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Cancer Screening Practices Among Sexual Orientation Groups

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Cancer Screening Practices Among Sexual Orientation Groups

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Abstract

Background: Increasing cancer screening testing is a national health initiative to decrease the mortality rates of all Americans; however, cancer screening practices among sexual minorities have been understudied.

Objectives: To assess and compare breast, cervical, prostate, and colorectal cancer screening practices among straight, lesbian, gay, and bisexual individuals.

Methods: A descriptive-correlational study was conducted using data from the Center for Disease Control and Prevention 2014 Behavioral Risk Factor Surveillance System survey. Respondents who answered questions about their cancer screening practices and sexual orientation were included.

Results: This study identified disparities in breast cancer screening practices with bisexual women (81.9%) meeting the screening recommendation more often than lesbian (78.2%) and straight women (77.5%) (p = 0.012). Disparities were identified in colorectal cancer screening practices with bisexual men and women (73.3%) meeting the screening recommendations more often than lesbian women and gay men (69.1%) and straight individuals (68.9%) (p = 0.006). Disparities were identified in prostate cancer screening practices with gay men (66.5%) meeting the screening recommendation more often than bisexual (58.1%) and straight men (47.8%) (p < 0.001). Disparities were not identified in cervical cancer screening practices among the different sexual orientation groups (p = 0.061).

Conclusion: There is a direct correlation between breast, colorectal, and prostate cancer screening practices among sexual orientation groups.

Cancer Screening Practices Among Sexual Orientation Groups

Background

In 2017, it was estimated that 1,688,780 individuals in the United States would be diagnosed with cancer and 600,920 would die of cancer and cancer-related complications (American Cancer Society [ACS], 2017). Cancer screenings have long been a national health initiative to decrease the mortality rates of all Americans. The National Health Interview Survey reported that the cancer screening rates in 2010 were less than their intended targets: breast cancer screening rate was 72.4%, less than the target rate of 81%; cervical cancer screening rate was 83%, less than the target rate of 93%; colorectal cancer screening rate was 58.6%, less than the target rate of 70.5% (Center for Disease Control [CDC], 2014). In 2010, the prostate cancer screening rate was 37.8% (Jemal, Fedewa, & Ma, 2015).

The United States Preventative Services Task Force (USPSTF) recommends breast cancer screening via mammography for women aged 50 to 74 every two years and cervical cancer screening via Pap test for women aged 21 to 65 at least every three years regardless of sexual activity (CDC, 2014). Men and women aged 50 to 75 should be screened for colorectal cancer in one of the following three ways: a fecal occult blood test (FOBT) every year, sigmoidoscopy every five years and a FOBT every three years, or a colonoscopy every 10 years (CDC, 2014). In 2010, the ACS recommended that men at an average risk for prostate cancer be screened at age 50 using a prostate-specific antigen (PSA) test, and men that are at a higher risk should receive this screening test before 50 years of age; however, the USPSTF (2012) and CDC (2016) no longer recommend prostate cancer screening in men who do not have symptoms of prostate cancer.

Problem Statement

In 2017, the National Cancer Institute estimated that 3% to 35% of premature deaths could have been avoided through cancer screening. In addition to avoiding death, early detection of cancer can reduce morbidity rates due to the fact that treatment regimens for earlier-stage cancers are often less aggressive than that of more advanced-stage cancers (ACS, 2017).

In recent years, the percentage of Americans who have been screened for cancer remains below national targets, with continued racial and ethnic disparities. Cancer screening rates were lower among Asians for breast cancer (64.1), for cervical cancer (75.4%), and for colorectal cancer (46.9%) when compared with Whites. Hispanics were less likely to be screened than non-Hispanics for breast cancer (69.7%), for cervical cancer (78.7%), and for colorectal cancer (46.5%) (CDC, 2014). Furthermore, studies have shown that cancer screening in relation to sexual orientation among heterosexual, lesbian, gay, and bisexual individuals have been understudied (Heslin, Gore, King, & Fox, 2008). Several studies have suggested that lesbians are less likely than heterosexual women to undergo cancer screening (Bowen, Boehmer, & Russo, 2007). Additionally, "there have been no quantitative analyses comparing the use of cancer tests among gay, bisexual and heterosexual men" (Heslin, Gore, King, & Fox, 2008, p. 2).

Purpose

The purpose of the study was to investigate breast, cervical, colorectal, and prostate screening practices among different sexual orientation groups. Findings from this research can be used to improve identified cancer screening rates and to educate providers about the disparities that exist within cancer screenings practices among straight, lesbian, gay, and bisexual individuals. The long-term purpose of this study is to increase cancer screening practices and to reduce cancer-related disparities among sexual minorities.

Research Questions

The following research questions were assessed:

1. What percentage of adult women aged 50 to 74 surveyed in the 2014 Behavioral Risk Factor Surveillance System reported having a breast cancer screening within the last two (2) years?

2. What percentage of adults women aged 21 to 65 surveyed in the 2014 Behavioral Risk Factor Surveillance System reported having a cervical cancer screening within the last three (3) years?

3. What percentage of adult men and women aged 50 to 75 surveyed in the 2014 Behavioral Risk Factor Surveillance System reported having a colorectal cancer screening within the last ten (10) years?

4. What percentage of adult men aged 40 and older surveyed in the 2014 Behavioral Risk Factor Surveillance System reported having a prostate cancer screening within the last two (2) years?

Hypotheses

The following research hypotheses were tested:

1. H_1: There is a difference in breast cancer screening practices of adult women aged 50 to 74 among straight, lesbian, and bisexual individuals.

2. H_2: There is a difference in cervical cancer screening practices of adult women aged 21 to 65 among straight, lesbian, and bisexual individuals.

3. H_3: There is a difference in colorectal cancer screening practices of adult men and women aged 50 to 75 among straight, lesbian, gay, and bisexual individuals.

4. H_4: There is a difference in prostate cancer screening practices of adult men aged 40 and older among straight, gay, and bisexual individuals.

Significance

The significance of this study was to further analyze the relationship and disparities between breast, cervical, colorectal, and prostate cancer screening practices and sexual orientation. In the past, researchers have been able to identify disparities related to cancer screening rates and sexual orientation, specifically same-sex and bisexual subgroups. These identified disparities have assisted the medical community in furthering their efforts in promoting the importance of cancer screenings in this growing, medically underserved community (Fredriksen-Goldsen, Kim, Barkan, Muraco, & Hoy-Ellis, 2013).

An examination of the literature revealed a deficit of research associated with cancer screening among sexual minorities, particularly among the members of the male gay community. By identifying which specific cancer screening disparities are associated with specific sexual orientation groups, health systems, providers, nurses, and other health care professionals will be able to further promote the importance of cancer screenings in vulnerable populations.

Literature Review

Cancer Prevention through Screening

"Prevention is defined as the reduction of cancer mortality via reduction in the incidence of cancer" (PDQ Screening and Prevention Editorial Board, 2017). This can be accomplished through behavior modifications and changes such as avoiding carcinogens, pursuing a healthy lifestyle, avoiding dietary practices that may modify cancer causing factors or genetic predispositions, and undergoing medical interventions when necessary. Through early cancer detection strategies, precancerous lesions can be removed (PDQ Screening and Prevention Editorial Board, 2017).

Breast Cancer Screening

In 2013, a study revealed statistics illustrating that breast cancer screening rates were below the established *Healthy People 2020* target of 81.1% (Sabatino, White, Thompson, & Klabunde, 2015). After adjusting for age, 72.6% of women aged 50 to 74 reported undergoing a mammography within the last two years. This rate was below the 2008 *Healthy People 2020* baseline of 73.7%. Mammography use was also correlated with educational level with higher screening rates (81.2%) among college graduates when compared to those with only a high school education (69.1%; $p < 0.001$). Lastly, 81% of women who utilized mammography reported having an annual household income >400% of federal poverty threshold compared to 64% for 139% to 250% of federal poverty threshold ($p < 0.001$). The study concluded that the use of mammography as a screening tool for detecting breast cancer was stable during 2000 to 2013 ($p = 0.10$). However, these statistics also revealed that further studies need to be conducted to better identify the disparities that are present, which negatively impact this cancer screening rate (Sabatino, White, Thompson, & Klabunde, 2015).

Cervical Cancer Screening

In 2013, a United States national study was conducted to examine the prevalence of cervical cancer screening rates in women between 21 to 65 years of age (Sabatino, White, Thompson, & Klabunde, 2015). The report revealed that cervical cancer screenings are significantly below the *Healthy People 2020* established target of 93.0% (after adjusting for age, 80.7%; $p < 0.001$); perhaps more importantly, these rates are below the 2008 baseline of 84.5%. When looking at Pap test usage among races, Blacks (82.2%) were more likely to meet the cancer screening recommendation followed by Whites (81.2%), then Hispanics (76.9%), and lastly Asians (70.1%; $p < 0.001$). Cervical cancer screening rates were higher among college graduates (86.6%) when compared to individuals with a high school diploma (75.1%; $p < 0.001$).

Additionally, Pap testing was higher among those with an annual household income >400% of federal poverty threshold (87.7%) when compared to those who earned 139% to 250% of federal poverty threshold (76.8%; p < 0.001). In conclusion, this study revealed that Pap test usage declined significantly by 5.5% from 2000 to 2013 (p < 0.001), illustrating the need for further studies to determine causes and disparities that negatively impact women from seeking cervical cancer screenings (Sabatino, White, Thompson, & Klabunde, 2015).

Colorectal Cancer Screening

In a study conducted to examine the prevalence of colorectal screening rates among men and women aged 50 to 75, the overall percentage after adjusting for age was 58.2%; this percentage is significantly below the *Health People 2020* established target of 70.5% and was slightly above the 2008 baseline of 52.1% (Sabatino, White, Thompson, & Klabunde, 2015). The researchers found that colorectal cancer screening rates were lower among Asians (49.5%; p = 0.01) and all Hispanic subgroups (41.5%; p < 0.001) except Puerto Ricans when compared with Whites (58.4%; p = 0.01) and non-Hispanic (59.6%; p < 0.001) respondents respectively. Higher colorectal cancer screening rates have been associated with increased levels of education; 53.4% among high school graduates compared to 66.7% among college graduates, (p < 0.001). Higher household incomes were also related to higher screening rates; adults who earned >400% above poverty threshold had a screening rate of 65.6% compared to 52.6% of those who earned 139% to 250% of poverty threshold (p < 0.001). Use of colorectal screening tests was slightly lower among men (56.7%) than women (58.9%, p = 0.047). This study highlighted that there is a further need to investigate disparities associated with colorectal screening rates (Sabatino, White, Thompson, & Klabunde, 2015).

Prostate Cancer Screening

The American Cancer Society (2017) released a statement citing, "declines in prostate specific antigen (PSA) testing that came after changes in government screening guidelines have abated in recent years, according to a new study." The ACS reports that approximately one in three men aged 50 or older still receive routine PSA testing. The recommendations for PSA-based prostate cancer screening have changed considerably in recent years. In 2008, the ACS (2017) stated,

> The US Preventive Services Task Force (USPSTF) recommended against PSA-based prostate cancer screening among men 75 years or older, and in 2012, the group recommended against PSA testing for men of all ages. Other organizations, including the American Cancer Society, now emphasize shared-decision making for men 50 years or older who have a long life expectancy. A previous study by ACS investigators showed shifting recommendations had led to a decline in PSA screening rates, which dropped from 37.8% in 2010 to 30.8% in 2013 among men 50 years or older, resulting in substantial declines in prostate cancer incidence.

In an effort to determine if this trend was continuing, a secondary study was conducted; in 2015, the ACS conducted a National Health Interview Survey (NHIS) to examine prostate testing patterns (Fedewa, Ward, & Brawley, 2017). The researchers received responses from 16,196 men aged 50 and older, and more than half were aged 50 to 64. The researchers discovered that primary care providers "may be choosing to continue to offer PSA testing based on their beliefs about screening and interpretation of clinical trial results, as well as recommendations from other public health organizations that still support PSA testing, albeit with shared decision making" (Fedewa, Ward, & Brawley, 2017, p. 1040). Additional results revealed that three-quarters of the men had visited their primary care provider in the past year and that among men aged 50 or

older, rates of PSA testing for routine reasons in the previous year remained stable at 32.1%.

Although there has been stabilization in prostate cancer screening rates, researchers conclude

that additional studies need to be conducted to determine other disparities, which could be

affecting these rates (Fedewa, Ward, & Brawley, 2017).

Lesbian/Bisexual Women and Cancer Screening Rates

        Previous studies related to sexual orientation and cancer screening practices have

identified that lesbian and bisexual women differ from heterosexual women when it comes to

undergoing routine cancer screenings (Cochran, et al., 2001). Differences in sexual behavioral

risk factors among lesbians such as onset of sexual activity, number of sexual partners, and safe

sex practices have been linked to reduced reporting of routine cancer screenings. Lesbians and

bisexual women are less likely to follow through with recommended screenings due to

behavioral risk factors such as nulliparity, alcohol use, tobacco use, and obesity (Matthews,

Brandenburg, Johnson, & Hughes, 2004). In a study examining heterosexual and lesbian sister

pairs over the age of 40, self-reported lesbian-identified sisters had significantly more education,

less pregnancies, were pregnant for fewer months, had fewer children and less months of

breastfeeding, had higher body mass indices, exercised less times per week, and performed less

breast self-examinations than their heterosexual sister (Quinn, et al., 2015). "Some studies

reported that lesbian and bisexual women were less likely than heterosexual women to have had

a recent mammogram, whereas other studies reported that lesbian women were more likely to get

mammography, and other studies observed no differences by sexual orientation" (Quinn, et al.,

2015, p. 8). A recent study analyzed a national sample of lesbian and bisexual women aged 21 to

26 and found that cervical cancer screening were more common among women who had

disclosed their sexual orientation to their health care provider; however, cervical cancer

screening was less common among women who self-identified as lesbian, but had not disclosed

their sexual orientation to a health care provider (Quinn, et al., 2015). Although there were

limited recent published data related to colorectal screening rates in lesbian and bisexual women,

a population-based study revealed no differences in colorectal screening rates by sexual

orientation (McElroy, Wintemberg, & Williams, 2015).

Gay/Bisexual Men and Cancer Screening Rates

        Research related to cancer screening practices among gay and bisexual men have been

understudied (Quinn, et al., 2015). This could be attributed to the fact that 40% of men who have

sex with men do not reveal their sexual orientation to their health care provider. Studies have

found that gay and bisexual men get less routine health care than other men. Men who have sex

with men have faced a number of barriers to getting the health care and the cancer screenings

they need, including obtaining affordable health insurance and acquiring health insurance

policies that cover unmarried partners. Research also revealed that there is fear of discrimination

among gay men; many gay men do not tell their health care providers about their sexual

orientation because they worry about discrimination affecting the quality of health care they

receive. Negative experiences with health care providers can lead some men to delay or avoid

medical care, especially routine care such as cancer screening (Quinn, et al., 2015). Previous

studies have shown men in the general population who receive prostate cancer screening are also

more likely to undergo colorectal cancer screening (Smith, et al., 2015). Other studies, however,

have found the opposite to be true among gay or bisexual men where more men received

screening for colorectal cancer than for prostate cancer (Heslin, Gore, King, & Fox, 2008).

Although there is very little information related to prostate cancer screening testing among

sexual orientation groups, a cross-sectional analysis of 19,410 men in the California Health

Interview Survey found no differences in prostate cancer screening rates by sexual orientation (Quinn, et al., 2015).

Theoretical Foundation

Scientists have used the Health Belief Model (HBM) to examine how health beliefs influence an individual's decisions about whether to seek cancer screening services (Austin, Ahmad, McNally, & Stewart, 2002). The HBM was used as the theoretical foundation for this study. The HBM was deemed appropriate for this study since the data collected was extrapolated from the CDC's Behavioral Risk Factor Surveillance System (BRFSS) database based on personal decisions and/or beliefs as to whether or not to undergo a cancer screening for breast, cervical, colorectal, and prostate cancer.

Health Belief Model

The four constructs of the HBM are perceived susceptibility, perceived benefits, perceived barriers, and perceived seriousness. Modifying variables, cues to action, and self-efficacy are all components of the HBM. The first construct, perceived susceptibility, is an individual's assessment of his or her chances of getting the disease. The second construct, perceived benefits, is an individual's conclusion as to whether the new behavior is better than what he or she is already doing. The third, perceived barriers, is an individual's opinion as to what will stop him or her from adopting the new behavior. The fourth construct, perceived seriousness, is an individual's judgment as to the severity of the disease. Modifying variables are an individual's personal factors that affect whether or not the new behavior is adopted. Cues to action are those factors that will start a person on the way to changing a behavior. Finally, self-efficacy is a personal belief in one's own ability to do something (Hayden, 2014, p. 35).

Health Belief Model and Breast Cancer Screening

In 2012, a study was released that examined health beliefs as predictors of whether or not women underwent breast cancer screenings (Aflakseir & Abbasi, 2012). One-hundred and thirteen female participants completed the Champion Health Beliefs Scale, which focused on women's beliefs related to perceived susceptibility to breast cancer, perceived benefits and barriers of mammography screening, and questions related to breast self-examinations (BSE). The study revealed that 51% of women had self-reported as utilizing BSEs, and only 21% had a mammography as part of the breast cancer screening regimen. Logistical regression revealed that a health care professional's recommendation and the women's perceived barriers significantly predicted mammography screening rates, which explains 27% of the variance of mammography practice. The researchers further explained that the women who had fewer perceived barriers to mammography screening and those women who had received a recommendation from their health care provider were more likely to undergo cancer screening (Aflakseir & Abbasi, 2012). The study suggested that perceived barriers to breast cancer screening should be considered when health care professionals are providing recommendations for breast cancer screening to their female patients.

Health Belief Model and Cervical Cancer Screening

Researchers conducted a study using the Champion Health Beliefs Scale to explain the beliefs of women with regard to cervical cancer and Pap testing (Guvenc, Akyuz, & Acikel, 2011). The HBM Scale was found to be valid and a reliable tool in assessing women's health beliefs related to cervical cancer and Pap test screenings. Furthermore, the HBM Scale has shown that it can be a valuable tool for health care providers and researchers in developing cervical cancer screening programs to better educate women about the importance of cervical cancer screening (Guvenc, Akyuz, & Acikel, 2011).

Health Belief Model and Colorectal Cancer Screening

A study was conducted using the HBM to better understand how perceived barriers and benefits to colon cancer screening among Black men and women effect screening behaviors (James, Campbell, & Hudson, 2002). Logistic regression was used to assess the relationship between barriers and beliefs to colon cancer screening, self-reporting history FOBT, flexible sigmoidoscopy, and colonoscopy. The researchers found that there were significant barriers related to recent FOBT and sigmoidoscopy; however, significant benefits were identified with recent FOBT and colonoscopy, but not recent FOBT. The researchers concluded that people's perceptions of sigmoidoscopy, colonoscopy, and FOBT might differ in terms of importance for colorectal cancer screening (James, Campbell, & Hudson, 2002). This conclusion served the medical community well by illustrating the importance of education and exploration of health beliefs related to colorectal screening practices.

Current colorectal screening rates among men are suboptimal due to prospective practical and psychosocial barriers. One of the potential barriers to colorectal cancer screening among men is the belief that endoscopic screening poses a perceived threat to their masculinity. Indeed, beliefs about masculinity have been predictive of other preventive health behaviors among men (Christy, Mosher, & Rawl, 2014).

Health Belief Model and Prostate Cancer Screening

In a study to assess health beliefs associated with prostate cancer screening among retired men, 180 men aged 50 to 70 were surveyed using questionnaires related to the HBM (Ghodsbin, Zare, Jahanbin, Ariafar, & Keshavarzi, 2014). The results revealed that 95.6% of men surveyed had no experience of digital rectal examination (DRE) and 85.6% had no experience with PSA testing for prostate cancer screening. When participants were asked about knowledge related to

prostate screening, 86.1% reported no prior knowledge of such screening. After educating the

participants about prostate cancer screening processes, 74.4% reported good health motivation to

undergo screening, and 90.5% had perceived health benefits from prostate cancer screening

(Ghodsbin, Zare, Jahanbin, Ariafar, & Keshavarzi, 2014). The results of this study indicate that

education about prostate and other cancer screenings can positively impact health beliefs and

behavior.

<div align="center">**Identify and Defining Variables**</div>

The dependent variables for this study were: 1) Breast cancer screening via mammogram

in adult women aged 50 to 74 who have received a mammogram within the recommended time

period of every 2 years. A mammogram is an x-ray of each breast to look for breast cancer. 2)

Cervical cancer screening via Pap test in adult women aged 21 to 65 who have received a Pap

test within the recommended time period of every 3 years. A Pap test is a test for cancer of the

cervix. 3) Colorectal cancer screening in adult men and women aged 50 to 75 who have had one

or more of the recommended screenings within the recommended time interval: a FOBT every

year; a FOBT within the past 3 years and a sigmoidoscopy within the last 5 years; or have had a

colonoscopy in the last 10 years. A FOBT is a blood stool test that may use a special at home kit

to determine whether the stool contains blood. Sigmoidoscopy and colonoscopy are exams in

which a tube in inserted in the rectum to view the colon for signs of cancer or other health

problems. 4) Prostate cancer screening via prostate-specific antigen (PSA) test in adult men

aged 40 years and older who have had a PSA test within the recommended time period of 2

years. A PSA test is a blood test to check for prostate cancer. The dependent variables and their

descriptive definitions for this study are described on Appendix A.

The independent variables for this study are defined by sexual orientation groups: straight is defined as men having sex with women, but not men; lesbian is defined as women having sex with other women, but not men; gay is defined as men having sex with other men, but not women; bisexual is defined as men having sex with women and other men and women having sex with men and other women. The independent variables and their descriptive definitions for this study are described on Appendix A.

Demographics and characteristics of the sample were gender (male or female), race (White, Black, Hispanic, or Asian), martial status (married or unmarried), education level (high school or lower, or greater than high school), and annual household income (less than or equal to $35,000/year, greater than $35,000 to $49,999/year, $50,000 to $74,999/year, or greater than $75,000). The demographic and categorical variables and their descriptive definitions for this study are described on Appendix A.

Methodology Overview

Research Design

This study used a descriptive-correlational design. Secondary data was collected from the 2014 CDC's BRFSS national database. All patient identifiers were removed for privacy purposes. This data was open and had unrestricted public access. The CDC had stipulated that when using the BRFSS public data sets it is not required to obtain permission to utilize its data as "data and materials produced by federal agencies are in the public domain and may be reproduced without permission", but "ask that any published material derived from the data acknowledge CDC's BRFSS as the original source" (CDC, 2015) .

Power Analysis

For the purpose of this study, a power analysis was performed utilizing the following data points: effective size (Cohen's *d)*: 0.5, statistical power level: 0.8, probability level (alpha): 0.05, which yielded a sample size of 128 for a two-tailed hypothesis test (Soper, 2017). To estimate the sample size, we assume that one group would have a screening rate of 70% and the other group would have 55%. With alpha of 0.05, to have 80% power to detect the difference in screening rates, the researcher needed 163 in each group. Since there were three sexual orientation groups, 489 respondents were needed for this study.

Study Population/Sample/Sampling

The target population was adult men and women who live in the United States. No recruitment, consenting, or enrollment of any subjects were necessary as the samples for this study stemmed from secondary data obtained from CDC's public, de-identified data sets. The sample was randomly selected, population-based, representative sample of the United States (CDC, 2014). The sample populations were derived from adults who completed the BRFSS survey questionnaire and resided in any one of the 50 states, District of Columbia, or three U.S. territories (BRFSS, 2014).

Inclusion Criteria

The researchers defined inclusion critieria as respondents who answered "yes" or "no" to the respective cancer screening question and who answered "straight", "lesbian or gay", or "bisexual" to the sexual orienation question. Additionally, respondents who answered each cancer screening question must be within the age range for each cancer screening recommendation.

Exclusion Criteria

The researchers defined exclusion criteria as respondents who didn't answer, or answered "other" or "don't know/not sure" about whether or not they underwent the respective cancer screening within the recommended time period and to their sexual orienation, demographic, and categorical characteristics.

BRFSS Data Collection Procedures

The 2014 CDC BRFSS was a survey questionnaire that was performed for one calendar year, operating from January 1, 2014 through December 31, 2014. Participates in the survey were from any one of the 50 states, District of Columbia, or three U.S. territories (Puerto Rico, Guam, U.S. Virgin Islands). Survey respondents were non-institutionalized adults aged 18 or older living in a private residence or some form of college housing. The CDC developed a database, Ci3 WinCATI, that allows for each state to upload their survey results monthly. This functionally allowed the CDC to immediately begin processing the data for public viewing and analysis. The BRFSS was comprised of a core set of questions, optional BRFSS modules, and state-added questions. In 2014, there were 19 optional modules performed during the survey period. The survey was developed through the partnership of a governing body representing state health officials selected to represent regions, BRFSS coordinating work groups, and CDC program managers. The survey was performed through probability sampling utilizing telephone landlines or mobile telephones as a source of reaching respondents. To ensure reliable and consistent data collection, state coordinators or interviewer supervisors conduct repeated and specific training of interviewers on the BRFSS questionnaire and procedures before interviewers perform data collection. In addition, interviewer performances' are also evaluated through interviewer-monitoring systems, which included listening to the interviewer only at an on-site

location, listening to both the interviewer and respondent at remote locations, and/or using

verification callbacks (CDC, 2015).

Instrumentation and Measurements

The BRFSS questions related to the dependent variables, breast, cervical, colorectal, and

prostate cancer screening practices, was based on the respondents' answer as to whether or not

they underwent the screening within the recommended time period. Respondents' answers were

coded as (1) "yes" or (2) "no."   The BRFSS question related to the independent variable, sexual

orientation, respondents' answers were coded as (1) "straight", (2) "lesbian or gay", or (3)

"bisexual." The BRFSS question related to the demographic variable, gender, respondents'

answers were coded (1) male or (2) female. The BRFSS question related to the demographic

variable, race, respondents' answers were coded (1) White, (2) Black, (3) Hispanic, or (4) Asian.

The BRFSS question related to the demographic variable, marital status, respondents' answers

were coded (1) married or (2) unmarried. The BRFSS question related to the demographic

variable, education level, respondents' answers were coded (1) high school or lower or (2)

greater than high school. The BRFSS question related to the demographic variable, annual

household income, respondents' answers were coded (1) less than or equal to $35,000/year, (2)

greater than $35,000 to $49,999/year, (3) $50,000 to $74,999/year, or (4) greater than $75,000.

Dependent, independent, and demographic variables and their operational definitions and

specifications are located on Appendix A.

The validity and reliability of the BRFSS has been studied in great length. The CDC

reported that the BRFSS has been shown time and time again to be a reliable and trustworthy

data collection system, which can be used as the basis for further research and investigation

(CDC, 2017). These BRFSS validity and reliability studies have shown that the BRFSS was

"valid in national estimates, within state estimates and comparisons across states" (CDC, 2017).

The most recent study to examine the validity and reliability of the BRFSS data was, *Adolescent*

and Young Adult Preventive Care: Comparing National Survey Rates by Adams, Park, and

Irwin, Jr. (2015). In their study, four 2011 surveys were identified: National Health Interview

Survey, National Survey of Children's Health (2011–2012), and Medical Expenditure Panel

Survey (MEPS) for adolescents, and MEPS and Behavioral Risk Factor Surveillance System for

young adults. The study revealed that surveys varied by most assessed features, but

demographic profiles were similar. Preventive visit rates varied significantly across adolescents

(43% to 81%) and young adults (26% to 58%). The largest differences in visit rates were in

comparisons of subjective assessments to a more detailed assessment coded from specific

records of visits kept by respondents. Sociodemographic differences in visit rates were

consistent across surveys (CDC, 2017).

The data collected from the 2014 BRFSS survey was easily accessible to all, and

available online without an associated cost; therefore, by using this data collection system, it

served as a cost-effective measure to reduce the financial burden of this study on the researchers.

Data Collection Procedures and Timeline

The data for this study was obtained from the 2014 BRFSS by the primary researcher

once The George Washington University (GWU) Institutional Review Board (IRB) granted

permission to proceed with data collection and analysis since the study did not constitute human

subjects research. Inclusion and exclusion criteria were applied to select the sample. All

variables were coded as defined in the measurement section.

The timeline for our study began on January 17, 2017 with the research plan, which

included formulating the background, problem statement, purpose, specific aims, possible

hypotheses/research questions, significance and literature review, theoretical framework, identifying and defining variables, method overview, Citi-training, intervention, instrument and measurement, data collection procedures, data analysis plan, research ethics, establishing a timeline, and IRB submission. The finalized research proposal components were submitted on May 2, 2017 for approval via NURS 8498 – Research Proposal course. On March 1, 2017, Dr. Qiuping (Pearl) Zhou was selection as the primary advisor to the researcher and in August 2017, Dr. Dana Hanes was selected as the secondary advisor for this study. The researcher then contacted Dr. Zhou and presented her with the premise of the study. Data collection and entry, scrubbing, analysis, and write-up of findings began in October 2017, and concluded on January 31, 2018. Additional literature review and revisions to our study occurred until February 20, 2018. Final submission of the research project occurred on March 27, 2018, and development and manufacturing of the study poster board presentation occurred April 2, 2018 and was presented to faculty on May 18, 2018.

Data Analysis Plan

SPSS 24 (IBM Corp., 2016) was used to analyze the collected data. Descriptive statistics were performed on all study variables. To test the hypotheses, Chi-Square tests were used to analyze for differences between the dependent variables (breast, cervical, colorectal, and prostate cancer screening practices) and sexual orientation (straight, lesbian or gay, bisexual). Statistical significance was set at 0.05. Additional analyses were performed to correlate the demographic variables of race, martial status, education level, and annual household income level with each cancer screening with the addition of gender for colorectal cancer screening.

Ethical Considerations

Since this is a descriptive-correlational study that analyzed de-identified public data, it was not considered a human subject research study; therefore, the George Washington University Institutional Review Board deemed IRB approval was not necessary.

Results

Breast Cancer Screening

In the sample, 77.5% of straight, 78.2% of lesbian, and 81.9% of bisexual respondents self-reported as having met the breast cancer screening recommendation. The difference was statistically significant ($x^2 = 8.916$, p = 0.012). The results are summarized on Table A1. The racial demographic results showed 78.3% of White, 76.4% of Black, 70.5% of Hispanic, and 82.5% of Asian respondents self-reported as having met this screening recommendation. The difference was statistically significant ($x^2 = 46.081$, p < 0.001). Among adults who were married, 78.1% met the screening recommendation and of those who were unmarried, 78.1% met the screening recommendation. The difference was not statistically significant ($x^2 = 0.043$, p = 0.837). Among respondents who had self-reported having completed high school or lower, 77.8% met the screening recommendation and of those who had completed education greater than high school, 78.3% met the screening recommendation. The difference was not statistically significant ($x^2 = 2.924$, p = 0.087). For annual household income level, 77.7% of respondents who self-reported earning less than or equal to $35,000/year, 77.5% of those earning greater than $35,000 to $49,999/year, 77.9% of those earning greater than $50,000 to $74,999/year, and 78.9% of those earning greater than $75,000/year met the screening recommendation. The difference was statistically significant ($x^2 = 19.296$, p < 0.001). The results are summarized on Table A2.

Cervical Cancer Screening

In the sample, 81.8% of straight, 81.4% of lesbian, and 83.6% of bisexual respondents self-reported as having met the cervical cancer screening recommendation. The difference was not statistically significant (x^2 = 0.958, p = 0.619). The results are summarized on Table B1. The racial demographic results showed 83.0% of White, 80.4% of Black, 82.5% of Hispanic, and 76.8% of Asian respondents self-reported as having met the screening recommendation. The difference was statistically significant (x^2 = 115.708, p < 0.001). Among adults who were married, 82.5% met the screening recommendation and of those who were unmarried, 82.6% met the screening recommendation. The difference was not statistically significant (x^2 = 0.202, p = 0.653). Among respondents who had self-reported having completed high school or lower, 82.2% met the screening recommendation and of those respondents who had completed education greater than high school, 82.7% met the screening recommendation. The difference was not statistically significant (x^2 = 3.684, p = 0.055). For annual household income level, 82.4% of respondents who self-reported earning less than or equal to $35,000/year, 82.5% of those earning greater than $35,000 to $49,999/year, 82.4% of those earning greater than $50,000 to $74,999/year, and 82.5% of those earning greater than $75,000/year met screening the recommendation. The difference was not statistically significant (x^2 = 0112, p < 0.990). The results are summarized on Table B2.

Colorectal Cancer Screening

In the sample, 68.9% of straight, 69.1% of lesbian and gay, and 73.3% of bisexual respondents self-reported as having met the colorectal cancer screening recommendations. The difference was statistically significant (x^2 = 10.351, p = 0.006). The results are summarized on Table C1. The gender demographic results indicated 69.3% of respondents who self-reported as male, and 69.2% of females met screening recommendations. The difference was not

statistically significant ($x^2 = 0.219$, p = 0.639).   The racial demographic results showed 69.6% of White, 69.8% of Black, 70.4% of Hispanic, and 55.9% of Asian respondents self-reported as having met the screening recommendations. The difference was statistically significant ($x^2 = 355.56$, p < 0.001). Among adults who were married, 69.3% met the screening recommendation and of those who were unmarried, 69.2% met the screening recommendation. The difference was not statistically significant ($x^2 = 0.271$, p = 0.602).   Among respondents who had self-reported having completed high school or lower, 69.0% met the screening recommendation and of those who had completed education greater than high school, 69.4% met the screening recommendation. The difference was statistically significance ($x^2 = 5.165$, p = 0.023). For annual household income level, 69.0% of respondents who self-reported earning less than or equal to $35,000/year, 69.1% of those earning greater than $35,000 to $49,999/year, 69.3% of those earning greater than $50,000 to $74,999/year, and 69.7% of those earning greater than $75,000/year met screening the recommendation. The difference was statistically significant ($x^2 = 9.755$, p = 0.021). The results are summarized on Table C2.

Prostate Cancer Screening

In the sample, 47.8% of straight, 66.5% of gay, and 58.1% of bisexual respondents self-reported as having met the prostate cancer screening recommendation. The difference was statistically significant ($x^2 = 79.794$, p < 0.001). The results are summarized on Table D1. The racial demographic results showed 48.6% of White, 42.5% of Black, 47.5% of Hispanic, and 54.2% of Asian respondents self-reported as having met this screening recommendation. The difference was statistically significant ($x^2 = 167.48$, p < 0.001).   Among adults who were married, 48.3% met the screening recommendation and of those who were unmarried, 48.5% met the screening recommendation. The difference was not statistically significant ($x^2 = 0.239$, p =

0.625).   Among respondents who had self-reported having completed high school or lower, 48.3% met the screening recommendation and of those who had completed education greater than high school, 48.4% met the screening recommendation. The difference was not statistically significance (x^2 = 0.133, p = 0.716). For annual household income level, 48.6% of respondents who self-reported earning less than or equal to $35,000/year, 48.1% of those earning greater than $35,000 to $49,999/year, 48.5% of those earning greater than $50,000 to $74,999/year, and 48.4% of those earning greater than $75,000/year met screening the recommendation. The difference was not statistically significant (x^2 = 1.023, p = 0.796). The results are summarized on Table D2.

Discussion

Breast Cancer Screening

Our findings support the hypothesis that there is a statistically significant difference in breast cancer screening practices among sexual orientation groups. Bisexual women met the breast cancer screening recommendation more than lesbians, followed by straight women. These findings contradict the results of the Matthews, Brandenburg, Johnson, and Hughes study in 2004; their study revealed that lesbian and bisexual women are less likely to follow through with this screening recommendation. Our results also revealed that bisexual women were the only sexual orientation group to reach and exceed the *Healthy People 2020* breast cancer screening target rate.

There was a disparity in this cancer screening with regard to race; Asians met the recommendations more than Whites, followed by Hispanics, and with Blacks showing as the least likely to follow through with this recommendation. This study also showed that there is a correlation between breast cancer screening practices and annual household income; higher

annual household incomes relate to higher screening rates. Martial status and education level were not statistically significant; therefore, they did not represent a disparity within this cancer screening study.

Cervical Cancer Screening

Our findings did not support the hypothesis that there is a statistically significant difference in cervical cancer screening practices among sexual orientation groups. Women reported similar screening practices regardless of sexual orientation, which contradicts the Matthews, Brandenburg, Johnson, and Hughes study in 2004 which revealed that lesbian and bisexual women are less likely to follow through with this screening recommendation. Our results also revealed that all three sexual orientation groups were still significantly below the *Healthy People 2020* cervical cancer screening target rate.

There was a disparity in this cancer screening with regard to race; Whites met the recommendations more than Hispanics, followed by Blacks, and with Asians showing as the least likely follow through with this recommendation. The respondent's reported martial status, education level, and annual household income results were not statistically significant; therefore, they do not represent a disparity within this cancer screening study.

Colorectal Cancer Screening

Our findings support the hypothesis that there is a statistically significant difference in colorectal cancer screening practices among sexual orientation groups. Bisexual women and men met the colorectal cancer screening recommendation more than lesbians and gay men, followed by straight individuals. These results only add to the on-going discussion as to whether or not sexual orientation influences an individual's decision to undergo colorectal cancer screening as evidenced by the finding in the McElroy, Wintemberg, and Williams study in 2015,

which revealed no difference in colorectal screening rates among lesbian and bisexual women. Additionally, the Smith, et al. study in 2015 showed that men in the general public who receive prostate cancer screening are more likely to undergo colorectal cancer screening, however the Heslin, Gore, King, and Fox study in 2008 contradicted these findings. Our findings also revealed that bisexuals exceeded the Healthy People 2020 target rate for colorectal cancer screening, whereas lesbians, gay men, and straight individuals did not reach the target.

There was a disparity in this cancer screening with regard to race; Hispanics met the recommendations more than Blacks, followed by Whites, and with Asians showing as the least likely to follow through with this recommendation. The results showed that there is a correlation between colorectal cancer screening rates and annual household income; higher annual household incomes relate to higher screening rates. The researchers further identified a correlation between respondent's level of education and meeting this screening recommendation; higher education levels relate to higher screening rates. The respondent's martial status results were not statistically significant; therefore, they do not represent a disparity within this cancer screening study.

Prostrate Cancer Screening

Our findings support the hypothesis that there is a statistically significant difference in prostate cancer screening practices among sexual orientation groups. Gay men met the prostate cancer screening recommendation more than bisexual men, followed by straight men. These results contradict the Quinn, et al. study in 2015, which found there to be no differences in prostate cancer screening rates by sexual orientation.

There was a disparity in this cancer screening with regard to race; Asians met the recommendations more than Whites, followed by Hispanics, and with Blacks showing as the

least likely to follow through with this recommendation. The respondent's martial status, education level, and annual household income results were not statistically significant; therefore, they do not represent a disparity within this cancer screening study.

Study Limitations

This study has a fundamental limitation in that it only represents respondent's answers to certain cancer screening practices and sexual orientation in one calendar year in the United States. Secondly, this study did not evaluate all types of cancer screenings available, or the sub-elements of each screening to uncover any additional disparities. Thirdly, the BRFSS survey relied on self-reported cancer screening practices; therefore recall bias may have skewed the study results. Next, it is unclear as to whether or not the respondents were knowledgeable of the respective cancer screening recommendations, which may have influenced their decision to undergo a particular screening. Finally, since there are opposing prostate cancer screening recommendations, it is unclear which recommendation the respondents were following; therefore, it is possible that results of this screening may be skewed and underlying disparities associated with this cancer screening and sexual orientation were masked.

Implications and Recommendations for Practice, Policy, and Future Research

Based on the findings of this study, it is apparent that disparities exist in certain cancer screenings among sexual orientation groups, therefore it is paramount that all health care providers recognize the importance of discussing cancer screening with all individuals regardless of sexual orientation or any other cultural, socioeconomic, or demographic characteristics. Providers who are accepting, affirming, and inclusive of sexual minority groups may help patients to be more willing to undergo cancer screening tests.

Health care provider biases and other demographic factors such as having health care insurance still influence an individual's decision to undergo cancer screenings. Policies need to be developed to ensure that every patient is properly and routinely screened for potentially life-threatening cancers according to screening recommendations since these factors inhibit equitable access to care and uptake of cancer screening testing within the lesbian, gay, and bisexual community. In addition to additional policy development, training programs need to be developed to educate the medical community on being more inclusive of sexual minority groups.

With the repeal of the Affordable Care Act's (ACA) Individual Mandate, individuals could become at risk for developing cancer due to reduced cancer screening practices related to insufficient or lack of health care coverage. To better understand how the repeal of the Individual Mandate could impact cancer screening practices, it is recommended that a study be performed using these and other cancer screenings to compare cancer screening practices prior to the implementation of the Individual Mandate, during the years for which the mandate was in effect, and then after the repeal of the mandate.

Additional demographics that may be useful in future studies surrounding these variables include health care coverage status, retirement status, racial screenings rates by sexual orientation among the different cancer screenings, and cancer screening practices among different generational groups, religions, and geographic regions within the United States.

Lastly, there are two predominant recommendations for prostate cancer screening. The researcher recommends that a consensus be reached among health care policy makers in an effort to properly screen or not screen this population for prostate cancer as this may influence a patient's decision as to whether or not to undergo screening.

Conclusion

This study has revealed that there is a direct correlation between certain cancer screenings and sexual orientation and other demographic and categorical characteristics. Breast and colorectal cancer screening results revealed bisexuals met the recommendations more often than straights and lesbians. Prostate cancer screening results showed that gay men met the recommendation more often than straight and bisexual men and there was no statistically significant difference in cervical cancer screenings among the different sexual orientation groups. Based on the results of this study when compared with other study results, it is apparent that further studies related to cancer screening practices and sexual orientation need to be conducted in order to further clarify and identify disparities between these variables.

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Table A1. **Respondent Women Aged 50 to 74 Who Have Fully Met the Breast Cancer Screening Recommendation Among Sexual Orientation Groups**

	Sexual Orientation			
	Straight (n = 38,695)	Lesbian/Gay (n = 784)	Bisexual (n = 816)	Stats χ^2, p value
Breast Cancer Screening				8.916, p=0.012
Yes	29,988 (77.5%)	613 (78.2%)	668 (81.9%)	
No	8,707 (22.5%)	171 (21.8%)	148 (18.1%)	

Table B1. **Respondent Women Aged 21 to 65 Who Have Fully Met the Cervical Cancer Screening Recommendation Among Sexual Orientation Groups**

	Sexual Orientation			
	Straight (n = 38,473)	Lesbian (n = 414)	Bisexual (n = 415)	Stats χ^2, p value
Cervical Cancer Screening				0.958, p = 0.619
Yes	31,470 (81.8%)	337 (81.4%)	347 (83.6%)	
No	7,003 (18.2%)	77 (18.6%)	68 (16.4%)	

Table C1. **Respondent Men and Women Aged 50 to 75 Who Have Fully Met the Colorectal Cancer Screening Recommendation Among Sexual Orientation Groups**

	Sexual Orientation			
	Straight (n = 66,521)	Lesbian/Gay (n = 1,110)	Bisexual (n = 1,144)	Stats χ^2, p value
Colorectal Cancer Screening				10.351, p = 0.006
Yes	45,835 (68.9%)	767 (69.1%)	839 (73.3%)	
No	20,686 (31.1%)	343 (30.9%)	305 (26.7%)	

Table D1. **Respondent Men Aged 40 and Older Who Have Fully Met the Prostate Cancer Screening Recommendation Among Sexual Orientation Groups**

	Sexual Orientation			
	Straight (n = 40,641)	Gay (n = 445)	Bisexual (n = 458)	Stats χ^2, p value
Prostate Cancer Screening				79.794, p < 0.001
Yes	19,442 (47.8%)	296 (66.5%)	266 (58.1%)	
No	21,199 (52.2%)	149 (33.5%)	192 (41.9%)	

Table A2. **Respondent Women Aged 50 to 74 Who Have Fully Met the Breast Cancer Screening Recommendation and Related Factors**

	Met Breast Cancer Screening Recommendation		Stats
	Yes	No	χ^2, p value
Race/Ethnicity			46.081, p < 0.001
White (n = 100,519)	78,749 (78.3%)	21,770 (21.7%)	
Black (n = 8,459)	6,465 (76.4%)	1,994 (23.6%)	
Hispanic (n = 10,311)	7,991 (77.5%)	2,320 (22.5%)	
Asian (n = 2,403)	1,983 (82.5%)	420 (17.5%)	
Marital status			0.043, p = 0.837
Married (n = 71,846)	56,100 (78.1%)	15,746 (21.9%)	
Unmarried (n = 57,105)	44,617 (78.1%)	12,488 (21.9%)	
Education			2.924, p = 0.087
High school or lower (n = 47,008)	36,594 (77.8%)	10,414 (22.2%)	
Greater than high school (n = 82,034)	64,196 (78.3%)	17,838 (21.7%)	
Income Level			19.296, p < 0.001
Equal Less than $35K (n = 43,468)	33,767 (77.7%)	9,701 (22.3%)	
>$35K to $49,999 (n = 16,226)	12,579 (77.5%)	3,647 (22.5%)	
>$50K to $74,999 (n = 17,505)	13,632 (77.9%)	3,873 (22.1%)	
Greater than $75K (n = 33,125)	26,125 (78.9%)	7,000 (21.1%)	

Table B2. **Respondent Women Aged 21 to 65 Who Have Fully Met the Cervical Cancer Screening Recommendation and Related Factors**

	Met Cervical Cancer Screening Recommendation		Stats
	Yes	No	χ^2, p value
Race/Ethnicity			115.708, p < 0.001
White (n = 93,851)	77,937 (83.0%)	15,914 (17.0%)	

Black (n = 9,916)	7,976 (80.4%)	1,940 (19.6%)	
Hispanic (n = 9,284)	7,658 (82.5%)	1,626 (17.5%)	
Asian (n = 3,053)	2,346 (76.8%)	707 (23.2%)	
Marital status			0.202, p = 0.653
Married (n = 67,874)	55,973 (82.5%)	11,901 (17.5%)	
Unmarried (n = 53,879)	44,485 (82.6%)	9,394 (17.4%)	
Education			3.684, p = 0.055
High school or lower (n = 44,275)	36,403 (82.2%)	7,872 (17.8%)	
Greater than high school (n = 77,577)	64,121(82.7%)	13,456 (17.3%)	
Income Level			0.112, p = 0.990
Equal Less than $35K (n = 41,209)	33,958 (82.4%)	7,251 (17.6%)	
>$35K to $49,999 (n = 15,422)	12,723 (82.5%)	2,699 (17.5%)	
>$50K to $74,999 (n = 16,495)	13,597 (82.4%)	2,898 (17.6%)	
Greater than $75K (n = 30,965)	25,541 (82.5%)	5,424 (17.5%)	

Table C2. **Respondent Men and Women Aged 50 to 75 Who Have Fully Met the Colorectal Cancer Screening Recommendation and Related Factor**

	Met Colorectal Screening Recommendation		Stats
	Yes	No	χ^2, p value
Gender			0.219, p = 0.639
Male (n = 92,442)	64,088 (69.3%)	28354 (30.7%)	
Female (n = 128,934)	89,267 (69.2%)	39,667 (30.8%)	
Race/Ethnicity			355.56, p < 0.001
White (n = 170,991)	118,934 (69.6%)	52,057 (30.4%)	
Black (n = 14,752)	10,303 (69.8%)	4,449 (30.2%)	
Hispanic (n = 17,937)	12,636 (70.4%)	5,301 (29.6%)	

	Asian (n = 3,971)	2,218 (55.9%)	1,753 (44.1%)	
Marital status				0.271, p = 0.602
Married (n = 122,489)	84,911 (69.3%)	37,578 (30.7%)	
Unmarried (n = 96,956)	67,111 (69.2%)	29,845 (30.8%)	
Education				5.165, p = 0.023
High school or lower (n = 80,060)	55,220 (69.0%)	24,840 (31.0%)	
Greater than high school (n = 139,514)	96,876 (69.4%)	42,638 (30.6%)	
Income Level				9.755, p = 0.021
Equal Less than $35K (n = 74,000)	51,024 (69.0%)	22,976 (31.0%)	
>$35K to $49,999 (n = 27,488)	18,991 (69.1%)	8,497 (30.9%)	
>$50K to $74,999 (n = 29,729)	20,608 (69.3%)	9,121 30.7%)	
Greater than $75K (n = 56,080)	39,109 (69.7%)	16,971 (30.3%)	

Table D2. **Respondent Men Aged 40 and Older Who Have Fully Met the Prostate Cancer Screening Recommendation and Related Factors**

	Met Prostate Cancer Screening Recommendation		Stats
	Yes	No	χ^2, p value
Race/Ethnicity			167.48, p < 0.001
White (n = 101,049)	49,101 (48.6%)	51,948 (51.4%)	
Black (n = 9,614)	4,083 (42.5%)	5,531 (57.5%)	
Hispanic (n = 10,754)	5,105 (47.5%)	5,649 (52.5%)	
Asian (n = 2,310)	1,251 (54.2%)	1,059 (45.8%)	
Marital status			0.239, p = 0.625
Married (n = 72,914)	35,250 (48.3%)	37,664 (51.7%)	
Unmarried (n = 57,375)	27,816 (48.5%)	29,559 (51.5%)	
Education			0.133, p = 0.716

High school or lower (n = 47,664)	23,033 (48.3%)	24,631 (51.7%)	
Greater than high school (n = 82,683)	40,042 (48.4%)	42,641 (51.6%)	
Income Level			1.023, p = 0.796
Less or Equal to $35K (n = 44,176)	21,448 (48.6%)	22,728 (51.4%)	
>$35K to $49,999 (n = 16,162)	7,772 (48.1%)	8,390 (51.9%)	
>$50K to $74,999 (n = 17,558)	8,507 (48.5%)	9,051 (51.5%)	
Greater than $75K (n = 33,062)	16,006 (48.4%)	17,056 (51.6%)	

Appendix A – Variables

Variables	Variable Type and Form	Theoretical / Descriptive Definition	Operational Definition / Specifications
Breast cancer screening exam via mammogram	Dependent / Nominal	Adult women aged 50 to 74 who have received a mammogram within the recommended time period of every 2 years. A mammogram is an x-ray of each breast to look for breast cancer.	1=Yes 2=No
Cervical cancer screening via Pap test	Dependent / Nominal	Adult women aged 21 to 65 who have received a Pap test within the recommended time period of every 3 years. A Pap Test is a test for cancer of the cervix.	1=Yes 2=No
Colorectal cancer screening via fecal occult blood test (FOBT), sigmoidoscopy, or colonoscopy	Dependent / Nominal	Adult men and women aged 50 to 75 who have had one or more of the recommended colorectal screening tests within the recommend time interval: a FOBT every year; a FOBT within the past 3 years and a sigmoidoscopy within the last 5 years; or have had a colonoscopy in the last 10 years. A FOBT is a blood stool test that may use a	1=Yes 2=No

		special kit at home to determine whether the stool contains blood. Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the colon for signs of cancer or other health problems.	
Prostate cancer screening via Prostate-Specific Antigen (PSA) test	Dependent / Nominal	Adult men aged 40 and older who have had a PSA test within the recommended time period of 2 years. A PSA test is a blood test to check for prostate cancer.	1=Yes 2=No
Sexual Orientation	Independent / Demographic / Nominal	Self-identified, self-reported sexual orientation: Straight (men having sex with women, but not men), Lesbian (women having sex with other women, but not men), Gay (men having sex with other men, but not women), Bisexual (men having sex with other men and women; women having sex with other women and men)	1=Straight 2=Lesbian or gay 3=Bisexual
Gender	Demographic / Nominal	Patient's biological sex	1=Male 2=Female

Race	Demographic / Nominal	Biological or genetic traits based on various sets of physical characteristics	1=White 2=Black/African-American 3=Hispanic/Latino 4=Asian
Marital Status	Demographic / Nominal	Status of current relationship	1=Married 2=Unmarried
Educational Level	Demographic / Categorical	Level of education completed	1=High School or lower 2=Greater than high school
Annual Household Income	Demographic / Categorical	Amount of current household income	1=<=$35,000 2=$35,000-$49,999 3=$50,000-$74,999 4=>=$75,000