The Association of Sexual Orientation with Prostate, Breast, and Cervical Cancer Screening and Diagnosis

Michael Herriges (✉ herriges.m@live.sgu.ac.cy)

SUNY Upstate Medical University: State University of New York Upstate Medical University
<https://orcid.org/0000-0001-7975-3977>

Ruben Pinkhasov

SUNY Upstate Medical University: State University of New York Upstate Medical University

Keren Lehavot

VA Puget Sound Health Care System

Oleg Shapiro

SUNY Upstate Medical University: State University of New York Upstate Medical University

Joseph M. Jacob

SUNY Upstate Medical University: State University of New York Upstate Medical University

Thomas Sanford

SUNY Upstate Medical University: State University of New York Upstate Medical University

Nick Liu

SUNY Upstate Medical University: State University of New York Upstate Medical University

Gennady Bratslavsky

SUNY Upstate Medical University: State University of New York Upstate Medical University

Hanan Goldberg

SUNY Upstate Medical University: State University of New York Upstate Medical University

Research Article

Keywords: Breast Neoplasms, Early Detection of Cancer, Prostatic Neoplasms, Sexual and Gender Minorities, Uterine Cervical Neoplasms

Posted Date: April 30th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-476694/v1>

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Abstract

Purpose

Data on heterogeneity in cancer screening and diagnosis rates among lesbians/gays and bisexuals (LGBs) is lacking. Recent studies showed that LGBs have decreased healthcare utilization compared to heterosexual counterparts. Few studies have examined how sexual orientation impacts cancer screening and prevalence. We, therefore, investigated the association between sexual orientation and prevalent sex-specific cancer including prostate (PCa), breast (BC), and cervical (CC) cancer.

Methods

This was a cross-sectional survey-based US study, including men and women aged 18+ from the Health Information National Trends Survey (HINTS) database between 2017-2019. The primary endpoint was individual-reported prostate, breast, and cervical cancer screening and prevalence rates among heterosexual and LGB men and women. Multivariable logistic regression analyses assessed association of various covariates with undergoing screening and diagnosis of these cancers.

Results

Overall, 4,441 and 6,333 heterosexual men and women, respectively, were compared to 225 and 213 LGB men and women, respectively. LGBs were younger and less likely to be screened for PCa, BC, and CC than heterosexuals. A higher proportion of heterosexual women than lesbian and bisexual women were screened for CC with pap smears (95.36% vs. 90.48% and 86.11%, $p < 0.001$) and BC with mammograms (80.74% vs. 63.81% and 45.37%, $p < 0.001$). Similarly, a higher proportion of heterosexual men than gay and bisexual men were screened for PCa with PSA blood tests (41.27% vs. 30.53% and 27.58%, $p < 0.001$).

Conclusion

There were more heterosexuals than LGBs screened for CC, BC, and PCa. Healthcare professionals should be encouraged to improve cancer screening among LGBs.

Introduction

Population-based health studies are crucial in informing the prioritization of public health decisions and investments in health promotion activities. Relatively recent inclusion of sexual orientation (SO) measures in a limited number of federal and state health surveillance surveys has allowed the production of population-based information about gay/lesbian and bisexual (LGB) individuals' health and their status relative to heterosexual individuals. While the volume of SO data has been increasing, published studies focusing on this population are limited in number and scope, especially with regards to cancer screening and diagnosis.

Several studies have demonstrated SO disparities with respect to health behaviors, outcomes, and healthcare utilization. Published literature suggests LGBs may potentially engage more in health risk behaviors, including smoking and excessive drinking [1-2], and are at higher risk of poor health outcomes, including mood disorders and cardiovascular disease [3-4], compared to their heterosexual peers. Others found gay men have a higher prevalence of hypertension and heart disease, lesbians have a higher prevalence of obesity and stroke, and LGBs overall are more likely to delay seeking healthcare due to cost [5-6]. Additionally, LGBs are more likely to have lower rates of both health insurance and regular primary care provider (PCP) [1,7].

For women, the U.S. Preventive Services Task Force recommends screening at regular intervals for breast (BC) and cervical cancer (CC) from age 50 and 21 years old, respectively, with a mammogram and pap smear, respectively, at a frequency of every two and three years, respectively [8-9]. For men, The American Urologic Association guidelines recommend screening for prostate cancer (PCa) with a PSA blood test from age 55-69 years old at a frequency of every two years or more [10].

HPV infection has been firmly established biologically and epidemiologically as the causal agent for CC, with the virus responsible for up to 99.7% of CC cases [11]. Risk of contracting HPV increases with the number of sexual partners and lack of protection during sexual intercourse. LGB women have been found to have more risk factors for HPV infection compared to heterosexual women including more sexual partners, early onset of sexual activity, history of sexually transmitted infections, and lack of use of protection during sexual intercourse [12-13]. Furthermore, for decades healthcare professionals were not aware that HPV could be transmitted between women during sexual activity [14-15]. Consequently, LGB women were not advised to receive pap smears as regularly as heterosexual women [14-16]. They have also been less advised about safe sex practices to reduce the risk for HPV transmission [17]. This historical misinformation continues to influence physicians and LGB women's cancer screening behaviors [14, 16].

Regarding BC, data from the Women's Health Initiative revealed LGB women have a higher prevalence of BC than heterosexual women, despite similar mammography screening rates [18]. LGB women compared to heterosexual women also have significantly higher 5-year and lifetime risks for developing BC [19]. This increased risk could potentially be due to reproductive-related differences as LGB women have fewer pregnancies, live births, miscarriages, and abortions, raising the risk of BC [19-20]. Furthermore, on average, heterosexual women are pregnant significantly longer in total months and breastfeed for more months than LGB women, both of which are known to decrease BC risk [19, 21].

To date, there is little data on how SO impacts sex-specific screening of prevalent cancers. There have been a handful of studies demonstrating LGBs have lower utilization of CC and PCa screening [22-23]. There are some data from BC studies showing inconsistent results regarding whether LGB women had higher risks than heterosexual women, mostly because these studies were relatively small [24]. Additionally, a cross-sectional national study found white LGBs had a higher prevalence of being diagnosed with any cancer when compared to their heterosexual counterparts [6], suggesting LGBs might

be at higher risk for cancer development. To address these important knowledge gaps, we investigated SO identity disparities in screening and prevalence of highly prevalent sex-specific cancers, including BC, CC, and PCa, using a nationally representative data source. We hypothesized LGBs would report decreased usage of cancer screening measures but relatively increased prevalence of cancer diagnosis.

Methods

2.1: Data Source and Study Design

This cross-sectional study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement, and the Survey Reporting Guideline (SURGE) [25]. Data for this study were retrieved using the Health Information National Trends Survey Database (HINTS, 5th Ed.) to identify all men and women living in the US who were included in the annual national survey from cycles 1-3 (January 2017 – April 2019). Prior cycles were not included, as questions assessing our outcomes of interest were not present. The HINTS is a population-based survey database, part of the National Cancer Institute's (NCI) Division of Cancer Control and Population Sciences. The data that support the findings of this study are openly available (<https://hints.cancer.gov/>) and are routinely collected with the main goal of obtaining data on the use and dissemination of cancer-related information by the American population. Importantly, data from differing cycles represent unique respondents as individuals are never resurveyed. All data were previously de-identified by the NCI and publicly available, waiving the need for institutional review board approval.

2.2: Sampling and Survey

Survey design, sampling technique, and execution have been previously described [26]. In summary, areas with high and low concentrations of racial and ethnic minorities were sampled equally. Surveying was conducted by mail with a monetary incentive to increase the participation rate. Mailing protocol followed a modified Dillman approach [27] with four mailings: initial mailing, reminder postcard, and two follow-up mailings. Most households received one survey per mailing (in English), while households marked as potentially Spanish speaking received two surveys per mailing (one English and one Spanish).

2.3: Inclusion Criteria and Endpoints

Inclusion criteria were limited to male and female respondents above the age of 18, who reported SO for the question "Do you think of yourself as... Heterosexual, or straight; Homosexual, or gay or lesbian; Something else – Specify." This study excluded respondents who selected "Something else – Specify" in response to the SO question. The primary endpoint was self-reported screening of BC, CC and PCa via mammography, pap smear, and PSA testing, respectively. This was ascertained with the questions: "When did you have your most recent mammogram to check for breast cancer, if ever?;" "How long ago did you have your most recent Pap test to check for cervical change?;" and "A PSA test is used to check for prostate cancer. Have you ever had a PSA test?" Specific time responses were not used for mammogram or pap smear; rather, any usage was counted as ever having the respective test for the

analyses. Ever having a PSA test was a Yes or No question. The secondary endpoint was self-reported prevalence of BC, CC, and PCa. This was ascertained by the questions: “Have you ever been diagnosed as having cancer?” and “What type of cancer did you have?” The former question was a Yes/No response, used for any cancer diagnosis in our analyses. The latter question had over 20 specific cancer diagnosis response options that were the same across the years surveyed: bladder, bone, BC, CC, colon, endometrial, head/neck, Hodgkin’s lymphoma, renal, leukemia, lung, melanoma, non-Hodgkin’s lymphoma, oral, ovarian, pancreatic, pharyngeal, PCa, rectal, skin, and stomach cancer. Our analyses used responses for BC, CC, and PCa diagnoses.

2.4: Covariates

We collected all a priori selected demographic and socioeconomic variables deemed relevant in assessing the prevalence of cancer screening and diagnosis, using Andersen’s Healthcare Utilization Model and existing literature [28-31]. Demographic covariates included age, race (White, Black, Hispanic, Asian, and Other), US geographical region (Northeast, Midwest, South, West), metropolitan area (yes/no), living with a spouse (yes/no), and year of survey (2017-2019). Health-related covariates included body mass index (BMI) and smoking status (current, former, never). Socioeconomic status variables included education level (<high school, high school graduate, some college education, Bachelor’s degree, and post bachelor’s degree), household yearly income level (\$0-19,999, \$20,000-34,999, \$35,000-49,999, \$50,000-74,999, and above \$75,000), health insurance coverage (yes/no), and regular primary care provider (PCP) (yes/no).

2.5: Missing Data and Statistical Analyses

According to data published in the HINTS survey website, hot-deck imputation was used for missing data [32]. In this data processing procedure, every case with a missing value is assigned the corresponding value of a “similar” case in the same imputation class. Descriptive analyses included mean and standard deviation for continuous variables and proportions for discrete variables. For comparison of discrete and continuous variables, the chi-squared test and the Kruskal-Wallis test were employed, respectively. Multivariable logistic regression analyses assessed the association of various covariates with the prevalence of having been screened for PCa, CC, and BC, and the prevalence of having been diagnosed with these, or any cancer. All statistical tests were two-tailed and a p-value of < 0.05 was considered significant. Statistical analyses were performed using SPSS® statistical software version 23.0 (SPSS Inc., Chicago, IL).

Results

The overall survey response rate varied slightly in each year, with 32.4% in 2017, 32.9% in 2018, and 30.3% in 2019. Among men in the sample, 4,441 (95.18%) identified as heterosexual, 167 (3.58%) as gay, and 58 (1.24%) as bisexual. Among women in the sample, 6,333 (96.75%) identified as heterosexual, 105 (1.60%) as lesbian, and 108 (1.65%) as bisexual. Demographic and socioeconomic characteristics of the

sample across sex and SO is presented (Table 1). Heterosexuals were more prevalent in higher age groups compared LGBs in both men and women, $p < 0.001$. There was a larger proportion of heterosexual individuals who lived with their spouse for men (63.95% vs. 32.93% and 29.31%, $p < 0.001$). A higher proportion of LGBs were current smokers and LGB men had higher education (college graduate or more) (Table 1). Significantly more heterosexual than LGB women had regular PCP and health insurance.

The reported unadjusted screening and prevalence rates for PCa, BC, and CC is depicted in Figure 1. A higher proportion of heterosexual women than lesbian and bisexual women were screened for CC with pap smears (95.36% vs. 90.48% and 86.11%, $p < 0.001$) and BC with mammograms (80.74% vs. 63.81% and 45.37%, $p < 0.001$). Similarly, a higher proportion of heterosexual men than gay and bisexual men were screened for PCa with PSA blood tests (41.27% vs. 30.53% and 27.58%, $p < 0.001$). Although the prevalence rates of BC and PCa were not significantly different, more LGB women were diagnosed with CC (4.8% lesbian and 3.7% bisexual vs. 1.8% heterosexual, $p = 0.039$).

Multivariable logistic regression models assessed associations between various covariates with PCa, BC, and CC screening (Table 2). These analyses demonstrated that a gay/lesbian and bisexual orientation was associated with decreased OR of 0.56 (95% CI 0.34-0.91, $p = 0.018$) and 0.39 (95% CI 0.16-0.91, $p = 0.030$), respectively, for ever having had a PSA test, 0.42 (95% CI 0.23-0.77, $p = 0.005$) and 0.41 (95% CI 0.25-0.69, $p = 0.001$), respectively, for ever having had a mammogram, and 0.19 (95% CI 0.09-0.41, $p < 0.001$) and 0.19 (95% CI 0.10-0.37, $p < 0.001$), respectively, for ever having had a pap smear. Additional covariates showing increased associations with PCa and BC screening included age, Black race, increased annual income, having health insurance, reporting to have a PCP, and a previous history of cancer. For CC, age, annual income, reporting to have a PCP and a smoking history were shown to be associated with an increased screening of CC.

Table 3 demonstrates the multivariable logistic regression model assessing associations between various covariates with PCa, BC, and CC prevalence. Importantly, SO was not associated with an increased risk of being diagnosed with any of these cancers. In this analysis, age was shown to be associated with an increased prevalence of PCa and BC, but with a decreased prevalence of CC. Additionally, Blacks were associated with an increased risk of having PCa and BC compared to Whites. Supplemental Table 1 shows the multivariable logistic regression model assessing the associations between the various covariates with any cancer diagnosis. This shows that lesbian orientation was associated with an increased odds ratio of 1.82 (95% CI 1.04-3.19, $p = 0.037$) in women for ever having any cancer diagnosis, but no such association was shown for men.

Discussion

In this nationally representative US survey-based study of self-reported outcomes, 4.82% of men and 3.25% of women identified themselves as LGBs. These figures are consistent with current estimates that 4.5% of individuals identify as LGB in the US [33]. Unadjusted comparisons demonstrated that LGBs were shown to have a lower likelihood of having PCa, BC, and CC screening compared to their heterosexual

counterparts. They also showed a higher likelihood of CC diagnosis in LGB females. Multivariable models adjusting for known confounders showed that LGB orientation was associated with a decreased likelihood of ever having PCa, BC and CC screening tests, but not associated with increased or decreased prevalence of these cancers.

Minority stress and discrimination, particularly within healthcare settings, may help explain some of the disparities found in this study. For example, studies have shown that LGBs may not disclose their SO to avoid discrimination [34-35]. Even though most LGBs would most likely provide their SO if asked, most physicians feel patients will refuse to provide this information and are therefore less prone to routinely enquire about their SO [36]. For those LGBs that do disclose their orientation, evidence exists that they experience discrimination even from their healthcare providers [35]. Given this historical discrimination, it would not be surprising that some LGBs may avoid routine physician visits and screening tests, resulting in fewer examinations, tests, and decreased engagement in health-promoting and preventative measures. This could ultimately lead to a late diagnosis of cancer, resulting in a more aggressive and advanced cancer, associated with worse outcomes. It has recently been shown that LGB women are less likely than their heterosexual peers to obtain BC and CC screening due to independent psychological variables, including fear of rejection and discrimination, fear of negative evaluation, concealment of SO, and stigma consciousness related to their SO [37]. Importantly, like our findings, LGBs have been shown to have a lower likelihood of having a PCP and health insurance [1, 7], both of which contribute to a decreased utilization of screening tests [38]. Additionally, the misinformation given to LGB women for decades regarding the risks of CC likely continues to contribute to the disparities between heterosexuals and LGB women in CC screening measures [14, 16]. Taken together, the synergistic effect of discrimination, misinformed patients and physicians, lack of insurance, and lack of a PCP provide a confluence of risks that can potentially explain our findings.

A recent study by Lee, Jenkins, & Adjei Boake in 2020 assessed cancer screening by residence and SO [39]. Their study analyzed a total of 171,790 participants from the 2014 and 2016 Behavioral Risk Factor Surveillance System (BRFSS). Although this study assessed screening rates for BC and CC, it did not assess PCa screening or cancer prevalence. It showed that rural LGBs are less likely to have CC and BC screenings compared to urban heterosexuals, similar to our study. They found that lesbians were less likely in general to be screened for CC compared to heterosexuals, similar to our findings. Although this study assessed many individuals, it was limited to 20-26 states and is not representative of the entire US population. While epidemiological databases in the US have recently included SO information, there have been reports of cancer diagnosis prevalence among LGBs in the UK [40]. Saunders et al. assessed BC, CC, and PCa diagnoses amongst LGBs and heterosexuals in the UK but did not address cancer screening. Their study assessed 240,010 treated cancer survivors, of whom 2,199 (0.9%) reported an LGB orientation. They found no significant differences between LGBs and heterosexuals in the prevalence of the most common cancers, including BC and PCa, similar to our results.

Other noteworthy factors in our multivariable analyses associated with increased cancer screening included age, having a PCP, and health insurance. Factors associated with decreased screening included

Asian race. Former smokers (compared to current smokers) were less likely to have had a PSA test. Compared to current smokers, never smokers were more likely to have had mammograms. It is well established that cancer prevalence rises with age [41] and having a PCP and health insurance leads to increased screening rates due to increased utilization of health-promoting measures [38]. Asian race (compared to White) in the US has been previously found to be associated with decreased utilization of screening tests [42]. Additionally, smoking is a risk factor for the development of CC [43] and BC [44], while not being an established risk factor of PCa. It has recently been shown that active smoking is strongly associated with decreased cancer screening for BC and CC [45].

The current study has several limitations. Importantly, the data is retrospective consisting of inherent biases, with possible inaccurate or unreported data entry. As a survey-based study, it is prone to recall bias among responding subjects. Additionally, while this database accounts for many significant socio-economical and clinical factors, direct ascertainment of other relevant clinical information is lacking, such as known malignancy risk factors, including family history, personal genetic risk factors, detailed history of medical comorbidities, and diet. Importantly, all analyses were based on self-reported outcomes without confirmation of type and timing of cancer diagnosis. There is also no data on the timing and frequency of cancer screening tests, only if they had ever had the respective test. As previously stated, LGBs may also have been deterred from reporting their SO due to fear of discrimination; therefore, some response bias may be present. However, the anonymous nature of the surveys makes this bias less likely in our opinion. Another limitation of the current study is that only SO self-identification was assessed, which is only one out of three dimensions that need to be assessed. This is not aligned with published best practice recommendations for measuring SO. Conceptually, SO has three major dimensions: self-identification (how one identifies one's SO), sexual behavior (the sex of sex partners; i.e., same sex, different sex, both sexes, or never had sex) and sexual attraction (sex or gender of individuals that someone feels attracted to) [46].

Despite these limitations, our study represents a large and nationally representative cohort of US men and women providing self-reported outcomes. These data suggest that in addition to other established and known specific socio-economic risk factors, LGBs may be less likely to undergo screening of prevalent sex-specific malignancies such as PCa, BC, and CC. These findings suggest that a change is needed in current practices, and providers may need additional education about the need to screen LGB adults for sex-specific cancers. Furthermore, questions regarding SO should be implemented routinely when gathering medical histories from patients to better identify and assist this potentially “at-risk” population.

Declarations

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest/Competing interests: The authors have no conflicts of interest to declare that are relevant to the content of this article.

Availability of data and material: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Code availability: Statistical analyses were performed using SPSS® statistical software version 23.0 (SPSS Inc., Chicago, IL).

Authors' contributions: Michael J. Herriges: Conceptualization, Data curation, Investigation, Visualization, Writing – original draft, Writing – review and editing. Ruben Pinkhasov: Writing – review and editing. Keren Lehavot: Writing – review and editing. Oleg Shapiro: Writing – review and editing. Joseph M. Jacob: Writing – review and editing. Thomas Sanford: Writing – review and editing. Nick Liu: Writing – review and editing. Gennady Bratslavsky: Writing – review and editing. Hanan Goldberg: Conceptualization, Formal analysis, Methodology, Project administration, Supervision, Validation, Writing – review and editing.

Ethics approval: All data were previously de-identified by the NCI and publicly available, waiving the need for institutional review board approval.

Consent to participate: All data were previously de-identified by the NCI and publicly available, waiving the need for institutional review board approval.

Consent for publication: All data were previously de-identified by the NCI and publicly available, waiving the need for written consent for publication.

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Tables

Due to technical limitations, table 1 to 3 is only available as a download in the Supplemental Files section.

Figures

Figure 1

Prevalence of screening and diagnosis of breast, cervical, and prostate cancer

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SummaryofSupplementalTable1.pdf](#)
- [Table1.docx](#)
- [Table2.docx](#)
- [Table3.docx](#)