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## Perceptions of and barriers to cancer screening by the sexual and gender minority community: a glimpse into the health care disparity

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### Abstract

**Purpose:** A disparity exists in cancer screening rates for the lesbian, gay, bisexual, transgender and queer (LGBTQ+) community. We sought to understand the perceptions and baseline knowledge of cancer screening among LGBTQ+ community members.

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Authors Contributions

All authors significantly contributed to the study and manuscript. All authors read and approved the final manuscript.

Conflict of interest

The authors declare no conflict of interest.

Declarations

Ethics Approval

IRB: The Institutional Review Board approved this study prior to data collection.

Consent to participate

Informed consent was obtained from all individual participants included in the study

Consent for publication

Informed consent was obtained from all individual participants included in the study

Code Availability

Not applicable

**Methods:** Survey administered via social media from June 2018 to October 2018. We asked thirty-one questions focused on cancer screening, human papillomavirus, emotional distress, and experience with the healthcare system. Those included were age-eligible for cancer screening. Cancer screening attitudes and knowledge, as well as perceptions of the health care system were investigated.

**Results:** There were 422 respondents: 24.6% identified as female, 25.5% as male, 40.1% transgender and 9.6% as other. 65.4% of the LGBTQ+ community is not certain what cancer screening to do for themselves. Only 27.3% and 55.7% knew that HPV was a risk factor associated with head and neck cancer and anal cancer respectively. Half stated their emotional distress prevents them from getting cancer screening. It was identified that process changes in making appointments, comforts during the visit, and formal training for physicians and nurses could increase cancer screening compliance for this community. The transgender population had notably more gaps in knowledge of appropriate cancer screening and excess emotional distress.

**Conclusion:** Gaps in cancer screening knowledge, and emotional and financial distress may be responsible for the disparity of lower cancer screening rates for the LGBTQ+ population, and the transgender population may be most at risk. Appreciating the cancer screening concerns of the LGBTQ+ population can help shape future clinical and institutional approaches to improve healthcare delivery.

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## Introduction

Cancer screening guidelines were initiated in the 1960's and evidence demonstrates that early detection can decrease the number of cancer related deaths [1–2]. Unfortunately, existing cancer screening guidelines do not consider unique medical scenarios of the LGBTQ+ population which accounts for 4.5% of the US population [3]. In 2011, the LGBTQ+ population was identified as vulnerable after a report demonstrated the community has poor access to healthcare, increased proportion of persons with cancer, HIV, and depression and healthcare needs incompletely understood by medical professionals [4]. In 2015 the NIH established the sexual and gender minority (SGM) research office and by 2016, SGM were designated by the NCI as a health disparity population [5].

The oncology care disparities in the LGBTQ+ community are multifactorial and poorly understood. The 2011 National Transgender Discrimination Survey showed 50% of respondents postponed preventative care services because they could not afford it and 19% were denied health care because of their gender nonconforming status [6–9]. LGBTQ+ patients have a higher proportion of cancer risk factors including HIV, HPV, tobacco use, alcohol use, nulliparity, and a high fat diet [10]. The combination of increased risks of cancer, lack of access to health care, and distrust of providers is thought to translate to poor outcomes in the LGBTQ+ population [11–12].

Despite the critical need for improved health care in the LGBTQ+ community, there are no cancer screening guidelines specific to the LGBTQ+ population which leads to uncertainty for both health care providers and community members [13]. In this study, we sought to understand the unmet and unique needs of the LGBTQ+ population. In a survey of over 400 LGBTQ+ community members, half of the respondents were not certain what cancer

screenings should be done, what age they should begin, and half of patients had emotional distress due to cancer screening with 40% concerned about medical insurance. It was also found that respondents agree that cancer screening may improve if the medical infrastructure helped to decrease their emotional distress surrounding cancer screening with additional training for medical professionals, improved scheduling and comfort during exams. We present the first study assessing the knowledge and perceptions of the LGBTQ+ community on cancer screening.

## Methods

An IRB approved redcap survey was administered on social media to engage LGBTQ+ community members via Thomas Jefferson University Hospital. The survey was posted 540 times between 6/2–10/10/2018 to online groups including general LGBT, transgender general, female to male, male to female, lesbian, gay, queer, bisexual, and other across the social media platforms Facebook, Reddit, and other blogs. 82% of the postings were on Facebook groups. The anonymous survey included a consent statement for the interviewee to agree to participate and no protected health information was collected as part of the survey. Participants were not compensated for completing the survey.

### Inclusion/Exclusion Criteria

The target audience was individuals who self-identified with the LGBTQ+ community. We targeted English-speaking adults over the age of 18 as those would be eligible for cancer screening.

### Survey

The survey was developed to better understand the knowledge and needs of the LGBTQ+ community, to increase cancer screening and reduce barriers towards medical care. The survey used words and phrases that were gender and identity neutral and considered inclusivity. The survey asked 31 questions across several topics: 1) awareness of cancer screening exams, 2) knowledge of HPV as a risk factor for certain cancers, 3) emotions experienced when going to the doctor, 4) experience with the healthcare system, and 5) demographic characteristics. (Table 1). The questionnaire ended with an open-ended response section to allow participants to provide suggestions on how to improve patient-provider interactions and the health care experience for LGBTQ+ patients.

### Statistical Analysis

Subgroup analysis was performed to determine if a patient's identification, age, residence area, and education status might influence their views on cancer screening. The subpopulations included: a) Trans (MTF, FTM, other) vs. Non-Trans (female, male), b) Age  $\leq 30$  vs. Age  $>30$ , c) Urban vs. Non-Urban (suburban and rural) and d) education: Non-Degree (Less than high school, high school diploma, some college) vs. Degree (Bachelor's or associate's degree, Some graduate training, graduate or professional training). Chi-square or Fisher's exact test were conducted to investigate significant differences in subgroups. The significance level was set *a priori* to the 0.05 level. All analyses were performed with SAS 9.4 (SAS Institute Inc., Cary, NC).

## Results

The survey was completed by 428 individuals with a complete data set from 422 individuals. Demographic data is summarized in Table 1 but briefly, 24.6% identified as female, 25.5% as male, 40.1% transgender (22.4% as transgender female to male, 17.7% as transgender male to female), and 9.6% as other. 52% of the respondents were over 30 years old, with most living in urban or suburban areas, and 64% with a college degree or greater.

### Understanding and Beliefs of Screening

Overall, members of LGBTQ+ community are uncertain which cancer screening exams are appropriate. 276 respondents (65.4%) not certain what cancer screening to do for themselves and 300 (71.4%) uncertain what age to begin screening. It was clearly recognized by 79.7% of respondents, that each sub-population within the LGBTQ+ community has unique health concerns. While most respondents understood that the lesbian community should have breast (94.8% suggest mammograms) and cervical cancer (92.7% suggest pap smears) screening, the response was less overwhelming for the gay population. It was believed that mammogram screening should be done in 85.1% of transgender men, 31.3% of transgender men after mastectomy, 49.3% of transgender women, and 79.4% for transgender women who are taking hormone supplements. Interestingly, 390 (93.1%) answered it was true that transgender women who are taking supplemental hormones are at risk for breast cancer though not all believed screening should be done. The respondents views on the importance of pap smears for the transgender populations included 81.5% for transgender men, 79.3% for transgender men after mastectomy, 23.5% for transgender women, and 25.4% for transgender women taking hormone supplements.

### Knowledge of Human Papilloma Virus Association with Cancer

It was universally understood by 92.8% of respondents that all sexually active people are at risk for HPV infections. To also gauge the knowledge of how HPV can affect cancer risk in the LGBTQ+ population, respondents were queried for their understanding of which cancer types were associated with HPV. While 89.6% appreciated that HPV was associated with cervical cancer, only 27.3% and 55.7% understood that HPV was associated with head and neck cancer and anal cancer respectively.

### Personal Emotional Response to Cancer Screening

Several survey questions were designed to determine if members of the LGBTQ+ community have emotional distress associated with cancer screening. Most community members (83.6%) were nervous or anxious at least some of the time when thinking about cancer screening with 49.3% of individuals responding that they were often or always nervous/anxious with a smaller proportion (30.8%) feeling that they were excessively worried about cancer screening and unable to think of anything else. While 41.9% stated they were often or always overwhelmed by the thought on cancer screening, only 17% felt depressed or helpless. Almost 50% of LGBTQ+ community members either agreed

or strongly agreed that their emotional distress prevents them from getting regular cancer screenings such as mammograms, pap smears and colonoscopies.

## Health Care Infrastructure Perceptions

Questions were also designed to understand the intricacies of LGBTQ+ community members concerns with the healthcare infrastructure that may prevent comfort with appropriate cancer screening. Unfortunately, 43% either agreed or strongly agreed that they were concerned about their medical insurance not paying for screening services due to misgendering however 92 subjects did not answer this particular question. With regards to interacting with medical staff, 48.6% of people surveyed agreed or strongly agreed that scheduling appointments online would be an effective way of avoiding confusion regarding determining appropriate screening. Seventy percent agreed or strongly agreed that medical staff using last name alone instead of personal pronouns (Mr./Mrs.) would lessen misgendering and discomfort. Over 90% responded that they think it is important for physicians and nurses to have formal training to prevent misgendering and confusion when they have appointments for cancer screening. In order to make health care office waiting areas more comfortable for all patients, 49.5% believed offered a private waiting area is important, with 64.5% believing allowing patients to change just before imaging is important, and 69% believe that using gender neutral décor including garments is important.

## Subgroup Analyses

### Subgroup Analysis for Transgender vs. Non-Transgender Community Members (Subgroup A), Table 2.

This univariate analysis was done on 419 respondents and showed that 50% of respondents were transgender. There was a trend for transgender patients to be slightly less aware of what cancer screening should be done (30.1% vs 38.6%,  $p=0.07$ ). In addition, the transgender population did not fully understand the link between HPV and various cancer types with a statistically significant difference in knowing the link between HPV and head and neck cancer ( $p < 0.01$ ). Transgender community members were significantly more likely to be nervous/anxious, excessively worried, depressed/helpless and overwhelmed by thoughts of cancer screening ( $p < 0.01$  for all questions). In addition, transgender patients were more likely to have emotional distress regarding misgendering and insurance payments ( $p < 0.01$  for all questions). Formal training for healthcare providers was thought to be more significantly prudent by transgender patients.

### Subgroup Analysis for Age 30 vs. Age > 30 (Subgroup B), Table 3.

To determine if age affected beliefs of cancer screening, analysis was done for 417 respondents less than (48%) and greater than age 30 (52%). Patients >30 trended to be more aware of what cancer screening should be done. While significantly more respondents >30 years old were aware that anal cancer was associated with HPV ( $p=0.01$ ), they were significantly less likely to associate HPV with cervical cancer ( $p < 0.01$ ). The >30 year old population had a trend toward having less nervousness/anxiety, excessive worrying, depression/helplessness, and were significantly less likely to feel overwhelmed ( $p=0.01$ ).

**Subgroup Analysis for Urban vs. Non-Urban (Subgroup C), Table 4.**

Of the 417 respondents, no statistically significant differences were observed.

**Subgroup Analysis for Degree vs. Non-Degree (Subgroup D), Table 5.**

Subgroup analysis was done to determine if those with a degree (64% with a Bachelor's or Associate's degree, some graduate training, graduate or professional training) were more comfortable with cancer screening. All 422 respondents were included and those with a degree had a significantly increased proportion of respondents understanding what screening to ( $p=0.04$ ) with a trend towards improved awareness of the HPV association with various cancers, especially head and neck cancer ( $p=0.03$ ). Respondents without a degree were significantly more likely to have any distress such as nervousness/anxiety ( $p=0.01$ ), excessively worried ( $p<0.01$ ), depressed/helpless ( $p<0.01$ ) and were less likely to be overwhelmed ( $p=0.01$ ) when thinking about cancer screening.

**Discussion**

The results of this survey include the baseline knowledge of cancer screening in the LGBTQ+ patient population and reveals barriers and unmet needs in the health care system as identified by this diverse group of individuals. Overall, the LGBTQ+ community we surveyed were unsure of the appropriately indicated cancer screening and, when coupled with emotional and financial concerns, negatively impacted the desire for members of the SGM community to adhere to cancer screening. The survey input from the community provides ideas for interventions that may decrease emotional distress when visiting a health care professional including an option for online scheduling, not using personal pronouns, providing gender neutral gowns and office décor, and providing all staff with basic education about the LGBTQ+ community.

To decrease health disparities in cancer outcomes for the LGBTQ+ population, it is essential that community members understand the cancer screening that should be undertaken but it was found that approximately two-thirds of those surveyed were not certain what cancer screenings should be done for themselves and almost three-quarters were unsure what age screening should begin. Cancer screening is especially important since it has been established that the LGBTQ+ population have increased risk factors for cancer including increased rates of tobacco and alcohol consumption [14–16].

Most individuals surveyed agreed each LGBTQ+ sub-population has different health concerns, however the respondents had no consensus about which specific screenings are recommended, especially in transgender patients. For example, community members were unified in their perspective on screening recommendations for the lesbian population but not the transgender population. This is congruent with studies showing transgender women were less likely to have screening mammograms [17]. Based on the present survey, 93% of respondents agreed that transgender women taking hormones are at increased risk for breast cancer. It is known that 71% of MTF take exogenous hormones which allows breast tissue to transition to Tanner stage IV and create biological changes, but the malignant potential is unknown and warrants further investigation to create definitive recommendations

[18]. Population based studies from the Dutch (2,307 patients) and the U.S. Veterans Administration Healthcare System (3,566 patients) demonstrate a reduced risk of breast cancer for transgender compared to cis-gender women [19–20]. Although the incidence may be slightly lower in transgender women, the Dutch found that 60% of MTF have dense or extremely dense breasts indicating possible false negative mammogram results with recommendations for a second method of breast screening [13,21]. In addition, depending on the type of mastectomy performed, patients may still need screening depending on how much breast tissue was removed [22]. UCSF has developed screening recommendations suggesting mammogram every two years starting at age 50 or 10 years after starting hormone therapy which may be controversial since some patients will begin exogenous hormones as young as 10–12 years old [23]. Community members with advanced degrees had a more accurate assessment of cancer screening needed. The confusion surrounding cancer screening is multifactorial, stemming in part from the lack of trust in the health care community, lack of physician education, and lack of consensus guidelines. Standardized and national guidelines need to be established by governing bodies such as NCCN and ASCO that consider the type of gender reassigning surgeries a patient may have had and the duration of exogenous hormone therapy.

Overall the risks associated with HPV infection were not well understood, with the least awareness from the transgender population. Most understood infection was related to sexual activity and cervical cancer, however only half of those surveyed knew that HPV is a risk for anal cancer and less than a third knew it was a risk for head and neck cancer. Since the LGBTQ+ population has increased risk for HPV infection and lower rates of vaccination, this survey suggests additional education of the risks of HPV infection and benefits of vaccination is crucial and could have a significant impact on this population, especially now that the CDC has expanded the vaccine recommended ages up to age 45 [24–29].

Evaluating potential reasons community members may decline or avoid cancer screenings, it was found that emotional and financial concerns contribute to the cancer screening disparity in the LGBTQ+ population. Seeking healthcare can be an emotional burden, but the LGBTQ+ population may be more vulnerable [30–31]. This study found that 83.6% of community members were nervous or anxious at least some of the time, 41.9% often/always overwhelmed and 17% felt depressed/helpless. This notion is supported since anxiety and depression are more prevalent in SGM youth [32–33]. Half of our respondents stated emotional distress prevented them from getting cancer screening which is a public health concern. In particular, the transgender population is most prone to anxiety, worry and depression making this population vulnerable. Respondents with advanced education or older age had less overall emotional distress suggesting improved education on cancer screening may improve concerns. Lastly, 43% of all respondents and 66% of transgender respondents were concerned that insurance would not cover cancer screening due to misgendering. This is complex because patients in same-sex relationships are less likely to have health insurance coverage [35].

Implementing change in cancer screening perspectives will require a multidisciplinary approach and the survey results demonstrate that online scheduling of appointments, education and training for healthcare professionals to include sensitivity and creation

of comfortable space in waiting and changing rooms with neutral décor may improve screening rates. Survey respondents believed changes to the process of making appointments and comfort with the actual visit could make a difference in their perceptions of cancer screening. For instance, 48% wanted the ability to schedule appointments online to avoid using pronouns (70%) and confusion regarding which screening should be done, 70% wanted gender neutral décor including garments and 50–65% wanted alternate waiting and changing rooms. Prior studies suggest that equality signs and gender-neutral language were perceived as safer [36]. Over 90% responded it is important for health care providers to have formal training to prevent misgendering and confusion during cancer screening appointments which has been shown in other studies [37]. The SGM population is known to use word of mouth and social media to find providers who are LGBTQ+ “friendly” [38]. The Association of Professors of Gynecology is designing curricula for medical students but education about unique medical concerns of the LGBTQ+ population for all health care providers is needed to establish increased comfort of our patients and increased rates of cancer screening [39].

These findings suggest that gaps in cancer screening knowledge and emotional and financial distress for the LGBTQ+ population may be at the root of the disparity that exists in lower cancer screening rates. The medical community must establish cancer screening guidelines nuanced on specific health care issues related to SGM patients that must be coupled with education for the LGBTQ+ population about what cancer screening should be done when. In addition, while some may be reticent to undergo cancer screening, many SGM patients may reconsider if they believed healthcare professionals had more education on the topic and the environment was more sensitive to specific needs. This study has shown that the transgender population is most at risk due to gaps in knowledge of appropriate cancer screening and excess emotional distress. Appreciating the cancer screening concerns of the LGBTQ+ population and nuances of each subpopulation can help shape future clinical and institutional approaches to improve healthcare delivery. There should be continued research on sexual and gender minority cancer screening disparities so that plans for implementing optimal health care delivery can ensue.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Availability of data and material

All data generated or analysed during this study are included in this published article and its supplementary information files



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**Table 1.**

Summary Statistics of Entire Survey (n = 422).

	All (n = 422)
<b>Which of the following do you identify with?, n (%) <sup>1</sup></b>	
Female	103 (24.6)
Male	107 (25.5)
Transgender (FTM)	94 (22.4)
Transgender (MTF)	75 (17.9)
Other	40 (9.6)
<b>What is your age?, n (%) <sup>2</sup></b>	
30 or Under	200 (48.0)
31 – 40	108 (25.9)
41 – 50	43 (10.3)
51 – 60	43 (10.3)
Over 60	23 (5.5)
<b>Which of the following best describes your sexual orientation?, n (%) <sup>3</sup></b>	
Lesbian	79 (18.8)
Gay	106 (25.2)
Bisexual	85 (20.2)
Heterosexual	32 (7.6)
Queer	83 (19.7)
Other	36 (8.6)
<b>Which of the following best describe the area in which you reside?, n (%) <sup>2</sup></b>	
Rural	72 (17.3)
Suburban	185 (44.4)
Urban	160 (38.4)
<b>What is the highest level of education you have completed?, n (%)</b>	
Less than high school (grade 11 or less)	12 (2.8)
High school diploma (including GED)	36 (8.5)
Some college	104 (24.6)
Bachelor's or associate's degree	155 (36.7)
Some graduate training	24 (5.7)
Graduate or professional training	91 (21.6)
<b>I am certain of what cancer screening to do for myself, n (%)</b>	
Yes	146 (34.6)
No	276 (65.4)
<b>I am certain of what age to begin my cancer screening, n (%) <sup>4</sup></b>	
TRUE	120 (28.6)

	<b>All (n = 422)</b>
FAULSE	300 (71.4)
<b>Within the LGBTQ+ community, each sub-population has very different health concerns, n (%) <sup>4</sup></b>	
Strongly agree	116 (27.6)
Agree	219 (52.1)
Neutral	59 (14.1)
Disagree	15 (3.6)
Strongly disagree	11 (2.6)
<b>Lesbian women (Checked), n (%)</b>	
Mammograms	400 (94.8)
Pap Smears	391 (92.7)
Oral Screening Exams	352 (83.4)
<b>Gay men (Checked), n (%)</b>	
Mammograms	70 (16.6)
Pap Smears	45 (10.7)
Oral Screening Exams	383 (90.8)
<b>Transgender men (Checked), n (%)</b>	
Mammograms	359 (85.1)
Pap Smears	344 (81.5)
Oral Screening Exams	361 (85.6)
<b>Transgender men after mastectomy (Checked), n (%)</b>	
Mammograms	132 (31.3)
Pap Smears	334 (79.2)
Oral Screening Exams	362 (85.8)
<b>Transgender women (Checked), n (%)</b>	
Mammograms	208 (49.3)
Pap Smears	99 (23.5)
Oral Screening Exams	372 (88.2)
<b>Transgender women taking hormone supplements (Checked), n (%)</b>	
Mammograms	335 (79.4)
Pap Smears	107 (25.4)
Oral Screening Exams	362 (85.8)
<b>Transgender men are at risk for breast cancer, n (%) <sup>4</sup></b>	
TRUE	391 (93.1)
FAULSE	29 (6.9)
<b>Transgender women who are taking supplemental hormones are at risk for breast cancer, n (%) <sup>1</sup></b>	
TRUE	390 (93.1)
FAULSE	29 (6.9)

	All (n = 422)
<b>All sexually active people are at risk for HPV infections, n (%)</b> <sup>5</sup>	
TRUE	388 (92.8)
FAULSE	30 (7.2)
<b>A HPV infection is a risk factor for which cancers? (Checked), n (%)</b>	
Anal cancer	235 (55.7)
Cervical cancer	378 (89.6)
Head and Neck cancer	115 (27.3)
None	11 (2.6)
<b>Nervous, anxious or on edge, n (%)</b> <sup>4</sup>	
Never	19 (4.5)
Rarely	50 (11.9)
Sometimes	144 (34.3)
Often	101 (24.1)
Always	106 (25.2)
<b>Excessively worried, cannot think about anything else, n (%)</b> <sup>1</sup>	
Never	69 (16.5)
Rarely	116 (27.7)
Sometimes	105 (25.1)
Often	76 (18.1)
Always	53 (12.7)
<b>Depressed or helpless, n (%)</b> <sup>1</sup>	
Never	107 (25.5)
Rarely	121 (28.9)
Sometimes	120 (28.6)
Often	41 (9.8)
Always	30 (7.2)
<b>Overwhelmed, n (%)</b> <sup>6</sup>	
Never	68 (16.4)
Rarely	68 (16.4)
Sometimes	105 (25.3)
Often	101 (24.3)
Always	73 (17.6)
<b>My concern about emotional distress prevents me from getting regular cancer screenings. (e.g. mammograms, pap smears, colonoscopies, etc...), n (%)</b> <sup>7</sup>	
Strongly agree	86 (21.1)
Agree	116 (28.4)
Neutral	60 (14.7)

	All (n = 422)
Disagree	93 (22.8)
Strongly disagree	53 (13.0)
<b>I am concerned about medical insurance not paying for my screening services due to misgendering, n (%) <sup>8</sup></b>	
Strongly agree	66 (20.0)
Agree	77 (23.3)
Neutral	43 (13.0)
Disagree	65 (19.7)
Strongly disagree	79 (23.9)
<b>Scheduling appointments online would be an effective method of avoiding confusion to figure out the screening appropriate for me, n (%) <sup>9</sup></b>	
Strongly agree	11 (2.7)
Agree	186 (45.9)
Neutral	80 (19.8)
Disagree	28 (6.9)
Strongly disagree	11 (2.7)
<b>If staff did not use personal pronouns (Mr. / Mrs. / Miss. / Ms.) and instead called patients by their last name only, it would lessen misgendering and discomfort, n (%) <sup>10</sup></b>	
Strongly agree	143 (36.4)
Agree	132 (33.6)
Neutral	62 (15.8)
Disagree	33 (8.4)
Strongly disagree	23 (5.9)
<b>I think it is important for _____ to have formal training to prevent misgendering / confusion when I present for my cancer screening (Checked), n (%)</b>	
Physicians	385 (91.2)
Nurses	382 (90.5)
Clerical staff	351 (83.2)
Technicians	343 (81.3)
Others	108 (25.6)
<b>In order to make waiting areas more comfortable for all patients, I believe it is important to _____. (Checked), n (%)</b>	
Offer separate, private waiting areas for patents who request	209 (49.5)
Give patients the option to change immediately before imaging, to avoid waiting in gowns/robes	272 (64.5)
Use gender neutral decor (including patient garments)	291 (69.0)
None of these	50 (11.9)
Other	22 (5.2)

<sup>1</sup> There were 3 missing data for this question

<sup>2</sup> There were 5 missing data for this question

<sup>3</sup> There were 1 missing data for this question

- <sup>4</sup>There were 2 missing data for this question
- <sup>5</sup>There were 4 missing data for this question
- <sup>6</sup>There were 7 missing data for this question
- <sup>7</sup>There were 14 missing data for this question
- <sup>8</sup>There were 92 missing data for this question
- <sup>9</sup>There were 17 missing data for this question
- <sup>10</sup>There were 29 missing data for this question.

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**Table 2.**

Subgroup Analysis for Subgroup A (Trans vs. Non-Trans), n=419.

	Non-Trans (n=210, 50%)	Trans (n=209, 50%)	p-value
<b>I am certain of what cancer screening to do for myself (Yes), n (%)</b>	81 (38.6)	63 (30.1)	0.07
<b>A HPV infection is a risk factor for which cancers? (Checked), n (%)</b>			
Anal cancer	126 (60.0)	108 (51.7)	0.09
Cervical cancer	194 (92.4)	182 (87.1)	0.07
Head and Neck cancer	72 (34.3)	42 (20.1)	<0.01
None	3 (1.4)	8 (3.8)	0.14
<b>Nervous, anxious or on edge, n (%)<sup>1</sup></b>			
Never	14 (6.7)	5 (2.4)	<0.01
Rarely	37 (17.7)	13 (6.3)	
Sometimes	70 (33.5)	72 (34.6)	
Often	49 (23.4)	52 (25.0)	
Always	39 (18.7)	66 (25.2)	
<b>Excessively worried, cannot think about anything else, n (%)<sup>2</sup></b>			
Never	48 (23.1)	21 (10.1)	<0.01
Rarely	64 (30.8)	50 (24.0)	
Sometimes	43 (20.7)	61 (29.3)	
Often	32 (15.4)	44 (21.2)	
Always	21 (10.1)	32 (15.4)	
<b>Depressed or helpless, n (%)<sup>2</sup></b>			
Never	78 (37.5)	29 (13.9)	<0.01
Rarely	62 (29.8)	57 (27.4)	
Sometimes	47 (22.6)	72 (34.6)	
Often	14 (6.7)	27 (13.0)	
Always	7 (3.4)	23 (11.1)	
<b>Overwhelmed, n (%)<sup>3</sup></b>			
Never	49 (23.8)	19 (9.2)	<0.01
Rarely	38 (18.5)	29 (14.1)	
Sometimes	56 (27.2)	48 (23.3)	
Often	38 (18.5)	62 (30.1)	
Always	25 (12.1)	48 (23.3)	
<b>My concern about emotional distress prevents me from getting regular cancer screenings. (e.g. mammograms, pap smears, colonoscopies, etc...), n (%)<sup>4</sup></b>			
Strongly agree	25 (12.3)	61 (30.4)	<0.01
Agree	44 (21.6)	70 (34.8)	
Neutral	37 (18.1)	22 (11.0)	

	Non-Trans (n=210, 50%)	Trans (n=209, 50%)	p-value
Disagree	63 (30.9)	30 (14.9)	
Strongly disagree	35 (17.2)	18 (9.0)	
<b>I am concerned about medical insurance not paying for my screening services due to misgendering, n (%)</b> <sup>5</sup>			
Strongly agree	6 (4.3)	58 (31.0)	<b>&lt;0.01</b>
Agree	11 (7.9)	66 (35.3)	
Neutral	18 (12.9)	25 (13.4)	
Disagree	38 (27.1)	26 (13.9)	
Strongly disagree	67 (47.9)	12 (6.4)	
<b>Scheduling appointments online would be an effective method of avoiding confusion to figure out the screening appropriate for me, n (%)</b> <sup>6</sup>			
Strongly agree	50 (25.4)	49 (23.9)	0.31
Agree	94 (47.7)	91 (44.4)	
Neutral	34 (17.3)	46 (22.4)	
Disagree	11 (5.6)	16 (7.8)	
Strongly disagree	8 (4.1)	3 (1.5)	
<b>If staff did not use personal pronouns (Mr. / Mrs. / Miss. / Ms.) and instead called patients by their last name only, it would lessen misgendering and discomfort, n (%)</b> <sup>7</sup>			
Strongly agree	52 (28.3)	91 (44.2)	<b>&lt;0.01</b>
Agree	64 (34.8)	68 (33.0)	
Neutral	35 (19.0)	25 (12.1)	
Disagree	16 (8.7)	16 (7.8)	
Strongly disagree	17 (9.2)	6 (5.9)	
<b>I think it is important for _____ to have formal training to prevent misgendering / confusion when I present for my cancer screening (Checked), n (%)</b>			
Physicians	183 (87.1)	200 (95.7)	<b>&lt;0.01</b>
Nurses	184 (87.6)	196 (93.8)	<b>0.03</b>
Clerical staff	169 (80.5)	182 (87.1)	0.07
Technicians	161 (76.7)	182 (87.1)	<b>0.01</b>
Others	44 (21.0)	64 (30.6)	<b>0.02</b>

<sup>1</sup>There were 2 missing data for this question (1 in Non-Trans and 1 in Trans)

<sup>2</sup>There were 3 missing data for this question (2 in Non-Trans and 1 in Trans)

<sup>3</sup>There were 7 missing data for this question (4 in Non-Trans and 3 in Trans)

<sup>4</sup>There were 14 missing data for this question (6 in Non-Trans and 8 in Trans)

<sup>5</sup>There were 92 missing data for this question (70 in Non-Trans and 22 in Trans)

<sup>6</sup>There were 17 missing data for this question (13 in Non-Trans and 4 in Trans)

<sup>7</sup>There were 29 missing data for this question (23 in Non-Trans and 3 in Trans).

**Table 3.**

Subgroup Analysis for Subgroup B (Age ≤ 30 vs. Age &gt; 30), n=417.

	Age ≤ 30 (n=200, 48%)	Age > 30 (n=217, 52%)	p-value
I am certain of what cancer screening to do for myself (Yes), n (%)	61 (30.5)	83 (38.3)	0.10
A HPV infection is a risk factor for which cancers? (Checked), n (%)			
Anal cancer	99 (49.5)	134 (61.8)	<b>0.01</b>
Cervical cancer	191 (95.5)	184 (84.8)	<b>&lt; 0.01</b>
Head and Neck cancer	52 (26.0)	62 (28.6)	0.56
None	3 (1.5)	8 (3.7)	0.22
Nervous, anxious or on edge, n (%) <sup>1</sup>			
Never	7 (3.5)	12 (5.6)	0.07
Rarely	20 (10.0)	29 (13.4)	
Sometimes	61 (30.5)	82 (38.0)	
Often	50 (25.0)	49 (22.7)	
Always	62 (31.0)	44 (20.4)	
Excessively worried, cannot think about anything else, n (%) <sup>2</sup>			
Never	29 (14.6)	39 (18.1)	0.08
Rarely	46 (23.1)	69 (31.9)	
Sometimes	50 (25.1)	53 (24.5)	
Often	43 (21.6)	33 (15.3)	
Always	31 (15.6)	22 (10.2)	
Depressed or helpless, n (%) <sup>2</sup>			
Never	47 (23.6)	58 (26.9)	0.84
Rarely	58 (29.2)	61 (28.2)	
Sometimes	56 (28.1)	64 (29.6)	
Often	22 (11.1)	19 (8.8)	
Always	16 (8.0)	14 (7.2)	
Overwhelmed, n (%) <sup>3</sup>			
Never	22 (11.2)	45 (21.0)	<b>0.01</b>
Rarely	30 (15.2)	38 (17.8)	
Sometimes	46 (23.4)	57 (26.6)	
Often	61 (31.0)	39 (18.2)	
Always	38 (19.3)	35 (16.4)	
My concern about emotional distress prevents me from getting regular cancer screenings. (e.g. mammograms, pap smears, colonoscopies, etc...), n (%) <sup>4</sup>			
Strongly agree	48 (25.3)	38 (17.8)	0.37
Agree	50 (26.3)	64 (29.9)	
Neutral	30 (15.8)	30 (14.0)	

	Age 30 (n=200, 48%)	Age > 30 (n=217, 52%)	p-value
Disagree	40 (21.1)	53 (24.8)	
Strongly disagree	22 (11.6)	29 (13.6)	
<b>I am concerned about medical insurance not paying for my screening services due to misgendering, n (%)</b> <sup>5</sup>			
Strongly agree	31 (20.5)	35 (19.9)	0.70
Agree	30 (19.9)	46 (26.1)	
Neutral	20 (13.3)	23 (13.1)	
Disagree	33 (21.9)	31 (17.6)	
Strongly disagree	37 (24.5)	41 (23.3)	
<b>Scheduling appointments online would be an effective method of avoiding confusion to figure out the screening appropriate for me, n (%)</b> <sup>6</sup>			
Strongly agree	49 (25.8)	50 (23.7)	0.14
Agree	92 (48.4)	93 (44.1)	
Neutral	38 (20.0)	40 (19.0)	
Disagree	9 (4.7)	19 (9.0)	
Strongly disagree	2 (1.1)	9 (4.3)	
<b>If staff did not use personal pronouns (Mr. / Mrs. / Miss. / Ms.) and instead called patients by their last name only, it would lessen misgendering and discomfort, n (%)</b> <sup>7</sup>			
Strongly agree	72 (38.7)	69 (33.8)	0.18
Agree	69 (37.1)	62 (30.4)	
Neutral	24 (12.9)	38 (18.6)	
Disagree	12 (6.5)	21 (10.3)	
Strongly disagree	9 (4.8)	14 (6.9)	
<b>I think it is important for _____ to have formal training to prevent misgendering / confusion when I present for my cancer screening (Checked), n (%)</b>			
Physicians	183 (91.5)	199 (91.7)	0.94
Nurses	189 (94.5)	190 (87.6)	<b>0.01</b>
Clerical staff	170 (85.0)	178 (82.0)	0.41
Technicians	165 (82.5)	175 (80.7)	0.63
Others	47 (23.5)	61 (28.1)	0.28

<sup>1</sup>There were 1 missing data for this question (1 in Age > 30)

<sup>2</sup>There were 2 missing data for this question (1 in Age 30 and 1 in Age > 30)

<sup>3</sup>There were 6 missing data for this question (3 in Age 30 and 3 in Age > 30)

<sup>4</sup>There were 13 missing data for this question (10 in Age 30 and 3 in Age > 30)

<sup>5</sup>There were 90 missing data for this question (49 in Age 30 and 41 in Age > 30),

<sup>6</sup>There were 16 missing data for this question (10 in Age 30 and 6 in Age > 30)

<sup>7</sup>There were 27 missing data for this question (14 in Age 30 and 13 in Age > 30).

**Table 4.**

Subgroup Analysis for Subgroup C (Urban vs. Non-Urban), n=417.

	Non-Urban (n=257, 62%)	Urban (n=160, 38%)	p-value
<b>I am certain of what cancer screening to do for myself (Yes), n (%)</b>	87 (33.9)	57 (35.6)	0.71
<b>A HPV infection is a risk factor for which cancers? (Checked), n (%)</b>			
Anal cancer	134 (52.1)	98 (61.3)	0.07
Cervical cancer	230 (89.5)	143 (89.4)	0.97
Head and Neck cancer	64 (24.9)	50 (31.3)	0.16
None	8 (3.1)	3 (1.9)	0.54
<b>Nervous, anxious or on edge, n (%) <sup>1</sup></b>			
Never	12 (4.7)	7 (4.4)	0.20
Rarely	33 (12.9)	17 (10.7)	
Sometimes	78 (30.5)	66 (41.5)	
Often	68 (26.6)	31 (19.5)	
Always	65 (15.4)	38 (23.9)	
<b>Excessively worried, cannot think about anything else, n (%) <sup>2</sup></b>			
Never	43 (16.9)	26 (16.4)	0.93
Rarely	70 (27.5)	45 (28.3)	
Sometimes	61 (23.9)	43 (27.0)	
Often	48 (18.8)	26 (16.4)	
Always	33 (12.9)	19 (12.0)	
<b>Depressed or helpless, n (%) <sup>2</sup></b>			
Never	69 (27.1)	38 (23.9)	0.32
Rarely	69 (27.1)	50 (31.5)	
Sometimes	69 (27.1)	50 (31.5)	
Often	30 (11.8)	10 (6.3)	
Always	18 (7.1)	11 (6.9)	
<b>Overwhelmed, n (%) <sup>3</sup></b>			
Never	44 (18.6)	25 (15.9)	0.39
Rarely	39 (15.4)	28 (17.8)	
Sometimes	57 (22.5)	47 (29.9)	
Often	66 (26.1)	33 (21.0)	
Always	47 (18.6)	25 (15.9)	
<b>My concern about emotional distress prevents me from getting regular cancer screenings. (e.g. mammograms, pap smears, colonoscopies, etc...), n (%) <sup>4</sup></b>			
Strongly agree	54 (22.0)	30 (19.1)	0.94
Agree	66 (26.8)	47 (29.9)	
Neutral	36 (14.6)	24 (15.3)	

	Non-Urban (n=257, 62%)	Urban (n=160, 38%)	p-value
Disagree	58 (23.6)	35 (22.3)	
Strongly disagree	32 (13.0)	21 (13.4)	
<b>I am concerned about medical insurance not paying for my screening services due to misgendering, n (%)<sup>5</sup></b>			
Strongly agree	38 (19.1)	26 (20.5)	0.57
Agree	45 (22.6)	32 (25.2)	
Neutral	30 (15.1)	13 (10.2)	
Disagree	42 (21.1)	22 (17.3)	
Strongly disagree	44 (22.1)	34 (26.8)	
<b>Scheduling appointments online would be an effective method of avoiding confusion to figure out the screening appropriate for me, n (%)<sup>6</sup></b>			
Strongly agree	52 (20.9)	44 (29.1)	0.06
Agree	111 (44.6)	75 (49.7)	
Neutral	58 (23.3)	21 (13.9)	
Disagree	20 (8.0)	8 (5.3)	
Strongly disagree	8 (3.2)	3 (2.0)	
<b>If staff did not use personal pronouns (Mr. / Mrs. / Miss. / Ms.) and instead called patients by their last name only, it would lessen misgendering and discomfort, n (%)<sup>7</sup></b>			
Strongly agree	89 (37.1)	53 (35.8)	0.88
Agree	78 (32.5)	52 (35.1)	
Neutral	36 (15.0)	25 (16.9)	
Disagree	22 (9.2)	10 (6.8)	
Strongly disagree	15 (6.3)	8 (5.4)	
<b>I think it is important for _____ to have formal training to prevent misgendering / confusion when I present for my cancer screening (Checked), n (%)</b>			
Physicians	232 (90.3)	148 (92.5)	0.44
Nurses	232 (90.3)	145 (90.6)	0.91
Clerical staff	214 (83.3)	133 (83.1)	0.97
Technicians	206 (80.2)	133 (83.1)	0.45
Others	72 (28.0)	34 (25.4)	0.12

<sup>1</sup>There were 2 missing data for this question (1 in Non-Urban and 1 in Urban).

<sup>2</sup>There were 3 missing data for this question (2 in Non-Urban and 1 in Urban).

<sup>3</sup>There were 7 missing data for this question (4 in Non-Urban and 3 in Urban).

<sup>4</sup>There were 14 missing data for this question (11 in Non-Urban and 3 in Urban).

<sup>5</sup>There were 91 missing data for this question (58 in Non-Urban and 33 in Urban).

<sup>6</sup>There were 17 missing data for this question (8 in Non-Urban and 9 in Urban).

<sup>7</sup>There were 29 missing data for this question (17 in Non-Urban and 12 in Urban).

**Table 5.**

Subgroup Analysis for Subgroup D (Degree vs. Non-degree), n=422.

	Non-Degree (n=152, 36%)	Degree (n=270, 64%)	p-value
<b>I am certain of what cancer screening to do for myself (Yes), n (%)</b>	43 (28.3)	103 (38.2)	<b>0.04</b>
<b>A HPV infection is a risk factor for which cancers? (Checked), n (%)</b>			
Anal cancer	81 (53.3)	154 (57.0)	0.46
Cervical cancer	132 (86.8)	246 (91.1)	0.17
Head and Neck cancer	32 (21.1)	83 (30.7)	<b>0.03</b>
None	6 (4.0)	5 (1.9)	0.21
<b>Nervous, anxious or on edge, n (%) <sup>1</sup></b>			
Never	6 (4.5)	13 (4.8)	<b>0.01</b>
Rarely	12 (8.0)	38 (14.1)	
Sometimes	45 (29.8)	99 (36.8)	
Often	35 (23.2)	66 (24.5)	
Always	53 (35.1)	53 (19.7)	
<b>Excessively worried, cannot think about anything else, n (%) <sup>2</sup></b>			
Never	16 (10.6)	53 (19.8)	<b>&lt; 0.01</b>
Rarely	39 (25.8)	77 (28.7)	
Sometimes	31 (20.5)	74 (27.6)	
Often	36 (23.8)	40 (14.9)	
Always	29 (19.2)	24 (9.0)	
<b>Depressed or helpless, n (%) <sup>2</sup></b>			
Never	28 (18.5)	79 (29.5)	<b>&lt; 0.01</b>
Rarely	44 (29.1)	77 (28.7)	
Sometimes	39 (25.8)	81 (30.2)	
Often	24 (15.9)	17 (6.3)	
Always	16 (10.6)	14 (5.2)	
<b>Overwhelmed, n (%) <sup>3</sup></b>			
Never	15 (10.0)	53 (20.0)	<b>0.01</b>
Rarely	27 (18.0)	41 (15.5)	
Sometimes	31 (20.7)	74 (27.9)	
Often	45 (30.0)	56 (21.1)	
Always	32 (21.3)	41 (15.5)	
<b>My concern about emotional distress prevents me from getting regular cancer screenings. (e.g. mammograms, pap smears, colonoscopies, etc...), n (%) <sup>4</sup></b>			
Strongly agree	38 (26.6)	48 (18.1)	<b>0.05</b>
Agree	44 (30.8)	72 (27.2)	
Neutral	22 (15.4)	38 (14.3)	

	Non-Degree (n=152, 36%)	Degree (n=270, 64%)	p-value
Disagree	28 (19.6)	65 (24.5)	
Strongly disagree	11 (7.7)	42 (15.9)	
<b>I am concerned about medical insurance not paying for my screening services due to misgendering, n (%)</b> <sup>5</sup>			
Strongly agree	32 (26.2)	34 (16.4)	0.12
Agree	32 (26.2)	45 (21.6)	
Neutral	14 (11.5)	29 (13.9)	
Disagree	20 (16.4)	45 (21.6)	
<b>Strongly disagree</b>	24 (19.7)	55 (26.4)	
<b>Scheduling appointments online would be an effective method of avoiding confusion to figure out the screening appropriate for me, n (%)</b> <sup>6</sup>			
Strongly agree	37 (25.3)	63 (24.3)	0.96
Agree	67 (45.9)	119 (46.0)	
Neutral	27 (18.5)	53 (20.5)	
Disagree	10 (6.9)	18 (7.0)	
Strongly disagree	5 (3.4)	6 (2.3)	
<b>If staff did not use personal pronouns (Mr. / Mrs. / Miss. / Ms.) and instead called patients by their last name only, it would lessen misgendering and discomfort, n (%)</b> <sup>7</sup>			
Strongly agree	55 (38.5)	88 (35.2)	0.43
Agree	52 (36.4)	80 (32.0)	
Neutral	19 (13.3)	43 (17.2)	
Disagree	8 (5.6)	25 (10.0)	
Strongly disagree	9 (6.3)	14 (5.6)	
<b>I think it is important for _____ to have formal training to prevent misgendering / confusion when I present for my cancer screening (Checked), n (%)</b>			
Physicians	135 (88.8)	250 (92.6)	0.19
Nurses	133 (87.5)	249 (92.2)	0.11
Clerical staff	122 (80.3)	229 (84.8)	0.23
Technicians	116 (76.3)	227 (84.1)	<b>0.05</b>
Others	38 (25.0)	70 (25.9)	0.83

<sup>1</sup>There were 2 missing data for this question (1 in Non-Degree and 1 in Degree).

<sup>2</sup>There were 3 missing data for this question (1 in Non-Degree and 2 in Degree).

<sup>3</sup>There were 7 missing data for this question (2 in Non-Degree and 5 in Degree).

<sup>4</sup>There were 14 missing data for this question (9 in Non-Degree and 5 in Degree).

<sup>5</sup>There were 92 missing data for this question (30 in Non-Degree and 62 in Degree).

<sup>6</sup>There were 17 missing data for this question (6 in Non-Degree and 11 in Degree).

<sup>7</sup>There were 29 missing data for this question (9 in Non-Degree and 20 in Degree).