

DETERMINANTS OF FEMALE COLLEGE STUDENTS' LIKELIHOOD OF ACCEPTING SELF-SAMPLING FOR CERVICAL CANCER PREVENTION

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Abstract: Cervical cancer screening (CCS) including Human Papillomavirus self-sampling test (HPVSST) offers opportunities for the early detection of malignancy or lesions before onset of symptoms when treatment of cancer is most effective. Self-sampling can increase CCS in college students, however, female students' attitudes toward HPVSST are understudied. Guided by the Theory of Planned Behavior (TPB), we examined associations between psychosocial factors (attitude, subjective norm, perceived control) and college students' likelihood of accepting self-sampling. Participants in survey group 1 (n=158) were not shown pictures of HPVSST materials before completing the survey and another group of participants in survey group 2 (n=159) completed the survey were shown an image of the materials. Independent variables included attitudes, subjective norms, perceived control and knowledge. Dependent variable was intention for self-sampling. Multiple linear regression models and independent samples t-tests were used to analyze data. Women's attitudes and perceived control were significantly associated with intention for self-sampling ($p < 0.001$) accounting for 51.5% of the variance in survey group 1 (Adjusted $R^2 = .515$) and 48.7% of the variance in survey group 2 (Adjusted $R^2 = .487$). Women who completed the survey without seeing HPVSST materials had significantly higher intention for accepting self-sampling than those who saw the pictures ($M=8.02$). Positive attitude, subjective norm, and knowledge were also significantly higher in the group who completed the survey without seeing the material ($p < 0.001$). Attitude and perceived control predict the likelihood of college women's acceptance of HPV self-sampling, and future interventions can target those psychosocial factors.

Keywords: Cervical Cancer Screening, Self-Sampling, College Women, Theory of Planned Behavior

INTRODUCTION

The field of public health has made great strides in decreasing the death rate caused by cervical cancer (Denny et al., 2015). The decrease is on account of prevention efforts and cervical cancer screening such as the Human Papillomavirus (HPV) vaccination as well as improved treatment strategies (Denny et al., 2015). Despite the efforts and advancements in public health, cervical cancer remains a significant public health concern that deserves adequate attention. Each year, at least 11,000 cervical cancer diagnoses are made in the United States and about 4,000 women will die due to cervical cancer (Cervical Cancer Statistics, 2023). Improvements have been made to help decrease the public health burden; however, work is still necessary in this area.

Successful approaches in this field have been accomplished by prevention and screening such as HPV tests, and Pap test which have successfully detected early stages of cervical cancer. Early detection is vital for cervical cancer since treatment is highly successful when begun in the early stages of the cancer. Guidelines set by the Centers of Disease Control and Prevention (CDC) currently recommend cervical cancer screening for women 21 to 65 years old.

For women 21-29, pap tests are recommended every 3 years. It is recommended that women 30-65 have a pap test every 3 years, HPV test alone every 5 years or both tests conducted every 5 years [2].

Even with recommended guidelines in place, the cervical cancer screening rates for women are still below the targeted United States goal (*Cervical Cancer Screening, 2022; Increase the proportion of females who get screened for cervical cancer — C-09*). Data from the last 5 years indicates that between 73.5%-78% of women within the recommended age range are up to date with cervical cancer screening. This is below the intended Healthy People 2030 goal of 79.2% of women being screened (*Cervical Cancer Screening, 2022; Increase the proportion of females who get screened for cervical cancer — C-09, n.d.; U.S. Cancer Statistics Data Visualizations Tool- Cervical Cancer Screening*, based on 2022 submission data (1999-2020)). Additionally, there are discrepancies between each state and their respective cervical cancer screening rates. Particularly, many Southwest and Midwest states have lower rates of cervical cancer screening than their West Coast and Northeastern counterparts (*U.S. Cancer Statistics Data Visualizations Tool- Cervical Cancer Screening*, based on 2022

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submission data (1999-2020)).

In the southern United States, and in Texas specifically, there has been evidence providing that there are lower cervical cancer screening rates in these regions (*Cervical Cancer in Texas*, 2019; Goding Sauer et al., 2020; Vash-Margita et al., 2021). Texas' cervical cancer screening rate of 75.44% for the recommended age range of 21-65 falls below the national average and is 39th overall among the 50 states (*National Cancer Institute: State Cancer Profiles- Screening and Risk Factors*, 2020). Unfortunately, these rates make cervical cancer the 3rd most common cancer for women in Texas. In 2019, about 1,395 women were diagnosed with cervical cancer in Texas and close to 450 died as a result of the disease (*Cervical Cancer in Texas*, 2019). Though these disparities are multiplex it is important to acknowledge the state-by-state differences to gain understanding on how to best help women in these regions.

Self-sampling tests are a viable option that may help to alleviate some of the common screening barriers experienced by women. There is sufficient evidence in the literature that the Human Papillomavirus self-sampling test (HPVSST) has potential to improve screening participation and thus reduce cervical cancer rates (Gupta et al., 2018). Self-sampling allows greater logistical flexibility for women to take a screening test without additional fear or anxiety. A study conducted in a comparable high-resource country revealed that women prefer self-sampling over clinician administered screening tests (Sultana et al., 2015). Higher preferability often leads to higher participation in the uptake of self-sampling which is beneficial to screening rates (Nishimura et al., 2021).

Despite the benefits, uptake rates of self-sampling still remain suboptimal (Reynolds, 2024). Often, the lack of participation in the self-sampling procedure is to a lack of awareness and lack of knowledge of the screening option. To better understand the screening behaviors of diverse women groups, it is important to gather data on the young women in our population. By understanding the cervical cancer screening behaviors and knowledge of the young women in the population, researchers may have better understanding of effective approaches to increasing cervical cancer screening at the recommended ages and increasing screening rates for women overall.

Some research studies have focused on the nuances of knowledge and perceptions about HPV and cervical cancer among college students. Most of the published research provides evidence that the college female population has little to no knowledge or uptake of HPV prevention and cervical cancer screenings (Chew et al., 2021; Shin et al., 2022; Staples et al., 2018). The college student population is composed of a variety of individuals from various backgrounds, thus barriers and lack of awareness of cervical cancer screening may be due to complex factors. For prevention methods such as receiving the HPV

vaccine, some researchers report medical mistrust as a barrier among college women (Kolar et al., 2015), as well as a general lack of understanding on knowledge and awareness (Yarici & Mammadov, 2023). Although there is a lack of specific screening rates reported for the subset population of university and college women, it has been noted in the literature that college women have also avoided or not engaged in preventative care such as cervical cancer screening (Ackerson et al., 2015). The self-reported barriers for women include fear of finding cancer, fear of pain, male physician presence, scheduling conflicts, having additional health problems, and lack of knowledge on the screening exam (Akinlotan et al., 2017; Head et al., 2009). These reported barriers provide useful insight to researchers on how to approach and provide solutions through alternative and flexible methods to increase screening participation. Although, HPV self-sampling was previously recommended for primarily women aged 30-65, as of 2025 the age for recommendation for self-sampling is now 25 and may be adapted in the future (Perkins et al., 2026). While college aged women generally fall under the recommended age for HPVSST, understanding their attitudes and intentions before reaching screening age may inform future educational interventions and improve screening uptake later in life.

Therefore the primary aim of this study was to use Theory of Planned Behavior (TPB) constructs to analyze the factors influencing the intentions to perform a self-sampling screening in a population of college-aged women attending a private university in the southern United States. The secondary purpose was to examine if college women who saw the pictures of the self-sampling kit would have different attitudes and willingness to use self-sampling compared to college women who did not see pictures of self-sampling kits before completing the survey.

Theoretical Framework

The Theory of Planned Behavior (TPB) is a theoretical framework used to predict human behavior (Ajzen, 1991). TPB contains four primary constructs in the framework. The construct of intention is the closest predictor that may influence behavior. In this study, if an individual has a stronger *intention* to uptake self-screening, the individual is more likely to *perform* self-screening.

The second construct in the framework is attitude. Attitude is comprised of two components: behavioral beliefs and outcome evaluations. This construct is how individuals assess their perspective of the behavior (i.e., self-screening). The theory's third construct is subjective norm which is split into the components of normative beliefs and motivation to comply. Subjective norm assesses the societal insistence to engage or not engage in a behavior such as cervical cancer screening. The last construct is perceived behavioral control which evaluates how a person perceives their ability to actively perform a behavior. The literature provides evidence that TPB is a useful mechanism for predicting factors that in-

fluence pap screening intentions (Duffett-Leger et al., 2008). Research on self-sampling screening is ongoing, this study is intended to contribute to the literature on this topic.

In addition to examining TPB constructs as predictors of intention, this study explored whether exposure to a visual representation of the HPV self-sampling kit influenced TPB constructs and intention. The image was hypothesized to shape participants' perceptions of self-sampling and therefore potentially have impact on attitudes, subjective norms, perceived behavioral control, and ultimately intention.

METHODS AND MATERIALS

Study Design and Sample

We conducted two separate iterations of a cross-sectional descriptive study with a convenience sample of students at a private religious university in Texas. Sample size determination was calculated using the following criteria: effect size (f^2) of 0.1, alpha of 0.05 and power of 0.95 and the number of predictors 10. Based on the G*Power analysis, a total sample size of at least 254 college women would be needed. The total sample size of participants included in the study was 317.

Data Collection

After obtaining IRB approval (Baylor University Institutional Review Board number 1695721), e-mails were the primary recruitment tool used for this study. Eligible participants were defined by the following: (1) currently attending a college course, (2) women (female-identified at birth), (3) can read and write in English and/or Spanish and (4) were willing to participate and able to give consent per Institutional Review Board stipulations. The survey was created via Qualtrics, and an anonymous link to the survey was generated. We asked various professors at the university to distribute to their students the link that led to the anonymous, self-administered survey that was used to recruit participants and collect data. Professors were contacted to help distribution of surveys to the courses they taught. Additional professors were then contacted via snowball methods and recommendations from other faculty/staff. The survey's opening webpage explained the purpose of the study, and the associated information of the study. The opening page also explained the rights of the participant, that participation is voluntary, and the opportunity to be entered in a raffle at the end of the study to win a \$50 gift card. Students indicated consent by continuing forward with the study and answering the Qualtrics survey. The survey took about 20 minutes to complete. The survey was administered two groups who were randomly selected based on a convenience sample. Students were asked to join as a survey participants but were randomly assigned either link to survey 1 (with picture) or link to survey 2 (without picture). The first group of students completed the survey without seeing the pictures of self-sampling kits (group 1 with no picture). The second

group students completed the same set of survey but also included a photograph image of self-sampling kit the image contained the box of the kit as well as all relevant contents of use including swab, and the lab bag to return (group 2 with picture).

Measures

The participants completed a 23-item survey consisting of demographic, dependent and independent variables. The survey was constructed and reviewed by an expert in the field (MA) for face and content validity.

Demographics. The survey contained questions related to demographic information such as race/ethnicity, level of degree being pursued, and health insurance status.

Dependent Variable. The outcome variable of self-sampling intention was measured by two items asking the participant their intention ("I intend to take the HPV self-sampling test if I get self-sampling kits") and likelihood ("I will likely take the HPV self-sampling test if self-sampling is available now"). The items were measured on a 5-point Likert scale with responses ranging from 1-Strongly Disagree to 5-Strongly Agree. The measures of intention have been similarly used to determine intention among college women to receive an HPV vaccination in preventing cervical cancer (Bennett et al., 2012; Britt et al., 2014; Sundstrom et al., 2018).

Independent Variables. The survey items measured four independent variables of knowledge (3-items), attitude (3-items), subjective norm (3-items), perceived control (3-items). All items were measured on a 5-point Likert scale ("strongly disagree", "somewhat disagree", "neither agree nor disagree", "somewhat agree" and "strongly agree"). Total scores for all items related to each construct were combined to create a composite score for each psychometric. A table providing detail on the score ranges for each variable can be found in appendix A.

Cronbach α was analyzed for each of the operationalized constructs and was found to be satisfactory for the variables (Bland & Altman, 1997). Attitude ($\alpha=.67$), subjective norm ($\alpha=.76$), perceived control ($\alpha=.61$), and intention ($\alpha=.86$). These values are presented as evidence that there is sufficient internal reliability of the measures.

Data Analysis

We used descriptive statistics, such as frequencies and means, for the demographic variables and other covariate data. Split group means and split group frequencies were calculated for each of the 2 groups. Independent samples t-tests and chi-square tests were conducted to determine differences between the two survey groups. Multiple linear regression was used to analyze the associations between the independent TPB psychometric variables and the intention to take a HPVST. The significant result was set a priori at a p-value < 0.05. All data were analyzed using the SPSS software version 28.

RESULTS

Demographic Characteristics

A total of 317 college women (group 1 with no picture, n = 158 and group 2 with picture n = 159) completed the survey. Most (64.4%) of the women were Caucasian, 14.5% of them were Hispanic women, 14.2% were Asian, 4.4% were Black/African-American and both American Indian/Alaskan Native and other racial/ethnic groups were each 1.3%. The majority of the college-aged women had

health insurance (95.9%), and the educational degrees being pursued by the women was mainly bachelor's degrees (65.7%), followed by graduate and professional degrees (19.2%).

The frequency for all survey participants having previously heard of HPV self-sampling (HPVSS) was 54.3%, indicating that the awareness of HPV self-collect testing was moderately split. About 61.2% of the participants were more likely to prefer providers performing the test instead of an HPVSS (Table 1).

Table 1. Descriptive statistics of demographic variables among study participants.

	N=317
Variable	Frequency, N (Percent %)
Group	
Group 1, no image of SST	158 (49.8)
Group 2, viewed image of SST	159 (50.2)
Race/Ethnicity	
Asian	45 (14.2)
American Indian/Alaskan Native	4 (1.3)
Black or African-American	14 (4.4)
Caucasian	204 (64.4)
Hispanic	46 (14.5)
Other	4 (1.3)
Health Insurance Status	
Yes	304 (95.9)
No	13 (4.1)
Heard about self-sampling	
Yes	172 (54.3)
I don't know	12 (3.7)
No	133 (42.0)
Level of Degree	
Not currently pursuing degree	13 (4.1)
Associates	5 (1.6)
Bachelor's	207 (65.7)
Graduate or Professional	61 (19.2)
Doctoral	29 (9.1%)
Screening Preference	
Self-sampling	123 (38.8)
Physician collected sampling	194 (61.2)

Main Findings

We ran a full linear regression with all participants that provided results indicating attitudes, and perceived behavioral control significantly predict participants intent of using self-sampling for screening, accounting for 50.6% of the variance (adjusted R-squared .506). Additional p-values can be found in Table 2.

Group Differences

Table 3 shows results of the bivariate analysis of the two groups, group 1 was not shown an image of the self-sampling kit, and group 2 did view an image of the self-sampling kit. There are a few notable differences between the groups. A larger majority of the respondents in group 2 had previously heard about HPV self-sampling (64.2%, $p < .001$). Participants in group 2 were more likely to report lower mean scores for knowledge (group 1: 13.17 ± 1.72 vs. group 2: 12.57 ± 2.06 ; $p = .003$), attitude (group 1: 11.81 ± 2.25 vs. group 2: 10.58 ± 2.31 ; $p < .001$), subjective norm (group 1: 9.75 ± 2.10 vs. group 2: 8.69 ± 2.76 ; $p < .001$), and intention to use self-sampling kit (group 1: 8.02 ± 1.97 vs. group 2: 7.25 ± 2.23).

We evaluated the associations between the women's knowledge, attitude, subjective norm, and perceived control toward the self-sampling intention for each group that provided similar results as the total participant sample. The final linear regression model (Table 4) showed that attitude and perceived control were both significant predictors of women's intention using self-sampling ($p < .001$). In group 1, attitude and perceived control construct variables accounted for 51.5% of the variance in self-sampling intention among the group 1 participants. Group 2 variables of attitude and perceived control accounted for 48.7% of the variance in self-sampling intention

among the group 2 participants. All other p-values can be found displayed in Table 4.

DISCUSSION

In this study we analyzed the Theory of Planned Behavior (TPB) factors that influence the intention to perform a self-sampling screening in a population of college-aged women attending a private university in the southern United States. The main results of this study provided information about awareness, differences in groups who have seen a self-sampling kit, and the association between these women's knowledge, attitude, subjective norm and, perceived control toward the self-sampling intention.

The study's first main finding was the awareness of the participants having previously heard of HPV self-sampling in each group. The result of the data revealed that only about half of the participants had heard of HPV self-sampling thus the awareness of HPV self-collect testing (HPVSST) was moderately split. This indicates there remains areas for improving the awareness of self-sampling as well as cervical cancer screening overall. Evidence from other studies supports this finding that awareness and knowledge of cervical cancer screening among female university studies is lacking (Ahmed et al., 2020).

Though the knowledge scores of both survey groups were sufficient, there was still room for improvement in helping women to make informed decisions in what tests may be right for them. This is supported in the literature by studies citing that there are still noted concerns such as lack of understanding how to use the test correctly or skepticism about self-sampling test accuracy (Reiter & McRee, 2015). These concerns may be remedied through additional information being distributed to women from credible and reliable sources.

Table 2. Multiple linear regression analysis for the association between TPB variables and intention for HPVSST- All participants

	Intention			
	Overall n=317			
Variable	Estimate	95%CI	P-value	Adj R ²
Knowledge	0.003	(-0.096, 0.103)	.951	.506
Attitude	0.325	(0.228, 0.423)	<.001*	
Subjective Norm	-0.032	(-0.110, 0.047)	.429	
Perceived Control	0.399	(0.310, 0.488)	<.001*	

Table 3. Bivariate analysis – Group 1 shown image of HPVST, Group 2 not show image of HPVST.

	N=317	N= 158		N= 159		
Variable	Percent (%)	Group 1 (%)	Group 1 Mean ± Std. Dev	Group 2 (%)	Group 2 Mean ± Std. Dev	P-Value
Survey Group						
Survey Group 1, no image of SST	49.8					
Survey Group 2, viewed image of SST	50.2					
Race/Ethnicity						.182
Asian	14.2	10.8		17.6		
American Indian/Alaskan Native	1.3	0.6		1.9		
Black or African American	4.4	2.5		6.3		
Caucasian	64.4	69		59.7		
Hispanic	14.5	15.8		13.2		
Other	1.3	1.3		1.3		
Health Insurance Status						.768
Have health insurance	95.9	95.6		96.2		
Does not have health insurance	4.1	4.4		3.8		
Have you heard about HPV self-sampling?						<.001*
Yes	54.3	44.3		64.2		
I don't know	3.7	3.2		4.4		
No	42.0	52.5		31.4		
If you have a choice, which of these two screening options would you prefer?						.146
Taking an HPV self-sampling test by yourself	38.8	34.8		42.8		
Provider (physician or nurse) giving the HPV sampling test	61.2	65.2		57.2		
Variable	Mean ± Std. Dev					
Knowledge	12.87±1.92		13.17±1.72		12.57±2.06	.003*
Attitude	11.20±2.36		11.81±2.25		10.58±2.31	<.001*
Subjective Norm	9.22±2.51		9.75±2.10		8.69±2.76	<.001*
Perceived Control	10.48±2.37		10.55±2.56		10.40±2.17	.294
Intention	7.63±2.14		8.02±1.97		7.25±2.23	<.001*

*Significance set at p<.05

Table 4. Multiple linear regression analysis for the association between TPB variables and intention for HPVSS-Groups

	Intention							
	Group 1 n= 158				Group 2 n= 159			
Variable	Estimate	Group 1 95%CI	P-value	Adj R ²	Estimate	Group 2 95%CI	P-value	Adj R ²
Knowledge	-0.011	(-0.142, 0.120)	.868	.515	-0.038	(-0.192, 0.116)	.629	.487
Attitude	0.298	(0.167, 0.429)	<.001*		0.306	(0.155, 0.456)	<.001*	
Subjective Norm	0.024	(-0.093, 0.141)	.688		-0.079	(-0.188, 0.029)	.151	
Perceived Control	0.388	(0.255, 0.451)	<.001*		.517	(0.370, 0.665)	<.001*	

An additional finding of the study were the psychometric differences between the two survey groups; one that did not see an image of a self-sampling test and one that did. The group that did see the image of a self-sampling kit reported lower scores for every construct; knowledge, attitude, subjective norm, and perceived control, as well as intention for HPVSS. The differences in the scores of the groups were all significantly different except for perceived control. The difference may be due to the presence of the image of the self-sampling kit in the second survey group as the scores for the second group were all significantly lower. These scores may have been lower for women who saw the image due to the image arising feelings of uncertainty or anxiety at the kits contents. This information may be constructive to helping formulate better messaging and communications for women who are hesitant when offered an opportunity to participate with a self-sampling kit.

The final key finding of this study was the association between the surveyed psychometrics and self-sampling intention. The results of the study report that attitude and perceived control are significant predictors of self-sampling intention among the college aged women in the study. This finding is supported by other studies that cited attitudes and perceived control as being strong factors in predicting intention of cervical cancer screening (Ackerson & Stines Doane, 2017; Duffett-Leger et al., 2008). In understanding the strongest predictors for the self-sampling test, this information may aid public health efforts towards women's screening, as well as appropriately planning interventions aimed at targeting these specific constructs.

Through this study, researchers sought to analyze the association between the TPB psychometrics and the intention of self-sampling. Though there was insightful information obtained through this study, there were also limitations present. The first limitation may be due to the bias present in using a convenience sample of university students. This limitation may contribute to a lack of generalizability to broader population groups and communities, but there

is potential for the study to be conducted in other diverse populations. In addition, when utilizing this population group, we omitted age as a collected variable and used the proxy of degree attainment to collect information. Since our study contained about 65% of the women to be attaining bachelor degrees we estimate many of those women to be about 18 to 22 years old. The next group of graduate and professional degrees is about 19% of the women who we estimate to be about 29-33 years old, based on internal university estimates. An additional limitation may be due to the self-reported nature of the survey, and potential social desirability bias in the respondents' answers. Though the researchers aimed for the anonymity of the survey to aid in making participants feel confident in providing candid responses.

Though there were limitations present in the study, we do believe the study contained many strengths. The primary strength being, while there is substantial empirical literature on the behaviors of women for traditional screening methods (Pap test, HPV test), there is limited information available on the predictors of self-sampling screening and this study fills that need. Furthermore, findings from this study should be verified by further research among additional diverse populations.

The implications of this study may be useful to the field of public health in two major ways. First, public health professionals should focus on the constructs of attitude and perceived behavioral control when aiming to increase intention to engage in HPV self-sampling. This may be through increasing positive perceptions of self-sampling and empowering women to understand how they can utilize self-sampling to be proactive in their health care. Secondly, the survey group that saw an image of a self-sampling kit had lower scores; therefore, it is inadequate to merely present women with the material and expect women to confidently engage with self-sampling. To increase engagement with self-sampling tests it may be useful for public health professionals to perform demonstrations to increase positive attitude and increase self-efficacy to perform the test. Ultimately

through the efforts of this study, more information has been acquired to aid in attempts to increase self-sampling screening.

CONCLUSION

The findings of this study indicate that attitude and perceived control were the two most significant predictors of self-sampling intention among college aged women. This study lends evidence that these two factors should be the focus when public health professionals create messaging and interventions to increase HPVSS and cervical cancer screening in this population. The results of this study may contribute to helping increase cervical cancer screening among women, ultimately leading to a decrease in cervical cancer deaths.

Funding Statement

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Conflict of Interest

All Authors complied with ethical standards.

Ethical Approval

All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and the 1964 Declaration of Helsinki and its later amendments. This article does not contain any studies with animals performed by any authors. Baylor Institutional Review Board (ref # 1695721) provided a notice of exemption in December 2020.

Authors' Contributions

Anjelica Elizondo is the corresponding writer and assisted in distributing and collecting data for the second round of surveys, conducting data analysis and writing of the manuscript. Matt Asare, contributed to survey formation, contributed to data analysis methods and editing of the manuscript. Cheyenne Dixon was the lead on survey formation, and contributed to review and editing of the manuscript.

References

Ackerson, K., & Stines Doane, L. (2017). Psychometric Testing of the Pap Smear Belief Questionnaire: Measuring Women's Attitudes and Beliefs Toward Cervical Cancer Screening. *J Nurs Meas*, 25(1), 77-89. <https://doi.org/10.1891/1061-3749.25.1.77>

Ackerson, K., Zielinski, R., & Patel, H. (2015). Female college students' beliefs about cervical cancer screening. *Journal of research in nursing*, 20(2), 147-159. <https://doi.org/10.1177/1744987115534950>

Ahmed, N. U., Rojas, P., & Degarege, A. (2020). Knowledge of Cervical Cancer and Adherence to Pap Smear Screening Test Among Female University Students in a Multiethnic Institution, USA. *J Natl Med Assoc*, 112(3), 300-307. <https://doi.org/10.1016/j.jnma.2020.03.007>

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision*

processes, 50(2), 179-211.

Akinlotan, M., Bolin, J. N., Helduser, J., Ojinnaka, C., Lichorad, A., & McClellan, D. (2017). Cervical Cancer Screening Barriers and Risk Factor Knowledge Among Uninsured Women. *Journal of community health*, 42(4), 770-778. <https://doi.org/10.1007/s10900-017-0316-9>

Bennett, K. K., Buchanan, J. A., & Adams, A. D. (2012). Social-Cognitive Predictors of Intention to Vaccinate Against the Human Papillomavirus in College-Age Women. *The Journal of social psychology*, 152(4), 480-492. <https://doi.org/10.1080/00224545.2011.639408>

Bland, J. M., & Altman, D. G. (1997). Cronbach's alpha. *BMJ (Online)*, 314(7080), 572-572. <https://doi.org/10.1136/bmj.314.7080.572>

Britt, R. K., Hatten, K. N., & Chappuis, S. O. (2014). Perceived behavioral control, intention to get vaccinated, and usage of online information about the human papillomavirus vaccine. *Health psychology & behavioral medicine*, 2(1), 52-65. <https://doi.org/10.1080/21642850.2013.869175>

Cervical Cancer in Texas. (2019). Texas Cancer Registry- Texas Department of State Health Services. <https://www.dshs.texas.gov/sites/default/files/tcr/data/screening/Cervical-Cancer-in-Texas.pdf>

Cervical Cancer Screening. (2022, April 2022). National Cancer Institute - Cancer Trends Progress Report. https://progressreport.cancer.gov/detection/cervical_cancer#:~:text=In%202019%2C%2073.5%25%20of%20women,date%20with%20cervical%20cancer%20screening

Cervical Cancer Statistics. (2023). Centers for Disease Control and Prevention (CDC). <https://www.cdc.gov/cancer/cervical/statistics/index.htm>

Chew, K. T., Kampan, N., & Shafiee, M. N. (2021). Perception and knowledge of human papillomavirus (HPV) vaccine for cervical cancer prevention among fully vaccinated female university students in the era of HPV vaccination: a cross-sectional study. *BMJ open*, 11(12), e047479-e047479. <https://doi.org/10.1136/bmjopen-2020-047479> (Original research)

Denny, L., Herrero, R., Levin, C., & Kim, J. J. (2015). Cervical Cancer. In H. Gelband, P. Jha, R. Sankaranarayanan, & S. Horton (Eds.), *Cancer: Disease Control Priorities, Third Edition (Volume 3)*. The International Bank for Reconstruction and Development / The World Bank 2015 International Bank for Reconstruction and Development / The World Bank. https://doi.org/10.1596/978-1-4648-0349-9_ch4

Duffett-Leger, L. A., Letourneau, N. L., & Croll, J. C. (2008). Cervical Cancer Screening Practices among University Women. *Journal of obstetric, gynecologic, and neonatal nursing*, 37(5), 572-581. <https://doi.org/10.1111/j.1552-6909.2008.00276.x>

- Goding Sauer, A., Bandi, P., Saslow, D., Islami, F., Jemal, A., & Fedewa, S. A. (2020). Geographic and sociodemographic differences in cervical cancer screening modalities. *Preventive Medicine*, 133, 106014-106014. <https://doi.org/10.1016/j.ypmed.2020.106014>
- Gupta, S., Palmer, C., Bik, E. M., Cardenas, J. P., Nuñez, H., Kraal, L., Bird, S. W., Bowers, J., Smith, A., Walton, N. A., Goddard, A. D., Almonacid, D. E., Zneimer, S., Richman, J., & Apte, Z. S. (2018). Self-Sampling for Human Papillomavirus Testing: Increased Cervical Cancer Screening Participation and Incorporation in International Screening Programs. *Frontiers in public health*, 6, 77-77. <https://doi.org/10.3389/fpubh.2018.00077>
- Head, S. K. M. P. H., Crosby, R. A. P., & Moore, G. R. M. D. M. P. H. (2009). Pap Smear Knowledge Among Young Women Following the Introduction of the HPV Vaccine. *Journal of pediatric & adolescent gynecology*, 22(4), 251-256. <https://doi.org/10.1016/j.jpag.2008.10.005>
- Increase the proportion of females who get screened for cervical cancer — C-09. (n.d.). Office of Disease Prevention and Health Promotion. <https://health.gov/healthypeople/objectives-and-data/browse-objectives/cancer/increase-proportion-females-who-get-screened-cervical-cancer-c-09#cit1>
- Kolar, S. K., Wheldon, C., Hernandez, N. D., Young, L., Romero-Daza, N., & Daley, E. M. (2015). Human Papillomavirus Vaccine Knowledge and Attitudes, Preventative Health Behaviors, and Medical Mistrust Among a Racially and Ethnically Diverse Sample of College Women. *J Racial Ethn Health Disparities*, 2(1), 77-85. <https://doi.org/10.1007/s40615-014-0050-2>
- National Cancer Institute: State Cancer Profiles- Screening and Risk Factors. (2020). National Cancer Institute. <https://statecancerprofiles.cancer.gov/risk/index.php?topic=women&risk=v17&race=00&type=risk&sortVariableName=percent&sortOrder=desc#results>
- Nishimura, H., Yeh, P. T., Oguntade, H., Kennedy, C. E., & Narasimhan, M. (2021). HPV self-sampling for cervical cancer screening: a systematic review of values and preferences. *BMJ Glob Health*, 6(5). <https://doi.org/10.1136/bmjgh-2020-003743>
- Perkins, R. B., Wolf, A. M. D., Church, T. R., Elkin, E. B., Skates, S. J., Etzioni, R. D., Guerra, C. E., Herzig, A., Hoffman, R. M., Oeffinger, K. C., Raoof, S., Shih, Y.-C. T., Walter, L. C., Zeigler-Johnson, C., Manassaram-Baptiste, D., & Smith, R. A. (2026). Self-collected vaginal specimens for human papillomavirus testing and guidance on screening exit: An update to the American Cancer Society cervical cancer screening guideline. *CA: A Cancer Journal for Clinicians*, 76(1), e70041. <https://doi.org/10.3322/caac.70041>
- Reiter, P. L., & McRee, A. L. (2015). Cervical cancer screening (Pap testing) behaviours and acceptability of human papillomavirus self-testing among lesbian and bisexual women aged 21-26 years in the USA. *J Fam Plann Reprod Health Care*, 41(4), 259-264. <https://doi.org/10.1136/jfprhc-2014-101004>
- Reynolds, S. (2024). *FDA Approves HPV Tests That Allow for Self-Collection in a Health Care Setting*. National Cancer Institute. <https://www.cancer.gov/news-events/cancer-currents-blog/2024/fda-hpv-test-self-collection-health-care-setting>
- Shin, H. Y., Kang, P., Song, S. Y., & Jun, J. K. (2022). Understanding of Cervical Screening Adoption among Female University Students Based on the Precaution Adoption Process Model and Health-Belief Model. *International journal of environmental research and public health*, 20(1), 700. <https://doi.org/10.3390/ijerph20010700>
- Staples, J. N., Wong, M. S., & Rimel, B. J. (2018). An educational intervention to improve human papilloma virus (HPV) and cervical cancer knowledge among African American college students. *Gynecologic oncology*, 149(1), 101-105. <https://doi.org/10.1016/j.ygyno.2017.10.015>
- Sultana, F., Mullins, R., English, D. R., Simpson, J. A., Drennan, K. T., Heley, S., Wrede, C. D., Brotherton, J. M. L., Saville, M., & Gertig, D. M. (2015). Women's experience with home-based self-sampling for human papillomavirus testing. *Bmc Cancer*, 15(1), 849-849. <https://doi.org/10.1186/s12885-015-1804-x>
- Sundstrom, B., Brandt, H. M., Gray, L., & Young Pierce, J. (2018). It's My Time: applying the health belief model to prevent cervical cancer among college-age women. *Journal of communication management (London, England)*, 22(2), 161-178. <https://doi.org/10.1108/JCOM-06-2016-0044>
- U.S. Cancer Statistics Data Visualizations Tool- Cervical Cancer Screening. (based on 2022 submission data (1999-2020)). U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute <https://gis.cdc.gov/Cancer/USCS/#/CancerScreening/>. <https://gis.cdc.gov/Cancer/USCS/#/CancerScreening/>
- Vash-Margita, A., Kobernik, E. K., Flagler, E. N., Quint, E. H., & Dalton, V. K. (2021). National Trends in Cervical Cancer Screening in Adolescents. *Journal of pediatric & adolescent gynecology*, 34(5), 717-724. <https://doi.org/10.1016/j.jpag.2021.02.097>
- Yarici, F., & Mammadov, B. (2023). An analysis of the knowledge of adults aged between 18 and 45 on HPV along with their attitudes and beliefs about HPV vaccine: the Cyprus case. *BMC women's health*, 23(1), 70-70. <https://doi.org/10.1186/s12905-023-02217-2>

Appendix

Appendix A. Distribution of range, means and standard deviation of TPB constructs

Variable		Possible Range	Observed Range	Mean $\pm$Std. Deviation
Group 1				
Knowledge		3.00-15.00	8.00-15.00	13.17 $\pm$ 1.72
Attitude		3.00-15.00	6.00-15.00	11.81 $\pm$ 2.25
Subjective Norm		3.00-15.00	3.00-15.00	9.75 $\pm$ 2.10
Perceived Control		3.00-15.00	3.00-15.00	10.55 $\pm$ 2.56
Intention		2.00-10.00	2.00-10.00	8.02 $\pm$ 1.97
Group 2				
Knowledge		3.00-15.00	4.00-15.00	12.57 $\pm$ 2.06
Attitude		3.00-15.00	4.00-15.00	10.58 $\pm$ 2.31
Subjective Norm		3.00-15.00	3.00-15.00	8.69 $\pm$ 2.76
Perceived Control		3.00-15.00	3.00-15.00	10.40 $\pm$ 2.17
Intention		2.00-10.00	2.00-10.00	7.25 $\pm$ 2.23