www.cancer.org/cancer/cervical-cancer/about/what-is-cervical-cancer.html

American Cancer Society. (2019c). Key Statistics for Cervical Cancer. Retrieved from https://www.cancer.org/cancer/cervical-cancer/about/key-statistics.html

American Cancer Society. (2018). Cancer Facts & Figures for Hispanics and Latinos. Retrieved from https://www.cancer.org/research/cancer-facts-statistics/hispanics-latinos-facts-figures.html

American College of Obstetricians and Gynecologists. (2017). Cervical Cancer Screening. Retrieved from https://www.acog.org/Patients/FAQs/Cervical-Cancer-Screening?IsMobileSet=false

Ashtarian, H., Mirzabeigi, E., Mahmoodi, E., & Khezeli, M. (2017). Knowledge about cervical cancer and Pap smear and the factors influencing the Pap test screening among women. *International Journal of Community Based Nursing and Midwifery*, *5*(2), 188-195. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5385241/

Amimo, F., Moon, T. D., Magit, A., & Sacarlal, J. (2018). Impact of per capita income on the effectiveness of school-based health education programs to promote cervical cancer screening uptake in Southern Mozambique. *Journal Of Global Infectious Diseases*, *10*(3), 152–158. doi: 10.4103/jgid.jgid_165_17

Babazadeh, T., Nadrian, H., Rezakhani Moghaddam, H., Ezzati, E., Sarkhosh, R., & Aghemiri, S. (2018). Cognitive determinants of cervical cancer screening behavior among housewife women in Iran: An application of health belief model. *Health Care for Women International, 39*(5), 555-570. doi: 10.1080/07399332.2018.1425873

Behavioral Risk Factor Surveillance System. (2017). Overview: BRFSS 2016. Retrieved from https://www.cdc.gov/brfss/annual_data/2016/pdf/overview_2016.pdf

Behavioral Risk Factor Surveillance System (2017b). BRFSS 2016 Summary Data Quality Report. Retrieved from https://www.cdc.gov/brfss/annual_data/2016/pdf/2016-sdqr.pdf

Bermedo-Carrasco, S., Peña-Sánchez, J. N., Lepnurm, R., Szafron, M., & Waldner, C. (2015). Inequities in cervical cancer screening among Colombian women: a multilevel analysis of a nationwide survey. *Cancer Epidemiology*, *39*(2), 229–236. doi: 10.1016/j.canep.2015.01.011

Bhandari, N. R., & Li, C. (2019). Impact of the Affordable Care Act's elimination of cost-sharing on the guideline-concordant utilization of cancer preventive screenings in the United States using medical expenditure panel Survey. *Healthcare (Basel, Switzerland)*, *7*(1), 36. doi: 10.3390/healthcare7010036

Bitler, M. P., & Carpenter, C. S. (2017). Effects of state cervical cancer insurance mandates on pap test rates. *Health Services Research*, *52*(1), 156–175. doi: 10.1111/1475-6773.12477

Bodson, J., Warner, E. L., & Kepka, D. (2016). Moderate awareness and limited knowledge relating to cervical cancer, HPV, and the HPV vaccine among Hispanics/Latinos in Utah. *Health Promotion Practice*, *17*(4), 548–556. doi: 10.1177/1524839916640271

Boom, K., Lopez, M., Daheri, M., Gowen, R., Milbourne, A., Toscano, P., … Schmeler, K. (2018). Perspectives on cervical cancer screening and prevention: challenges faced by providers and patients along the Texas-Mexico border. *Perspectives in Public Health*. Retrieved from https://journals.sagepub.com/doi/10.1177/1757913918793443

Cadet, T. J., Burke, S. L., Stewart, K., Howard, T., & Schonberg, M. (2017). Cultural and emotional determinants of cervical cancer screening among older Hispanic women. *Health Care for Women International*, *38*(12), 1289–1312. doi: 10.1080/07399332.2017.1364740

Camp, E. A., Prehn, A. W., Shen, J., Herbst, A. L., Strohsnitter, W. C., Hobday, C. D., Robboy, S. J., … Adam, E. (2015). Factors associated with a lack of Pap smear utilization in women exposed in utero to diethylstilbestrol. *Journal of women's health (2002)*, *24*(4), 308-15. doi: 10.1089/jwh.2014.4930

Cancer Prevention & Research Institute of Texas. (2019). Texas Cancer Plan. Retrieved from https://www.cprit.state.tx.us/about-us/texas-cancer-plan

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

Centers for Disease Control and Prevention. (2018). Annual Survey Data. Retrieved from https://www.cdc.gov/brfss/annual_data/annual_data.htm

Centers for Disease Control and Prevention. (2018b). U.S. Cancer Statistics Data Visualizations. Retrieved from https://gis.cdc.gov/Cancer/USCS/DataViz.html

Centers for Disease Control and Prevention. (2018). Cervical Cancer Statistics. Retrieved from https://www.cdc.gov/cancer/cervical/statistics/index.htm

Choi, E., Lee, Y. Y., Suh, M., Lee, E. Y., Mai, T. T. X., Ki, M., … Choi, K. S. (2018). Socioeconomic inequalities in cervical and breast cancer screening among women in Korea, 2005-2015. *Yonsei Medical Journal*, *59*(9), 1026–1033. doi: 10.3349/ymj.2018.59.9.1026

Curry, S. J., Krist, A. H., Owens, D. K., Barry, M. J., Caughey, A. B., Davidson, K. W., … Wong, J. B. (2018). Screening for cervical cancer: US preventive services task force recommendation statement. *JAMA*, *320*(7), 674–686. doi: 10.1001/jama.2018.10897

Damiani, G., Basso, D., Acampora, A., Bianchi, C. B. N. A., Silvestrini, G., Frisicale, E. M., … Ricciardi, W. (2015). The impact of level of education on adherence to breast and cervical cancer screening: Evidence from a systematic review and meta-analysis. *Preventive Medicine*, *81*, 281–289. doi:10.1016/j.ypmed.2015.09.011

Denson, V., & Keele, R. (2016). Cervical cancer screening practices of volunteer providers in faith-based clinics. *Journal for Nurse Practitioners*, *12*(1), 27–34. doi:10.1016/j.nurpra.2015.09.005

Documet, P., Bear, T. M., Flatt, J. D., Macia, L., Trauth, J., & Ricci, E. M. (2015). The association of social support and education with breast and cervical cancer screening. *Health Education & Behavior: The Official Publication Of The Society For Public Health Education*, *42*(1), 55–64. doi: 10.1177/1090198114557124

Ebu N. I. (2018). Socio-demographic characteristics influencing cervical cancer screening intention of HIV-positive women in the central region of Ghana. *Gynecologic Oncology Research and Practice*, *5*, 3. doi:10.1186/s40661-018-0060-6

Elmajjaoui, S., Ismaili, N., El Kacemi, H., Kebdani, T., Sifat, H., & Benjaafar, N. (2016). Epidemiology and outcome of cervical cancer in national institute of Morocco. *BMC Women's Health*, *16*, 1–8. doi: 10.1186/s12905-016-0342-2

Fernandez, M. E., Savas, L. S., Lipizzi, E., Smith, J. S., & Vernon, S. W. (2014). Cervical cancer control for Hispanic women in Texas: strategies from research and practice. *Gynecologic Oncology*, *132 Suppl 1*(0 1), S26-32. doi: 10.1016/j.ygyno.2013.12.038

Ginindza, T. G., & Sartorius, B. (2018). Projected cervical cancer incidence in Swaziland using three methods and local survey estimates. *BMC Cancer*, *18*(1), 639. doi: 10.1186/s12885-018-4540-1

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2015). *Health behavior: Theory, research, and practice* (5th ed.). San Francisco, CA: Jossey-Bass.

Gomez, N., Guendelman, S., Harley, K. G., & Gomez, S. L. (2015). Nativity and neighborhood characteristics and cervical cancer stage at diagnosis and survival

outcomes among Hispanic women in California. *American Journal Of Public Health*, *105*(3), 538–545. doi: 10.2105/AJPH.2014.302261

Grim, M., & Hortz, B. (2017). Theory in Health Promotion Programs. In Fertman, C. I., & Allensworth, D. D. (Eds.). *Health promotion programs: From theory to practice* (pp. 53-75). San Francisco, CA: Jossey-Bass

Hami, M. Y., Ehlers, V. J., & van der Wal, D. M. (2014). Women's perceived susceptibility to and utilisation of cervical cancer screening services in Malawi. *Health SA Gesondheid*, *19*(1), 1–8. doi:10.4102/hsag.v19i1.787

Hanske, J., Meyer, C. P., Sammon, J. D., Choueiri, T. K., Menon, M., Lipsitz, S. R., … Trinh, Q.-D. (2016). The influence of marital status on the use of breast, cervical, and colorectal cancer screening. *Preventive Medicine*, *89*, 140–145. doi: 10.1016/j.ypmed.2016.05.017

Haradhan Kumar Mohajan. (2017). Two criteria for good measurements in research: validity and reliability. *Annals of Spiru Haret University Economic Series*, (4), 59. doi: 10.26458/1746

HealthCare.gov. (n.d.). Health insurance: How it protects you from health and financial risks. Retrieved from https://www.healthcare.gov/why-coverage-is-important/coverage-protects-you/

Islam, R. M., Billah, B., Hossain, M. N., & Oldroyd, J. (2017). Barriers to cervical cancer and breast cancer screening uptake in low-income and middle-income countries: A systematic review. *Asian Pacific journal of cancer prevention: APJCP*, *18*(7), 1751-1763. doi:10.22034/APJCP.2017.18.7.1751

International Bureau of Education. (2019). Levels of Education. Retrieved from http://www.ibe.unesco.org/en/glossary-curriculum-terminology/l/levels-education

Jones, C. L., Jensen, J. D., Scherr, C. L., Brown, N. R., Christy, K., & Weaver, J. (2014). The health belief model as an explanatory framework in communication research: exploring parallel, serial, and moderated mediation. *Health Communication*, *30*(6), 566-76. doi: 10.1080/10410236.2013.87336

Karimy, M., Azarpira, H., & Araban, M. (2017). Using health belief model constructs to examine differences in adherence to Pap test recommendations among Iranian women. *Asian Pacific Journal of Cancer Prevention : APJCP*, *18*(5), 1389–1394. doi:10.22034/APJCP.2017.18.5.1389

Khalil, J., Bellefqih, S., Sahli, N., Afif, M., Elkacemi, H., Elmajjaoui, S., Kebdani, T., … Benjaafar, N. (2015). Impact of cervical cancer on quality of life: beyond the short term (Results from a single institution): Quality of life in long-term cervical cancer survivors: results from a single institution. *Gynecologic Oncology Research and Practice*, *2*, 7. doi:10.1186/s40661-015-0011-4

Khan, H. M. R., Gabbidon, K., Saxena, A., Abdool-Ghany, F., Dodge, J. M., & Lenzmeier, T. (2016). Disparities in cervical cancer characteristics and survival between white Hispanics and white Non-Hispanic women. *Journal of Women's Health (15409996)*, *25*(10), 1052–1058. doi: 10.1089/jwh.2015.5585

Lai, D., Bodson, J., Warner, E. L., Ayres, S., Mooney, R., & Kepka, D. (2017). Younger age and health beliefs associated with being overdue for Pap testing among Utah Latinas who were non-adherent to cancer screening guidelines. *Journal Of*

Immigrant And Minority Health, *19*(5), 1088–1099. doi: 10.1007/s10903-017-0559-7.

Landy, R., Pesola, F., Castañón, A., & Sasieni, P. (2016). Impact of cervical screening on cervical cancer mortality: estimation using stage-specific results from a nested case-control study. *British Journal Of Cancer*, *115*(9), 1140-1146. doi: 10.1038/bjc.2016.290

Leppink, J., O'Sullivan, P., & Winston, K. (2016). Effect size - large, medium, and small. *Perspectives On Medical Education*, *5*(6), 347–349. doi:10.1007/s40037-016-0308-y

Li, Y., Carlson, E., Villarreal, R., Meraz, L., & Pagan, J. A. (2017). Cost-effectiveness of a patient navigation program to improve cervical cancer screening. *American Journal of Managed Care*, *23*(7), 429–434. Retrieved from https://www.ajmc.com/journals/issue/2017/2017-vol23-n7

Leinonen, M. K., Campbell, S., Klungsøyr, O., Lönnberg, S., Hansen, B. T., & Nygård, M. (2017). Personal and provider level factors influence participation to cervical cancer screening: A retrospective register-based study of 1.3 million women in Norway. *Preventive Medicine*, *94*, 31–39. doi: 10.1016/j.ypmed.2016.11.018

Ma, G. X., Gao, W., Fang, C. Y., Tan, Y., Feng, Z., Ge, S., & Nguyen, J. A. (2013). Health beliefs associated with cervical cancer screening among Vietnamese Americans. *Journal of Women's Health*, *22*(3), 276–288. doi: 10.1089/jwh.2012.3587

Maar, M., Wakewich, P., Wood, B., Severini, A., Little, J., Burchell, A. N., Ogilvie, G., … Zehbe, I. (2014). Strategies for increasing cervical cancer screening amongst first nations communities in Northwest Ontario, Canada. *Health Care For Women International*, *37*(4), 478-95. doi: 10.1080/07399332.2014.959168

Madhivanan, P., Valderrama, D., Krupp, K., & Ibanez, G. (2016). Family and cultural influences on cervical cancer screening among immigrant Latinas in Miami-Dade County, USA. *Culture, Health & Sexuality*, *18*(6), 710–722. doi:10.1080/13691058.2015.1116125.

Mann, L., Foley, K. L., Tanner, A. E., Sun, C. J., & Rhodes, S. D. (2015). Increasing cervical cancer screening among US Hispanics/Latinas: A qualitative systematic review. *Journal Of Cancer Education: The Official Journal Of The American Association For Cancer Education*, *30*(2), 374-87. doi: 10.1007/s13187-014-0716-9

Majdfar, Z., Khodadost, M., Majlesi, F., Rahimi, A., Shams, M., & Mohammadi, G. (2016). Relationships between self-efficacy and Pap smear screening in Iranian women. *Asian Pacific Journal Of Cancer Prevention: APJCP*, *17*(S3), 263–268. Retrieved from http://journal.waocp.org/article_33928_f4a1800f7fed3bb16ce1fc4299d8fbd9.pdf

María Merino-Ventosa, & Rosa M. Urbanos-Garrido. (2018). Changes in income-related inequalities in cervical cancer screening during the Spanish economic crisis: a decomposition analysis. *International Journal for Equity in Health, Vol 17, Iss 1, Pp 1-12 (2018)*, (1), doi: 10.1186/s12939-018-0894-x

Miles-Richardson, S., Allen, S., Claridy, M., Booker, E., & Gerbi, G. (2017). Factors associated with self-reported cervical cancer screening among women aged 18 years and older in the United States. *Journal of Community Health*, *42*(1), 72–77. doi:10.1007/s10900-016-0231-5

Miri, M. R., Moodi, M., Sharif-Zadeh, G.-R., Malaki Moghadam, H., Miri, M., & Norozi, E. (2018). Cognitive predictors of cervical cancer screening's stages of change among sample of Iranian women health volunteers: A path analysis. *Plos One*, *13*(3). doi:10.1371/journal.pone.0193638

Mojica, C. M., Flores, B., Ketchum, N. S., & Liang, Y. (2017). Health care access, utilization, and cancer screening among low-income Latina women. *Hispanic Health Care International*, *15*(4), 160–165. doi: 10.1177/1540415317735343

Moore de Peralta, A., Holaday, B., & McDonell, J. (2015). Factors affecting Hispanic women's participation in screening for cervical cancer. *Journal Of Immigrant & Minority Health*, *17*(3), 684-695. doi: 10.1007/s10903-014-9997-7

Moore de Peralta, A., Holaday, B., & Mikisa Hadoto, I. (2017). Cues to cervical cancer screening among U.S. Hispanic women. *Hispanic Health Care International*, *15*(1), 5–12. doi: 10.1177/1540415316682494

Munseok Seo, Langabeer, J., Seo, M., & Langabeer II, J. R. (2018). Determinants of potentially unnecessary cervical cancer screenings in American women. *Journal of Preventive Medicine & Public Health*, *51*(4), 181–187. doi: 10.3961/jpmph.18.023

Musa, J., Achenbach, C. J., O'Dwyer, L. C., Evans, C. T., McHugh, M., Hou, L., Simon, M. A., Murphy, R. L., … Jordan, N. (2017). Effect of cervical cancer education and provider recommendation for screening on screening rates: A systematic review and meta-analysis. *PloS one*, *12*(9), e0183924. doi:10.1371/journal.pone.0183924

Nancy Nien-Tsu, C., Moran, M. B., Frank, L. B., Bal-Rokeach, S. J., Murphy, S.T., & Chen, N.N. (2018) Understanding cervical cancer screening among Latinas through the lens of structure, culture, psychology and communication. *Journal of Health Communication, 23*(7), 661-669. doi: 10.1080/10810730.2018.1500661

Nardi, C., Sandhu, P., & Selix, N. (2016). Cervical cancer screening among minorities in the United States. *Journal for Nurse Practitioners*, *12*(10), 675-682. doi:10.1016/j.nurpra.2016.08.036

National Cancer Institute. (2019). Cervical Cancer Screening (PDQ®)–Patient Version. Retrieved from https://www.cancer.gov/types/cervical/patient/cervical-screening-pdq

National Cancer Institute. (2018). State Cancer Profiles. Retrieved from https://statecancerprofiles.cancer.gov/quick-profiles/index.php?statename=texas

National Institutes of Health. (2018). Cervical Cancer. Retrieved from https://report.nih.gov/nihfactsheets/viewfactsheet.aspx?csid=76

Ncube, B., Bey, A., Knight, J., Bessler, P., & Jolly, P. E. (2015). Factors associated with the uptake of cervical cancer screening among women in Portland, Jamaica. *North*

American Journal of Medical Sciences, *7*(3), 104-13. doi:10.4103/1947-2714.153922

Nonzee, N. J., Ragas, D. M., Ha Luu, T., Phisuthikul, A. M., Tom, L., Dong, X., & Simon, M. A. (2015). Delays in cancer care among low-income minorities despite access. *Journal of Women's Health (15409996)*, *24*(6), 506–514. doi: 10.1089/jwh.2014.4998

Nguyen-Truong, C. K. Y., Hassouneh, D., Lee-Lin, F., Hsiao, C.-Y., Le, T. V., Tang, J., … Truong, A. M. (2018). Health care providers' perspectives on barriers and facilitators to cervical cancer screening in Vietnamese American women. *Journal of Transcultural Nursing: Official Journal of The Transcultural Nursing Society*, *29*(5), 441–448. doi: 10.1177/1043659617745135

Office of Disease Prevention and Health Promotion. (2019). HealthyPeople.gov. *Cancer*. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/cancer/objectives

Pan American Health Organization. (2015). Cervical Cancer Screening: Yesterday and Today. Retrieved from https://www.paho.org/hq/index.php?option=com_content&view=article&id=9995:2014-cervical-cancer-screening-yesterday-and-today&Itemid=40275&lang=en

Pankaj, S., Nazneen, S., Kumari, S., Kumari, A., Kumari, A., Kumari, J., … Kumar, S. (2018). Comparison of conventional Pap smear and liquid-based cytology: A study of cervical cancer screening at a tertiary care center in Bihar. *Indian Journal of Cancer*, *55*(1), 80–83. doi: 10.4103/ijc.IJC_352_17

Pickens, C. M., Pierannunzi, C., Garvin, W., & Town, M. (2018). Surveillance for certain health behaviors and conditions among states and selected local areas - behavioral risk factor surveillance system, United States, 2015. *Morbidity and Mortality Weekly Report. Surveillance Summaries (Washington, D.C.: 2002)*, *67*(9), 1–90. doi:10.15585/mmwr.ss6709a1

Roberto, C., Anita K., K., & Vishwam, P. (2010). Having a personal healthcare provider and receipt of adequate cervical and breast cancer screening. *Journal of the American Board of Family Medicine*, (1), 75. Retrieved from https://www.jabfm.org/content/23/1/75

Ronaldo Iachan, Carol Pierannunzi, Kristie Healey, Kurt J. Greenlund, & Machell Town. (2016). National weighting of data from the Behavioral Risk Factor Surveillance System (BRFSS). *BMC Medical Research Methodology*, (1), 1. doi: 10.1186/s12874-016-0255-7

Ryan, L. C., & Bauman, K. (2016). Educational Attainment in the United States: 2015. *U.S. Census Bureau.* Retrieved from https://www.census.gov/content/dam/Census/library/publications/2016/demo/p20-578.pdf

Sabik, L. M., Tarazi, W. W., Hochhalter, S., Dahman, B., & Bradley, C. J. (2018). Medicaid expansions and cervical cancer screening for low-income women. *Health Services Research*, *53*, 2870–2891. doi: 10.1111/1475-6773.12732

Sharma, J., Toi, P. C., Siddaraju, N., Sundareshan, M., & Habeebullah, S. (2016). A comparative analysis of conventional and SurePath liquid-based cervicovaginal cytology: A study of 140 cases. *Journal Of Cytology*, *33*(2), 80–84. doi: 10.4103/0970-9371.182525

Shirazi Zadeh Mehraban, S., Namdar, A., & Naghizadeh, M. M. (2018). Assessment of preventive behavior for cervical cancer with the health belief model. *Asian Pacific Journal Of Cancer Prevention: APJCP*, *19*(8), 2155–2163. doi: 10.22034/APJCP.2018.19.8.2155

Shoemaker, M. L., & White, M. C. (2016). Breast and cervical cancer screening among Hispanic subgroups in the USA: estimates from the National Health Interview Survey 2008, 2010, and 2013. *Cancer Causes & Control: CCC*, *27*(3), 453–457. doi: 10.1007/s10552-016-0718-5

Statistics Solutions. (2019). Statistical Power. Retrieved from https://www.statisticssolutions.com/statistical-power/

Statistical Solution. (2018).What is Logistic Regression? Retrieved from http://www.statisticssolutions.com/what-is-logistic-regression/

Statistical Solution. (2017). Quantitative Research Approach. Retrieved from http://www.statisticssolutions.com/quantitative-research-approach/

Sulat, J. S., Prabandari, Y. S., Sanusi, R., Hapsari, E. D., & Santoso, B. (2018). The validity of health belief model variables in predicting behavioral change. *Health Education (0965-4283)*, *118*(6), 499–512. Retrieved from https://www.emeraldinsight.com/doi/abs/10.1108/HE-05-2018-0027

Sullivan, G. M., & Feinn, R. (2012). Using effect size-or why the P value is not enough. *Journal of Graduate Medical Education*, *4*(3), 279–282. doi:10.4300/JGME-D-12-00156.1

Tadesse. S. K. (2015). Socio-economic and cultural vulnerabilities to cervical cancer and challenges faced by patients attending care at Tikur Anbessa Hospital: a cross sectional and qualitative study. *BMC Women's Health*, *15*, 75. doi:10.1186/s12905-015-0231-0

Teoh, D. (2016). A new era in cervical cancer screening: Balancing the risks and benefits of screening. *Journal Of Women's Health (15409996)*, *25*(3), 207-208. doi:10.1089/jwh.2015.5663

Texas Department of State Health Services. (2018). Data Dictionary. Retrieved from https://www.dshs.texas.gov/tcr/data/dictionary.aspx

2018 Texas Cancer Plan. (2018). Cancer Prevention and Research Institute of Texas. Retrieved from http://www.cprit.state.tx.us/images/uploads/tcp2018_web_09192018.pdf

Texas Department of State Health Services. (2016). Cervical Cancer Fact Sheet — Texas. Retrieved from https://www.dshs.texas.gov/uploadedFiles/Content/Prevention_and_Preparedness/tcccp/Cervical_Cancer_Factsheet_7_12_16%5B1%5D.pdf

Texas Health and Human Services. (2016). Texas behavioral risk factor surveillance system. Retrieved from https://www.dshs.texas.gov/chs/brfss/

United Health Foundation. (2019). Cervical Cancer Screening - Women, Texas, United States. Retrieved from https://www.americashealthrankings.org/explore/health-of-women-and-children/measure/cervical_cancer_screen_women/state/TX

U.S. Census Bureau. (2018). Hispanic Origin. Retrieved from https://www.census.gov/topics/population/hispanic-origin/about.html

U.S. Census Bureau. (2016). Educational Attainment. Retrieved from https://www.census.gov/topics/education/educational-attainment/about.html

U.S. Census Bureau. (2016b). Income. Retrieved from https://www.census.gov/topics/income-poverty/income/about.html

U.S. Census Bureau. (n.d.). American Community Survey. Retrieved from https://www.census.gov/acs/www/about/why-we-ask-each-question/marital/

U.S. Preventive Services Task Force. (2018). Cervical Cancer: Screening. Retrieved from https://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/cervical-cancer-screening2

Valdovinos, C., Penedo, F. J., Isasi, C. R., Jung, M., Kaplan, R. C., Giacinto, R. E., … Greenlee, H. A. (2016). Perceived discrimination and cancer screening behaviors in US Hispanics: the Hispanic community health study/study of Latinos sociocultural ancillary study. *Cancer Causes & Control: CCC*, *27*(1), 27–37. doi: 10.1007/s10552-015-0679-0

Velasco-Mondragon, E., Jimenez, A., Palladino-Davis, A. G., Davis, D., & Escamilla-Cejudo, J. A. (2016). Hispanic health in the USA: a scoping review of the literature. *Public health reviews*, *37*, 31. doi:10.1186/s40985-016-0043-2

Wei-Chen Tung, Minggen Lu, Smith-Gagen, J., & Yan Yao. (2016). Latina women and cervical cancer screening: Decisional balance and self-eficacy. *Clinical Journal of Oncology Nursing*, *20*(3), E61–E66. doi: 10.1188/16.CJON.E71-E76

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